Progress Report

Project Title: Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS
Award Number: NA21NOS0120093
Period of Activity: 07/01/2025 - 12/31/2025
Principal Investigator(s): Jan Newton, NANOOS Executive Director

1) Project Summary

Our overall project goal is to sustain the Northwest Association of Networked Ocean Observing Systems, NANOOS, as the Regional Coastal Ocean Observing System for the U.S. Pacific Northwest that serves regional stakeholders in alignment with the vision of the U.S. Integrated Ocean Observing System (IOOS®). NANOOS, with its essential subcomponents (integrated in-water and land-based Observing Systems, Data Management and Communications, Modeling and Analysis, and Education and Outreach) that are closely integrated within the national IOOS® system, provides significant societal benefits across a wide spectrum of users including federal, tribal, state, and local governments, marine industries, scientific researchers, Non-Governmental Organizations (NGOs), educators and the general public.

For FY2025 (= Y5 of the award = Y19 of NANOOS RCOOS) our objectives were to:

1) **Maintain NANOOS as the U.S. IOOS PNW Regional Association:** Sustain our proven role for regional coordination, administrative infrastructure, and stakeholder engagement, partnering with federal and non-federal (tribal, academic, state, local, industry, NGO, etc.) entities.
2) **Maintain surface current and wave observations:** Maintain existing HF-radar and wave mapping capabilities, providing critical national capacity along coasts and at critical ports.
3) **Sustain and enhance buoys and gliders in the PNW coastal ocean in coordination with national and regional programs:** Maintain, harden, enhance existing buoys and gliders, with focus on hypoxia, HABs, OA, and climate.
4) **Maintain multidisciplinary observational capabilities in PNW estuaries and the nearshore, in coordination with local and regional programs:** Sustain observing ability to aid sustainable resource management, water quality assessment, and sub-regional climate change evaluation.
5) **Maintain core elements of beach and shoreline observing:** Measure nearshore bathymetry, topographic beach profiles, and shoreline morphodynamics along OR and WA, contributing to hazard mitigation by providing essential observations and better decision support tools for coastal managers, planners, and engineers.
6) **Provide sustained support to a community of complementary regional numerical models:** Contribute to the operation of regional models, and the tools and products they support, covering the head of tide of estuaries to the outer edges of the Exclusive Economic Zone (EEZ) in both OR and WA.
7) **Maintain, harden, and enhance NANOOS' Data Management and Cyberinfrastructure (DMAC) system for routine operational distribution of data and information:** Sustain and enhance the DMAC system, including the NANOOS Visualization System (NVS), for dynamic and distributed data access.
8) **Continue to deliver existing and, to the extent possible, create innovative and transformative user-defined products and services for PNW stakeholders:** Continue our NVS innovation to succeed in this vital translation for meaningful and informative data products that address user needs and serve society.

9) **Sustain and expand NANOOS engagement to the extent possible:** Continue ongoing engagement with stakeholders and the public, increasing ocean awareness and literacy; to expand the ocean and coastal workforce; to improve our ability to provide relevant ocean and coastal data and information to communities; and to facilitate use of NANOOS products for societal objectives, the core task for which NANOOS exists.

During FY25, NANOOS has the following additional tasks funded via IOOS (4, 7-10, 13), NWFSC (5), NMFS (6), and the NOAA Ocean Acidification Program (10-12), as well as three pass-thru funded modeling projects (1-3):

1. For Salish Sea & Columbia River Operational Forecast System (SSCOFS) (Khangaonkar, UW Tacoma & Yun, PNNL)
2. For advancement of Coupled Ice-Ocean Forecast Capabilities in STOFS-3D-Alaska (Durski, OSU)
3. To initiate the design of NOS operation model infrastructure to support the development and operations of AI coastal models or hybrid AI-numerical models (Zaron, OSU)
4. For IOOS sponsorship for OceanHackWeek (Lee, Wu-Jung, UW)
5. To support OceanHackWeek-style events in 2025 and 2026 (Lee, Wu-Jung, UW)
6. For NMFS/NANOOS Glider collaboration in the Pacific, including off the U.S. west coast and in Hawaii (Barth, OSU)
7. To conduct HABs monitoring for NANOOS (several PIs)
8. To support Radiowave Operators Working Group (ROWG) (Kosro, OSU)
9. For NANOOS HFR Retune/Recap (Kosro, OSU)
10. To support the NOA-ON time series at CB06 (Hales, OSU)
11. To sustain OA measurements on the Washington coast at NOA-ON NANOOS Mooring Cha'ba (Mickett, APL-UW)
12. To support GOA-ON, J-Scope, and C-CAN outreach/education project (Newton, APL-UW)
13. For a one-time FY25 adjustment to base (ATB) to be used on identified user needs and the RA priorities (Newton, APL-UW)

2) Progress and Accomplishments

During the project period, NANOOS accomplished its objectives outlined above. NANOOS maintained the RCOOS subsystems it has developed, implemented, and integrated with NOAA IOOS funding and substantial external leverage. NANOOS remained focused on delivering data-based products and services that are easy to use to stakeholders to address high-priority issues and aid decision making. NANOOS continued its proactive interactions and regional coordination with a wide range of PNW stakeholders, to prioritize and refine our observations, products, and outreach efforts as funding allowed.

NANOOS milestones for this award are provided in Table 1 and reported on in detail throughout this document. Our assessment is that NANOOS has met these milestones for the reporting period. We report here on progress for: a) Governance and Management Subsystem; b) Observing Subsystem (surface currents and waves, shelf buoys/moorings/gliders, estuary buoys/moorings, and beaches and shorelines); c) Modeling and Analysis Subsystem (estuaries and shelves); and d) Data Management and Communications Subsystem (Data Management and Cyberinfrastructure (DMAC), User Products Committee (UPC), and Education and Outreach (E&O)).

Table 1. NANOOS Milestones.

Subsystem / Area	Milestone
Observing Subsystem	
Currents & Waves	**Maintain surface current and wave observations:** Maintain existing HF-radar and wave mapping capabilities, providing critical national capacity along coasts and at critical ports.
	PNW Coast HF Surface Current Mapping: *Lead PI: Kosro, OSU* - Maintain and operate 10 SeaSonde HF sites designated as Priority 1 sites by the national HF program; these are four long-range sites in OR, three in WA, one in CA, and two standard-range sites in OR - As resources allow, - 3 Priority 2 standard-range sites covering Heceta Bank, which is a source for HABs and of strong bathymetric flow perturbation, as well as the shelf portion of the OOI Endurance Array - Deliver data via NVS - Bring all data QA/QC to meet Certification standards
	Wave Imaging at Critical PNW Ports: *Lead PI: Haller, OSU* - Sustain existing marine radar observing station at USCG Station Yaquina Bay - Provide both real-time and historical wave information via NVS; mean and snapshot radar images are real-time viewable for use in environmental characterization - Bring all data QA/QC to meet Certification standards
Shelf	**Sustain and enhance buoys and gliders in the PNW coastal ocean in coordination with national and regional programs:** Maintain, harden, enhance existing buoys and gliders, with focus on hypoxia, HABs, OA, and climate.
	WA shelf buoys/moorings: *Lead PI: Mickett, UW* - Maintain the WA shelf (off La Push) Cha'ba buoy and the NEMO subsurface profiler at existing levels - Deliver NRT data streams via NVS - Bring all data QA/QC to meet Certification standards
	WA shelf HAB buoy/mooring: *Lead PI: Mickett, UW* - Support for the HAB ESP deployment on NEMO mooring - Deliver NRT data streams via NVS - Bring all data QA/QC to meet Certification standards
	WA La Push glider: *Lead PI: Lee, UW* - Maintain the La Push line glider at existing levels - Deliver NRT data streams via NVS - Bring all data QA/QC to meet Certification standards
	OR shelf buoy: *Lead PI: Kosro, OSU* - Maintain the CB-06 buoy off Coos Bay at existing levels

	- Deliver NRT data streams via NVS - Bring all data QA/QC to meet Certification standards
	<u>Columbia shelf mooring:</u> *Lead PI: Seaton/Gradoville, CRITFC* - Maintain the CMOP shelf mooring at existing levels - Deliver NRT data streams via NVS - Bring all data QA/QC to meet Certification standards
	<u>Washington shelf glider:</u> *PIs: Barth, OSU & Seaton, CRITFC* - Maintain the Washington shelf glider at existing levels - Deliver NRT data streams via NVS - Bring all data QA/QC to meet Certification standards
	<u>Northern California glider:</u> *Lead PI: Barth, OSU* - Maintain the Trinidad Head, CA, glider, shared with CeNCOOS, at existing levels - Deliver NRT data streams via NVS - Bring all data QA/QC to meet Certification standards
Estuaries	**Maintain multidisciplinary observational capabilities in PNW estuaries and the nearshore, in coordination with local and regional programs:** Sustain observing ability to aid sustainable resource management, water quality assessment, and sub-regional climate change evaluation.
	<u>Puget Sound, WA, profiling buoys:</u> *Lead PI: Travis, UW* - Maintain 6 Puget Sound estuarine profiling moorings at existing levels - Deliver data via NVS - Bring all data QA/QC to meet Certification standards
	<u>Puget Sound, WA, US ferry-box:</u> *Lead PI: Krembs, WDOE* - Maintain US-Canada ferry-box at existing levels, assuming COVID-19 does not preclude its operation - Deliver data via NVS - Bring all data QA/QC to meet Certification standards
	<u>Columbia River estuary, OR, moorings:</u> *Lead PI: Seaton/Gradoville, CRITFC* - Maintain CMOP estuarine moorings at existing levels - Deliver data via NVS - Bring all data QA/QC to meet Certification standards
	<u>South Slough/Coos Bay, OR, moorings:</u> *Lead PI: Helms, ODSL* - Maintain South Slough/Coos Bay estuarine moorings for the NERRS at existing levels - Deliver data via NVS - Bring all data QA/QC to meet Certification standards

Beaches & Shorelines	**Maintain core elements of beach and shoreline observing:** Measure nearshore bathymetry, topographic beach profiles, and shoreline morphodynamics along OR and WA, contributing to hazard mitigation by providing essential observations and better decision support tools for coastal managers, planners, and engineers.
	<u>WA beach and shoreline:</u> *Lead PI: Kaminsky, WDOE* - Maintain shoreline observations in WA at existing levels - Deliver data via NVS - Bring all data QA/QC to meet Certification standards
	<u>OR beach and shoreline:</u> *Lead PI: Allan, DOGAMI* - Maintain shoreline observations in OR at existing levels - Deliver data via NVS - Bring all data QA/QC to meet Certification standards
	<u>WA and OR bathymetry:</u> *Lead PI: Ruggiero, OSU* - Maintain nearshore bathymetric observations of beach and shoreline morphodynamics in WA and OR at existing levels - Deliver data via NVS - Bring all data QA/QC to meet Certification standards
Modeling & Analysis Subsystem	
WA & OR Estuaries & Coast Models	**Provide sustained support to a community of complementary regional numerical models:** Contribute to the operation of regional models, and the tools and products they support, covering the head of tide of estuaries to the outer edges of the Exclusive Economic Zone (EEZ) in both OR and WA.
	<u>NE Pacific and Salish Sea:</u> *Lead PI: MacCready, UW* - Support, at existing levels, the daily forecast model, LiveOcean, which simulates ocean circulation and biogeochemistry in the Salish Sea and in coastal waters of the NE Pacific, including Oregon, Washington, and British Columbia - Deliver model output via NVS - Model verification and validation
	<u>Columbia River estuary and plume:</u> *Lead PI: Seaton, CRITFC* - Support, at existing levels, the CRITFC circulation modeling and forecasting system, which covers the Columbia River estuary and plume - Deliver model output via NVS - Model verification and validation
	<u>PNW Coastal Waters:</u> *Lead PI: Zaron, OSU* - Support, at existing levels,the OSU real-time coastal ocean forecast model, which covers the coastal waters off OR and WA - Deliver model output via NVS - Model verification and validation

Data Management & Communications Subsystem	
Data Management & Cyberinfrastructure (DMAC)	**Maintain, harden, and enhance NANOOS' Data Management and Cyberinfrastructure (DMAC) system for routine operational distribution of data and information:** Sustain and enhance the DMAC system, including the NANOOS Visualization System (NVS), for dynamic and distributed data access.
	<u>Mature Regional DAC Operations:</u> *Lead PI: Tanner, UW* - Sustain, refresh, and enhance a highly available, robust, distributed hardware and software environment; maintain appropriate staffing and team coordination; maintain up-to-date operations and system documentation to ensure transparent and clear descriptions of DAC architecture - Engage new local providers (not NANOOS funded), integrate their data into NVS and IOOS DMAC services; strengthen DAC capabilities and resources through regional and thematic partnerships
	<u>NVS Support and Development:</u> *PIs: Tanner & Carini, UW* - Maintain NVS support leveraging regional user needs, feedback, and data reviews to continually improve the relevance and quality of metadata for observing and modeling data assets integrated and served by NANOOS - Sustain & enhance existing data streams, IOOS web services, GTS submission; implement NCEI data archiving, NDBC data archiving, Glider DAC submission, QARTOD; maintain and expand ERDDAP to leverage web services, serve NANOOS applications and users; evaluate where new tech (e.g., cloud, AI, etc.) may afford NANOOS better efficiencies and robustness
	<u>Engagement in National and Cross-regional DMAC Efforts:</u> *PIs: Tanner & Carini, UW* - Sustain participation in IOOS DMAC community activities, including QARTOD development, semantic mapping, OGC WMS/WFS support, climatology data development, UGRID support, and shared code development and testing - Extend to other areas via pan regional products with sister IOOS RAs; engage and leverage NSF-funded OOI, international GOA-ON activities, and Canadian collaborations; engage with other West Coast and Pacific efforts, including WCGA and IPACOA
User Products Committee (UPC)	**Continue to deliver existing and, to the extent possible, create innovative and transformative user-defined products and services for PNW stakeholders:** Continue our NVS innovation to succeed in this vital translation for meaningful and informative data products that address user needs and serve society.
	<u>Web Site:</u> *Lead PI: Tanner, UW* - Continue to evaluate and update web content relevant to stakeholder issues, especially those related to Maritime Operations, Ecosystem Assessment, Fisheries & Biodiversity, Coastal Hazards, and Climate; improve ease of usability and user tracking capabilities
	<u>Tailored Products Development:</u> *Lead PI: Tanner, UW*

	- Annually evaluate priorities for products at the Tri-Com meeting (DMAC, UPS, and E&O), based on outreach feedback, regional issues, and GC input, and will implement new tailored products to the extent possible
Education & Outreach (E&O)	**Sustain and expand NANOOS engagement to the extent possible:** Continue ongoing engagement with stakeholders and the public, increasing ocean awareness and literacy; to enhance the ocean and coastal workforce; to improve our ability to provide relevant ocean and coastal data and information to coastal communities; and to facilitate use of NANOOS products for societal objectives, the core task for which NANOOS exists.
	<u>Communication:</u> *Lead PIs: Wold & Newton, UW* - Maintain up-to-date success stories, employing effective use of social media and newsletters - Support national communication through IOOS Program Office and IOOS Association collaborations - Be responsive to regional and local events (e.g., harmful algal blooms, fish kills, marine heat waves, hypoxia, floods, etc.) to enhance relevancy to public and highlight regional stories with NANOOS members and partners - Maintain existing and build new relationships to stakeholder user groups and the education community enabling NANOOS to achieve effective education and outreach
	<u>Product Co-Development:</u> *Lead PIs: Wold, UW & Allan, DOGAMI* - Engage users in product co-development through focus groups; use targeted interviews or surveys to garner feedback and input on products as they are developed; gain feedback and conduct self-assessment after product release - Conduct trainings to broader user groups and evaluate trainings to optimize NANOOS functionality - Engage with regional formal education communities to use ocean observing and NANOOS products to support STEM education, and with regional non-formal education communities to facilitate the use of NANOOS products to foster community ocean literacy
	<u>Ocean Workforce Pipeline Development:</u> *Lead PIs: Newton & Wold, UW* - Work with the other IOOS regions and the Program Office on workforce development initiatives to expand the ocean, coastal, and Great Lake workforces and to improve our ability to provide relevant ocean and coastal data and information to communities. - On a more immediate and local scale, the NANOOS “Enabling Change” working group, made up of NANOOS staff and partners (currently federal, university, and state agency) will move forward with actions that match NANOOS’ commitment ability.
Governance & Management Subsystem	
Governance, Representation, Oversight, Coordination & Accountability	**Maintain NANOOS as the U.S. IOOS PNW Regional Association:** Sustain our proven role for regional coordination, administrative infrastructure, and stakeholder engagement, partnering with federal and non-federal (tribal, academic, state, local, industry, NGO, etc.) entities.

	Governance: *PIs: Newton, Rome & Carini, UW* - Assure that NANOOS has transparent, effective, and representational governance via its Governing Council and the NANOOS Executive Committee composed of its elected Board and its functional committee chairs - Assure these bodies are engaged in NANOOS prioritization of regional needs, work effort, and product development - Assure balance of stakeholders represented in NANOOS reflects that found in PNW - Conduct annual GC meeting
	Representation: *PIs: Newton, Rome & Carini, UW* - Represent NANOOS at IOOS Program Office and IOOS Association meetings, and at national meetings of significance - Engage at a regional level at meetings and workshops affecting PNW stakeholders and NANOOS
	Project Oversight: *PIs: Newton, Rome & Carini, UW* - Conduct annual all-PI meetings and Tri-Committee meetings, providing clear feedback and direction - Share project evaluation at the annual PI meeting
	Coordination: *PIs: Newton, Rome & Carini, UW* - Coordinate with West Coast RAs and other RAs to optimize and leverage capabilities and assure consistencies - Engage in sub-regional and user-group specific workshops to aid coordination and optimization of effort - Coordinate with Canada (CIOOS, MEOPAR, etc.)
	Accountability: *PIs: Newton, Rome & Carini, UW* - Submit required IOOS progress reports and respond to other requests - Attain recertification in 2023 as the Regional Information Coordination Entity of US IOOS for the PNW

A. Observing Subsystem:

Data from all assets reported here are served via NVS.

CURRENTS AND WAVES

Maintain surface current and wave observations: Maintain existing HF-radar and wave mapping capabilities, providing critical national capacity along coasts and at critical ports.

PNW Coastal HF Surface Current Mapping:

- *Maintain and operate 10 SeaSonde HF sites designated as Priority 1 sites by the national HF program; these are four long-range sites in OR, three in WA, one in CA, and two standard-range sites in OR [Kosro]*
- *As resources allow, 3 Priority 2 standard-range sites covering Heceta Bank, which is a source for HABs and of strong bathymetric flow perturbation, as well as the shelf portion of the OOI Endurance Array*

- *Deliver data via NVS [Kosro]*
- *Bring all data QA/QC to meet Certification standards [Kosro]*

Status: On track.
Summary: New site at KAL1 (Kalaloch, WA) installed and undergoing testing. Repositioned antennas at KAL1 to improve reception. Intermittent problems with cell connection in this remote area. WSP1 dome inner cables replaced to improve reception. Our MAN1 site, at Manhattan Beach, is down due to a lightning strike; we have a SeaSonde and permission to reinstall and are waiting for shelter completion. Our WIN1 site, at Winchester Bay, went down 1 March 2024 due to a lightning strike; repairs to instruments and infrastructure completed. Our WSP1 site, at Westport, WA, is repaired. The transition to new frequencies requires installation of replacement HF antennas. CBL repairs including tuner for SNR.
Accomplishments/Successes: Operation of HF sites and data delivery. All operating sites have new computers installed and all are operating on updated software, and new updated computers are ready for down sites as well.
Problems/Delays: Relocated antennas to improve reception characteristics at KAL1.

FY23 Non-core Task 3: *Expenses associated with SeaSondes for HFR [Kosro]*
Status: In Progress
Summary: Have State Parks' permission to re-install at MAN1; waiting for completion of equipment shelter by State Parks, expected this summer.
Accomplishments/Successes: Permission to install at MAN1 granted.
Problems/Delays: PSG1, negotiating permissions

FY24 Non-core Task 4: *One-time system add-on for HFR system-wide support and replacement for HFR manufactured last century [Kosro]*
Status: Delayed, now on track
Summary: Recapitalization needs in HFR Core section above revised to reflect this funding.
Accomplishments/Successes: Revised quote obtained for replacement HF equipment.
Problems/Delays: PI medical problems interfered.

FY24 Non-core Task 5: *For supplies, materials, and associated expenses needed to resume telemetering data to the IOOS HFR National Network from SeaSondes offline, including stations PSG1, MAN1, and SEA1 [Kosro]*
Status: Delayed, now on track.
Summary: Recapitalization needs in HFR Core section above revised to reflect this funding.
Accomplishments/Successes: N/A
Problems/Delays: PI medical problems interfered.

FY25 Non-core Task 8: *To support Radiowave Operators Working Group (ROWG) [Kosro]*
Status: On track
Summary: A steering team has been selected and a "save the date" for May 5-7, 2026, at Hatfield Marine Science Center in Newport, OR, has been distributed.
Accomplishments/Successes: See Summary
Problems/Delays: None

FY25 Non-core Task 9: *For NANOOS HFR Retune/Recap [Kosro]*
Status: Complete
Summary: With change of HFR to ITU operating frequencies, existing systems required re-tuning to the new frequencies, and modifications to allow for automated transmission of call signs. Codar was given the contract to make these upgrades systemwide.

Accomplishments/Successes: Codar updated several of our existing systems to work under the new ITU rules.
Problems/Delays: None

Wave Imaging at Critical PNW Ports:
- *Sustain the existing marine radar observing station at USCG Station Yaquina Bay [Haller]*
- *Provide both real-time and historical wave information via NVS; mean and snapshot radar images are real-time viewable for use in environmental characterization [Haller]*
- *Bring all data QA/QC to meet Certification standards [Haller]*

Status: Offline
Summary: We have an in-person meeting with the USCG Yaquina Bay station scheduled for January 26th to discuss the plans for repair of the watch tower. In the meantime we continue to work on our database structure and minor software improvements.
Problems/Delays: The USCG Yaquina Bay watchtower at Newport, OR, remains out of commission. Communication with the USCG was limited during the government shutdown. However, we have recently reconnected and will have a meeting on-site next week.
Accomplishments/Successes: We are presently exploring the potential of partnering with USCG to fund repairs to the observation tower.

SHELF
Sustain and enhance buoys and gliders in the PNW coastal ocean in coordination with national and regional programs: Maintain, harden, enhance existing buoys and gliders, with focus on hypoxia, HABs, OA, and climate.

Washington Shelf Buoys/Moorings:
- *Maintain the WA shelf (off La Push) Cha'ba buoy and the NEMO subsurface profiler at existing levels [Mickett]*
- *Deliver NRT data streams via NVS [Mickett]*
- *Bring all data QA/QC to meet Certification standards [Mickett]*

Status: On track
Summary: The Washington Coast buoy observation program continued the work of maintaining and operating two real-time moorings 13 miles NNW of La Push, Washington. During this reporting period most effort was focused on scheduling and carrying out the fall mooring servicing cruise. The primary objectives of this cruise, which took place over two very full days on November 11th and 12th, including the recovery of the summer Cha'Ba mooring and NEMO-subsurface profiling mooring and the deployment of the winter Cha'Ba mooring. Other activities included recovering the adjacent ESP HAB mooring, collecting CTD casts, and maintaining several small wave moorings as part of the Backyard Buoys project. This cruise was originally scheduled for mid-October, but was delayed twice due to very poor weather conditions. We were finally able to take advantage of a very short weather-window on November 11th.

Both mooring systems suffered unfortunate instrumentation and cellular telemetry failures on this deployment. For Cha'Ba, the pCO2 system stopped working just after a few days of being deployed in late April– continuing a long string of failures of this aging system. This failure occurred despite continued and significant efforts to coordinate pre-deployment tests with the PMEL Carbon Group that does most of the preparation for this system. As of the end of this reporting period the pCO2 system on winter Cha'Ba was operating as designed. The McLane profiler on the NEMO-subsurface mooring also failed to profile after about a week as well. This was later determined to be a result of the "top stopper" sliding down the profiling cable and impeding the profiler from ascending the mooring line. The issue with the profile is easily preventable, but we continue to be concerned about the performance of the Battelle pCO2 system.

This cruise was carried out on Oregon State University's R/V Pacific Storm out of Newport, OR, which required an expensive transit to/from Westport, WA from Newport, OR. The transit alone was $50k, which together with the 1.5 days of operations led to a cruise cost of near $100k. This is not sustainable going forward given current funding levels for this cruise (~$77k) that is provided through NOAA OAP. Unfortunately there are no other capable vessels in the region that can carry out this work in the fall when the weather conditions can be variable. As such, we are evaluating the timing of the "fall" cruise to attempt to reduce costs by using APL's R/V Robertson, which is used for the spring deployments and recoveries.

The anchor recovery systems for the ESP and Cha'Ba mooring also failed again, resulting in these anchors and chain remaining on the bottom. Due to the continued poor performance of the anchor recovery system for Cha'Ba specifically, we are investigating a re-design of the mooring that would preclude the need for a complex anchor recovery system.

Thankfully, we are making progress in replacing some of the aging mooring components. Thanks to IRA/BIL funds, a new McLane profiler arrived in May (after the cruise) to replace the existing one that is now 15 years old. Also, we have been making significant progress on building a new Cha'ba controller, which will likely help with inductive communication issues. We are still working with the PMEL Carbon Group to find a solution for the aging Battelle mapCO2 system. Still, these deployments will provide an excellent data set with most instruments logging internally even if not being transmitted in near real-time. In particular, we have three different pH sensors on Cha'ba at approximately 1 m depth. The comparison of the three, along with reference bottle samples at deployment and recovery, will be an invaluable data set for industry partners to use to refine and improve their sensors.

Working with S. Travis, we have updated the real-time display of surface data for Cha'ba, to improve readability and flexibility with data streams from different sensors: https://nwem.apl.uw.edu/prod_CS_ChaBa.shtml. Also, the process of transferring all historical Cha'Ba and NEMO-Subsurface data—going back to 2010—onto the group's ERDDAP server continues. In addition to the Cha'Ba wind data, WQM CTD data, and NEMO-subsurface CTD data, much of the historical ADCP data is now accessible. Most of the near-real time data streams are also now passing through an ERDAPP server prior to being available on NANOOS Explorer, an improvement in QA/QC and streamlining data flow and archiving. All data currently available on the ERDDAP server can be found here: https://nwem.apl.washington.edu/erddap.

The team continued collaboration with Jennifer Hagen, Marine Policy Advisor for Quileute Natural Resources, who participated in our spring operations. The team also continued collaboration with Sea-Bird Electronics, which refurbished and renewed the loan of a Sea-Bird SeapHOX instrument that was deployed on the summer Cha'Ba mooring to collect deep (84 m) measurements of conductivity, temperature, depth, dissolved oxygen, salinity, and pH. As usual, fieldwork was coordinated with the NOAA/APL MERHAB ESP team, who deployed the ESP mooring nearby Cha'Ba and NEMO-subsurface during the spring cruise.

Accomplishments/Successes: Cha'ba/NEMO-subsurface mooring deployments, Puget Sound Marine Waters presentation.

Problems/Delays: Real-time data transmission, profiler. See above.

FY25 Non-core Task 11: *Support efforts for OA observing on NANOOS NOA-ON Cha'ba on the WA shelf [Mickett]*

Status: On track

Summary: Carbon measurements are conducted in partnership with PMEL Carbon Programs. The Cha'Ba MapCO2 carbon system is operated on both the summer and winter Cha'Ba buoys, with instruments swapped every 6-8 months in the spring and fall.

Accomplishments/Successes: Deployed Summer Cha'ba mooring last week of April. pCO2 system peripheral instruments working, but a stuck valve on the pCO2 sensor does not allow pCO2

water measurements. Due to the location and sea-state at Cha'ba, mid-season system swaps are difficult or not possible to do safely given funding. A second system was re-deployed on winter Cha'Ba on November 11th, and continued to operate as designed as of the end of the reporting period.
Problems/Delays: As described in the previous section, despite increased coordination, planning and training, the pCO2 system failed to perform once again. There have now been a string of failed deployments on Cha'ba. This system needs to be replaced!

Oregon Shelf Buoy:
- *Maintain the CB-06 buoy off Coos Bay at existing levels [Kosro]*
- *Deliver NRT data streams via NVS [Kosro]*
- *Bring all data QA/QC to meet Certification standards [Kosro]*

Status: On track
Summary: Mooring that was successfully recovered June 2025 has been rebuilt. We are awaiting a turnaround vessel and working weather window for redeployment.
Accomplishments/Successes: Data downloaded from previous deployment.
Problems/Delays: Difficulty booking a capable vessel for turnaround. We continue to try.

FY25 Non-core Task 10: *Support efforts for OA observing on NANOOS NOA-ON CB-06 off the OR shelf [Hales]*
Status: Delayed
Summary: The buoy is deployment-ready and has been dock-tested extensively. We have been unable to access ship time, as our normal support vessel has been committed to other non-local work, and the new vessel is in drydock and not expected to be in service until spring. The team continues to provide sample analyses for validation of in-water OA monitoring.
Accomplishments/Successes: Persistent deployment and monitoring. Maintained working relationship with Coos Bay vessel service provider and engaged with a new operator via interactions related to PacWave.
Problems/Delays: Vessel scheduling for workable ocean conditions continues to be a challenge for the OR coast, particularly in winter.

Columbia River Shelf Mooring:
- *Maintain the CMOP shelf mooring at existing levels [Seaton/Gradoville]*
- *Deliver NRT data streams via NVS [Seaton/Gradoville]*
- *Bring all data QA/QC to meet Certification standards [Seaton/Gradoville]*

Status: On track
Summary: The CRITFC Columbia River Shelf Mooring (SATURN-02) is a multi-depth, inter-disciplinary buoy with real-time telemetry. Deployed seasonally off the mouth of the Columbia River at ~35m depth, it measures wind, air temperature, barometric pressure, PAR, and water velocity, as well as temperature, salinity, dissolved oxygen, chlorophyll, turbidity, and quantum yield at 1, 6, 11, 16, 21, and 35m.
The SATURN-02 buoy was recovered in December 2024 and subsequently refurbished and prepared for re-deployment. Preparations included several system modernizations supported by IIJA funds, notably the integration and coding of a new microcontroller to improve buoy operations and real-time communication protocols. The vessel typically used for SATURN-02 deployments (M/V Forerunner) was unavailable for a spring or summer deployment window. As a result, CRITFC staff contracted with an alternative fishing vessel (Cape Windy), and the buoy was successfully deployed on August 26, 2025 and recovered on October 30, 2025. The deployment was successful, with biogeochemical data collected and telemetered during the coastal upwelling

season. Data are currently undergoing quality control, and field staff are beginning preparations for the spring 2026 deployment.
Accomplishments/Successes: SATURN-02 had a successful deployment with new field staff, a new vessel, and new modernizations and improvements.
Problems/Delays: None.

Washington La Push Glider:
- *Maintain the La Push line glider at existing levels [Lee]*
- *Deliver NRT data streams via NVS [Lee]*
- *Bring all data QA/QC to meet Certification standards [Lee]*

Status: On track
Glider IDs serving this line: SG263
Summary: SG263 was deployed on 7 March and recovered 12 December, 2025 after completing 1133 dives. At the time of this report, deployment of the replacement glider, SG272, awaits favorable conditions offshore. SGX gliders 249, 263 and 272 are dedicated to serving the NANOOS La Push line.
Accomplishments/Successes: Data processing and QC have been updated to our current standards, and data is flowing to the Glider DAC.
Problems/Delays: None

Washington Shelf Glider:
- *Maintain the Washington shelf glider at existing levels [Barth in collaboration with Seaton/Gradoville and Schumacker]*
- *Deliver NRT data streams via NVS [Barth]*
- *Bring all data QA/QC to meet Certification standards [Barth]*

Status: On track
Glider IDs serving this line: osu551, osu1138, osu592
Summary: Through a collaboration with the Columbia River Inter-Tribal Fish Commission (CRITFC), the OSU Glider Research group is conducting the NANOOS-funded glider sampling on the central Washington shelf. The program is designed to fly gliders off the central Washington coast, centered off Grays Harbor, WA, and south toward the Columbia River. The glider flies a mapping grid, from roughly the 30-m isobath, offshore to approximately the shelfbreak (~200 m). The mapping is done in consultation with the Quinault Indian Nation via Joe Schumacker, NANOOS Governing Council Representative and Executive Committee Representative for Tribes.

During the July to December 2025 reporting period, two glider maps were made in late July and mid September off central Washington. The glider was deployed for a total of 31 days, and produced 10 cross-shelf sections over 490 km with about 2223 vertical profiles of water properties. Glider data show that during July near-bottom, low-oxygen water was being upwelled onto the shelf creating a thick, hypoxic layer near the bottom. This layer filled up to half the water column from the 120-m isobath to the 50-m isobath over the shelf. In September, the hypoxic layer persisted near the bottom, but was pushed farther offshore as the winds shifted from summertime, upwelling-favorable to fall, variable and downwelling-favorable winds.These data are displayed on NVS.

CRITFC advertised, selected and hired two summer externs (one funded with core NANOOS funds) who were placed with the OSU Glider Research group for a research-based internship in coastal oceanography and underwater gliders. Working in Dr. Jack Barth's glider lab, the interns are gaining experience in data analysis, glider maintenance, and at-sea deployments, contributing to research on hypoxia off the Pacific Northwest coast. The program is part of CRITFC, NANOOS, and OSU's broader effort to cultivate the next generation of tribal ocean scientists. The two interns presented their final reports, both written and oral, during August 2025.

Accomplishments/Successes: Started the fifth, summer-season glider work off central Washington; continued operations with a reliable charter boat operator out of Westport, WA.
Problems/Delays: None

Trinidad Head Glider:
- *Maintain the Trinidad Head glider, shared with CeNCOOS, at existing levels [Barth]*
- *Deliver NRT data streams via NVS [Barth]*
- *Bring all data QA/QC to meet Certification standards [Barth]*

Status: On track
Glider IDs serving this line: osu686, sg266
Summary: Starting in early December 2014, the Oregon State University glider research group has been obtaining vertical sections of ocean properties off Trinidad Head, CA (41° 3.5'N) using an underwater glider. We use a 1000-m capable Seaglider equipped with the following sensors: CTD, dissolved oxygen (Aanderaa 4831 optode), light backscatter (700 nm), chlorophyll fluorescence and Colored Dissolved Organic Matter (CDOM) fluorescence (WET Labs Ecopuck). The gliders also measure depth-averaged velocity, which can be combined with geostrophic estimates of relative velocity to get absolute velocity and hence transport. The glider samples from approximately the 100-m isobath (~10km offshore) to 130W (~500 km offshore), repeating the line every 30 days. We collaborated with Dr. Eric Bjorkstedt (NOAA Southwest Fisheries Science Center, Humboldt State University) to facilitate fieldwork off Trinidad Head. We used two of our Seagliders in order to "hot swap" them on the line when their batteries ran low. During this reporting period, this effort was jointly funded by NANOOS and CeNCOOS.

For the reporting period, July to December 2025, a glider was on the TH line for 162 days during two deployments, sampled along 3006 km of track line covering the transect 14 times, and collected about 1826 vertical profiles of ocean properties. Glider uptime during this period was about 90%. Data are being sent in near real-time to the IOOS Glider Data Acquisition Center and, simultaneously, to the CeNCOOS and NANOOS data centers.
Accomplishments/Successes: We successfully put sg266, a new Seaglider SGX purchased with NANOOS and CeNCOOS funds, into operation on the TH line after it was repaired to correct a problem with the moving battery catching on nearby cables and thus impairing normal flight operations. Data from the Trinidad Head glider line are being used to monitor the end of the late 2025 Marine Heat Wave and the onset of ENSO neutral conditions (see Figure JB.1 below).
Problems/Delays: None

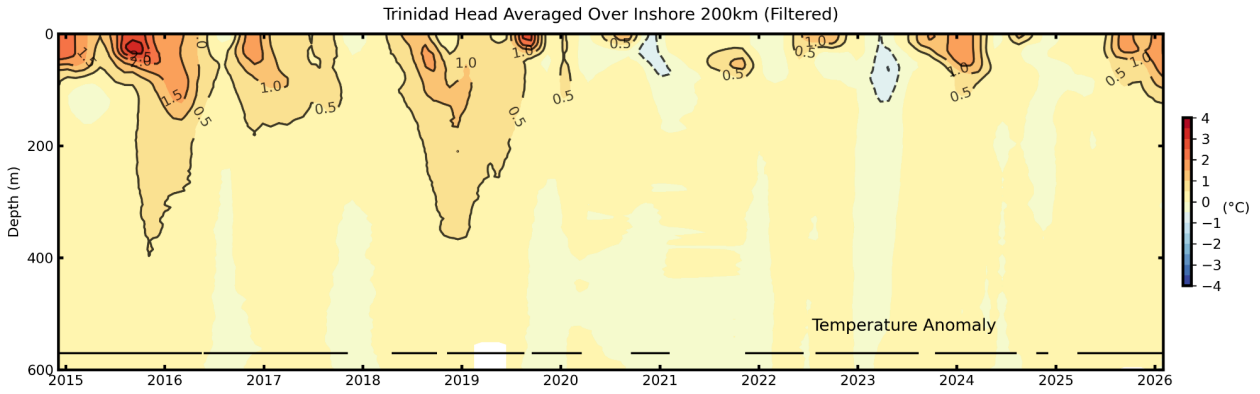

Figure JB.1: *Temperature anomaly from the Trinidad Head, CA (41° 3.5'N) glider line. Horizontal lines above the time axis indicate when the TH-Line glider was in the water.*

FY25 Non-core Task 6: *For NMFS/NANOOS Glider collaboration in the Pacific, including off the U.S. west coast and in Hawaii [Barth]*
Status: On track
Summary: Collaborate with NOAA Fisheries in using passive and active acoustics from gliders.
Accomplishments/Successes: Begun acquisition and installation of acoustic sensors on both Seaglider and Slocum underwater gliders.
Problems/Delays: None

FY25 Non-core Task 7: *Further HABs understanding and prediction to be distributed to tribes, UW, WA Sea Grant, OSU, and for data services relevant to HABs in service of the PNW HAB Bulletin for WA and OR and other PNW HAB observing [Mordy/McCabe (CICOES/NOAA), Trainer (UW ONRC), MacCready (UW Oceanography), Litle (UW Washington Sea Grant), Kavanaugh (OSU), Newton (UW APL)]*

Mordy/McCabe
Status: On track
Summary: PI McCabe has continued to collaborate with Barbara Hickey (UW School of Oceanography) and Vera Trainer (UW ONRC) to produce the Pacific Northwest Harmful Algal Blooms Bulletin (PNW HAB Bulletin) for coastal shellfish managers. A total of eight PNW HAB Bulletins are typically produced each calendar year, with nominally four Bulletins during spring razor clam digs and another four during fall razor clam digs.
Accomplishments/Successes: McCabe, Hickey, and Trainer produced three PNW HAB Bulletins to support coastal shellfish managers during the reporting period. These included the 18-Aug-2025, 29-Sep-2025, and 27-Oct-2025 Bulletins. Offshore data collected by the ESP mooring off northern WA were incorporated into all three Bulletins. On 18-Aug-2025, risk of a domoic acid outbreak was categorized as low, a result of extremely strong upwelling-favorable winds along the coast. Risk increased to medium on 29-Sep-2025 as a result of increased toxin concentrations off southern OR and the documented presence of healthy chain-forming *Pseudo-nitzschia* cells off northern CA that could be advected to southern OR during forecast storm conditions. At the end of Oct 2025, *P. cf. australis* cells were documented off central OR alongside moderate concentrations of particulate domoic acid in seawater samples. This resulted in a continuation of the medium risk rating. Fortunately, no new harvest closures resulted from domoic acid outbreaks.
Between the spring and fall razor clam seasons, high frequency (HF) radar data were transitioned from a public UCSD source to NOAA. Code was written to be able to utilize this source, which contained formatting changes from the prior UCSD source. In addition, federal employees were generally not permitted to perform work during the 43-day-long lapse in US Government appropriations in 2025. PI McCabe requested special “intermittent excepted” status to be able to produce additional PNW HAB Bulletins during October. He was eventually approved for a single day, and that enabled the 27-Oct-2025 Bulletin for coastal managers. At the end of the Government shutdown on 13-Nov, coastal ocean conditions were evaluated. It was determined that fall conditions had arrived, that *Pseudo-nitzschia* cell concentrations had dropped precipitously, and that risk of a large domoic acid event was likely low. This was communicated to coastal managers during a virtual ORHAB meeting, and no additional Bulletins were produced. The PNW HAB Bulletins continue to be made publicly available on both the ORHAB and NANOOS websites.
Problems/Delays: None

Trainer
Status: On track
Summary: The funds from the current performance period were used primarily to purchase and install distilled water systems for the Quinault and Makah Tribes as well as UW ONRC. These

systems will bring true lab capacities to these 3 facilities, increasing the capacity for these 3 sites to perform toxin analysis with clean water, ensuring the accuracy of this testing.
Accomplishments/Successes: UW ONRC in collaboration with ORHAB (Olympic Region Harmful Algae Bloom partnership), serves as a primary data source for state and tribal shellfish managers and the PNW HAB Bulletin on Washington's outer coast. The four Coastal Treaty Tribes (Hoh, Quileute, Makah, and the Quinault Indian Nation) are members along with state, federal and academic partners. Core funding for ORHAB's shore-based monitoring is provided by the Washington State Legislature from a percentage of recreational shellfish license fees but off-shore monitoring is not mandated.

The December 2025 fund balance for ONRC cost and tribal allocation is $72,210.50, necessary for participating in offshore sampling over-and-above their weekly shore-side sampling. A highlight in spending during this period was the purchase and installation of distilled water systems at the ONRC, Makah lab and Quinault lab. All Tribes received ELISA kits, allowing them to perform domoic acid analyses onsite in their labs in response to elevated HAB cell counts observed by microscopy. Trainer spent considerable time working with Beacon Analytical to troubleshoot the issues with the domoic acid ELISA which is now working well.

A key and lab access has been provided to the Hoh Tribe, allowing the Tribe to use the ONRC facility as a laboratory resource. All Tribes will play a pivotal role in processing samples and hosting the launching and retrieval for remote vehicle missions of the Lightfish. The funds provided here are proving important in helping each tribe meet that new challenge.

Trainer continued discussions with the Washington State Department of Health and PI, Kavanaugh, to explore future possibilities to expand ORHAB sampling to help manage Dungeness crab. In addition, she has been instrumental in assisting Maria Kavanaugh's project and the Oregon Department of Fish and Wildlife (ODFW) by making available new enzyme-linked immunoassay (ELISA) kits for the detection of domoic acid. Trainer is a committee member for Dr. Kavanaugh's student, Taylor Wood, who is working on establishing a program to train Dungeness crab fishers in Washington to sample for HABs. Trainer continues to work extensively with 2 companies, Sensoreal and AquaBC to test new dipstick methods for paralytic shellfish toxin (PST) which looks very promising for use by ORHAB, Washington shellfish growers, and our Oregon partners. Following the paralytic shellfish poisoning event in Oregon that sickened over 40 people (2 were intubated in the ICU), Trainer obtained contaminated shellfish samples from WDOH for PSTs and is in discussion with the WDOH about possible applications. The ultimate goal is to provide a cost-effective, easy-to-use test for all coastal monitoring personnel in WA and OR. A new harmful algae specialist has been hired to replace Anthony Odell who retired on 31 May 2025. Dr. Avery Tatters started his position on 21 July 2025 and the Lightfish training with Avery's assistance is scheduled for April 2026 in anticipation of the first PNW HAB Bulletins in Spring 2026. No Lightfish training was held in Fall 2025 due to delays from the government shutdown and the need for refurbishing the water sampling system by UW engineers.
Trainings/Meetings:

- ORHAB Annual Meeting, 15 January 2025
- Lightfish operational planning meeting, September 2025

MacCready
Status: On track
Summary: During this reporting period NANOOS support for MacCready's salary allowed for improvements to the reliability of the LiveOcean model system.
Accomplishments/Successes: MacCready runs the LiveOcean daily forecast model that is used as part of the information for the PNW HAB Bulletin. The model continued to run with high reliability during this period, and post-processing particle tracking results used by managers were produced daily. In this period we made several improvements to the LiveOcean system. These are detailed

later in the section: Modeling & Analysis Subsystem/WA & OR ESTUARIES & COAST MODELS. MacCready is training a postdoc, Dr. Kate Hewett, to assume responsibility for the daily forecasts when he retires.
Problems/Delays: None

Litle
Status: On Track
Summary: The SoundToxins program continues to provide support for phytoplankton monitoring throughout Washington's Marine Waters.
Accomplishments/Successes: For this reporting period we received and addressed 80 requests for support from SoundToxins participants and partners including requests for monitoring support, phytoplankton identification and data use requests. We received 85 emails alerting to the presence of harmful algal bloom species of which 34 of the alerts were passed on to the Washington State Department of Health as part of the phytoplankton cell presence alert system. We conducted 6 site visits including onboarding two new sites, one on San Juan Island, and one in Totten Inlet. We also held several virtual training sessions and continued progress on our website redesign and content development. We also continued regular internal strategy sessions and monthly meetings with WDOH.

In July, SoundToxins participated in the long-running middle-school education program, NOAA Science Camp with a harmful algal bloom session. We also developed and taught water quality curriculum for a 3-day aquaculture-focused NOAA Science Camp pilot program. We participated in 4 public outreach events including Oysterfest in Shelton, One Ocean Week in Seattle, South Sound Clean Water Partners at Burley Lagoon, and at Discovery Bay World Mark Condos. We presented to several policy makers including Washington state senator Sharon Shewmake and to Nancy Wallace from NOAA Oceanic and Atmospheric Research.
Problems/Delays: None.

Kavanaugh
Status: On track
Summary: We have transitioned to Year 4 of Cooperative Fisheries Plankton Research project to target plankton taxa, in particular the domoic-acid producing species *Pseudo-nitzschia* sp (P/N). In 2024, we additionally increased monitoring of the saxitoxin producing species *Alexandrium* sp in response to a Paralytic Shellfish Poisoning (PSP) event on the Oregon Coast. Commercial fishermen, including charter boats, as well as recreational fishermen, have been trained to collect seawater samples which are preserved and/or frozen for analyses in the lab. In the lab, we utilize imaging flow cytometry to rapidly assess plankton community composition, P/N abundance, dominant morphology (thick, thin), and environmental correlates. New procedures to collect filter samples for ELISA Domoic Acid analysis were implemented during the 2025 sampling season. A regular exchange of new sampling kits and collected samples was tested, and successfully implemented at a central location, Hatfield Marine Science Center in Newport, Oregon. An additional station was established at Pacific Seafoods in Newport, Oregon. Another kit exchange station has been established at the Oregon State University Port Orford Field Station in Port Orford, Oregon. The project funds graduate student stipend (for project coordination), technician time (to assist with running and annotating samples), and hourly undergraduate assistants.
Accomplishments/Successes: For each sampling season so far, 150-200 samples on average have been collected and processed within the Cooperative Fisheries Plankton Research project, yielding a total of over 800 new observations. It is estimated that the project will have more than 1000 total observations by the end of the 2026 sampling season.

For the 2025 sampling season, Lab Manager Kelly George trained new Graduate Student Taylor Wood on all aspects of managing the CFR project, including fishermen/sample coordination,

HMSC station establishment and maintenance, and outreach related to the project. For the 2025 sampling season, Wood and George successfully maintained the sample kit station at Hatfield Marine Science Center (HMSC). The station at HMSC was reinstated for the summer sampling season in early June, 2025, and fishermen sampling remains steady within the Newport-based fishermen cohort. In addition, in response to feedback from past participants, Wood successfully established a secondary Newport, Oregon kit station at Pacific Seafoods, a location that is more conveniently located for some of the fishermen colleagues than HMSC. The convenience of the Pacific Seafood station encouraged some fishermen to return to the project after taking a couple of years off from sampling. An additional fishermen sampling kit station, located in Port Orford, OR, was maintained June- September this year. This location was selected with the assistance of Tom Calvanese and Caroline Rice with Oregon State University. Sampling started through ODFW and OSU partnerships, and Calvanese and Rice leveraged community connections to recruit new commercial fishing participants.The secondary station at Port Orford allowed for regular sample collection by the ODFW Marine Reserves team during their Redfish Rocks Marine Reserve surveys. Although connections were established with several other prospective participants, ultimately one commercial fisher contributed water samples. Broader participation was hindered by ongoing Port construction and operational transition at the OSU Field Station. Future South coast participation is expected to increase with earlier recruitment and relocation of the sampling station to Port facilities.

In 2024, George and former undergraduate assistant Amanda Kent increased outreach for this project by establishing a monthly newsletter that is sent out to all sample-collecting participants of the project, as well as any other interested parties. The newsletter included three to four different topics each month, such as: updates on how the samples they have collected are being processed, information about the taxa being detected in the samples, educational information related to Harmful Algal Bloom (HAB) forming taxa such as *Alexandrium* sp. that caused recent shellfish closures on the Oregon Coast, sampling calls-to-action during HAB events, and more. In 2025, Wood continued production of the project newsletter to keep participants and interested parties up to date. For the continued benefit of the 2025 sampling season, Wood attended several Port Orford Seafood Market events to connect with the local South coast fishing community and encourage project participation. Wood also presented preliminary project results with research posters at the Western Society of Naturalists Annual Meeting in San Diego, Oregon's State of the Coast Conference in Coos Bay, and the Oregon State University Engagement Conference in Corvallis.

The CFR more closely monitored saxitoxin-producing *Alexandrium* sp. during the 2025 sampling season in response to the Paralytic Shellfish Poisoning (PSP) outbreak during the Summer of 2024. CFR personnel were prepared to conduct increased beach sampling efforts to assist Oregon Department of Fish and Wildlife (ODFW) in detecting *Alexandrium* sp. abundance if needed in the event of another *Alexandrium* sp. bloom. In 2024, CFR personnel conducted beach sampling at six beach locations on the Oregon coast. These locations were: Roads End State Recreation Site and Nelscott Beach in Lincoln City, Gleneden Beach and Moolack Beach in Lincoln County, Fogarty Creek State Recreation Area in Depoe Bay, and Agate Beach State Recreation Site in Newport, Oregon. At each site, environmental data including salinity and temperature were recorded, and seawater samples were collected. Seawater samples included whole seawater, as well as concentrated seawater samples that were collected using a plankton net. Samples were then analyzed for *Alexandrium* sp. and *Pseudo-nitzschia* sp. counts using imaging flow cytometry, which were then shared with ODFW to help inform management decisions regarding the PSP outbreak. *Alexandrium* sp. were detected in some CFR samples during the 2025 sampling season, prompting CFR personnel to work towards streamlining sampling workflows in order to share that data with the appropriate state departments as soon as possible. No new beach sampling responses were needed during the 2025 sampling season.

After Taylor Wood was brought into the Cooperative Fisheries Research project as a new Graduate Student Researcher in September 2024, Wood successfully managed the project for the 2025 sampling season, with George providing project assistance and additional training as needed. The project had 7 participating fishermen, including new participants with the establishment of the Port Orford sampling station, and fishermen returning to the project due to the establishment of the new, conveniently located Pacific Seafoods station in Newport after taking a sampling hiatus. One of Wood's goals for 2025 was to encourage stronger fishermen participation, yielding a higher-than-average volume of sample collections and observations for the 2025 sampling season, and that goal was accomplished with great success. In the upcoming 2026 sampling season, the project team plans to incorporate recent project feedback, retain previous project participants, and expand participation to include 2 new fishers.

Wood and George have developed protocols to overcome the challenges of coordinating Domoic Acid sampling that have been faced in previous years of the CFR project. Previously, subsamples of whole seawater were being reserved for later Domoic Acid processing. There were challenges in finding accessible Domoic Acid testing kits that were compatible with whole seawater samples rather than filter samples for particulate Domoic Acid (pDA). In 2024, George and Kent were able to source Domoic Acid ELISA kits that were compatible with whole seawater samples, and efficiently processed a large subset of DA samples dating back to the 2022 sampling season. This eliminated the large backlog of DA samples, and set the project up for success in the 2025 sampling season. With the source for reliable ELISA testing kits now available, Wood and George collaborated to develop a new protocol for preserving pDA samples for the CFR project. Rather than just saving whole seawater subsamples, for the duration of the 2025 season, Wood filtered seawater to collect pDA within 24-48 hours of fishermen collection, and preserved the filter samples in a -80 freezer for later ELISA analysis. Due to the distance between the main lab in Corvallis and the station in Port Orford, the fast 24-48 hour turnaround time between sample collection and filtering for pDA was not always possible for Wood and/or George to accomplish. In response to this challenge, personnel at the Port Orford station volunteered to assist with filtering incoming samples for pDA, and measuring the salinity of those samples. The method of using filter pDA samples for ELISA testing is a more reliable and method than using whole seawater for ELISA testing, so it is projected that the 2025 sampling season will yield a robust dataset of Domoic Acid concentration to analyze alongside imaging flow cytometry and environmental data once the pDA samples have all been processed.

Challenges/Delays: One challenge has been the coordination of filtering seawater samples for pDA within the ideal 24-48 hour window due to the distance between the sample kit stations and the main lab in Corvallis, OR. Filtering stations have been set up in the secondary labs in Newport and Port Orford, OR to help alleviate this challenge, but personnel aren't always able to travel to the secondary labs within that 24-48 hour timeframe. pDA filter samples were still collected from all sample kits, regardless of whether or not the 24-48 hour window had passed. pDA filter samples collected over 48 hours after fishermen have dropped off kits will be used to assess how imperative that timeframe is. Implementing an efficient workflow to process the pDA samples within a short timeframe after they have been collected has been a challenge, as there were delays in training for ELISA pDA analysis methods. With the completion of pDA analysis training, a more efficient pDA workflow will likely be able to be implemented for the 2026 sampling season. Through collaborative work with Dr. Vera Trainer's lab, the project team is actively working to help overcome ELISA tDA analysis challenges associated with high salt content in whole water samples. An additional challenge is keeping samples cool and well-preserved when participants are at sea for several days at a time on commercial fishing trips.

Bolm
Status: On Track
Summary: Funds were received by OSU in December 2025. Work will begin next reporting period.
Accomplishments/Successes: N/A
Problems/Delays: N/A

Newton
Status: On Track
Summary: During this reporting period, Newton oversaw all aspects of the NANOOS HABON effort. This included attending ORHAB meetings and discussing progress with each of the HABON PIs in Washington and Oregon. She coordinated with Tanner (UW, NANOOS web) to assure that all PNW HAB Bulletin and other HAB content matched the needs of the community. We are designing new content for the web, based on new infographics and pulling in content from other HABON PIs.
Accomplishments/Successes: Additional PNW HAB observing needs are being addressed through NANOOS' IRA work and are actively being coordinated with this core work.
Problems/Delays: None

ESTUARIES
Maintain multidisciplinary observational capabilities in PNW estuaries and the nearshore, in coordination with local and regional programs: Sustain observing ability to aid sustainable resource management, water quality assessment, and sub-regional climate change evaluation.

Puget Sound, WA, Profiling Buoys:
- *Maintain 6 Puget Sound estuarine profiling moorings at existing levels [Travis]*
- *Deliver data via NVS [Travis]*
- *Bring all data QA/QC to meet Certification standards [Travis]*

Status: On track
Summary: Work to maintain Puget Sound Profiling Buoys continued, including regular maintenance conducted at each of six buoy sites. Buoy maintenance includes instrument package swaps, winch repairs, and electrical and mechanical maintenance.
All Puget Sound Profiling buoy data products can be found on the team ERDDAP server (found here: https://nwem.apl.washington.edu/erddap) and are utilized for providing streamlined product creation into a uniform workflow. Puget Sound profiling buoy data is also delivered to NVS and has been made available to NDBC via the NANOOS ERDDAP server.
Accomplishments/Successes: Multiple successful maintenance operations and continued troubleshooting to identify root causes of rapid failure modes. The aging ORCA buoy at Point Wells was recovered and replaced with a recently redesigned ORCA2.0 mooring. The replacement has made the mooring safer, as old anchor lines were reaching the end of their useful life, and the new mooring design provides for a better platform for field teams to safely and efficiently perform operations. The new design uses a new buoyancy-driven float system for profiling, and also uses an updated controller system for more robust and consistent data transmission. An additional buoy at Dabob Bay has been retrofitted for the new buoyancy-driven float system and upgraded controller, until such time as a full buoy swap can be completed.
Problems/Delays: Continued profiling downtime was experienced due to aging systems and external factors, such as poor weather, preventing service visits to the buoys. The new ORCA2.0 mooring design has required additional attention for the first deployment due to unforeseen design issues, such as issues with instrument software integration and hardware design revisions, such as the addition of spring-based float stoppers and guideline-centering surface bungee lines. Supply

chain issues, including long lead times on ordering replacement parts, has slowed the regular maintenance schedule.

Puget Sound, WA, US-Canada ferry-box:

- *Maintain the US-Canada ferry-box despite challenges as ferry companies work to regain profitability with Canadian tourism having sharply dropped. [Krembs]*
- *Deliver data via NVS as data interface becomes available [Krembs]*
- *Ensure all data meets QA/QC Certification standards after successful fine tuning of the system. [Krembs]*

Status: All installations have been completed successfully, and the system is currently operating in autonomous test mode between Seattle and Victoria. Fine-tuning of geofencing operations and flow rates is ongoing.
Summary: Ecology has successfully maintained the en route ferry monitoring system with support from the Victoria Clipper engineering team. Progress continues as pump cycles and water flow to the sensors are operating smoothly, and data are being generated. Intermittent GPS signal strength issues are currently being addressed by relocating the GPS antenna to the bridge with new cable runs. Ship-to-shore power issues have been resolved, and the system is now running smoothly. Data telemetry and aggregation on AWS continue to work well.
Accomplishments/Successes: The team is continuing to fine-tune flow rates for the de-bubbler to optimize maximum flow and effective bubble removal. Winter ship maintenance is currently underway, providing an opportunity to complete work on the vessel.
Problems/Delays: None

Ferry-based monitoring - Washington State ferries (WSF)
Sponsor: Washington State Dept of Ecology
Jim Thomson, Applied Physics Laboratory, University of Washington,
Status: No new updates

Columbia River Estuary, OR, Moorings:

- *Maintain CMOP estuarine moorings at existing levels [Seaton/Gradoville]*
- *Deliver data via NVS [Seaton/Gradoville]*
- *Bring all data QA/QC to meet Certification standards [Seaton/Gradoville]*

Status: On track
Summary: CRITFC continued to maintain NANOOS-supported stations in the Columbia River estuary. The Point Adams (SATURN-03) pier-based, pumped station collected real-time data at all three levels, with some short data gaps during this period due to pump and/or flow meter replacement, through November 2025. In late October 2025, CRITFC staff were informed that the Point Adams Fish Packing plant, whose pier the station was located on, was being sold and that CRITFC was required to remove all instrumentation and equipment from the site as soon as possible. CRITFC complied, and data collection was terminated on November 11, 2025. CRITFC is currently assessing options for a replacement station. The Tongue Point (SATURN-04) pier-based, pumped station collected real-time data at both levels, with short data gaps due to pump, flow meter, and/or power issues. After a period of data gaps and suspected battery issues, a 24V-12V converter was installed in December 2025 in order to consolidate solar power systems and enable data logging for all powered station components, improving the ability to diagnose future data gaps. The Baker Bay (SATURN-07) buoy is currently on station and is scheduled for refurbishment; recovery is pending. The Youngs Bay (SATURN-09) buoy was recovered in January 2025 and is expected to be refurbished and re-deployed in spring or summer 2026. Staff began designing and coding new microcontroller boards for SATURN-07 and SATURN-09 buoys. Refurbishment of the buoys has been delayed in part due to limited working space during construction of the new CMOP

Field Office, which is expected to be completed by March 2026.The Cathlamet Bay (CBNC3) buoy was recovered in March 2025 and is scheduled to be re-deployed in early 2026. All stations except for CBNC3 (Cathlamet Bay) are real-time, and data are displayed on NVS. Data are subject to QA/QC, which is included in data submitted to NCEI via NANOOS and to the recently deployed ERDDAP server. The transition of CMOP data management servers to new hardware and operating systems is still in progress.
Accomplishments/Successes: Tongue Point maintained and power system improved. Rapid, professional decommissioning of the Point Adams station following notification of site sale, ensuring safe removal of all CMOP infrastructure.
Problems/Delays: Temporary buoy refurbishment delays due to Field Office construction and loss of the Point Adams site; both are being actively managed.

South Slough/Coos Bay, OR, Moorings:
- *Maintain South Slough/Coos Bay estuarine moorings for the NERRS at existing levels [Helms/DeMarzo]*
- *Deliver data via NVS [Helms/DeMarzo]*
- *Bring all data QA/QC to meet Certification standards [Helms/DeMarzo]*

Status: On track
Summary: South Slough Reserve continued data collection for a network of moored estuarine water quality observing stations as part of the NERRS System-Wide Monitoring Program with additional NANOOS support. Four real-time water quality stations in the South Slough estuary measured continuous water temperature, salinity, dissolved oxygen, pH, turbidity, and water level every 15 minutes over the period 7/01/25 – 12/30/25. Tom's Creek weather station provided real-time measurements of air temperature, relative humidity, barometric pressure, and wind speed/direction. Telemetry functions operated continuously for the Winchester Arm and Elliot Creek water quality stations and Tom's Creek weather platform. Water quality data collection was completed at the Charleston Bridge and Valino Island stations, but telemetry transmissions were unavailable in preparation for piling installations due to aged wood infrastructure and biofouling issues. During November 24-26, 2025, two steel pilings were installed at the Charleston Bridge and Valino Island water quality stations by Oregon Marine Construction. Water quality instruments will be deployed simultaneously at the old and new piling locations to satisfy NERRS requirements for moving long-term stations. In collaboration with the Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians (CTCLUSI), SSNERR maintains telemetry for the North Spit BLM water quality station, located in the lower Coos estuary. The North Spit station continues to be offline for the reporting period due to staff changes, but SSNERR will assist CTCLUSI when they are ready to resume data collection. Monthly sonde instrument exchanges, maintenance, and data management for all South Slough sites were completed following NOAA NERRS Centralized Data Management Office protocols.
Accomplishments/Successes: Water quality and meteorological time-series data were integrated into collaborative research and education programs at the Reserve. A NERRS wide data synthesis project to understand trends and drivers of change in hypoxia and eutrophication across Reserve sites was completed at the end of 2025 with manuscript revisions submitted to Nature, Communications Earth & Environment January 2026. The Reserve's 2024-2026 Margaret Davidson fellow is utilizing water quality data near green crab monitoring sites to understand trophic relationships and diets of wild crabs. A University of Oregon graduate student is researching sediment dynamics in kelp forests and has accessed meteorological and water quality data, including turbidity and TSS. The Reserve education and science program accessed water quality datasets for hosting OSU's Estuarine Ecology course in October 2025.
Problems/Delays: The Charleston Bridge and Valino Island water quality pilings were recently replaced at the end of November 2025 and staff are planning for instrument deployment overlaps

at the two stations once two sonde instrument packages are acquired. Data collection is continuing in the meantime at the original old piling locations.

BEACHES AND SHORELINES

Maintain core elements of beach and shoreline observing: Measure nearshore bathymetry, topographic beach profiles, and shoreline morphodynamics along OR and WA, contributing to hazard mitigation by providing essential observations and better decision support tools for coastal managers, planners, and engineers.

Washington Beach and Shoreline:

- *Maintain shoreline observations in WA at existing levels [Kaminsky]*
- *Deliver data via NVS [Kaminsky]*
- *Bring all data QA/QC to meet Certification standards [Kaminsky]*

Status: Complete for the season

Summary: NANOOS funds contribute to the Washington State Department of Ecology Coastal Monitoring & Analysis Program (CMAP) under technical direction by G. Kaminsky. This progress report summarizes the work completed during the reporting period under the interagency agreement to monitor Pacific Coast shorelines within the Columbia River littoral cell and South Beach near Kalaloch. Additionally, it highlights supplementary work made possible by leveraging other state and federal funding sources to enhance and expand CMAP's baseline monitoring efforts. These supplementary efforts build on shoreline monitoring data by delivering technical support to vulnerable coastal communities, monitoring additional sites, and advancing research on nature-based shoreline protection, further amplifying the impacts of NANOOS-funded work.

During this reporting period, the CMAP team completed summer and fall seasonal beach monitoring surveys in southwest Washington and northwest Oregon, including the beaches of Long Beach, Grayland Plains, North Beach, and Clatsop Plains, which make up the Columbia River littoral cell (CRLC). Additionally, in August, over 200 beach profiles were collected in key parts of the littoral cell to extend nearshore bathymetry profiles collected by the U.S. Geological Survey and Oregon State University using personal watercraft. In September/October and December, the CMAP team collected 96 cross-shore beach elevation profiles (up to 50 per season), 16 ATV surface maps, and nearly 60 sediment samples along 135 km (84 mi) of shoreline. Seasonal beach profile data and contour change plots are made available through the NANOOS Visualization System: Beach and Shoreline Changes portal. The portal has been updated with data through fall 2024, and is typically updated annually. Data for 2025 is expected to be added to the portal in early 2026. Observations from this dataset are used to inform Washington State Parks on permits that allow beach sand harvests for cranberry growers in Grayland. Data show the practice has been sustainable and without significant impact in terms of beach stability, but recent fluctuations in beach change suggest additional monitoring of the sand extraction area is warranted to determine any localized or cumulative effects.

The CMAP team continues to monitor active and planned dynamic revetments along Washington's Pacific Ocean coast at Westport, North Cove, Graveyard Spit, Benson Beach, and Ocean Shores as well as a natural analog at South Beach on the Olympic Peninsula. Our team provides data & monitoring results to these local communities to help inform their maintenance and adaptive management efforts. G. Kaminsky is coordinating with Webcam Coastal Observation System (WebCOOS) partners on the installation of a webcam for monitoring the effect of wave runup on the dynamic revetment and adjacent unprotected dune at the Westport by the Sea condominiums in Westport, WA. The first of two cameras was installed on November 15th. An annual update on beach and dynamic revetment monitoring was developed and shared with the homeowners association in September to help inform their maintenance activities. An annual report was delivered to the National Park Service documenting monitoring work completed and major

findings at South Beach over the past year as part of our permit requirement. Data collected by CMAP is regularly shared with engineering consultants who are designing and adaptively managing these modified shorelines. PI Kaminsky provided recommendations to WSDOT for modified design approaches for constructing a more resilient transition between static and dynamic structures at the root of Graveyard Spit.

In July, CMAP collaborated with the U.S. Geological Survey to complete beach and nearshore profile monitoring along the Elwha River delta and eastward along the Elwha bluffs to Ediz Hook, with bathymetric profiles extending along Ediz Hook. The survey has been performed annually from 2004 to 2013 around the delta and was then extended toward Ediz Hook in 2014 with annual data collection except in 2023. The monitoring data has enabled an unprecedented opportunity to examine the coastal response to restoration of sediment supply through removal of the Elwha and Glines Canyon dams between 2011 and 2014.

The CMAP team has started making progress towards releasing the long-term seasonal CRLC monitoring dataset on the web. CMAP is collaborating with DOGAMI to release both the Oregon and Washington beach profile data as two separate collections on the NOAA National Centers for Environmental Information (NCEI) website. We are currently in the process of preparing standard data formats and metadata.

Accomplishments/Successes: Data collected by the CMAP team continues to be used by the U.S. Army Corps of Engineers and various engineering consultants (e.g., Mott MacDonald at Oyhut Bay, Moffatt and Nichol at North Cove, and Blue Coast LLC at Westport) to assess local and regional coastal changes on Washington beaches, particularly at locations with dynamic revetments. Our expanded team of Coastal Engineers provides ongoing technical assistance to local communities like Westport by the Sea, North Cove, and Ocean Shores, as well as shoreline planners at Ecology in the review and evaluation of shoreline development projects along Washington's shorelines.

The CMAP team started to regularly deploy their new unmanned aerial systems (UAS) equipped with cameras and a lidar sensor to augment field surveys at the Oyhut Bay, Westport, North Cove, and Graveyard Spit dynamic revetments. Funding from the NANOOS Topic 1: Increasing Coastal Resilience and Equitable Service Delivery project (subaward UWSC15906) was leveraged to purchase the new lidar-drone system. The results have enhanced the resolution of 3D topographic surface maps and will improve our understanding of how these structures perform and how upland topography affects coastal flooding in a more comprehensive way. The UAS have also been helpful for rapid deployments to assess the impacts of coastal storms. At Ocean Shores, the UAS have enabled us to collect valuable data on the breach of Damon Spit and damage to marina infrastructure – areas adjacent to our project site, but critical to monitor for longer-term assessment of hazards and strategic mitigation planning. At Graveyard Spit, the UAS enhanced the resolution of CMAP's topographic survey for assessing the condition of the dynamic revetment under construction and in need of adaptive construction due to end scour and high longshore cobble transport at the root of Graveyard Spit. Ongoing work seeks to establish standardized processing workflows for feature mapping, profile extraction, quantifying surface change, and developing understanding how to use UAS data to effectively monitor large wood and vegetation.

We successfully hired a new CMAP Unit Supervisor (D. Buscombe) as well as two Natural Resource Scientist 3 positions (M. Kelley and K. DeVore) to help with maintaining and publishing the CRLC dataset, creating improved standard data products, updating the NVS website, and increasing our overall capacity for delivering technical support to coastal communities, advancing research into the optimal design, monitoring, and effectiveness of coastal resiliency infrastructure, and the geographic expansion of monitoring efforts.

Problems/Delays: Progress in processing all seasonal topographic survey data continues to be slow due to workload demands on staff. Attention has been given to sites with dynamic revetments to assess performance for providing technical guidance to local communities to help them prepare

for winter storms and king tides. Training for new staff on data processing is scheduled for January 2026. CRLC plots on NVS are available through December 2024 but an update is planned for early 2026 that will include a significant upgrade to the aesthetics, making the plots more intuitive to users. We also have a backlog of sediment samples, but significant progress is being made on processing these samples and interpreting the results, starting at the mouth of the Columbia River and working north, to try to get a more complete understanding of how sediments have changed in conjunction with observed morphology.

Oregon Beach and Shoreline:

- *Maintain shoreline observations in OR at existing levels [Allan]*
- *Deliver data via NVS [Allan]*
- *Bring all data QA/QC to meet Certification standards [Allan]*

Status: Complete for the season

Summary: The Oregon Beach and Shoreline Mapping Analysis Program (OBSMAP) efforts are led by J. Allan and his team at the Oregon Department of Geology and Mineral Industries (DOGAMI). Beach profile data – summer and fall surveys – were successfully collected in the Rockaway littoral cell (25 sites), along the Clatsop Plains (6 sites), and along the Neskowin cell (15 sites). Summer surveys were performed along the Newport littoral cell from Yachats to Otter Rock (73 sites, first time since 2022). Terrestrial scanning of the Beverly Beach littoral cell on the central Oregon coast was also collected (3rd year of activity), while new scan sites were established between Seal Rock and South Beach. Summer surveys were undertaken between August and October, 2025, while Fall surveys were completed in December. In addition to measurements of the transects, datum-based shorelines were also collected along each of the study areas. Beach profile and shoreline data have been processed, QA/QC'd, and archived both locally and remotely. The reduced profile plots, change plots, and trends have been posted to the NANOOS beach and shoreline portal.

DOGAMI staff continue to experiment with the use and application of a terrestrial laser scanner (TLS) to collect additional change information at various sites on the Oregon Coast, including the Columbia River dynamic revetment and foredune adjacent to the south jetty, and in the Newport area. An initial baseline scan was completed in October 2023 in the Newport area at Beverly Beach, with follow-up scans collected in April 2024, May 2025, and most recently in August 2025. Post-processing of these data continues to demonstrate the utility of this measurement approach, documenting bluff erosion changes over areas spanning several hundred m^2 at 13 of 15 transect sites. The scanning also captured preliminary documentation of differential bluff movement at several known coastal landslide sites in the Beverly Beach littoral cell. These data continue to be evaluated. DOGAMI staff were also able to implement new TLS scans on high coastal bluffs located between Yachats and South Beach in August 2025, establishing an initial baseline from which future scans (and lidar) can be compared against.

DOGAMI staff worked with NOAA National Centers for Environmental Information (NCEI) to begin the process of archiving and releasing Oregon's long-term OBSMAP seasonal monitoring datasets on the web. The sites presently under consideration are those in the Neskowin and Rockaway littoral cells and on the Clatsop Plains. DOGAMI is also assisting WA CMAP with their data archiving to ensure there is consistency between both sets of monitoring data. DOGAMI has already completed development of the OBSMAP metadata and is presently working to update the time series data.

DOGAMI PI Allan also provides assistance to NANOOS UPC. This includes maintaining and updating the long-term WaveWatch III wave and wind anomalies that are updated approximately every 2 months, as well as performing daily updates to the Regional PNW Wave and Wind Forecasts.

Accomplishments/Successes: Data collected as part of OBSMAP continue to be used by regional coastal managers (e.g., Oregon State Parks, Oregon Department of Land Conservation and Development agency), geoconsultants (e.g., work to evaluate dune grading options at Seaside) and the public to assess local and regional coastal changes taking place on Oregon beaches. Results from our monitoring were used by an OSU PhD student (under PI Ruggiero) to field-check satellite-based shoreline extractions and for future shoreline modeling, and for examining teleconnections in beach and shoreline responses to climate driven events. These data were recently published: Mohsen Taherkhani, Sean Vitousek, Marcan Graffin, Kilian Vos, Jonathan C Allan, George M Kaminsky, Peter Ruggiero, ENSO and PDO drive shoreline position anomalies in the US Pacific Northwest, *PNAS Nexus*, Volume 5, Issue 1, January 2026, pgaf404, https://doi.org/10.1093/pnasnexus/pgaf404
Problems/Delays: Weather delayed our fall survey of the Neskowin littoral cell (15 sites) in December. A backup survey is now scheduled for the end of January 2026.

Washington and Oregon Bathymetry:
- *Maintain nearshore bathymetric observations of beach and shoreline morphodynamics in WA and OR at existing levels [Ruggiero]*
- *Deliver data via NVS [Ruggiero]*
- *Bring all data QA/QC to meet Certification standards [Ruggiero]*

Status: Complete for the season
Summary: NANOOS funds contribute to P. Ruggiero's lab group at Oregon State University. This progress report summarizes the work completed during the reporting period under the interagency agreement to monitor Pacific Coast shorelines within the Columbia River littoral cell and Newport, OR. Additionally, it highlights supplementary work made possible by leveraging other funding sources to enhance coastal resilience in Cascadia coastal communities.

In collaboration with the Washington State Department of Ecology and the U.S. Geological Survey, P. Ruggiero's group at Oregon State University collected nearshore bathymetry data along the four sub-cells of the Columbia River littoral cell (CRLC). Over 220 individual cross-shore profiles were collected during summer 2024 extending from the lower inter-tidal to ~12 m of water depth (~2000 m from the shoreline). Approximately 400 kilometers of nearshore mapping took place within ~6 days of field data collection. These data have been processed from their raw format into deliverable text files and have passed a rigorous quality assurance process. In all cases, these nearshore bathymetry measurements have been combined with topographic measurement collected by Ecology developing complete maps of the nearshore planform. Ruggiero's group also collected nearshore bathymetry along the Newport littoral cell in Oregon to support field experiments and modeling efforts focused on the influence of the region's basalt reef on wave propagation. This collaborative field campaign is benefiting the US Army Corps of Engineers and other regional stakeholders. Data through 2023 are available via Stevens, A.W., Weiner, H.M., Wood, J.M., Ruggiero, P., Kaminsky, G.M., and Gelfenbaum G.R., 2019, Beach topography and nearshore bathymetry of the Columbia River littoral cell, Washington and Oregon (ver. 4.0, January 2024): U.S. Geological Survey data release, https://doi.org/10.5066/P9W15JX8. We expect data through 2025 to be released in winter 2026.
Accomplishments/Successes: These data continue to provide a critical source of information for improving coastal hazard mitigation along the coastlines of the CRLC and for understanding the morphodynamics of high-energy beaches (Figure PR. 1). For example, P. Ruggiero co-authored a paper summarizing the influence of climate variability on shoreline evolution along the Oregon and Washington coastline (Mohsen Taherkhani, Sean Vitousek, Marcan Graffin, Kilian Vos, Jonathan C Allan, George M Kaminsky, Peter Ruggiero, ENSO and PDO drive shoreline position anomalies in the US Pacific Northwest, *PNAS Nexus*, Volume 5, Issue 1, January 2026, pgaf404, https://doi.org/10.1093/pnasnexus/pgaf404).

Problems/Delays: None

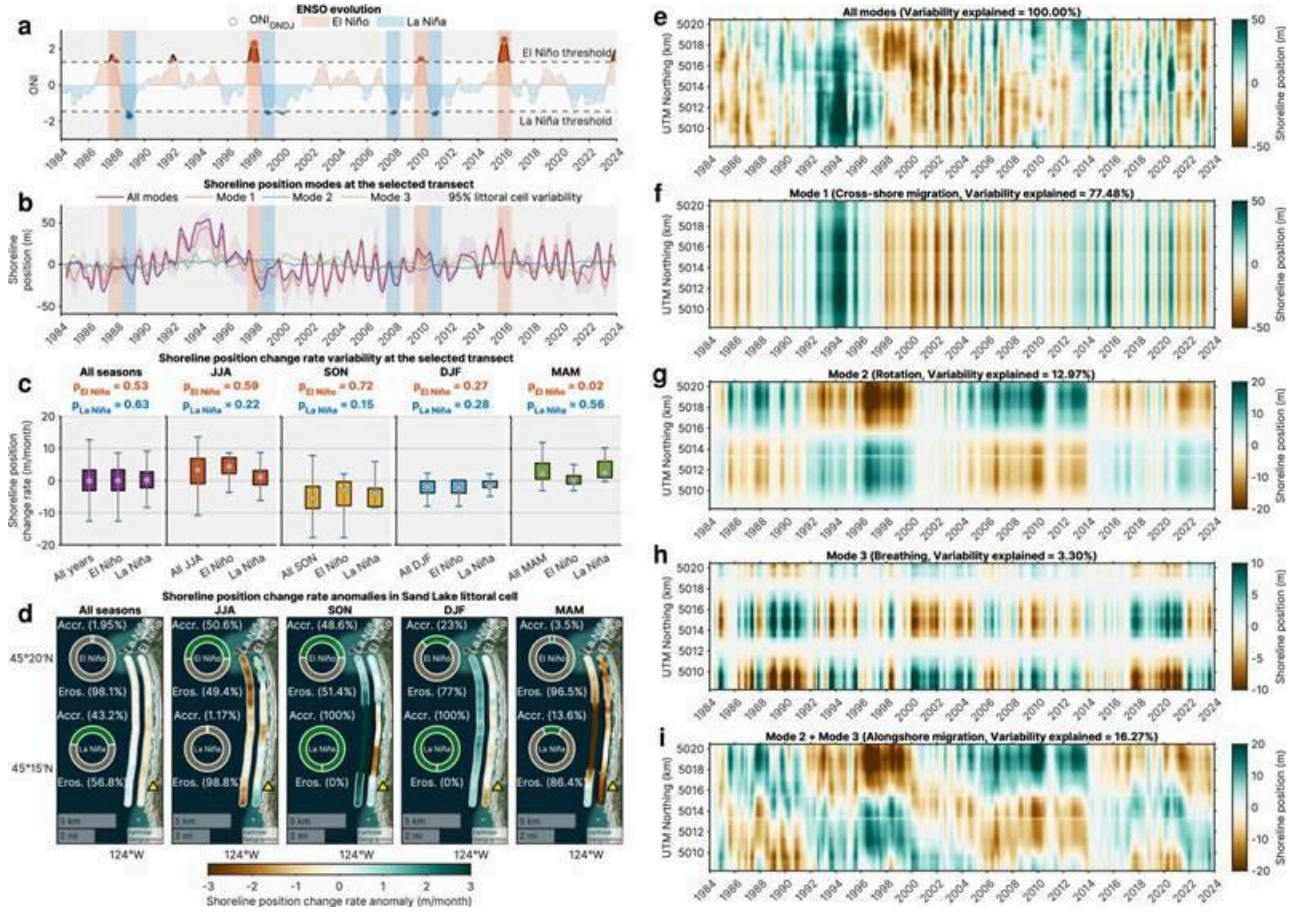

Figure PR. 1. Seasonal teleconnections between ENSO and shoreline positions in Sand Lake littoral cell. a) The evolution of ENSO (i.e. ONI index) during 1984– 2024; four selected "strong" El Niño and La Niña years, determined by their average ONI values during the October–November–December–January period (ONIONDJ), are marked with vertical red and blue stripes, respectively. b) Detrended (i.e. eliminated the linear fit to the 40-year shoreline position time series) shoreline positions and their top three dominant modes of variability derived via EOF analysis at a selected transect in this littoral cell (the location of this transect is shown via a yellow triangle in (d)). c) Box plots of shoreline position change rates in all years of record and the selected ENSO (El Niño and La Niña) years during a full wave year and individual boreal seasons in the selected (example) transect in this littoral cell. In these box plots, the central mark signifies the median, while the lower and upper edges of the boxes represent the 25th and 75th percentiles, respectively. The whiskers reach the furthest data points that are not classified as outliers. d) Anomalous shoreline position change rates throughout the entire Sand Lake littoral cell; positive (negative) values correspond to accretional (erosional) trends and transects with statistically significant anomalous shoreline position change rates (i.e. P<0.05) are enclosed by black circles. Also, the donut charts depict the proportion of transects in this littoral cell corresponding to anomalous erosional/ accretional-rate behavior during El Niño and La Niña years and seasons. e–i) Spatiotemporal representation of (linearly detrended) shoreline position variability and its corresponding top three dominant modes in this littoral cell calculated via EOF analysis. In this littoral cell, as in most other littoral cells in the PNW, mode 1 represents cross-shore migration, accounting for a substantial portion of shoreline position variability. Modes 2 and 3 in this littoral cell effectively illustrate the rotation and breathing patterns, respectively, while their combination effectively represents the alongshore sediment transport. Credit: basemaps, Earthstar Geographics (via MATLAB).

B. Modeling & Analysis Subsystem:

WA & OR ESTUARIES & COAST MODELS

Provide sustained support to a community of complementary regional numerical models: Contribute to the operation of regional models, and the tools and products they support, covering the head of tide of estuaries to the outer edges of the Exclusive Economic Zone (EEZ) in both OR and WA.

NE Pacific and Salish Sea:

- *Support, at existing levels, the daily forecast model, LiveOcean, which simulates ocean circulation and biogeochemistry in the Salish Sea and in coastal waters of the NE Pacific, including Oregon, Washington, and British Columbia [MacCready]*
- *Deliver model output via NVS [MacCready]*
- *Model verification and validation [MacCready]*

Status: On track

Summary: During this reporting period NANOOS support allowed for continued upgrades of the LiveOcean model system. Daily forecasts from the large NE Pacific domain and the nested Willapa Bay-Grays Harbor and South Puget Sound domains were reliably produced during this period and distributed to the public and stakeholders through the NANOOS NVS, the LiveOcean website, and a NANOOS server.

Accomplishments/Successes: In this period we continued testing and improving the latest version of the model. By adding 50% burial of organic carbon particles that sink to the sediment of the Salish we substantially improved the modeled pCO_2 in the deep water, which is important for our work on ocean acidification and marine carbon dioxide removal. We are 75% finished with a new long hindcast (October 2012 to present, cas7_t1_x11ab) with the improved model. We published a study, Xiong et al. (2025, JGR), quantifying the effect of the estuarine exchange flow on budgets of heat, nitrogen, and oxygen in the Salish Sea. This paper also documents many previous model improvements and validation. We made improvements to the smoothing of bathymetry in the intertidal region, leading to more reliable forecasts from the nested sub-models.

Problems/Delays: None

Columbia River Estuary and Plume:

- *Support, at existing levels, the CRITFC circulation modeling and forecasting system, which covers the Columbia River estuary and plume [Seaton]*
- *Deliver model output via NVS [Seaton]*
- *Model verification and validation [Seaton]*

Status: On track

Summary: CRITFC has maintained an extensive modeling system for the Columbia River coastal margin, denoted Virtual Columbia River (VCR). The VCR has evolved from multi-institutional collaborations involving modelers and non-modelers, in academia and across regional, federal, and tribal agencies. The modeling capabilities of the VCR has assisted the region in the study of salmon life cycle, habitat, estuarine pathways, and status under the Endangered Species Act and in relation to hydropower management and climate change.

Anchoring the system are simulations of circulation, conducted in four distinct forms: (1) daily forecasts, (2) multi-year simulation databases, currently 1999-2018, (3) scenario simulations, and (4) process simulations. Of these, daily forecasts are displayed on NVS. To meet the challenges that the highly energetic and strongly stratified Columbia River estuary and plume pose to numerical models, we have experimented with—and contrasted among—multiple codes (Thetis, SLIM, SELFE and SCHISM) representing different classes of unstructured-grid finite element methods.

Accomplishments/Successes: Maintained forecasts, with forecast overlays provided through CMOP website and NVS. During this reporting period we have continued calibration and evaluation of a new SCHISM model to be used for a new multi-year simulation database and eventual updated forecast. CMOP model data management and visualization servers were upgraded to modern hardware (hardware purchased with non-NANOOS funding) and operating systems.
Problems/Delays: CMOP server transition has interrupted display of forecast on NVS. Forecast transfer method will be modernized during this transition to upgrade display on NVS. Restoration of modernized display of forecasts in NVS is expected early in 2026.

PNW Coastal Waters:
- *Support, at existing levels, the OSU real-time coastal ocean forecast model, which covers the coastal waters off OR and WA [Zaron]*
- *Deliver model output via NVS [Zaron]*
- *Model verification and validation [Zaron]*

Status: On track
Summary: We continued real-time operation and support of our RTDAOW (Real Time Data Assimilation for Oregon and Washington) system on a daily basis. The data delivery is near-real-time and stable. At this moment we do not anticipate any substantive changes to the project Scope of Work.
Accomplishments/successes: We completed the transition from Dr. Erofeeva to Dr. Goncalves for producing daily forecasts. The data assimilation and modeling system continue to provide real-time forecasts to fishers and the public via the NANOOS Visualization System.
Problems/delays: None

FY25 Non-core Task 1: *Salish Sea & Columbia River Operational Forecast System v2 (SSCOFS) [Khangaonkar/Yun]*
- *Add temperature and salinity variables from SCCOFS v1 to NVS*
- *Build SSCOFSv2 using SCHISM*
- *Expand the model domain into coastal estuaries and refine lateral resolution*
- *Conduct skill assessment*
- *Add biogeochemical forecast capability for Salish Sea region*

Status: On track
Summary: Funds were distributed to UW PI Khangaonkar and the subaward to PNNL for co-PI Yun was executed.
Accomplishments/Successes: N/A
Problems/Delays: N/A

FY25 Non-core Task 2: *Advancement of Coupled Ice-Ocean Forecast Capabilities in STOFS-3D-Alaska [Durski]*
Status: On Track
Summary: We continue work with OCS-CSDL to develop a three-dimensional coupled ice-ocean forecast system for the coastal waters of Alaska (STOFS-3D-Alaska). This year as part of the task of continuing to improve the fully two-way coupled CICE(sea ice)/ 3-D SCHISM(ocean) Bering Sea model. This coupling is achieved within the Unified Forecast System framework using the NUOPC interoperability layer. In our analysis of the system performance we discovered issues with the data-atmosphere-ocean model coupling in UFS that caused sea surface temperatures to deviate strongly from observations, leading to delayed melting of sea ice. We have led efforts to update the SCHISM coupling module to alleviate these issues and are in the process of evaluating both the summer ice-free model performance within UFS and the winter time response with the improvements to the UFS SCHISM coupling interface. We have worked with the UFS NOAA team

to ensure that the CICE-standalone (with data-atmosphere through CMEPS) passes all regression tests as well. Continued collaboration with the UFS-coastal team is ensuring that the model development meshes seamlessly with other components of the coupled modeling framework.
Accomplishments/Successes: Finished regression testing of coupled CICE-CMEPS in UFS. Improved the SCHISM-UFS interface ('cap') to more accurately represent surface flux exchange between models.
Problems/Delays: None

FY25 Non-core Task 3: *Initiate the design of NOS operation model infrastructure to support the development and operations of AI coastal models or hybrid AI-numerical models [Zaron]*
Status: On track to commence in the next reporting period, January-June 2026.
Summary: Project planning and correspondence with our NOAA POC, Alexander Kurapov has begun.
Accomplishments/Successes: We are surveying the capabilities and limitations of existing software for developing hybrid AI-numerical models, principally the NSF-funded ForestClaw and Norwegian Research Council-funded gpuocean projects for massively parallel gpu-enabled fluid solvers.
Problems/Delays: None. Substantive work on this project will begin in the January-June 2026 timeframe.

C. Data Management & Communications Subsystem:

DATA MANAGEMENT & CYBERINFRASTRUCTURE (DMAC)
Maintain, harden, and enhance NANOOS' Data Management and Cyberinfrastructure (DMAC) system for routine operational distribution of data and information: Sustain and enhance the DMAC system, including the NANOOS Visualization System (NVS), for dynamic and distributed data access.

Mature Regional DAC Operations:
- *Sustain, refresh, and enhance a highly available, robust, distributed hardware and software environment; maintain appropriate staffing and team coordination; maintain up-to-date operations and system documentation to ensure transparent and clear descriptions of DAC architecture [Tanner, Travis]*

Status: On track
Summary: Continued maintenance and development of BlueHarvest, as needed. BlueHarvest is the internal NANOOS DMAC application for harvesting data from a wide range of data providers. The system is robust and maintains flexibility to accommodate a wide range of data providers/sources. It populates the NANOOS internal database in a standardized way so the data can be easily integrated into the various data products served on NVS. BlueHarvest also provides immediate feedback about data transmission frequency/latency, which enables NANOOS to identify and fix data flow issues more efficiently.
Accomplishments/Success: Consistent, reliable data harvesting.
Problems/Delays: None

- *Engage new local providers (not NANOOS funded), integrate their data into NVS and IOOS DMAC services; strengthen DAC capabilities and resources through regional and thematic partnerships [Tanner, Travis]*

Status: On track
Summary: Created new harvester for Ocean Networks Canada (ONC) platforms.
Accomplishments/Successes: Harvesting data from ONC platforms: Saanich Inlet, VENUS Strait of Georgia Central, VENUS Strait of Georgia East. Added Quinault spotters to data harvester.
Problems/Delays: None

NVS Support and Development:

- *Maintain NVS support leveraging regional user needs, feedback, and data reviews to continually improve the relevance and quality of metadata for observing and modeling data assets integrated and served by NANOOS [Tanner, Carini]*

Status: On track
Summary: Updated Oregon communities and brochure links in TsunamiEvac app. Added Quinault spotters to NVS. Updated OSU Yaquina harvester. Updated BlueHarvest NWEM harvesting to reference QC flags. Updated Maritime Operations app to reflect Coast Guard Needs. Started development of model transect viewer tool.
Accomplishments/Success: Updates to apps, new platforms, development of model transect viewer tool.
Problems/Delays: None

- *Sustain & enhance existing data streams, IOOS web services, GTS submission; implement NCEI data archiving, NDBC data archiving, Glider DAC submission, QARTOD; maintain and expand ERDDAP to leverage web services, serve NANOOS applications and users; evaluate where new tech (e.g., cloud, AI, etc.) may afford NANOOS better efficiencies and robustness [Tanner, Travis, Carini]*

Status: On track
Summary: All NANOOS gliders transmit their data to the Glider DAC. All NANOOS HFR transmit their data to the HFR DAC. All NANOOS-funded buoys/moorings and dock/land-based stations are visible in the NANOOS ERDDAP. Relevant data is harvested by NDBC to ensure availability for GTS ingestion.
Accomplishments/Success: Maintained existing data streams.
Problems/delays: The Columbia River Estuary buoys and land-based stations experienced a disruption to their automatic archival process to NCEI. The NANOOS DMAC team and CMOP PIs have a meeting scheduled with NCEI to re-establish this pathway and to discuss other NANOOS buoy/mooring data pathways.

Engagement in National and Cross-regional DMAC Efforts:

- *Sustain participation in IOOS DMAC community activities, including QARTOD development, semantic mapping, OGC WMS/WFS support, climatology data development, UGRID support, and shared code development and testing [Tanner, Travis, Carini]*

Status: On track
Summary: Travis attended IOOS DMAC webinars. The DMAC team regularly participates in national DMAC efforts. Travis, Carini, and Tanner anticipate contributing ideas to the IOOS DMAC Annual Meeting agenda and participating in the meeting both in-person and remotely.
Accomplishments/Successes: None
Problems/Delays: None

- *Extend to other areas via pan regional products with sister IOOS RAs; engage and leverage NSF-funded OOI, international GOA-ON activities, and Canadian collaborations; engage with other West Coast and Pacific efforts, including WCGA and IPACOA [Tanner, Carini]*

Status: On track
Summary: Worked with Ocean Networks Canada (ONC) to understand their data workflow and services. Developed new BlueHarvest harvesters to download and process data from ONC time-series and profile data streams.
Accomplishments/Successes: Development of capabilities to harvest time-series and profile data from ONC services.
Problems/Delays: None

FY25 Non-core Task 4: *For IOOS sponsorship for OceanHackWeek [Lee, Wu-Jung]*
Status: Complete
Summary: OceanHackWeek 2025 (OHW25) was held on 18-22 August 2025 at the UW School of Fisheries and Aquatic Sciences. The event was attended by 6 organizers, 4 "fellows," and 29 participants.
Accomplishments/Successes: OHW25 engaged participants ranging from undergraduate, graduate, postdocs, to early career scientists, who jointly developed a total of 7 group "hack" projects hosted on the OHW GitHub organization (https://github.com/oceanhackweek). The fellows were engaged in the event organization process from early on and functioned as project mentors and helpers throughout the event.
Problems/Delays: None

FY25 Non-core Task 5: *For support of OceanHackWeek-style events in 2025 and 2026 [Lee, Wu-Jung]*
Status: On track
Summary: A portion of Task 5 funds were used to support participant and organizer travel to OHW25. See Task 4 for details.
Accomplishments/Successes: See Task 4
Problems/Delays: None

USER PRODUCTS COMMITTEE (UPC)
Continue to deliver existing and, to the extent possible, create innovative and transformative user-defined products and services for PNW stakeholders: Continue our NVS innovation to succeed in this vital translation for meaningful and informative data products that address user needs and serve society.

Website:
- *Continue to evaluate and update web content relevant to stakeholder issues, especially those related to Maritime Operations, Ecosystem Assessment, Fisheries & Biodiversity, Coastal Hazards, and Climate; improve ease of usability and user tracking capabilities [Tanner]*

Status: On track
Summary: Add new items to the slideshow. Converted multi-stressors cruise animations section to function like plots section. Setup proxy and subdomain for APL IFCB dashboard. Updated San Juans PEF data files. Added additional locations to PNW Wave and Wind Forecasts product page. Created Education Student Interactions section and Expedition page.
Accomplishments/Successes: New and updated content.
Problems/Delays: None

Tailored Products Development:

- *Annually evaluate priorities for products at the Tri-Com meeting (DMAC, UPS, and E&O), based on outreach feedback, regional issues, and GC input, and will implement new tailored products to the extent possible [Tanner]*

Status: On track

Summary: This committee is composed of members from OHSU, UW, OSU, NANOOS E&O, and NOAA. NANOOS UPC chair Tanner participates in weekly "tag-up" calls with members from DMAC, UPC, E&O, and Web development to facilitate consistent work efforts, synergy across the committees, and improvements to product development and enhancements. Activities for this period centered around weekly NANOOS meetings.

Accomplishments/Success: Added Quinault spotters to NVS. Updated TsunamiEvac App Oregon Communities. Added additional locations to PNW Wave and Wind Forecasts product page. Created Education Student Interactions section and Expedition page. Created harvester for ONC. Added SWIFT/NDBC/CDIP platforms to BB apps. Updated Maritime Operations app to reflect Coast Guard Needs. Started development of model transect viewer tool.

Problems/delays: None

<u>EDUCATION & OUTREACH (E&O)</u>

Sustain and expand NANOOS engagement to the extent possible: Continue ongoing engagement with stakeholders and the public, increasing ocean awareness and literacy; to expand the ocean and coastal workforce; to improve our ability to provide relevant ocean and coastal data and information to communities; and to facilitate use of NANOOS products for societal objectives, the core task for which NANOOS exists.

Communication:

- *Maintain up-to-date success stories, employing effective use of social media and newsletters [Wold, Newton]*
- *Support national communication through IOOS Program Office and IOOS Association collaborations [Wold, Newton]*
- *Be responsive to regional and local events (e.g., harmful algal blooms, fish kills, marine heat waves, hypoxia, floods, etc.) to enhance relevance to public and highlight regional stories with NANOOS members and partners [Wold, Newton]*
- *Maintain existing and build new relationships to stakeholder user groups and the education community enabling NANOOS to achieve effective education and outreach [Wold, Newton]*

Status: On track

Summary: During this reporting period, NANOOS staff engaged with end users and educational partners (fishers and boaters in Washington and Oregon, Northwest Aquatic Marine Educators Conference, Pacific Coast Shellfish Growers Association Conference, Maritime Blue's One Ocean Week, USCG Sector Puget Sound, Marine Exchange of Puget Sound), mentored 10th graders at the Maritime High School, mentored an undergraduate UW Earthlab intern working with lesson plans that bring NVS data into the classroom, maintained content on social media, newsletters, website slideshow, etc., and regularly participated in IOOS Outreach and IOOS Strategic Communications committee meetings.

Accomplishments/Successes: Kickoff collaboration with Oregon Sea Grant and Oregon State University

Problems/Delays: None

Product Co-Development:

- *Engage users in product co-development through focus groups; use targeted interviews or surveys to garner feedback and input on products as they are developed; gain feedback and conduct self-assessment after product release [Wold, Tanner]*
- *Conduct trainings to broader user groups and evaluate trainings to optimize NANOOS functionality [Wold]*
- *Engage with regional formal education communities to use ocean observing and NANOOS products to support STEM education, and with regional non-formal education communities to facilitate the use of NANOOS products to foster community ocean literacy [Wold, Tanner]*

Status: On track
Summary: Incorporated informal user feedback, collected via engagement activities by Wold and Tanner, into enhancing NVS.
Accomplishments/Successes: Enhanced "Share My View" capability, additional "Current Conditions" variables
Problems/Delays: None

FY25 Non-core Task 12: *To support GOA-ON, J-Scope, and C-CAN outreach/education project [Newton]*

GOA-ON [Tanner/Newton]
Status: On track
Summary: Newton continued to serve as co-Chair of *Global Ocean Acidification Observing Network* (GOA-ON), along with Steve Widecombe, University of Khorfakkan. She represented IOOS on GOA-ON Executive Council calls and activities. Newton oversaw the efforts of NANOOS to power the GOA-ON web and data portal.

Tanner maintained the GOA-ON website, with updates to slideshow, webinars, and the addition of new regional hub pages. He updated the platform data harvester.
Accomplishments/Successes: Over the period, Newton aided the following activities: Newton participated in GOA-ON's online "OA Week" having supported the Secretariat on early planning and participating in sessions. She also attended meetings over the period on planning for the GOA-ON Executive Council meeting to be held the week before the Ocean Sciences Meeting in Glasgow, Scotland, and organizing planning for the Oceans in a High CO_2 World.

Tanner updated the GOA-ON member list harvester to use Google Docs API, updated GOA-ON LAOCA and North American Hub content, and worked on developing an automated platform metadata harvesting tool for the GOA-ON data portal.
Problems/Delays: None

J-SCOPE [Tanner]
Status: On track.
Summary: Tanner works with content provided by Samantha Siedlecki to create web pages for J-SCOPE forecasts.
Accomplishments/Successes: There were no J-SCOPE forecasts during this reporting period.
Problems/Delays: None.

C-CAN outreach/education project [Chadsey, Washington Sea Grant via Newton]
Status: On track
Summary: Progress was made during the period on Goal 1 (Education & Outreach subcommittee meetings). Washington Sea Grant student assistant Isaac Olson worked with CeNCOOS Engagement Specialist Alexandra Boutros to convene a C-CAN Outreach & Education working group of 15 west coast researchers, fishers, tribal representatives, and extension professionals to

inform the development of ocean acidification outreach products for west coast fishing communities. The full group met twice between July and December 2025 to discuss the target audience, content, and format of these products, and select a graphic designer. Outcome: over the next six months, they will design and produce a set of posters tailored to tribal and non-tribal fishermen in each of the three west coast states (WA, OR and CA).
Accomplishments/Successes: None yet
Problems/Delays: None

Ocean Workforce Pipeline Development:
- *Work with the other IOOS regions and the Program Office on workforce development initiatives to expand the ocean, coastal, and Great Lake workforce and to improve our ability to provide relevant ocean and coastal data and information to communities who need it. [Newton, Wold]*
- *On a more immediate and local scale, NANOOS actions that match NANOOS' commitment ability to foster opportunities for new entries to the ocean observing workforce [Newton, Wold]*

Status: On track
Summary: During this reporting period: NANOOS and partners supported summer interns at APL-UW funded by UW Earthlab, and at OSU co-funded by NANOOS and CRITFC.
Accomplishments/Successes: NANOOS staff hosted EarthLab summer interns through August 2025, worked with TAF@Saghalie educators to develop OA lesson plans in September 2025, mentored students at the Maritime High School throughout the year.

NANOOS and CRITFC co-funded a research-based internship for two tribal undergraduate students in coastal oceanography and underwater gliders. Working in Dr. Jack Barth's OSU glider lab, the interns gained experience in data analysis, glider maintenance, and at-sea deployments, contributing to research on hypoxia off the Pacific Northwest coast. The program is part of CRITFC, NANOOS, and OSU's broader effort to cultivate the next generation of tribal ocean scientists.

NANOOS co-sponsored two undergraduate students (with UW School of Oceanography) that sailed on the Statsraad Lehmkuhl expedition between Seattle and San Francisco. They were part of twelve UW students who Newton and other NANOOS staff (Rome and Hana Busse) mentored while on the cruise. The students, who ranged from a sophomore undergraduate to PhD candidate, wrote short reflections that can be viewed here:
https://www.nanoos.org/education/student_experiences/statsraad_lehmkuhl_expedition.php
Problems/Delays: None

D. Governance & Management Subsystem:

Governance:
- *Assure that NANOOS has transparent, effective, and representational governance via its Governing Council and the NANOOS Executive Committee composed of its elected Board and its functional committee chairs [Newton, Carini, Rome,UW]*
- *Assure these bodies are engaged in NANOOS prioritization of regional needs, work effort, and product development [Newton, Carini, Rome,UW]*
- *Assure balance of stakeholders represented in NANOOS reflects that found in PNW [Newton, Carini, Rome,UW]*
- *Conduct annual GC meeting [Newton, Carini, Rome,UW]*

Status: On track
Summary: Newton (NANOOS Executive Director), Carini (NANOOS Deputy Director), and Barnard (NANOOS Board Chair) continued to provide leadership to NANOOS operations and connection to the US IOOS enterprise. Newton, Carini, and Rome (NANOOS Senior Program Manager) assured progress on the above milestones. Carini was on FMLA for some of the period, returning in early September.

Accomplishments/Successes:
- Executive Committee meetings were held virtually bi-monthly in July, Sept, and December to advise NANOOS on its strategy and priorities.
- NANOOS held its Annual *NANOOS Governing Council (GC)* and *Principal Investigator (PI)* meetings on 11-12 August 2025 in Vancouver, WA.
Problems/Delays: None

Representation:
- *Represent NANOOS at IOOS Program Office and IOOS Association meetings, and at national meetings of significance [Newton, Carini, Rome,UW]*
- *Engage at a regional level at meetings and workshops affecting PNW stakeholders and NANOOS [Newton, Carini, Rome,UW]*

Status: On track
Summary: Newton participated in IOOS Program Office and IOOS Association calls. Newton is a member of the IOOS Association Executive Committee and participated in their teleconferences during the period.
Accomplishments/Successes: Newton and Carini attended the IOOS Fall Meeting in Traverse City, MI, on 15-19 September.
Throughout the period, Newton continued representing NANOOS and IOOS at various meetings, including:
- Newton was invited to present at the International Coastal Atlas Network 2025 ICAN Workshop Building Knowledge, Taking Action, in a session on "*Connections to the Ocean Decade: aiming to explore how projects are answering to the Ocean Decade Challenges*" speaking about how Backyard Buoys is meeting coastal community needs for wave data through co-design and co-production.
- Newton, Wold, and Tanner met with the USCG Puget Sound Sector to discuss their data and data visualization needs at their headquarters on the Seattle waterfront in September; follow-up conversations are continuing with some NANOOS products launched: https://nvs.nanoos.org/MaritimeOps
- Newton and Wold were invited to speak to the Puget Sound Harbor Safety Committee in November, with a follow-up invitation to provide a NANOOS booth at the National Harbor Safety Conference in Seattle during March 2026.
- Newton participated on the Steering Committee to plan for the Seattle One Ocean Week that NANOOS member Maritime Blue sponsored, including the visit from Statsraad Lehmkul, the Norwegian tall ship on its voyage around the world in October. She participated in three One Ocean Week events: Bridging the Gap: Turning Research into Real-World Solutions; Importance of Ocean Data: an opportunity for dual-use?; and The Vast and Deep Ocean, the latter of which featured NANOOS and student researchers from the University of Washington.
- Newton worked with the UW Office of Global Affairs, UW School of Oceanography, Maritime Blue, and the Statsraad Lehmkuhl to co-sponsor 11 students for the sail from Seattle to San Francisco. https://www.nanoos.org/news/index.php?item=OneOceanExpedition251117

Problems/Delays: None

Project Oversight:
- *Conduct annual all-PI meetings and Tri-Committee meetings, providing clear feedback and direction [Newton & Rome, UW]*
- *Share project evaluation at the annual PI meeting [Newton, UW]*

Status: On track
Summary: Newton, Carini (Sept-Dec), and Rome participated in weekly Tri-Comm calls and coordinated with PIs throughout the period. The annual NANOOS all-PI meeting was held in conjunction with (following) the Governing Council meeting in Vancouver, WA, 11-12 August.
Accomplishments/Successes: The annual all-PI meeting was well attended. After PI updates, Newton led the project evaluation for the GC and PIs. We reviewed past accomplishments, discussed issues, and prioritized activity for the new 5-y IOOS proposal from the combined PI and GC audience.
Problems/Delays: None

Coordination:
- *Coordinate with West Coast RAs and other RAs to optimize and leverage capabilities and assure consistencies [Newton, Carini, Rome,UW]*
- *Engage in sub-regional and user-group specific workshops to aid coordination and optimization of effort [Newton, Carini, Rome,UW]*
- *Coordinate with Canada [Newton, Carini, Rome,UW]*

Status: On track
Summary: Newton, Carini, and Rome engaged activities over the period with regional and local entities in a variety of venues and opportunities. Newton and Rome attended Ocean Networks Canada's Salish Sea workshop 14-17 July 2025; Newton gave an invited NANOOS overview. We are continuing follow-up meetings to discuss Indigenous, observing (sharing buoy design), and data matters. NANOOS is working to re-establish ONC data streams on NVS.
Accomplishments/Successes: Newton was selected as a member of the West Coast Ocean Science Action Agenda Advisory Committee and attended its kick off meeting 14 November, virtual. See below for additional activities.
Problems/Delays: None

Accountability:
- *Submit required IOOS progress reports and respond to other requests [Newton & Carini, UW]*
- *Attain recertification in 2023 as the Regional Information Coordination Entity of US IOOS for the PNW [Carini, UW]*

Status: On track
Summary: Progress report and other requests have been fulfilled during the period. NANOOS was successfully recertified in 2023.
Accomplishments/Successes: While Progress Reports in the IOOS requested format have been filed on time, a more readable format is produced and these reports are publicly available at https://www.nanoos.org/about_nanoos/documents.php.
Problems/Delays: None

Additional NANOOS coordination and representation included:
- Carini serves as a NANOOS representative on the NSF-funded Cascadia Coastlines and Peoples Hub (CoPes Hub) Community Advisory Council (CAC). As such, she served on the planning committee for the Coastal Hazards Workshop #3. She was unable to attend the virtual CAC meeting on 19 Sep 2025, due to the conflicting IOOS Fall Meeting in Traverse City, MI, hosted by GLOS. She normally attends CAC meetings quarterly.

- Carini serves as the NANOOS point of contact for Pacific Northwest WebCOOS activities. As such, she has attended regional and national WebCOOS project meetings and coordinated outreach to entities (HOAs, hotels, etc.) on the WA and OR coasts for webcam deployments.
- In coordination with Washington state agencies, tribes, industry, and others, Newton represented NANOOS at the Marine Resources Advisory Council virtual meetings and in person during this period on 16 December.
- NANOOS provided updates on oceanographic conditions in the Pacific Northwest for the *NOAA WestWatch* webinar series on 15 July and 23 September along with the other two west coast RAs.
- NANOOS made contributions to *PSEMP Puget Sound Marine Condition Updates* bi-montly throughout the period: 23 July and 24 Sept, including aiding publication of the annual 2024 Marine Waters Overview in summer.
- NANOOS continued work on the development of OA indicators for the West Coast Ocean Data Portal, also engaging with CeNCOOS.
- NANOOS is supporting a project in collaboration with Oregon State University and NOAA PMEL on Multi-Stressors off the Pacific Northwest Coast. Newton attended the Multi-stressors MTAG meetings virtually during the period, including in person at Forks, WA, on 9-10 December. Tanner provided a new visuals capability to the website: https://www.nanoos.org/products/multi-stressors/visuals/visuals.php
- Locally, Newton served on the Steering Committees of C-CAN, OASeS, ORHAB, Cascadia CoPes Hub, and the Puget Sound Environmental Monitoring Program. She informed regional and national groups about the west coast OAH indicator work.

Keeping the goals and capabilities of NANOOS and IOOS represented internationally, NANOOS Administration and PIs made several important contributions:

- Newton served as a member of the *Canadian IOOS (CIOOS) Pacific* Regional Oversight Committee and maintained communication over the period. Also in Canada, Newton chaired the *Marine Environmental Observation, Prediction, and Response* Network, a Canadian Center of Excellence (MEOPAR) International Science Advisory Committee.
- Newton continued as a member of the Science Advisory Team for the *Joint European Research Infrastructure in the Coastal Ocean* (JERICO) along with Henry Ruhl (CeNCOOS) and Clarissa Anderson (SCCOOS). There were no reviews during the period.
- Coordination with the Global Ocean Acidification Observing Network (GOA-ON) is described in non-core task 5.
- Newton participated in OceanObs'29 planning and was asked to be on the International Science Advisory Committee.
- MacCready continued service on the Olympic Coast National Marine Sanctuary's Advisory Council as the primary Research representative (2023-2026). He also serves on the SeaGrant Willapa Grays Harbor Estuary Collective Scientific Advisory Committee.
- Barth is the academic representative on the North Pacific Marine Science Organization's (PICES) Governing Council and took part in the PICES Annual Meeting and Governing Council meeting on November 10-16, 2025.

FY25 Non-core Task 13: *For a one-time FY25 adjustment to base (ATB) to be used on identified user needs and the RA priorities [Newton]*

- *Fill Engagement and Outreach funding gap to provide dedicated time for outreach to local branches of the US Coast Guard and regional harbor safety committees and for product co-development with these stakeholders*

Status: On track
Summary: Reached our two main target audiences and have plans for follow-up.

Accomplishments/Successes: Visited USCG Puget Sound Sector offices and met with CAPT Mark McDonnell, CDR Daniel Delgado, LCDR Lily Andrews, and several on 8 September 2025. Determined their needs and made a plan for product development and follow-up meetings. Met with the Marine Exchange of Puget Sound at a Harbor Safety Committee meeting on 5 December 2025 to present NVS and further understand data needs of this community. A virtual meeting was scheduled for early 2026 and NANOOS was invited to attend the National Harbor Safety Conference.
Problems/Delays: None

E. Presentations & Publications Acknowledging NANOOS Support:

Presentations: underline indicates NANOOS PI

Gostic, M., and Kaminsky, G., 2025. Monitoring & adaptive management. Delivered to the Shoreline and Coastal Planners Group at the Dynamic revetments: Site-based design, permitting, and coordination to implement nature-based solutions field trip, Westport, WA, 16 September 2025.

Gradoville, MR, and Seaton, C. 2025. "Ocean and estuary science at the Columbia River Inter-Tribal Fish Commission." CEOAS REU Seminar Series, Oregon State University, Corvallis, OR, 2 July 2025.

Kaminsky, G., Gostic, M., Sumaiya, and Weiner, H., 2025. Monitoring for enhanced engineering design of nature-based dynamic cobble revetments. Delivered to the American Shore & Beach Preservation Association National Conference, Long Beach, CA, 9 October 2025.

Kaminsky, G., Gostic, M., Sumaiya, and Weiner, H., 2025. Monitoring a dynamic cobble revetment for performance, maintenance, and design. Delivered to the Composite Beaches and Dynamic Revetments Network, Virtual, 3 December 2025.

Newton, J. 2025. "Backyard Buoys: meeting coastal community needs for wave data through co-design and co-production." International Coastal Atlas Network (ICAN) Workshop Building Knowledge, Taking Action - "*Connections to the Ocean Decade: aiming to explore how projects are answering to the Ocean Decade Challenges*" panelist, Virtual, 1 October 2025. https://ican.iode.org/meetings

Newton, J. 2025. "NANOOS Observing System and science observations from it" VENUS Salish Sea Workshop, Ocean Networks Canada, Victoria, BC, Canada, 14-17 July 2025. https://indico.oceannetworks.ca/event/7/contributions/

Newton, J. 2025. GOA-ON OA Week 2025: The OARS Framework for Action, panelist; 14 October 2025. https://www.youtube.com/watch?si=z-8CK-yvDHrQEUvJ&v=uAfWOEZzwQI&feature=youtu.be

Newton, J. 2025. GOA-ON OA Week 2025: Co-development of Research, speaker; 15 October 2025. https://www.youtube.com/watch?v=VJuUz3jkI8E

Newton, J. 2025. GOA-ON OA Week 2025: A Tribute to Dr. Richard Feely, session moderator, 16 October 2025. https://www.youtube.com/watch?v=Z8izztDGu1I

Newton, J. 2025. One Ocean Week: Bridging the Gap: Turning Research into Real-World Solutions, panel moderator, Seattle, WA, 20 October 2025.

Newton, J. 2025. One Ocean Week: Importance of Ocean Data: an opportunity for dual-use? panelist, Seattle, WA, 23 October 2025.

Newton, J. 2025. One Ocean Week: The Vast and Deep Ocean, co-organizer, chair, and speaker, Seattle, WA, 24 October 2025.
https://www.nanoos.org/news/index.php?item=OneOceanExpedition251117

Sumaiya, Kaminsky, G., Weiner, H., Gostic, M., and Dietrich, J., 2025. Monitoring updates of the nature-based shoreline protection at Westport. Delivered to the Westport by the Sea condo association owners, Westport, WA, 20 September 2025.

Publications: underline indicates NANOOS PI

Graffin, M., Almar, R., Bergsma, E., Boucharel, J., Vitousek, S., Taherkhani, M., and Ruggiero, P., 2025. Waterline responses to climate forcing along the North American West Coast, Communications Earth & Environment, https://doi.org/10.1038/s43247-025-02414-x

Magel C.L., Nugraha A, Sutherland DA, Helms AR, Niessner J and Khangaonkar T (2025) Biophysical model of eelgrass and water quality in Coos Bay, OR shows greater mitigation potential for ocean acidification than hypoxia. Front. Mar. Sci. 12:1585621.
https://doi.org/10.3389/fmars.2025.1585621

Keogh, M.E., Sutherland, D.A., Eidam, E.F., Souza, T.D., Schmitt, J., Helms, A.R., and David K. Ralston. Estuarine Sediment Dynamics and the Importance of Storms in Moving (and Removing) Mud. *Estuaries and Coasts* 48, 104 (2025). https://doi.org/10.1007/s12237-025-01524-1

M. Taherkhani, S. Vitousek, M. Graffin, K. Vos, J.C. Allan, G.M. Kaminsky, P. Ruggiero, ENSO and PDO drive shoreline position anomalies in the US Pacific Northwest, *PNAS Nexus*, Volume 5, Issue 1, January 2026, pgaf404, https://doi.org/10.1093/pnasnexus/pgaf404

Van IJzendoorn, C., Wengrove, M., Ruggiero, P., Bond, H.G., 2025. Measurements and modeling of aeolian sediment transport on dynamic cobble berm revetments, Coastal Engineering, https://doi.org/10.1016/j.coastaleng.2025.104859

Xiong, J., MacCready, P., & Leeson, A. (2025). Impact of Estuarine Exchange Flow on Multiple Tracer Budgets in the Salish Sea. Journal of Geophysical Research: Oceans, 130(11). https://doi.org/10.1029/2024JC021645