Progress Report

Project Title: Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS
Award Number: NA21NOS0120093
Period of Activity: 01/01/2025 - 06/30/2025
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 FY2024 (= Y4 of the award = Y18 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 FY24, NANOOS has the following additional tasks funded via IOOS (3-5) and the NOAA Ocean Acidification Program (6-7), as well as two pass-thru funded modeling projects (1-2):

1. For Bering Sea coupled ice-ocean forecast system: aligning with UFS and operational testing (Durski, OSU)
2. For enhancement of NOS modeling capabilities for Northern Pacific (STOFS-3D-Pacific) in support of disaster prevention and safe navigation (OCS) (Seaton, CRITFC)
3. To further HABs understanding and prediction via a pilot project to support key elements needed to produce the Pacific Northwest Harmful Algal Bloom Bulletin (http://www.nanoos.org/products/habs/forecasts/home.php), including offshore and ESP sampling, beach sampling by tribes and the State of Oregon, analysis, and circulation modeling; sustain SoundToxins (Several PIs, see individual reports below)
4. For replacement of HFR manufactured last century (Kosro, OSU)
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, OSU)
6. Project resources in support of the NOAA Ocean Acidification Observing Network (NOA-ON) CB-06 (Hales/Kosro, OSU)
7. Project resources in support of the NOA-ON Ch'aba, the GOA-ON, and the J-SCOPE (Several PIs, see individual reports below)

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.
	Mature Regional DAC Operations: *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
	NVS Support and Development: *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
	Engagement in National and Cross-regional DMAC Efforts: *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.
	Web Site: *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
	Tailored Products Development: *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,	**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.

Coordination & Accountability	<u>Governance:</u> *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 the that found in PNW - Conduct annual GC meeting
	<u>Representation:</u> *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
	<u>Project Oversight:</u> *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
	<u>Coordination:</u> *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.)
	<u>Accountability:</u> *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. With permission, moved antennas to improve reception. Intermittent problems with cell connection in this remote area. WSP1 dome inner cables replaced to improve reception. CORDC uptime stats of 88% and 61% (#2 and #7 for the national system) for Sep-Nov and Dec-Feb respectively. Our MAN1 site, at Manhattan Beach, is down due to a lightning strike; we have permission to reinstall and are waiting for shelter completion. Our WIN1 site, at Winchester Bay, went down March 1st 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: Negotiated improved site characteristics at KAL1.

FY23 Non-core Task 3: *Expenses associated with SeaSondes for HFR [Kosro]*
Status: In Progress
Summary: Have permission to 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.

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: The radar station on the USCG Yaquina Bay watchtower at Newport, OR, was operated from January 1 through mid-February of this reporting period. At this point the system went offline due to infrastructure issues detailed below. While operational, the data acquisition and processing system generated imagery and reported wave parameters and wave spectra from nearshore locations in near-real-time. These were published to NVS and a comprehensive Oregon State University website (linked to from NVS). A listing of recorded radar data is available via the OSU website, and work continues to make a searchable database of radar recordings. Development is also underway to provide more detailed wave spectrum information, possibly including secondary peaks.
Problems/Delays: As noted above, the system ceased operation in February due to weather-induced damage to the USCG watchtower in which the radar control & processing unit and data acquisition PC were housed. The "cab" of the tower is no longer weather-tight. Furthermore, the metal steps to the top of the tower have corroded to the point where it is no longer safe to ascend the tower without safety equipment and special precautions. The USCG has condemned the tower for the time being and we do not know when repairs will be made. For now, the radar system remains offline as the data acquisition PC has been retrieved from the tower to prevent any damage from rain ingress.
Accomplishments/Successes: No new changes were made to the radar system or web products during this period. 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 preparing for and carrying out our spring mooring servicing cruise. During this cruise, which took place the last week of April, we successfully deployed the summer Cha'ba mooring and the NEMO-subsurface profiling mooring. The winter Cha'ba mooring had been recovered the previous December after it broke free from a faulty acoustic release and a series of exceptional winter storms. Although the deployments were successful, real-time data return from the moorings has been exceptionally poor this summer on a variety of systems. As of the time of reporting, the PMEL pCO2 system was not reporting the

pCO2 concentration in the water, although other measurements on this system are being reported. Also, the inductive sensors on Cha'ba are only reporting infrequently, or some not at all. The Deep SeapHOx, which was generously calibrated and loaned to us by Sea-Bird, was reporting a faulty pressure value. On the NEMO-subsurface mooring, the profiler stopped profiling after about a week, though is continuing to report data. Many of these issues can be attributed to aging systems and instrumentation. Thankfully, we are making progress in replacing some of these 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 the 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.

Observations from the previous summer and winter deployments were presented in April at the Puget Sound Marine Waters 2024 Review. A highlight of the observations from these deployments was the rapid transition of water properties on the shelf during very intense fall storms (e.g. November bomb cyclone), which showed full water-column mixing.

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 winter 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.

FY24 Non-core Task 7: *Support efforts for OA observing on NANOOS NOA-ON Cha'ba on the WA shelf [Mickett, Newton]*

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.

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!

FY24 Non-core Task 3: *Support for fabrication of an additional HAB water sampler for the new Seasats AUV [Mickett]*
Status: Complete
Summary: See summary in last period's progress report.

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: The mooring system was deployed in January 2025 and recovered in late June 2025.
Accomplishments/Successes: Good data return from internally-recording devices, with exception of ADCP.
Problems/Delays: ADCP leaked seawater (appears to have been a breach in the case) and will need to be replaced. Telemetry of real-time data interrupted due to fast battery discharge. However, multiple redundancies allowed good position tracking throughout, and recording much of the instruments to internal recorders, which have been downloaded ashore.

FY24 Non-core Task 6: *Support efforts for OA observing on NANOOS NOA-ON CB-06 off the OR shelf [Hales]*
Status: On track
Summary: The OA system has experienced a number of failures with the PMEL system in recent deployments. The system has had an increased frequency of valve failures and seemingly random reboot issues in recent deployments. The system deployed on the mooring turnaround cruise on 28 January 2025 failed within several weeks of that deployment, and upon recovery it was discovered that the protective dummy plug on the main-unit comms bulkhead connection was missing. This was likely due to OSU operator error, as the comms plug needs to be accessed through the extensive sealion-deterrent netting prior to deployment to initiate the system-startup, and it is challenging to positively confirm the dummy-plug mating through this limited access while at sea. The winter-time deployment and unavailability of coincident workable days and vessel availability made it impossible to field-service the system prior to the buoy recovery in June 2025. The team has the replacement buoy ready to re-deploy, but is currently without clear vessel availability.
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 successfully recovered in December 2024. Through this reporting period, the SATURN-02 buoy was refurbished and prepared for a 2025 deployment. This was the first preparation of SATURN-02 by new field staff; all previous SATURN-02 deployments through CMOP's history were led by the previous CMOP field lead who is now retired. The buoy was successfully prepared for deployment by current staff, including refurbishing and improving the physical buoy and mooring and programming a new control board system (Arduino). The buoy is currently awaiting deployment. The usual vessel used for deployments and recoveries (M/V Forerunner) was unavailable for deployment in May or June 2025 and will likely be unavailable for the summer. An alternate vessel was identified and chartered. The buoy is on-track to be deployed in July 2025, pending a suitable weather window for safe deployment.
Accomplishments/Successes: SATURN-02 was successfully refurbished and prepared for deployment by newly trained field staff, including significant physical refurbishments and programming a new control board system.
Problems/Delays: Deployment delayed to summer 2025 due to vessel availability and weather.

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 2025, and has completed 564 dives as of 21 July, 2025. Projected recovery is currently mid-December, 2025.
Accomplishments/Successes: Fabrication of a second NANOOS glider is complete. Data processing and QC have been updated to our current standards, and data is flowing to the 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
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 January to June 2025 reporting period, one glider map was made in late May-early June off central Washington. The glider was deployed for a total of 15 days, and produced 6 cross-shelf sections over 270 km with about 2400 vertical profiles of water properties. Glider data show that near-bottom, low-oxygen water was being upwelled onto the shelf in early spring with some hypoxia confined to the bottom boundary layer. There was a hint of very low dissolved oxygen (DO < 1 ml/l) near the bottom on the inshore end (water depth < 50 m) just off Taholah,

WA, but that feature was small in spatial extent. 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.

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

Northern California 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, January to June 2025, a glider (newly repaired sg266) was on the TH line for 134 days during one deployment, sampled along 2400 km of track line covering the transect 6 times, and collected about 1302 vertical profiles of ocean properties. Glider uptime during this period was about 74% after launch of sg266 in early March, 2025. 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 2023-2024 El Niño and the onset of ENSO neutral conditions (see Figure JB.1 below).

Problems/Delays: None.

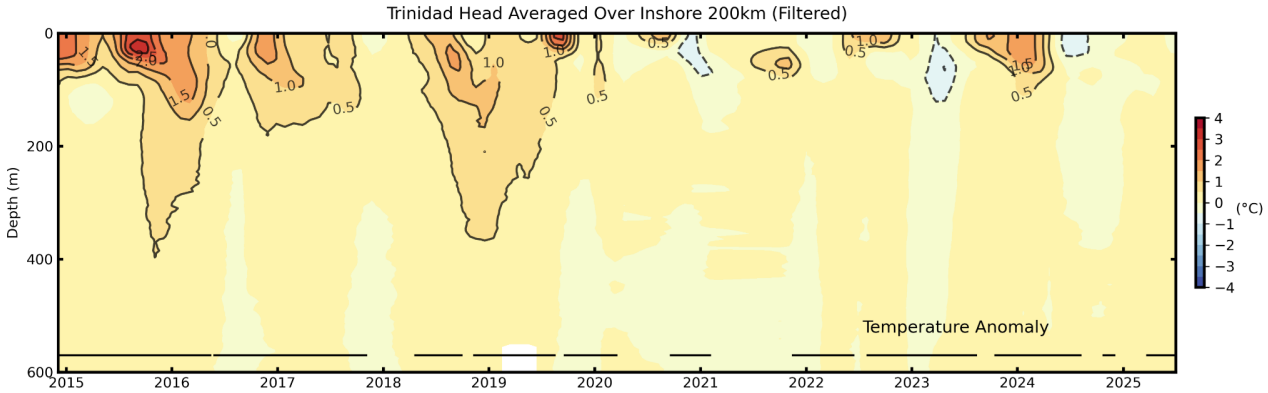

Figure JB.1: *Temperature anomaly from the Trinidad Head, CA (41° 3.5'N) glider line. Horizontal lines above the time axis indicate when the TH-Line glider was in the water.*

FY24 Non-core Task 3: *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) 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 four PNW HAB Bulletins to support coastal shellfish managers during the reporting period. These included the 07-Apr-2025, 21-Apr-2025, 05-May-2025, and 23-May-2025 Bulletins. *Pseudo-nitzschia* cells typically begin to appear in samples collected at area beaches during April, but this year cells did not begin to appear in significant numbers until May. As a result, risk of a toxic *Pseudo-nitzschia* bloom was characterized as generally 'low' throughout spring 2025. Of the four Bulletins that were issued this spring, three received a 'low risk' rating. The exception was the 05-May-2025 Bulletin, which was rated 'medium risk'; this came as a result of domoic acid beginning to appear in the environment (both at the ESP mooring off northern WA, and in crab viscera collected off southern OR) coupled with an approaching large storm. Fortunately, domoic acid concentrations in shellfish tissue remained low throughout the open spring recreational and tribal razor clam harvest periods. Offshore samples collected by the ESP mooring were incorporated into both of the May PNW HAB Bulletins. In addition, McCabe worked with PI Kavanaugh to incorporate offshore *Pseudo-nitzschia* cell abundance estimates collected in mid-May via an underway IFCB aboard the NOAA Ship *Bell M. Shimada* into the 23-May-2025 Bulletin. The PNW HAB Bulletins are 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 distributed to each tribe partnering in the ORHAB program to improve off-shore HAB monitoring capacity over-and-above

the weekly shore-side sampling undertaken as part of ORHAB's state-funded monitoring program. In addition, funds were used to support training on the use of the Autonomous Surface Vehicle (ASV), the SeaSats "Lightfish", which is used to sample at offshore HAB retentive sites, including the Juan de Fuca Eddy (Washington) and Heceta Bank (Oregon). Some funds still remain after the current reporting period.

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 June 2025 fund balance for ONRC cost and tribal allocation is $23,517, necessary for participating in offshore sampling over-and-above their weekly shore-side sampling. The IRA funds balance is $13,692. IRA funds were used to purchase a -80C freezer for sample storage which is now installed at the ONRC lab. This freezer and purchases described below are equipment upgrades necessary to process higher volumes of samples, especially in support of deployments of the Lightfish, an Autonomous Surface Vehicle (ASV). 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.

In addition, a Trilogy fluorometer was purchased for Quinault lab to enable the Tribe to perform chlorophyll analyses onsite. A computer and microscope were purchased for the Hoh lab, giving them the capability of performing their own HAB cell counts, and also save their data and associated images. The equipment and supplies allow the Tribes to establish independent sampling and laboratory operations. A key and access has been provided to the Hoh Tribe, allowing the Tribe to use the ONRC facility as a laboratory resource. The installation of the water sampling system in the ASV technology for off-shore monitoring in Washington has been delayed but it is anticipated that the system will be installed by September. The Tribes 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 has been invited to serve as a committee member for Dr. Kavanaugh's student who is working on establishing a program to train Dungeness crab fishers in Washington to sample for HABs. Trainer continues to work extensively with a new company, Sensoreal, to test a new dipstick method 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.

Problems/Delays: A new harmful algae specialist has been hired to replace Anthony Odell who retired on 31 May 2025. Dr. Avery Tatters attended the Lightfish operational training in May 2025. He will start his position on 21 July 2025 and we anticipate that the initial Lightfish deployments

under Avery's leadership will be scheduled for late September in anticipation of the first PNW HAB Bulletins in October 2025.

Trainings/Meetings:

- ORHAB annual ELISA training and In-person Annual Meeting, 22-23 January 2025
- Dialogues with Industry - HABs (Dialogue 2) User-Driven Ocean Information, sponsored by NHABON with Trainer as a panelist, 29 January 2025
- Lightfish operational planning meeting, 1 March 2025
- Lightfish operator training and deployment, 7-8 May 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 Puget Sound.

Accomplishments/Successes: For this reporting period we received and addressed 138 requests for support from SoundToxins participants and partners including requests for monitoring support, phytoplankton identification and data use requests. We received 51 emails alerting to the presence of harmful algal bloom species of which 20 of the alerts were passed on to the Washington State Department of Health as part of the phytoplankton cell presence alert system.

In February we held our annual training and meeting, which consisted of 2 short virtual refresher training sessions and 2 full in-person days. For our in-person training this year, we invited a specialist from Florida (Kate Hubbard) to train our monitoring program on identifying *Karenia*, (which, along with *Azadinium* were added to our list of target genera starting this year). We were also joined by Anthony Odell from ORHAB and acquired live cultures of most of our target HAB species for live observation. We also hosted a 2-part virtual training covering species-level Non-Harmful Phytoplankton Taxonomy in April and May.

We trained new monitors for two critical sites where monitoring had temporarily paused (Dabob Bay and Penn Cove) and added 4 new sites who had either never monitored before or not for the last 5 years. We presented at the Shellfish Growers Conference, Willapa Grays Harbor Estuary Collaborative Spring meeting, PSEMP 2024 Overview Workshop, and at Sound to Sea: Working Together to Build Resilient Coastal Communities. We also presented to a college-level course at Evergreen College, and contributed to K-12 education with Water Quality lessons at both NOAA Science Camp and the NOAA Science Camp Aquaculture Mini-Sessions.

SoundToxins held a formal internal strategy session, regularly met with scientific advisors, and established a regular monthly meeting with WDOH. Some procedural changes were made to protect the safety of staff and volunteers while still maintaining scientific rigor. Internal documents were created and updated for organizational purposes. The process of updating the SoundToxins website was started.

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 are being 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. A second 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 600 new observations. It is estimated that the project will have nearly 800 total new observations by the end of the 2025 sampling season. For the 2024 sampling season, George successfully maintained the sample kit station at Hatfield Marine Science Center (HMSC) with the assistance of Post-Bac Researcher Amanda Kent. For the 2025 sampling season, George has 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. 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. A second fishermen sampling kit station, located in Port Orford, OR, was established in June. This location was selected with the assistance of Tom Calvanese and Caroline Rice with Oregon State University. Sampling has started through ODFW and OSU partnerships, and Calvanese and Rice are leveraging community connections to recruit new commercial fishing participants. After establishing the Port Orford secondary station, samples have been collected through partnership with the ODFW Marine Reserves team and other OSU collaborators. A south coast cohort of commercial fishermen have been trained on sampling protocols and sampling is expected to increase as fishing conditions allow. It is anticipated that fishermen will continue sampling consistently through the end of September 2025.

In 2024, George and Kent increased outreach for this project this year in two key ways. They established 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 addition to the newsletter, George attended two Oregon coast fishermen-centered meetings to engage a broader audience of Oregon fishermen. In 2025, Wood and Kavanaugh attended ODFW's 8th Fishermen-Scientist Ocean Acidification and Hypoxia (OAH) Roundtable Meeting in Newport, OR in May, where they connected with Oregon coast fishermen about potential data sharing concerns, and re-established connections with fishermen whom had collected samples in

years prior, but took a year or more off from sampling for various reasons. Wood also attended the first Port Orford Seafood Market event to connect with the local fishing community and share information about the project in an effort to recruit fishermen to collect samples at the south coast station.

The CFR is more closely monitoring 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 are 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. have been detected in some CFR samples so far 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.

In September, 2024, a new Graduate Student researcher, Taylor Wood, was brought into the Cooperative Fisheries Research project. Wood is now successfully managing the project for the 2025 sampling season, with George providing project assistance and additional training as needed. The project is expected to have 5-10 participating fishermen, potentially more with the establishment of the Port Orford sampling station. One of Wood's goals is to encourage stronger fishermen participation, yielding a higher-than-average volume of sample collections and observations for the 2025 sampling season.

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 saving whole seawater subsamples, Wood is filtering seawater to collect pDA within 24-48 hours of fishermen collection, and preserving 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 is not always possible for Wood and/or George to accomplish. In response to this challenge, personnel at the Port Orford station have 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.

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 are still being collected from all sample kits, regardless of whether or not the 24-48 hour window has passed. pDA filter samples collected over 48 hours after fishermen have dropped off kits will be used to assess how imperative that timeframe is. An additional challenge is keeping samples cool and well-preserved when participants are gone for several days at a time on commercial fishing trips.

Hunter (carry-over FY23 funds only)
Status: On Track
Summary: The funds from the performance period were used to provide near-shore HAB monitoring capacity in Oregon coastal waters as there is no state-funded program. Funds pay for a phytoplankton specialist and all supplies and services.
Accomplishments/Successes: ODFWM had full staffing of a phytoplankton specialist for this reporting period. Through continued collaboration with coastal tribes and watershed districts volunteer sample collectors, ODFW was able to sample nearly all sites every week compared to some sites being only every other week. A total of 173 near-shore samples were analyzed for HABs from 8 sites along the Oregon coast. HAB species were found in 148 of those samples with *Pseudo-nitzschia ssp.* being the primary HAB (123 samples). Elevated numbers of *Pseudo-nitzschia spp* occurred in May-June with cells/liter exceeding 700,000 on Clatsop Beach at the beginning of June. Further analysis for particulate domoic acid (pDA) was conducted on 14 samples with results all below the accumulation threshold (200 ng/L). All data collected was summarized and used in the PNW HAB bulletin.
Problems/Delays: None

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.
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. Additional monitoring of sensor calibrations has improved the recency of instrument calibration, and all sensors have current and/or recent calibrations. Upgrades of cellular modems on different buoys have improved cellular coverage, reducing the frequency and length of periods of intermittent service, while adding GPS tracking ability to buoys. Two new personnel members have been added to the team, and team productivity continues to increase as the team members become more proficient in their roles. Major infrastructure preventative maintenance was made to the Bellingham Bay buoy by replacing an aging anchor and swapping out instruments.
Problems/Delays: Continued profiling downtime was experienced due to aging systems and external factors, such as poor weather, preventing service visits to the buoys. Additional challenges include long spin-up time for the new team members, reducing overall capabilities while the team becomes more proficient.

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 running in autonomous test mode between Seattle and Victoria. Fine-tuning of the system is underway.
Summary: Ecology has successfully maintained the en route ferry monitoring system with the support of the Victoria Clipper engineering team. In recent months, significant progress has been made, including finalizing system installations and moving into the testing phase. We are excited to see data being transmitted from the ship to our databases.
Accomplishments/Successes:
•Implemented a Local Area Network and installed a cellular router to enable sensor data to stream to an external database.
•Pump duty cycles, delivering water to the sensors, are currently dictated by the ferry sailing schedule, but will be integrated with GPS geofencing after ship-to-shore power issues are resolved. This integration will automate the pump and water delivery process, ensuring sensors operate only in clean water away from port areas (and also not during fuel runs).
Current Focus: With the full ferry-box system now installed, the team is focused on monitoring and fine-tuning autonomous system components and data streams.

1. Optimizing challenges related to the ship-to-shore power transitions while in port; these are currently being addressed electronically.
2. Finalizing a basic web-based data viewer for WA Ecology staff to access the data.
3. Supporting integration of future collaborative sensors into the ferry system (e.g., pCO_2, Micah Horwith).

Problems/Delays: None currently. However, as the ferry operates during daytime hours, work onboard is limited to the evenings when ferry staff are available. This has temporarily slowed adjustments needed to be made directly on the Victoria Clipper.

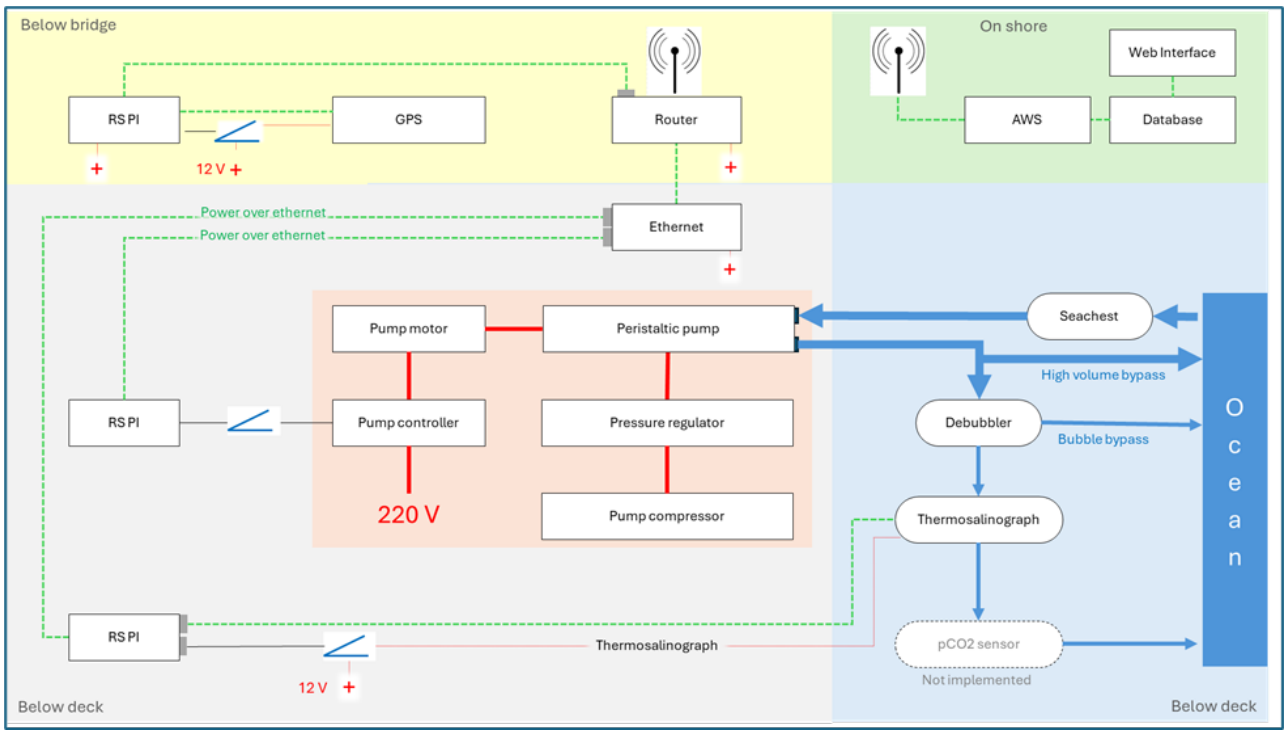

Figure shows a schematic diagram for wiring, datacables and plumbing of the Victoria Clipper ferry system. Lines represent data (green), power (red thin line voltages 12V and thick line 220V), water (blue). Background colors depict the location on the ferry (yellow below the bridge on passenger deck 1, grey-blue in the starboard hull) and on shore (green).

Ferry-based monitoring - Washington State ferries (WSF)
Sponsor: Washington State Dept of Ecology; Jim Thomson, Applied Physics Laboratory, UW
Status: Data collection continues, data quality assurance and controls are in place, data management and archiving has been switched to a different server and new public-facing data links are currently being implemented.
Summary: This work has continued the collection, processing, management, and distribution of marine water quality data using sensors onboard the Washington State ferries. The installation of the sensors occurred under a prior agreement (C1400045, C1600199) and continued under the present agreement (C2400004).
Data collection: Data collection primarily uses Acoustic Doppler Current Profilers (ADCPs) that are hull-mounted on two vessels in the Washington State Ferry system: the M/V Salish and M/V Kennewick. The Salish data collection began in May 2014, and the Kennewick data collection began in Nov 2014. Data acquisition initially used dedicated APL-UW computers onboard the vessels, with network access provided by WSF. At the request of WSF, these computers were retired in 2020, and WSF provided virtual machines running on WSF servers to support data acquisition.
Data processing: The data processing follows an established SOP (Standard Operating Procedure) and QA/QC (Quality Assurance, Quality Control) sequence for data levels (L): L0, L1, L2. Quality control is essential, because the hull-mounted ADCPs often suffer from bubble contamination downstream of the double-ended propellers on the ferries. The L2 quality control also ensures there is valid bottom tracking and sufficient data in each cell.

Data dissemination: The data collection is described at an APL-UW hosted "ferries for science" webpage (https://apl.uw.edu/ferriesforscience) and the data access is described there. Both html and THREDDS access are supported. The new (pending) archive will also be linked.
Problems/Delays: Data management and archiving: The L1 and L2 data are hosted on a Digital Ocean server that was originally established by Integral Consulting. Recent expenditures include the paid storage on this third-party server and salary support for APL-UW staff to manage the transfer and organization of data. The Digital Ocean server has had, however, an unacceptable amount of down-time in recent months. As a response, APL-UW has prepared a second, more permanent archive of the data to be hosted on the Dryad or ResearchWorks platforms available via UW libraries. That archive is presently pending.

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 for all three levels, with some short data gaps during this period due to pump and/or flow meter replacement. The Tongue Point (SATURN-04) pier-based, pumped station was fully rebuilt after transitioning to a neighboring pier when the US Coast Guard demolished the previous pier. In situ temperature and salinity data from Tongue Point were collected throughout this period with only small data gaps and pumped data were collected continuously after the station was restored in spring 2025. The Baker Bay (SATURN-07) buoy is currently on station. This buoy is due for refurbishment and is currently awaiting recovery. The Cathlamet Bay (CBNC3) buoy was recovered in March 2025 and is scheduled to be re-deployed in summer 2025. The Youngs Bay (SATURN-09) buoy was recovered in January 2025. 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. CMOP data management servers were partially transitioned to new hardware and operating systems. Additionally, field staff, data quality analyst, and Gradoville participated in week-long group in person activities and training aimed at improving data quality and intercomparability of chlorophyll sensor data during April 2025, resulting in new protocols for running chlorophyll standards in situ at pier-based stations.
Accomplishments/Successes: Tongue Point transition to a neighboring pier was completed, with pumped data restored. Pier-based stations were maintained. Two estuary buoys were recovered.
Problems/Delays: None

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. Three of 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 1/01/25 – 6/30/25. The Charleston Bridge station was inoperable January-June 2025 due to biofouling and failed deployment infrastructure. In May, a

temporary instrument deployment tube was installed, and data collection resumed 6/10/2025. Tom's Creek weather station provided real-time measurements of air temperature, relative humidity, barometric pressure, and wind speed/direction. Telemetry transmissions occurred 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 functions have been unavailable in preparation for piling installations due to aged wood infrastructure and biofouling issues. The new platforms will be upgraded with YSI Storm 3 telemetry systems. The Reserve has a contract in place with Oregon Marine Construction for piling replacements in Fall 2025, during the ODFW in water work period for the Coos estuary. 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 has been offline for the reporting period due to personnel changes. SSNERR staff will assist CTCLUSI with deployment tube and instrument installation to resume data collection this summer. Monthly sonde instrument exchanges, maintenance, and data management for all operational sites were completed for the station network following NOAA NERRS Centralized Data Management Office protocols.
Accomplishments/Successes: Water quality and weather time-series data were integrated into several collaborative research and education programs at the Reserve. A biophysical model evaluating the interaction of water quality and eelgrass in the Coos estuary was completed in June 2025. A coring project examined sediment dynamics to understand seasonal storm impacts on deposition in tidal marshes and mudflats with implications for native species recovery; turbidity and precipitation data from 4 stations were analyzed. The Reserve's 2024-2026 Margaret Davidson fellow is utilizing water quality data near green crab monitoring sites and a University of Oregon student is surveying fish populations to understand changes in biodiversity. The Reserve education program accessed water quality datasets for Teachers on the Estuary (TOTE) training workshops held in June. The Reserve is hosting several science summer interns, from NOAA's National Centers for Coastal Ocean Science, Oregon Sea Grant, and OSU's Oregon Coast STEM Hub that are assisting with water quality fieldwork and laboratory sample processing.
Problems/Delays: The Charleston Bridge and Valino Island water quality piling replacements were originally planned for Spring 2025; however, there were permitting and environmental compliance delays due to capacity shifts, grant management, and process changes at NOAA Office for Coastal Management. Therefore, the ODFW in-water work window for Spring was missed.

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) led 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 winter and spring 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). These surveys include up to 50 cross-shore beach elevation profiles per season, 9 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. Observations from this dataset were used to inform Washington State Parks on permits to allow beach sand harvests for cranberry growers. Data show the practice is sustainable and without significant impact in terms of beach stability. Reports were delivered to both Washington State Parks and Oregon Department of Parks and Recreation, documenting work completed over the past few years and major findings of the monitoring work, as part of our permit requirements with those agencies.

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 winter preparation and maintenance 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. An annual update on beach and dynamic revetment monitoring was developed and shared with the homeowners association in June 2025 to help inform their maintenance activities.

Results from data collected at beaches on either side of the Columbia River Mouth were presented to USACE in May to inform their practices on the Beneficial Use of Dredged Material. CMAP presented on two areas of concern: (1) Dune erosion at the south end of Benson Beach near the Columbia River North Jetty that could be slowed with the installation of a planned dynamic revetment, and (2) a low saddle in the dunes south of the cobble revetment that was constructed near the South Jetty. Continued erosion of the dunes in this area could eventually lead to a breach of Clatsop Spit.

In March, two Coastal Engineers met with staff from the Quinault Indian Nation to learn about coastal hazard challenges facing the Taholah community and to provide technical assistance. They assessed the condition of the community's seawall and flood berm infrastructure—both of which are in need of maintenance—and offered technical input to support future planning. The engineers also provided guidance on how to engage with the U.S. Army Corps of Engineers (the infrastructure owner) to help emphasize the urgency of needed upgrades to ensure adequate flood protection.

With help from a colleague at the U.S. Geological Survey, the CMAP team has started making progress towards releasing the long-term seasonal CRLC monitoring dataset on the web. We are currently in the process of preparing and testing a standard data format.

Accomplishments/successes: Data collected by the CMAP team continue to be used by the USACE and consultants (e.g., Mott MacDonald at Oyhut Bay and Moffatt and Nichol at North Cove) 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, and shoreline planners at Ecology in the review and evaluation of shoreline development projects along Washington's shorelines.

Sediment sample processing has resumed after repair of our sieve shaker in December 2024. We acquired a new GNSS receiver to use as a second dedicated base station, enabling us to have two teams deployed in the field at the same time. To increase efficiency in data collection and reduce safety risks to field staff, we have acquired two unmanned aerial systems (UAS) equipped with cameras and a lidar sensor that will allow us to capture three-dimensional data on the beach and engineered structures, like dynamic revetments. This high-resolution data will improve our understanding of how these structures work in a more comprehensive way. Our small UAS with camera has been deployed to collect Structure-from-Motion (SfM) photogrammetry to augment field surveys at the Oyhut Bay, Westport, and North Cove dynamic revetments and these results have enhanced the resolution of our 3D topographic surface maps.
Problems/Delays: Progress in processing all seasonal topographic survey data continues to be slow due to workload demands on staff. CRLC plots on NVS are available through December 2024. Attention has been given to sites with dynamic revetments to assess performance for providing technical guidance to local communities. We have just hired new staff to help maintain the CRLC dataset starting this fall.

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 – winter surveys – were successfully collected in the Rockaway littoral cell (25 sites), along the Clatsop Plains (6 sites), and along the Neskowin cell (15 sites); terrestrial scanning of the Beverly Beach littoral cell on the central Oregon coast were also collected. Surveys were undertaken in March and April 2025. 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 and most recently in May 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.
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 are also being 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.
Problems/delays: None

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: P. Ruggiero's group at Oregon State University completed, via collaborations with the USGS and the Washington Department of Ecology, the processing of nearshore bathymetry data collected in summer 2024 along the four sub-cells of the Columbia River littoral cell (CRLC). Over 220 individual cross-shore profiles were collected during summer 2020 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 bringing the data to certification standards. In all cases these nearshore bathymetry measurements have been combined with topographic measurements collected by Ecology developing complete maps of the nearshore planform. 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.

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. For example, P. Ruggiero co-authored a paper summarizing shoreline evolution along the entire North American West Coast that used NANOOS data to calibrate Satellite Derived Shorelines (see Graffin, M et al. in Publications).

Problems/delays: N/A

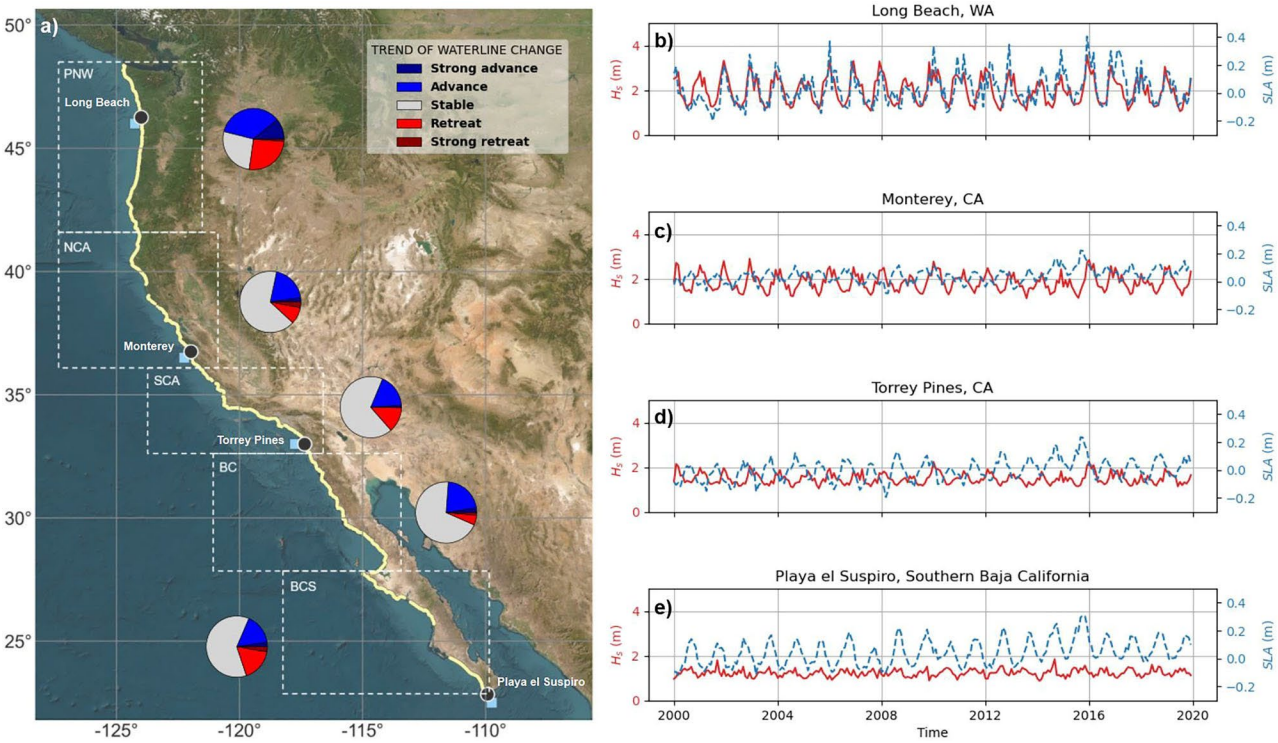

Fig. 1. Study area overview with hydrodynamic forcings and beach morphology states. a) Map of

the North American West Coast, the monitored coastline is shown in light yellow. Dashed boxes delineate the different subregions of the study area. Pie charts show the regional distribution of advancing/retreating waterline trends during 2000–2022 derived from the dataset presented in this study. b–e) Time series of monthly averaged significant wave height (Hs, red) and sea level anomaly (SLA, blue) at Long Beach, WA, Monterey, CA, Torrey Pines, CA and Playa el Suspiro, Baja California Sur (from top to bottom) between 2000–2020, with wave data from ERA5 dataset (ECMWF, 2020101) and sea-level provided by NOAA102–104 tide gages (replaced by AVISO (CNES, 2020105) data at Playa el Suspiro). Black circles (blue squares) on (a) indicate locations of the four sites (closest ERA5 wave model nodes) described on the right panels. The lateral boundaries of the rectangles delineating the subregions are intended solely to visually illustrate the extent of each subregion and should not be interpreted as representing the offshore or nearshore limits of the coastal system. We use the ESRI World Imagery layer as the background map.

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 for MacCready's salary 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 made several significant improvements to the forecast model: (i) Tide phase was adjusted, giving better performance on the coast. (ii) We transitioned to using a new ocean forecast, GLORYS, a European product, for the model open boundaries. This is faster and more reliable than the HYCOM forcing we had been using, with no degradation in performance. (iii) We made significant improvements to the biogeochemical fields in the Salish Sea by adding 50% burial of organic particles. (iv) We updated ROMS to the latest version, which included improvements to the treatment of advection and turbulence, resulting in fewer blowups and hence more reliable forecasts. Model performance was validated against an expanded collection of observational data, now including NSF/OOI velocity measurements and several pCO2 sensors. We have also initiated a collaboration with Dr. Walter Torres (UW/APL) to add surface gravity waves to the Willapa Bay/Grays Harbor nested model. This is a region of the LiveOcean domain which is most likely to be affected by waves. At the request of shellfish growers, we added more daily forecast movies for this nested model as well, now including temperature, salinity, and velocity. An example is here: http://faculty.washington.edu/pmacc/LO/p5_willapa_temp_top.html. Finally, we created a new Data Access portal on the LiveOcean website to begin the process of making distribution of model

extractions to scientists and other stakeholders easier: http://faculty.washington.edu/pmacc/LO/data_access.html.
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.

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: The data assimilation and modeling system continue to provide real-time forecasts to fishers and the public via the NANOOS Visualization System, e.g., as the Tuna Forecast and SeaCast applications.
Problems/delays: None

FY24 Non-core Task 1: *Bering Sea coupled ice-ocean forecast system: aligning with UFS and operational testing [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 this task we have developed the fully two-way coupled CICE(sea ice)/ 3-D SCHISM(ocean) Bering Sea model so that winter simulation can be accomplished and the transition to spring/summer well represented. This coupling has been achieved within the Unified Forecast System framework using the NUOPC interoperability layer. For initial validations of the sea ice dynamics comparisons are being made with the standalone UFS CICE model that we developed in the first year of the project and satellite sea ice concentration data. Model validation will continue, focusing on the ability of the ocean component of the model to capture the evolution of the Bering Sea shelf stratification. 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: The Bering Sea CICE/SCHISM coupled model shows the capability to capture the timing and spatial extent of sea ice in the Bering Sea through early winter (full winter season simulations are currently being conducted). The standalone CICE manuscript on sea ice characteristics both in typical and extreme low-ice years in the Bering Sea is currently under minor revision and will be resubmitted shortly. These accomplishments set the stage for full all-season simulations in the Bering Sea and expansion of the coupled domain into the Chukchi and Beaufort seas.
Problems/delays: None

FY24 Non-core Task 2: *Enhancement of NOS modeling capabilities for Northern Pacific (STOFS-3D-Pacific) in support of disaster prevention and safe navigation (OCS) [Seaton]*
Status: On Track
Summary: We have worked with OCS-CSDL to develop and improve a model of the Northern Pacific (extending from the Bering Strait and 30° S). During the first half of 2025, we: a) integrated National Water Model (NWM) and Copernicus Global Flood Awareness System (GloFAS) inputs, which provide historical and forecast discharge along the entire Pacific rim; b) developed and incorporated a high resolution grid for the LA-Long Beach area, at the request of US Coast Guard, to support Search and Rescue efforts; c) developed model-data comparisons for surface currents using IOOS HF Radar DAC; and d) handed off the latest version of the model to CSDL, with user evaluation and operationalization of STOFS-3D-Pacific planned for the second half of 2025.
Accomplishments/successes: Completed preparation for development of operational NOAA storm surge model STOFS-3D-Pacific.
Problems/delays: None

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: Updated and created new data harvesters, added new data sources to NANOOS ERDDAP. Created harvester for WA MOCI index.
Accomplishments/Successes: Updated or created harvesters for SSCOFS, CDIP 280 Yaquina, NWEM, ORCA, OSU Yaquina, CB-06, NEMO, USGS, and Taylor Shellfish Dabob Bay.
Problems/Delays: None

FY23 Non-core Task 4: *A one-time increase for core needs [Newton]*
Status: Complete
Summary: This one-time increase was used to support NANOOS fiscal and administrative needs. Hana Sawanobori, hired in November 2023 as NANOOS Grants and Contracts Manager, assisted with grants administration, reporting, and communication with PI on budget status.
Accomplishments/Successes: NANOOS PIs are up to date with fiscal status, following the UW fiscal transition, that resulted in information disruption.
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: Created data workflow and harvester for Taylor Shellfish Dabob Bay. Combined glider and AV apps into a single unified autonomous vehicles app. Added custom routes for users to dynamic tsunami evacuation maps. Added WA MOCI index to Averages and Anomalies app. Renamed and relocated the “Share My View” feature to make it more accessible.
Accomplishments/Success: Created data workflow and harvester for Taylor Shellfish Dabob Bay. Added new platforms to NVS. Unified autonomous vehicles apps. Added routes to dynamic tsunami evacuation maps.
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. Mirrored ORCA moorings, Sel'haeam mooring, gliders, and NANOOS-coordinated Backyard Buoys sites onto the NANOOS ERDDAP server. Coordinated NANOOS-sourced datasets with NDBC to ensure availability for GTS ingestion. NDBC harvest in situ buoy data from the NANOOS ERDDAP. Columbia River Estuary buoys and land-based stations are archived periodically and automatically via an NCEI Data Submission Agreement (set up for PI Seaton). NANOOS will pursue establishing an analogous pathway with NCEI and the Washington Shelf Buoys/Moorings and Puget Sound Profiling Moorings (PIs Travis and Mickett).
Accomplishments/Success: Maintained existing data streams.
Problems/delays: None

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: Carini, Travis, and Tanner participated heavily in the IOOS Annual DMAC Meeting 29 April - 1 March 2025 (remote attendance), specifically with a presentation and breakout session about Backyard Buoys IRA Topic 2 DMAC goals, objectives, and work plans. NANOOS platforms available via the NANOOS ERDDAP are being included in IOOS datasets. Carini, Travis, and Tanner attended IOOS DMAC webinars and contributed ideas to the IOOS DMAC Annual Meeting agenda. Established a ROR persistent identifier for NANOOS data products, and have added it as a metadata field to NANOOS in situ datasets.
Accomplishments/Successes: In situ datasets transmitted via the NANOOS ERDDAP.
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: Tanner and Carini continue to collaborate with PacIOOS and AOOS DMAC through their NSF-funded Convergence Accelerator Backyard Buoys project.
Accomplishments/Successes: Development and updates of data services for Backyard Buoys project. Updates to Backyard Buoys ERDDAP. Creation of Backyard Buoys Dashboard, a web-based application for managing buoy deployments.
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 slideshow. Added January and April 2025 J-SCOPE Forecasts. Added HAB Website Bulletin Valuation Content.

Accomplishments/Successes: New and updated content.
Problems/Delays: None

FY24 Non-core Task 7: *Sustain NANOOS' work to develop and maintain the GOA-ON data portal [Tanner]*
Status: On track
Summary: Updated slideshow, webinar, and other content. Updated platform data harvester.
Accomplishments/Successes: Maintained GOA-ON website and data portal.
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: Changed "Snapshot" tool to "Share My View", relocated button to more visible area, and streamlined process of creating a custom view. Added user-specific routing to iOS and Android TsunamiEvac mobile apps. Developed and modified Backyard Buoys Dashboard to meet user needs.
Problems/delays: None.

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 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, Sound Water Stewards, the Columbia River Estuary Conference, Seattle Maritime High School, Technology Access Foundation, Earthlab Internship, Oregon Sea Grant Coastal Haz), mentored 10th graders at the Maritime High School, mentored an undergraduate 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 Committee meetings.
Accomplishments/Successes: None
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 Allan, into enhancing NVS.
Accomplishments/Successes: NVS Fishers webinar
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 utilizing a 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 to foster opportunities for new entries to the ocean observing workforce [Newton, Wold]*

Status: On track
Summary: During this reporting period, NANOOS Staff and working group members met regularly to discuss efforts to increase opportunities for interns with respect to ocean observing and understanding ocean science.
Accomplishments/Successes: Hosted EarthLab summer interns beginning in June (runs through August), presented OA to students at TAF@Saghalie in May, mentored students at the Maritime High School throughout the year.
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: J. Newton (NANOOS Executive Director) and A. Barnard (NANOOS Board Chair), and M. Kosro (NANOOS Board Vice Chair) continued to provide leadership to NANOOS operations and connection to the US IOOS enterprise. Newton, R. Carini (NANOOS Deputy Director), and N. Rome (NANOOS Senior Program Manager) assured progress on the above milestones. Carini took FMLA after having her baby in early May; she will return in early September.
Accomplishments/Successes:
- Executive Committee meetings were held virtually bi-monthly in January, March, and May to advise NANOOS on its strategy and priorities.
- NANOOS elected two new EC members, Rachel Aronson, Maritime Blue (NGO seat), and Rob Ellison, Sea Bird Electronics (Industry seat), who started in May.
- NANOOS is planning its Annual *NANOOS Governing Council (GC)* and *Principal Investigator (PI)* meetings to be held 11-12 August 2025 in Vancouver, WA.

Problems/Delays: None

FY24 Non-core Task 7: *Support for salary for Newton as GOA-ON Co-Chair [Newton]*
Status: On track
Summary: Newton continued to serve as co-Chair of *Global Ocean Acidification Observing Network* (GOA-ON), along with Steve Widecombe, Plymouth Marine Labs. She represented IOOS on GOA-ON Executive Council (EC) calls and activities. She aided the Secretariat in planning UNOC3 side events.
Accomplishments/Successes: Over the period, she aided the following activities:

Newton hosted the GOA-ON in person Executive Council meeting in Seattle, WA, 28-30 January 2025 at the University of Washington Applied Physics Laboratory.

Newton was invited to the GOA-ON Biology Working Group meeting in Helsinger, Denmark, to review progress and chart how better to involve the regional hub membership.

Newton attended the One Ocean Science Congress (3-6 June) and the United Nations Ocean Conference 3 (9-12 June) in Nice, France, giving talks on GOA-ON and OARS at several side events and attending various workshops including on ocean observations, indigenous efforts, and mCDR.

Newton oversaw the efforts of NANOOS to power the GOA ON web and data portal through funding from NOAA OAP (non-core task 6).

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 this period.
Accomplishments/Successes: Newton and Rome attended the IOOS Spring Meeting in Washington, DC on 24-28 March. Newton presented on NANOOS' IRA Ecosystem Obs efforts and represented NANOOS on the Hill. At the 25th IOOS Anniversary, Newton introduced Congresswoman Bonamici, who had introduced IOOS Reauthorization to the House, and the office of Senator Cantwell, who had been awarded IOOS' first Congressional recognition award. Newton serves on the IOOS Strategic Communications WG.

Throughout the period, Newton continued representing NANOOS and IOOS at various meetings, including:

- Giving a seminar about NANOOS at the University of Washington Applied Physics Laboratory
- Attending SLURP at the invitation of the Pacific Coast Shellfish Growers Association
- Giving a seminar about NANOOS and OA work under NOAA at the Western Washington University's Environmental Speaker Series.
- Giving a briefing on NANOOS and collaborations for the CIMERS (Cooperative Institute for Marine Resources Studies) Review Board
- Briefing the Oregon Ocean Policy Advisory Council on NANOOS and what would be at stake if it lost funding
- Participating on the Steering Committee for the One Ocean Week and sailing journey of the Statsraad Lehmkul, the Norwegian tall ship that is voyaging around the world and visiting Seattle.

Problems/Delays: None

Project Oversight:

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

Status: On track

Summary: Newton, Carini, and Rome participated in weekly Tri-Comm calls and coordinated with PIs throughout the period. The annual NANOOS Governing Council and PI meetings will be held in Vancouver, WA, 11-12 August. The Tri-Committee meeting was held 10-11 April in Seattle and virtually.

Accomplishments/Successes: The Tri-Committee meeting was useful, as usual, for reviewing past accomplishments, reviewing what did not get done and why, and prioritizing our list for the year.

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 were invited to Ocean Networks Canada's Salish Sea workshop in July 2025 and are planning additional meetings to discuss Indigenous, Observing, and Data matters.

Accomplishments/Successes: See below for additional activities.

- The All Hands Backyard Buoys (includes NANOOS, AOOS, PacIOOS) meeting was hosted by the Quileute Tribe in La Push, WA, 19-20 February 2025. Newton and Carini planned the meeting and presented. Also attending from NANOOS were Wold (engagement and education), Mickett and Archer (moorings), Tanner and Dioso (data apps), and Travis (data management).
- Newton was invited by the National Academies of Sciences, Engineering, and Medicine to attend an EarthObs Meeting of Experts (ocean) on data in Seattle on 17 June 2025. She was asked to lead the ocean acidification breakout.

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 maintained 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. As such, she attended the Coastal Hazards Workshop #2 on 10-11 February 2025 in Astoria, OR, and the CoPes Hub Annual Meeting on 24-26 April 2025 in Seattle, WA.
- 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, during this period on 22 May.
- NANOOS provided updates on oceanographic conditions in the Pacific Northwest for the *NOAA WestWatch* webinar series on 13 May and 15 July, along with the other two west coast RAs.
- NANOOS made contributions to *PSEMP Puget Sound Marine Condition Updates* bi-montly throughout the period: 22 January, 19 March, 28 May, including the annual 2024 summary 30 April.
- 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. Tanner provided a new visuals capability to the website:
- Locally, Newton served on the Steering Committees of C-CAN, OASeS, ORHAB, Cascadia CoPes Hub, OCNMS Climate Vulnerability Assessment Working Group, and the Puget Sound Environmental Monitoring Program. She informed regional and national groups about the west coast OAH indicator work.
- Newton hosted and attended the annual OASeS community meeting (29 May), a J-SCOPE modeling meeting (30 May), and the biennial Washington Ocean Acidification Center Science Symposium (28 May) with regional partners.

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 is on the One Ocean Advisory Committee and attended virtual meetings for the tall ship Statsraad Lehmkuhl's visit to Seattle during its year-long One Ocean Expedition.
- 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 Intersessional Governing Council virtual meeting on May 29, 2025.

E. Presentations & Publications Acknowledging NANOOS Support:

Presentations: underline indicates NANOOS PI

Acker, R., Selden, K., and Kaminsky, G., 2025. Beach monitoring in Pacific County: Informing coastal resilience work. Pacific County Marine Resource Council Science Conference, Long Beach, WA, 17 May 2025.

Durski, SM, Alexander Kurapov, Jihun Jung, Joey Smith, Bahram Khazaei, Fellicio Castellao, Joseph Zhang, Saeed Moghimi, "A Tale of Two Models: Intercomparison of Bering Sea simulations from structured (ROMS) and unstructured (SCHISM) grid models", OceanPredict '24, Paris, November 2024

Giannakos, S., Gostic, M., and Kaminsky, G., 2025. Coastal Monitoring to Inform Resilience and Restoration Projects. Washington Association of District Employees conference. Leavenworth, Washington, June 10, 2025.

Gostic, M., Weiner, H., Drummond, H., Selden, K., and Kaminsky, G., 2025. Monitoring a natural cobble berm to inform nature-based solutions for high-energy coasts. Composite Beach and Dynamic Revetment Network, virtual, 24 June 2025.

Gradoville, MR. CMOP observatory shows repeated hypoxia in the Columbia River estuary. Climate and Ocean Acidification Seminar Series, NOAA NWFSC. March 2025, Seattle, WA (virtual).

Gradoville, MR, Riseman, S, Seaton, C, Salazar Estrada, AE, Feldman, D, Hales, B. New high-resolution pCO2/TCO2 observations complement long-term hypoxia monitoring in the lower Columbia River estuary. Washington Ocean Acidification Center Symposium, May 2025, Seattle, WA.

Gradoville, MR, Riseman, S, Seaton, C, Salazar Estrada, AE, Feldman, D, Hales, B. New continuous ocean acidification monitoring in the Columbia River estuary. Columbia River Estuary Conference, May 2025, Troutdale, OR.

Heminway, S.S., Cohn, N., van IJzendoorn, C., Ruggiero, P., Wengrove, M., Weiner, H., Kaminsky, G.M., Hacker, S.D., and Whalen, D., 2025. Comparing Process-Based and Reduced

Complexity Dune Evolution Models: A Case Study of Long Beach, WA, USA. Coastal Dynamics, Aveiro, Portugal, April 2025

MacCready, P., K. Hewett, J. Xiong, A. Leeson, D. Mascarenas, Erin Broatch 2025 “The Underwater Amazon of Puget Sound. Webinar for the Wonders of the Salish Sea public lecture series. April 2025.

MacCready, P., K. Hewett, J. Xiong, A. Leeson, D. Mascarenas, Erin Broatch 2025 “ORCA Buoys in Hood Canal and the LiveOcean Model” Invited talk for the Tahuya Community Club. May 2025.

MacCready, P., K. Hewett, J. Xiong, A. Leeson, D. Mascarenas, Erin Broatch 2025 “Simulating Carbonate Chemistry in the Salish Sea & PNW Coastal Waters using the LiveOcean Model” Talk at the Washington Ocean Acidification Center Conference, May 2025.

Newton, J. 2025. “The Value of Integrating Social and Ecological Science into Regional Vulnerability Assessments to Ocean Acidification: a case study from the Olympic Coast” Western Washington University Environmental Seminar Series, Bellingham, WA, 6 March 2025.

Newton, J., and R. Carini, 2025. “Understanding NANOOS and its Impact Nationally, in the Pacific Northwest and at APL” Applied Physics Laboratory Departmental Seminar Series, Seattle, WA, 1 April 2025.

Newton, J. 2025. “Northwest Association of Networked Ocean. CIMERS” Virtual meeting of the CIMERS Review Panel, 6 May 2025.

Newton, J. 2025. “Northwest Association of Networked Ocean & OPAC: What is at stake?” Invited to OPAC virtual meeting, 7 May 2025.

Newton, J. 2025. “Backyard Buoys: Supporting the next generation of ocean scientists” One Ocean Science Congress, Nice, France, 5 June 2025.

Boulay, S., Newton, J. Wisdom, S, Iwamoto, M., Carini, R., Watson J., 2025. “Backyard Buoys: Meeting coastal Indigenous community needs for wave data through co-design and co-production” poster at the Ocean Ocean Science Congress, Nice, France, 4-6 June 2025.

Newton, J. 2025. “Minimising and addressing OA: The role of GOA-ON & OARS” United Nations Ocean Conference side event, 10 June 2025.

Newton, J. 2025. “Ocean Acidification, GOA-ON, and OARS” United Nations Ocean Conference side event, 11 June 2025.

Skaggs, T., Weiner, H., Gostic, M., Kaminsky, G., Dietrich, J., Hacking, A., Alampay, G., Selden, K., and McCandless, D., 2025. Monitoring of a cobble berm in Olympic National Park to inform designs of nature-based coastal protection structures. National Park Service North Coast & Cascades Science Days, virtual, 13 February 2025.

Smith,JC, Jung, J., Kazaei, B., Kurapov, A. and, Durski S., "Exploring Sea Ice Mass Balance and Subseasonal Variability in the Eastern Bering Sea Shelf for winters of 2019-2022 using CICE6" OS41F-0514, AGU, Washington DC, USA December 2024

Smith, J.C., Kurapov, A. , Durski, S. Jung, J., Kazaei, B., Cassalho, F., Zhang, J., Hadda, J., Turucoglu, U., Moghimi, S., and Myers, E., "Implementation of CICE6 in UFS-coastal: A regional standalone application to the Bering Sea", ORA Arctic meeting: "Coastal Sea Ice Predictions and Engagement" April 2025

Smith, J.C., Kurapov, A., Durski, S., Jung, J., Kazaei, B., Cassalho, F., Zhang, J., Hadda, J., Turucoglu, U., Moghimi, S., and Myer, E., "CICE as a regional sea ice model in the Bering Sea: skill assessment and ice mass balances", NOAA Coastal Ocean Modeling Seminars June 2025

Sumaiya, Kaminsky, G., Weiner, H., and Gostic, M., 2025. Monitoring updates of the nature-based shoreline protection at Westport. Delivered to the Westport by the Sea condo association owners, Westport, Washington, 4 June 2025.

Weiner, H., Giannakos, S., Kaminsky, G., Stevens, A., et al., 2025. Mouth of Columbia River Beach Morphology Monitoring Updates. Lower Columbia Solutions Group Meeting, Astoria, Oregon, 6 May 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

Brasseale, E., & MacCready, P. (2025). Seasonal Wind Stress Direction Influences Source and Properties of Inflow to the Salish Sea and Columbia River Estuary. Journal of Geophysical Research: Oceans, 130(2). doi:10.1029/2024jc022024.

Magel CL, 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