

## Progress Report

**Project Title:** Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS

**Award Number:** NA21NOS0120093

**Period of Activity:** 07/01/2024 - 12/31/2024

**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 diversify NANOOS engagement to the extent possible:** Continue ongoing engagement with diverse stakeholders and the public, increasing ocean awareness and literacy; to diversify the ocean and coastal workforce; to improve our ability to provide relevant ocean and coastal data and information to underserved or underrepresented 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 diverse 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
<b>Observing Subsystem</b>	
Currents & Waves	<p><b>Maintain surface current and wave observations:</b> Maintain existing HF-radar and wave mapping capabilities, providing critical national capacity along coasts and at critical ports.</p> <hr/> <p><u>PNW Coast HF Surface Current Mapping:</u>  <i>Lead PI: Kosro, OSU</i></p> <ul style="list-style-type: none"> <li>- 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</li> <li>- 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</li> <li>- Deliver data via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <hr/> <p><u>Wave Imaging at Critical PNW Ports:</u>  <i>Lead PI: Haller, OSU</i></p> <ul style="list-style-type: none"> <li>- Sustain the existing marine radar observing station at USCG Station Yaquina Bay</li> <li>- Provide both real-time and historical wave information via NVS; mean and snapshot radar images are real-time viewable for use in environmental characterization</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul>
Shelf	<p><b>Sustain and enhance buoys and gliders in the PNW coastal ocean in coordination with national and regional programs:</b> Maintain, harden, enhance existing buoys and gliders, with focus on hypoxia, HABs, OA, and climate.</p> <hr/> <p><u>WA shelf buoys/moorings:</u>  <i>Lead PI: Mickett, UW</i></p> <ul style="list-style-type: none"> <li>- Maintain the WA shelf (off La Push) Cha'ba buoy and the NEMO subsurface profiler at existing levels</li> <li>- Deliver NRT data streams via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <hr/> <p><u>WA shelf HAB buoy/mooring:</u>  <i>Lead PI: Mickett, UW</i></p> <ul style="list-style-type: none"> <li>- Support for the HAB ESP deployment on NEMO mooring</li> <li>- Deliver NRT data streams via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <hr/> <p><u>WA La Push glider:</u>  <i>Lead PI: Lee, UW</i></p> <ul style="list-style-type: none"> <li>- Maintain the La Push line glider at existing levels</li> <li>- Deliver NRT data streams via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <hr/> <p><u>OR shelf buoy:</u>  <i>Lead PI: Kosro, OSU</i></p>

	<ul style="list-style-type: none"> <li>- Maintain the CB-06 buoy off Coos Bay at existing levels</li> <li>- Deliver NRT data streams via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <p><u>Columbia shelf mooring:</u> <i>Lead PI: Seaton/Gradoville, CRITFC</i></p> <ul style="list-style-type: none"> <li>- Maintain the CMOP shelf mooring at existing levels</li> <li>- Deliver NRT data streams via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <p><u>Washington shelf glider:</u> <i>PIs: Barth, OSU &amp; Seaton, CRITFC</i></p> <ul style="list-style-type: none"> <li>- Maintain the Washington shelf glider at existing levels</li> <li>- Deliver NRT data streams via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <p><u>Northern California glider:</u> <i>Lead PI: Barth, OSU</i></p> <ul style="list-style-type: none"> <li>- Maintain the Trinidad Head, CA, glider, shared with CeNCOOS, at existing levels</li> <li>- Deliver NRT data streams via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul>
Estuaries	<p><b>Maintain multidisciplinary observational capabilities in PNW estuaries and the nearshore, in coordination with local and regional programs:</b> Sustain observing ability to aid sustainable resource management, water quality assessment, and sub-regional climate change evaluation.</p> <p><u>Puget Sound, WA, profiling buoys:</u> <i>Lead PI: Travis, UW</i></p> <ul style="list-style-type: none"> <li>- Maintain 6 Puget Sound estuarine profiling moorings at existing levels</li> <li>- Deliver data via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <p><u>Puget Sound, WA, US ferry-box:</u> <i>Lead PI: Krembs, WDOE</i></p> <ul style="list-style-type: none"> <li>- Maintain US-Canada ferry-box at existing levels, assuming COVID-19 does not preclude its operation</li> <li>- Deliver data via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <p><u>Columbia River estuary, OR, moorings:</u> <i>Lead PI: Seaton/Gradoville, CRITFC</i></p> <ul style="list-style-type: none"> <li>- Maintain CMOP estuarine moorings at existing levels</li> <li>- Deliver data via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <p><u>South Slough/Coos Bay, OR, moorings:</u> <i>Lead PI: Helms, ODSL</i></p> <ul style="list-style-type: none"> <li>- Maintain South Slough/Coos Bay estuarine moorings for the NERRS at existing levels</li> <li>- Deliver data via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul>

Beaches & Shorelines	<p><b>Maintain core elements of beach and shoreline observing:</b> 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.</p> <hr/> <p><u>WA beach and shoreline:</u>  <i>Lead PI: Kaminsky, WDOE</i></p> <ul style="list-style-type: none"> <li>- Maintain shoreline observations in WA at existing levels</li> <li>- Deliver data via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <hr/> <p><u>OR beach and shoreline:</u>  <i>Lead PI: Allan, DOGAMI</i></p> <ul style="list-style-type: none"> <li>- Maintain shoreline observations in OR at existing levels</li> <li>- Deliver data via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul> <hr/> <p><u>WA and OR bathymetry:</u>  <i>Lead PI: Ruggiero, OSU</i></p> <ul style="list-style-type: none"> <li>- Maintain nearshore bathymetric observations of beach and shoreline morphodynamics in WA and OR at existing levels</li> <li>- Deliver data via NVS</li> <li>- Bring all data QA/QC to meet Certification standards</li> </ul>
<b>Modeling &amp; Analysis Subsystem</b>	
WA & OR Estuaries & Coast Models	<p><b>Provide sustained support to a community of complementary regional numerical models:</b> 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.</p> <hr/> <p><u>NE Pacific and Salish Sea:</u>  <i>Lead PI: MacCready, UW</i></p> <ul style="list-style-type: none"> <li>- Support, at existing levels, the daily forecast model, LiveOcean, which simulates ocean circulation and bio-geochemistry in the Salish Sea and in coastal waters of the NE Pacific, including Oregon, Washington, and British Columbia</li> <li>- Deliver model output via NVS</li> <li>- Model verification and validation</li> </ul> <hr/> <p><u>Columbia River estuary and plume:</u>  <i>Lead PI: Seaton, CRITFC</i></p> <ul style="list-style-type: none"> <li>- Support, at existing levels, the CRITFC circulation modeling and forecasting system, which covers the Columbia River estuary and plume</li> <li>- Deliver model output via NVS</li> <li>- Model verification and validation</li> </ul> <hr/> <p><u>PNW Coastal Waters:</u>  <i>Lead PI: Zaron, OSU</i></p> <ul style="list-style-type: none"> <li>- Support, at existing levels, the OSU real-time coastal ocean forecast model, which covers the coastal waters off OR and WA</li> <li>- Deliver model output via NVS</li> <li>- Model verification and validation</li> </ul>

<b>Data Management &amp; Communications Subsystem</b>	
Data Management & Cyberinfrastructure (DMAC)	<p><b>Maintain, harden, and enhance NANOOS' Data Management and Cyberinfrastructure (DMAC) system for routine operational distribution of data and information:</b> Sustain and enhance the DMAC system, including the NANOOS Visualization System (NVS), for dynamic and distributed data access.</p>
	<p><u>Mature Regional DAC Operations:</u> <i>Lead PI: Tanner, UW</i></p> <ul style="list-style-type: none"> <li>- 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</li> <li>- 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</li> </ul>
	<p><u>NVS Support and Development:</u> <i>PIs: Tanner &amp; Carini, UW</i></p> <ul style="list-style-type: none"> <li>- 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</li> <li>- Sustain &amp; 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</li> </ul>
	<p><u>Engagement in National and Cross-regional DMAC Efforts:</u> <i>PIs: Tanner &amp; Carini, UW</i></p> <ul style="list-style-type: none"> <li>- 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</li> <li>- 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</li> </ul>
User Products Committee (UPC)	<p><b>Continue to deliver existing and, to the extent possible, create innovative and transformative user-defined products and services for PNW stakeholders:</b> Continue our NVS innovation to succeed in this vital translation for meaningful and informative data products that address user needs and serve society.</p>
	<p><u>Web Site:</u> <i>Lead PI: Tanner, UW</i></p> <ul style="list-style-type: none"> <li>- Continue to evaluate and update web content relevant to stakeholder issues, especially those related to Maritime Operations, Ecosystem Assessment, Fisheries &amp; Biodiversity, Coastal Hazards, and Climate; improve ease of usability and user tracking capabilities</li> </ul>
	<p><u>Tailored Products Development:</u> <i>Lead PI: Tanner, UW</i></p>

	<ul style="list-style-type: none"> <li>- Annually evaluate priorities for products at the Tri-Com meeting (DMAC, UPS, and E&amp;O), based on outreach feedback, regional issues, and GC input, and will implement new tailored products to the extent possible</li> </ul>
<p>Education &amp; Outreach (E&amp;O)</p>	<p><b>Sustain and diversify NANOOS engagement to the extent possible:</b> Continue ongoing engagement with diverse stakeholders and the public, increasing ocean awareness and literacy; to diversify the ocean and coastal workforce; to improve our ability to provide relevant ocean and coastal data and information to underserved or underrepresented communities; and to facilitate use of NANOOS products for societal objectives, the core task for which NANOOS exists.</p> <hr/> <p><u>Communication:</u>  <i>Lead PIs: Wold &amp; Newton, UW</i></p> <ul style="list-style-type: none"> <li>- Maintain up-to-date success stories, employing effective use of social media and newsletters</li> <li>- Support national communication through IOOS Program Office and IOOS Association collaborations</li> <li>- 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</li> <li>- Maintain existing and build new relationships to stakeholder user groups and the education community enabling NANOOS to achieve effective education and outreach</li> </ul> <hr/> <p><u>Product Co-Development:</u>  <i>Lead PIs: Wold, UW &amp; Allan, DOGAMI</i></p> <ul style="list-style-type: none"> <li>- 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</li> <li>- Conduct trainings to broader user groups and evaluate trainings to optimize NANOOS functionality</li> <li>- 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</li> </ul> <hr/> <p><u>Diversity, Equity, and Inclusion:</u>  <i>Lead PIs: Newton &amp; Wold, UW</i></p> <ul style="list-style-type: none"> <li>- Work with the other IOOS regions and the Program Office on workforce development initiatives to expand and diversify the ocean, coastal, and Great Lake workforces and to improve our ability to provide relevant ocean and coastal data and information to underserved or underrepresented communities.</li> <li>- 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.</li> </ul>
<p><b>Governance &amp; Management Subsystem</b></p>	
<p>Governance, Representation, Oversight,</p>	<p><b>Maintain NANOOS as the U.S. IOOS PNW Regional Association:</b> 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.</p>

Coordination & Accountability	<p><u>Governance:</u>  <i>PIs: Newton, Rome &amp; Carini, UW</i></p> <ul style="list-style-type: none"> <li>- 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</li> <li>- Assure these bodies are engaged in NANOOS prioritization of regional needs, work effort, and product development</li> <li>- Assure balance of stakeholders represented in NANOOS reflects the diversity found in PNW</li> <li>- Conduct annual GC meeting</li> </ul>
	<p><u>Representation:</u>  <i>PIs: Newton, Rome &amp; Carini, UW</i></p> <ul style="list-style-type: none"> <li>- Represent NANOOS at IOOS Program Office and IOOS Association meetings, and at national meetings of significance</li> <li>- Engage at a regional level at meetings and workshops affecting PNW stakeholders and NANOOS</li> </ul>
	<p><u>Project Oversight:</u>  <i>PIs: Newton, Rome &amp; Carini, UW</i></p> <ul style="list-style-type: none"> <li>- Conduct annual all-PI meetings and Tri-Committee meetings, providing clear feedback and direction</li> <li>- Share project evaluation at the annual PI meeting</li> </ul>
	<p><u>Coordination:</u>  <i>PIs: Newton, Rome &amp; Carini, UW</i></p> <ul style="list-style-type: none"> <li>- Coordinate with West Coast RAs and other RAs to optimize and leverage capabilities and assure consistencies</li> <li>- Engage in sub-regional and user-group specific workshops to aid coordination and optimization of effort</li> <li>- Coordinate with Canada (CIOOS, MEOPAR, etc.)</li> </ul>
	<p><u>Accountability:</u>  <i>PIs: Newton, Rome &amp; Carini, UW</i></p> <ul style="list-style-type: none"> <li>- Submit required IOOS progress reports and respond to other requests</li> <li>- Attain recertification in 2023 as the Regional Information Coordination Entity of US IOOS for the PNW</li> </ul>



## **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, with some delays

**Summary:** During this reporting period, work was completed for the operation and processing of data from the HF sites and their transfer to the IOOS HF data assembly center via our local portal, with CORDC uptime stats of 84% and 81% (#2 and #3 for the national system) for Apr-Jun and Jul-Sep respectively. Our MAN1 site, at Manhattan Beach, is down due to a lightning strike and needs to be completely re-installed; we now have permission from Oregon Parks to proceed. Our WIN1 site, at Winchester Bay, went down March 1<sup>st</sup> due to a lightning strike; electricians have now rewired the shed. All other damaged components have been replaced or sent off for repairs. Our WSP1 site, at Westport, WA, is experiencing SWR issues with the Tx antenna and ongoing troubleshooting, it is operating at a diminished capacity (60-75%). The transition to new frequencies requires installation of replacement HF antennas.

**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:** Permit received for at northernmost site KAL1, in the Olympic National Park; test installation begins in February.

#### ***FY23 Non-core Task 3: Expenses associated with SeaSondes for HFR [Kosro]***

**Status:** In Progress

**Summary:** Still negotiating for permissions to install new equipment at PSG1, MAN1.

**Accomplishments/Successes:** N/A

**Problems/Delays:** PI medical problems interfered.

#### ***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

**Summary:** Recapitalization needs in HFR Core section above revised to reflect this funding.

**Accomplishments/Successes:** N/A

**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

**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:** On track

**Summary:** The radar station on the USCG Yaquina Bay watchtower at Newport, OR, was operated nearly continuously through this reporting period. 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.

**Accomplishments/Successes:** No new changes were made to the radar system or web products during this period. With the exception of occasional maintenance outages, the system continues to operate reliably.

In related work, Randy Pittman traveled to the WebCOOS workshop to learn about the program and facilitate a new WebCOOS observing station at the Shilo Inn at Nye Beach, which is also in the field of view of our radar station.

**Problems/Delays:** At the beginning of this reporting period, the radar was inoperative due to a failed magnetron. On 14 Aug 2024 this part was replaced, and the radar was restored to operation.

**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. Most of the effort during this period was focused on the recovery of the summer moorings (Cha'ba, NEMO-subsurface) and deployment of the Winter Cha'ba mooring, which was carried out from October 21-24 aboard the R/V *Pacific Storm* out of Westport, WA. This cruise was very successful with all objectives met and all systems recovered in good working condition. Data coverage over the summer deployment was near 100% for all instruments from both moorings, with the exception of the PMEL pCO<sub>2</sub> system which failed shortly after deployment in the spring. All systems were working well on the Winter Cha'ba mooring, including the pCO<sub>2</sub>, after deployment. Unfortunately due to several extremely strong storms including the "bomb cyclone" of November, 20, winter Cha'ba broke free on the 14th of December, fortunately drifting into the Strait of Juan de Fuca over

the course of about a day. The buoy with attached instruments was recovered with the help of the U.S. Coast Guard and the F/V *Alyeska* of Neah Bay late on December 15th. The cause of the failure was determined to be failure of the acoustic release, with the release electronics failing and commanding the release to open. Severe accelerations during the storms may have caused the release electronics to fail in this manner and we are presently working with the manufacturer to address the issue. Due to limited budget funds, Winter Cha'ba will not be re-deployed before the spring 2025 cruise to deploy the Summer Cha'ba and NEMO-subsurface moorings. The team will also be working to redesign the winter mooring to reduce these large accelerations if possible.

A few positive highlights are that 1) the newly-purchased HydroCat EP V2 (replacing the now-defunct shallow WQM CTD) is working well, providing shallow CTD measurements including DO and pH, and 2) the new NEMO-Subsurface controller continues to perform well, with the McLane crawler collecting over 2000 profiles over the deployment. The deep SeapHOx, once again borrowed from Seabird, also continues to perform well and provide real-time deep DO and pH data.

The process of transferring all historical Cha'Ba and NEMO-Subsurface data—going back to 2010—onto the group's ERDDAP server continues. In addition to the Cha'Ba wind data, WQM CTD data, and NEMO-subsurface CTD data, much of the historical ADCP data is now accessible. Most of the near-real time data streams are also now passing through an ERDAPP server prior to being available on NANOOS Explorer, an improvement in QA/QC and streamlining data flow and archiving. All data currently available on the ERDDAP server can be found here: <https://nwem.apl.washington.edu/erddap>.

The team continued collaboration with Jennifer Hagen, Marine Policy Advisor for Quileute Natural Resources, who participated in our spring operations. The team also continued collaboration with Sea-Bird Electronics, which refurbished and renewed the loan of a Sea-Bird SeapHOX instrument that was deployed on the 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 recovery, Winter Cha'ba deployment and then emergency recovery. Again excellent data return on NEMO-Subsurface with new buoy controller. With the exception of the pCO<sub>2</sub> system (as noted above), real-time data transfer worked flawlessly for both moorings.

**Problems/Delays:** Acoustic release failure on Cha'ba, subsequent emergency recovery. See pCO<sub>2</sub> system problems 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 MapCO<sub>2</sub> 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:** Winter Cha'ba system working until emergency mooring recovery following acoustic release failure on December 15, 2024.

**Problems/Delays:** As described in the previous section, despite increased coordination, planning and training, the pCO<sub>2</sub> system failed to perform once again, stopping shortly after deployment on Cha'Ba in the spring of 2024. Discussions with the PMEL team suggest that a trip to the buoy would likely not remedy the issue and that a full system swap might be necessary. Weather did not permit swapping the system during the summer deployment, but the system was successfully working following the deployment of the Winter Cha'ba mooring on the 22nd of October.

Unfortunately, as noted above this deployment was cut short due to the mooring breaking free from its anchor chain on December 14th.

***FY23 Non-core Task 9: Support for OMAO allotment of FY23 resources in support of a vessel charter pool to service Cha'ba [Mickett]***

**Status:** Completed

**Summary:** These funds are to augment NCCOS MERHAB funds to deploy the ESP HAB-monitoring mooring adjacent to the Cha'Ba mooring.

**Accomplishments/Successes:** The remaining funds were used to support the August 2024 and October 2024 mooring operations.

**Problems/Delays:** None

***FY23 Non-core Task 10: Support NOAA-ON NANOOS Cha'ba - Charter Vessel Pool [Mickett]***

**Status:** Completed

**Summary:** Funding to support Cha'ba mooring servicing cruises will be used to cover the fall 2024 cruise aboard the R/V Pacific Storm.

**Accomplishments/Successes:** Cruise took place from October 20-24, from Westport to Westport. All cruise objectives met, recovering 3 moorings and two landers and deploying the Winter Cha'ba mooring.

**Problems/Delays:** None

***Washington Shelf HAB Buoy/Mooring:***

- *Support for the HAB ESP deployment on NEMO mooring [Mickett]*
- *Deliver NRT data streams via NVS [Mickett]*
- *Bring all data QA/QC to meet Certification standards [Mickett]*

**Status:** Complete

**Summary:** Due to constraints caused by the COVID19 pandemic this deployment was delayed from the spring of 2021, as originally planned, to the spring of 2022. The ESP mooring was deployed near the NANOOS NEMO and Cha'ba moorings on May 3rd with regular, real-time measurements of the HAB toxin domoic acid extending until late June as planned. The mooring was recovered on August 3rd.

Reliable, regular, real-time measurements of offshore domoic acid concentrations were made available to stakeholders via the NANOOS Real-time HABs website. The website was updated prior to the spring ESP deployment.

**Accomplishments/Successes:** This deployment was an unqualified success, with reliable, regular, real-time measurements of offshore domoic acid concentrations distributed to stakeholders via weekly email summaries and the [NANOOS Real-time HABs website](#). The website was successful in providing HAB toxin and valuable contextual data to stakeholders. This information was critical to assessing the risk of HABs on the Washington coast.

**Problems/Delays:** None

***FY24 Non-core Task 3: Support for fabrication of an additional HAB water sampler for the new Seasats AUV [Mickett]***

**Status:** Complete

**Summary:** Funding will support the fabrication of a custom, APL-designed Water Sampling System (WSS) that will be fitted in the Seasats Lightfish Autonomous Surface Vehicle (ASV) This supports an IOOS OTT project that was delayed/set back due to the switch to a more capable ASV.

**Accomplishments/Successes:** The APL-UW Water Sampling System (WSS) is complete with the first operational mission planned for mid-July. A successful field test of the Lightfish with the

WSS was completed in Puget Sound in June. Used aboard the Lightfish Autonomous Surface Vehicle (ASV) this system will allow the rapid collection of offshore whole water and filtered samples for subsequent shoreside processing. It represents a significant leap forward in offshore HAB sampling.

**Problems/Delays:** None

**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 March 2024 and operating normally. Assembly for the next buoy recovery/deployment was completed October 2024, but extreme seastates and limited vessel availability eliminated all chances for a turnaround until January of 2025. Previously lost down-tether thermistors still need replacing.

**Accomplishments/Successes:** Persistent deployment and monitoring for 9 months. Maintained working relationship with Coos Bay vessel service provider, and established a relationship with a new. Buoy/mooring system withstood the Bomb Cyclone event of November 2025, where seastates (Hmax) exceeded 13m

**Problems/Delays:** Vessel scheduling for workable ocean conditions continues to be a challenge for the OR coast. The Fall season of 2024 was marked by a rapid transition in early October to large seastates driven by local storms and large swell originating from significant low-pressure systems in the open North Pacific. The combination of these local and remote effects climaxed in the Bomb Cyclone event of November 2024, yielding wave heights exceeding 13m (Hmax ~13.2m). Buoy swapout is scheduled for 28 January 2025.

**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 been functioning well since Hales performed a field repair on the MApCO2 unit in July. The unit will be replaced with a new PMEL system on the mooring turnaround cruise on 28 January 2025.

**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. MApCO2 system seems to have some repeated characteristic failure modes; fortunately we have been able to perform small-boat field repairs to resolve these adaptively.

**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 deployed in June 2024. Throughout the 2024 deployment, the buoy collected the standard data described above with improved nitrate data through a SUNA v2 nitrate sensor, which captures the full UV spectrum range and enables post-corrections for temperature and salinity biases. Real-time preliminary data were available on NVS and the ERDDAP server, with subsequent delivery to NDBC, throughout the deployment. In early November 2024, the buoy drifted approximately 2.5 km northwest of its deployment location during a period of large waves and king tides, followed by an additional 1 km movement northwest when a bomb cyclone pushed the buoy to the edge of the Columbia River shipping channel. The Columbia River Bar Pilots alerted CRITFC that the buoy's new location posed a potential navigational hazard. Since CRITFC's usual vessel was not available for immediate recovery, CRITFC contacted the Coast Guard for assistance, and on December 11, 2024, the crew of the U.S. Coast Guard Cutter ELM recovered the buoy. This was a successful recovery with no known damage to instruments. Post-recovery instrument tests and data QC for the 2024 deployment are being finalized, and CRITFC is on track for a spring 2025 deployment of SATURN-02.

During 2024 CRITFC completed a major field staff transition, with the former field lead now fully retired. New staff members continued to acquire necessary training, including CRITFC technicians (Salazar and Feldman) and PIs (Gradoville and Seaton) completing a 4-day Oregon State University Motorboat Operator Training Course in September, 2024.

**Accomplishments/Successes:** Successful 2024 deployment and recovery. Improved nitrate data quality. Progress with field staff training.

**Problems/Delays:** None

#### **Washington La Push Glider:**

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

**Status:** On track

**Glider IDs serving this line:** SG263

**Summary:** SG263 was deployed on 26 November, 2024, but suffered a roll sensor failure that forced recovery on 25 January, 2025, after completing 287 dives. Recovery was executed through a charter to R/V Zephyr. SG263 is currently being serviced, and will be redeployed in Q1 or early Q2, 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 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 July to December 2024 reporting period, two glider maps were made off central Washington, one each in July and September. The glider was deployed for a total of 30 days, and produced 15 cross-shelf sections over 700 km with about 7000 vertical profiles of water properties. Glider data show that near-bottom, low-oxygen water was being upwelled on to the shelf in both July and September. Hypoxic and even severely hypoxic (DO concentrations less than 0.5 ml/l) waters reached about to the 40 m isobath in July. This prompted Joe Schumacker to issue a "NOTICE: LOW OXYGEN EVENT IN QUINAULT TREATY AREA" to the Quinault Indian Nation Leadership and Ocean Fishers on July 25, 2024. These data are [displayed on NVS](#).

**Accomplishments/Successes:** Completed the fourth, summer-season glider work off central Washington; continued operations with a reliable charter boat operator out of Westport, WA; Joe Schumacker (Quinault Indian Nation - QIN) briefed ocean users about oxygen levels in the coastal ocean.

**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

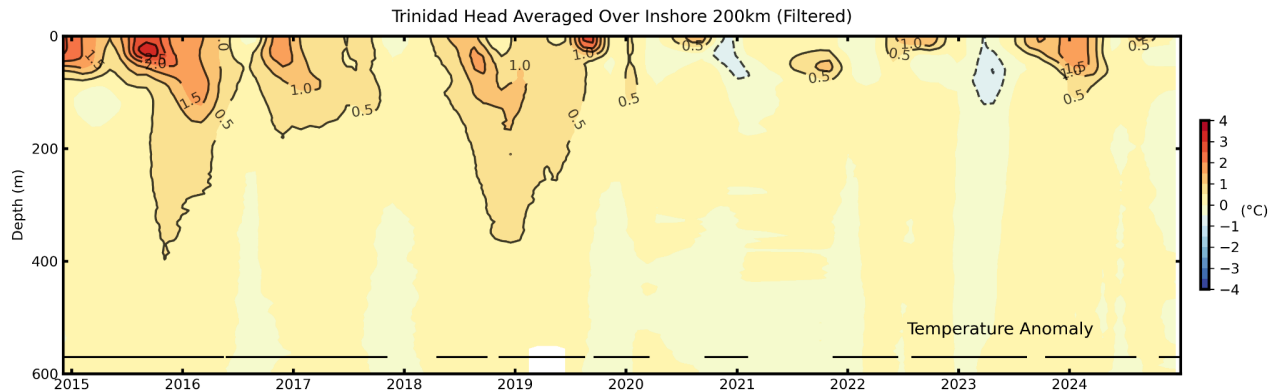
**Glider IDs serving this line:** osu685, osu686

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

For the reporting period, July to December 2024, a glider was on the TH line for 105 days during two deployments, sampled along 1931 km of track line covering the transect 5 times, and collected about 1075 vertical profiles of ocean properties. Glider uptime during this period was about 60% due to early failure of a new Seaglider SGX (see below). 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 Seaglider 686, purchased with NANOOS and CeNCOOS funds, into operation on the TH line. We also launched a new Seaglider SGX (sg266) and it performed well for 1.5 months before it needed to be recovered for repair. Data from the Trinidad Head glider line are being used to monitor the end of the 2023-2024 El Niño and the onset of ensuring La Niña conditions (see Figure JB.1 below).

**Problems/Delays:** The oxygen sensors failed early in the mission of sg686; we have replaced that sensor after glider recovery. The new Seaglider SGX (sg266) purchased with BIL funds was launched in late October 2024, but a hardware failure required recovery in early December. That glider is presently at UW/APL for repair. We hope to get it back out on the TH line by Feb 2025.



**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 16-Aug-2024, 13-Sep-2024, 09-Oct-2024, and 07-Nov-2024 Bulletins. Risk of a toxic *Pseudo-nitzschia* bloom was characterized as 'high' in mid-August, a result of elevated seawater particulate domoic acid (pDA) concentrations, increased shellfish DA concentrations, and forecast northward winds. Risk was characterized as medium throughout the remainder of fall 2024 despite some seawater samples containing elevated pDA. During a 08-Oct ORHAB meeting, PI McCabe openly questioned the accuracy of pDA values being reported by new ELISA kits in use by ORHAB, WDFW, and ODFW, citing the fact that razor clams were not accumulating toxins at expected rates despite elevated pDA concentrations. WDFW and ODFW personnel agreed that toxin concentrations from the new kits appeared questionable. Subsequent analysis by WDFW and ODFW personnel suggested that the new kits were, in fact, reporting pDA concentrations at significantly higher levels than prior ELISA kits. This is a critically important issue because pDA values are used in early-warning and there is a well-established threshold value for pDA, above which, razor clams begin to accumulate DA in their tissue. ORHAB, WDFW, and ODFW personnel continue to work with the ELISA manufacturer in an effort to resolve this issue. 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 will be used to sample at offshore HAB retentive sites. Some funds still remain after the current reporting period, but will be spent as soon as UW approvals have been obtained for high cost (>\$10k items), such as the distilled water system (including travel and installation). We onboarded our new UW Olympic Natural Resources Center (UW ONRC) administrative assistant, Renee Reed, in late January 2024, so purchasing is becoming more streamlined.

**Accomplishments/Successes:** UW ONRC in collaboration with ORHAB (Olympic Region Harmful Algae Bloom Partnership), serves as a primary data source for state and tribal shellfish managers and the PNW HAB Bulletin on Washington's outer coast. The four Coastal Treaty Tribes (Hoh, Quileute, Makah, and the Quinault Indian Nation) are members along with state, federal and academic partners. Core funding for ORHAB's shore-based monitoring is provided by the Washington State Legislature from a percentage of recreational shellfish license fees but off-shore monitoring is not mandated.

The December 2024 fund balance for ONRC cost and tribal allocation of \$68,721.48 necessary for participating in offshore sampling over-and-above their weekly shore-side sampling. This included equipment upgrades necessary to process the higher volumes of samples and the support of deployments of the Lightfish, an Autonomous Surface Vehicle (ASV). The equipment and supplies allow the Tribes to establish independent sampling and laboratory operations, which will be the focus for the remaining funds for Hoh Tribe. An Memorandum of Understanding has been signed by ONRC and the Hoh Tribe which will allow the Tribe to use the ONRC facility as a laboratory resource. The recent field testing and installation of the water sampling system in the ASV technology for off-shore monitoring in the region has exposed the pivotal role existing tribal labs are playing in processing samples and hosting the launching and retrieval for remote vehicle missions, as shown below. 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 worked 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:** The purchase of high-cost items (~10k each) required 3 independent bids which delayed the purchase of equipment by almost 1 year. These purchases have now been made and will be reflected on the budget in early 2025. The delivery and installation of water systems at the ONRC lab, Quinault tribe and Makah tribe is scheduled for February 2025.

### **Trainings/Meetings:**

- ORHAB annual ELISA training and In-person Annual Meeting, 22-23 January 2025
- Lightfish training for coastal collaborators with SeaSats corporation, Virtual, 5 June 2024
- Lightfish deployment, Newport, OR, 3-5 July 2024

- Lightfish training for Oregon collaborators, Neah Bay, WA, 17-18 July 2024

### **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 transitioned the daily model runs to newer hardware in the UW supercomputer system (purchased with other funds) that resulted in more reliable forecasts. We updated and simplified our python environment, and improved our forecast driver code to allow for cleaner integration of nested sub-models. We also continued training of Dr. Jilian Xiong as part of the LiveOcean succession plan in anticipation of Dr. MacCready's retirement. Dr. Xiong successfully maintained the forecast on her own for the last half of December 2024.

**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 75 requests for support from SoundToxins participants and partners including requests for monitoring support, phytoplankton identification and data use requests. We received 68 emails alerting to the presence of harmful algal bloom species of which 25 of the alerts were passed on to the Washington State Department of Health as part of the phytoplankton cell presence alert system. During the reporting period a three part training series of Regional HABs Taxonomy. We also conducted virtual training sessions for 4 new monitors and conducted 4 site visits to support monitors. We presented formally at the Willapa Grays Harbor Estuary Collaborative summer and fall meetings to address the large paralytic shellfish poisoning event that affected the coast in May 2024. We also presented at the Pacific Shellfish Growers Association meeting as well as an outreach presentation at the Port Townsend Wooden Boat Festival. We hired and onboarded Melissa Petrich, a new Water Quality Specialist at Washington Sea Grant, who started on December 2 and will be helping with the management of the SoundToxins program.

**Problems/Delays:** The previous PI, Teri King, left the program for a new position in September 2023. The SoundToxins program continues the essential functions of providing support for phytoplankton monitoring in Puget Sound, but is still operating under reduced capacity causing some delays for lower priority tasks.

### **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. 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. 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 Umpqua Bait in Winchester Bay, 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 nearly 500 new observations. For the 2024 sampling season, George has successfully maintained the sample kit station at Hatfield Marine Science Center (HMSC), and trained Post-Bac Researcher Amanda Kent on fishermen/sample coordination, HMSC station maintenance, and outreach related to the project. The station at HMSC was reinstated for the summer sampling season in late May, 2024, and fishermen sampling remained steady from June through the end of September.

George and Kent have increased outreach for this project this year in two key ways. They have 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 includes 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 has attended two Oregon coast fishermen-centered meetings to engage a broader audience of Oregon fishermen. These meetings were ODFW's 7th Fishermen-Scientist Ocean Acidification and Hypoxia (OAH) Roundtable Meeting in Newport, OR in May, and the July Oregon Coast Anglers (OCA) meeting in Winchester Bay, OR, which Kent also attended. At the OCA meeting, George gave a 30 minute presentation on the Cooperative Fisheries Plankton Research project in an effort to recruit participants local to the Reedsport and Winchester Bay, OR area.

A second fishermen sampling kit station, located at Umpqua Bait in Winchester Bay, OR, was established in July. This location was selected with the assistance of local fishermen and coordinator of the OCA meetings, Steve Godin. George maintained regular contact with Godin in an attempt to establish fishermen participation, but few responded to the call to action at this location. George and Godin have planned more effective ways to recruit more fishermen in the Reedsport/Winchester Bay area for the 2025 sampling season to ensure more sampling in the area if the Umpqua Bait sampling station is reestablished.

During the Paralytic Shellfish Poisoning (PSP) outbreak due to *Alexandrium* sp. during the Summer of 2024, Kavanaugh, George, and Kent conducted beach sampling to assist Oregon Department of Fish and Wildlife (ODFW) in detecting *Alexandrium* sp. abundance 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.

In September, 2024, a new Graduate Student researcher, Taylor Wood, was brought into the Cooperative Fisheries Research project. Wood will be managing the project beginning in the 2025 sampling season, with George providing project assistance as needed. The project is expected to have 5-10 participating fishermen. 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.

**Challenges/Delays:** One challenge has been the coordination of pDA and TDA samples for comparisons. There have been some issues with kit availability and loss of kits. We have found reliably sourceable ELISA DA testing kits that can be employed for regular DA testing during the 2025 sampling season, and have begun using these kits to process the backlog of TDA samples from all sampling seasons dating back to 2022. We are working towards new, more robust sampling protocols to include better practices for pDA sample collection for the 2025 sampling season and onward.

#### **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:** ODFW, after a reporting period with interrupted staffing, 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 169 near-shore samples were analyzed for HABs from 8 sites along the Oregon coast. HAB species were found in 123 of those samples with *Pseudo-nitzschia* spp. being the primary HAB (110 samples). Elevated numbers of *Pseudo-nitzschia* spp occurred in July-October with cells/liter exceeding a million 14 times. Further analysis for particulate domoic acid (pDA) was conducted on 47 samples with results ranging from low (<40ng/l) to extremely high (>5,800). Additionally, 13 nearshore water samples were collected during the commercial Dungeness crab fishery market testing in November. While HAB species were observed, they were at very low levels. All data collected was summarized and used in the PNW HAB bulletin.

**Problems/Delays:** ODFW phytoplankton project has been having difficulties with new ELISA kits and the results they have been providing. Coastal shellfish managers have developed a matrix of early detection protocols based upon cell counts and ELISA results. The new kits provide results that are significantly different from the previous kits that the early detection protocols were developed from. The kit manufacturer and coastal shellfish managers have been working to resolve this discrepancy.

#### **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:** Remaining PNW HAB observing needs were addressed through NANOOS' IRA proposal and are 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.

The test deployment of the new mooring design to take profiles via a float system instead of a winched system was completed in August 2024. The test deployment was a success, with the float system successfully taking ~3 profiles every day over the approximately 4 month test deployment period. The test gives us confidence in the new profiling mooring design, which is targeted for the deployment of the first of the new buoys in the summer of 2025.

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.

**Accomplishments/Successes:** Multiple successful maintenance operations, and continued troubleshooting to identify root causes of rapid failure modes. Additional monitoring of sensor calibrations have improved the recency of instrument calibration. Data availability via ERDDAP has been further improved to include all necessary fields needed for direct ingestion in GTS via NDBC data services. This includes all data from the meteorological stations on the buoys, as well as gridded data from the profiles themselves.

**Problems/Delays:** Continued profiling downtime was experienced due to aging systems and external factors, such as poor weather, preventing service visits to the buoys. Long lead times have caused challenges in keeping sensor calibrations recent. Continued problems with cellular coverage resulted in intermittent data harvesting from the profiling mooring at Twanoh. Aging infrastructure resulted in the chain of a mooring anchor leg breaking at the Carr Inlet buoy, necessitating an emergency swap and repair of the anchors for this buoy. This work was done during the last week of August 2024. In September 2024, a hole was discovered in the hull of the team's primary field work vessel, the R/V Spray. The vessel was immediately taken out of service until repairs could be made. Repairs to the vessel were completed in November 2024. Additional challenges include personnel turnover, resulting in reduced capacity for field work and buoy maintenance.

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

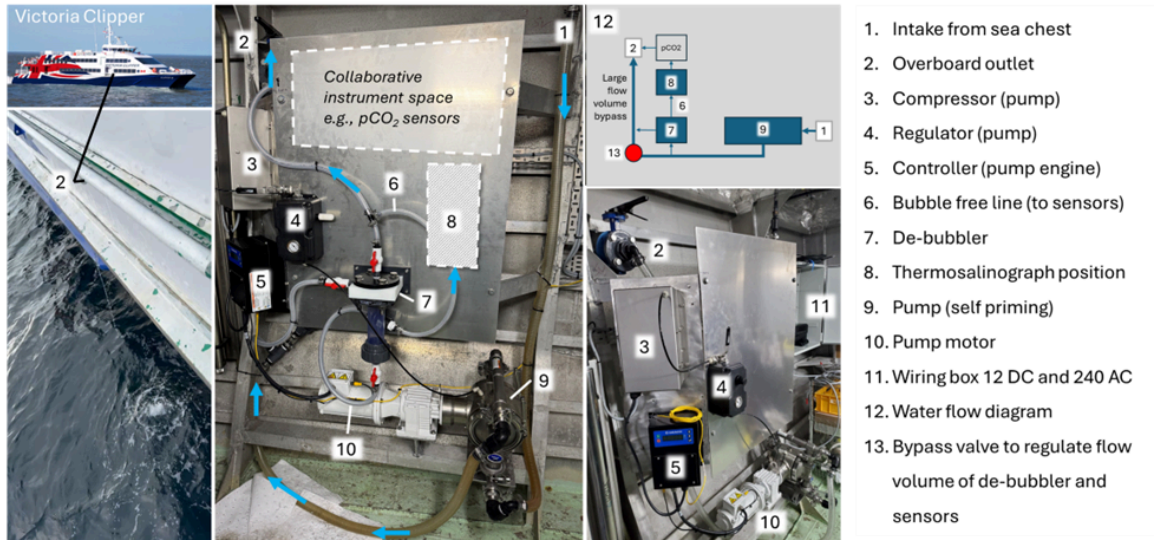
- *Maintain US-Canada ferry-box at existing levels following COVID-19 and the companies struggle to regain profitability [Krembs]*
- *Deliver data via NVS [Krembs]*
- *Bring all data QA/QC to meet Certification standards [Krembs]*

**Status:** Continuing as ship dock time allows for the implementation of the remaining systems.

**Summary:** Ecology has successfully maintained the en route ferry monitoring system with the support of the Victoria Clipper engineering team. Over the past few months, progress has continued, with further installations moving forward steadily. We are excited and well-positioned to complete the reinstallation of the ferry box onto the ferry.

**Accomplishments/Successes:**

- Successfully installed and tested the debubbler, fine-tuning flow rates, pump frequency, and pressures to optimize water flow to the sensors. Test runs confirmed the debubbler's effectiveness in delivering a bubble-free water stream to the thermosalinograph and other sensor lines.
- Completed the electrical installation of all 240V lines supporting the pump and its control system, performed by a Coast Guard-certified electrician.
- Prepared for the final installation of Raspberry Pi sensor controllers and the communication network, scheduled for the coming month.



**Current Focus:** Our team has successfully completed the installation, testing, and optimization of water flow components. The focus is to implement the Raspberry Pi controller and communication network on the ferry.

1. Test and run sensors within the predefined geogrid while the Victoria Clipper is en route.
2. Establish data transfer protocols, paving the way to future data binning, and QA/QC routines in an external database.
3. Develop a basic web-based data viewer to provide WA Ecology staff with a way to access the data
4. Provide all plumbing to integrate future collaborative sensors (e.g., pCO<sub>2</sub>) into the ferry system.

**Problems/Delays:** None

**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 is still being 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. A new pumped station was constructed, but problems with circuit boards, charge

controllers, and flow meters have caused significant data gaps for pumped data. Extensive troubleshooting was conducted and problems were diagnosed during this period, and the pumped system is expected to be fully functional in early 2025. The Baker Bay (SATURN-07) buoy was deployed in November 2023 and is currently on station. The buoy is still collecting high quality physical data, but the biogeochemical sensors are producing low-quality data and the buoy is scheduled for recovery in early 2025. A new Baker Bay buoy is currently being constructed and will be deployed in spring 2025. The Cathlamet Bay (CBNC3) buoy remains on station. The Youngs Bay (SATURN-09) buoy was deployed in March 2024 and serviced shortly thereafter. SATURN-09 produced high-quality data throughout 2024 and is scheduled to be recovered, rebuilt, and redeployed in 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.

**Accomplishments/Successes:** Estuary stations were maintained. Progress was made in troubleshooting the pumping system at Tongue Point.

**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. The four real-time water quality stations in the South Slough estuary measured continuous water temperature, salinity, dissolved oxygen, pH, turbidity, and water level measurements every 15 minutes over the period 7/01/24 – 12/31/24. 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 and Tom's Creek weather platforms. Water quality data collection was completed at the Charleston Bridge and Valino Island stations, but telemetry functions have been unavailable in preparation for steel piling installations due to aged wood infrastructure. The new platforms will be upgraded with YSI Storm 3 telemetry systems. The Reserve is working with contractors for planning the piling replacements. 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 CTCLUSI station has been offline for the reporting period due to personnel changes. Monthly sonde instrument exchanges, maintenance, and data management for 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. One project is an Oregon Ocean Science Trust biophysical modeling project evaluating the interaction of water quality and eelgrass in the Coos estuary. The Reserve's Margaret Davidson fellow completed her thesis research on eelgrass seedling response to marine heat waves and defended her thesis *Spatiotemporal variability in Eelgrass Reproductive Properties in an Oregon estuary* on 8/2/2024. The Reserve education team accessed water quality datasets for programs on climate change and developing exhibits for the Reserve's Visitor Center. The Reserve hosted two Summer interns, from the NSF Research for Undergraduate program and NOAA's National Centers for Coastal Ocean Science along with a part-time Fall intern that assisted the science program with water quality and eelgrass fieldwork and laboratory sample processing.

**Problems/Delays:** The Charleston Bridge water quality station continues to have seasonal fouling issues in the summer affecting monthly instrument exchanges and the station will be relocated. The Valino Island station has an unstable wood pile platform, and the sensors are affected by sediment changes predominantly in the winter. The new station will be relocated further into the channel to resolve these issues.

## **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 summer and fall seasonal beach monitoring surveys in southwest Washington and northwest Oregon, including the beaches of Long Beach, Grayland Plains, North Beach, and Clatsop Plains, which make up the Columbia River littoral cell (CRLC). In August, over 200 beach profiles were collected in key parts of the littoral cell to extend nearshore bathymetry profiles collected by the U.S. Geological Survey and Oregon State University using personal watercraft. In September and December, the CMAP team collected 96 cross-shore beach elevation profiles (up to 50 per season), 16 ATV surface maps, and nearly 60 sediment samples along 135 km (84 mi) of shoreline. Seasonal beach profile data and contour change plots are made available through the [NANOOS Visualization System: Beach and Shoreline Changes portal](#).

Ecology continues to monitor active and planned dynamic revetments along the Pacific coast at Westport, North Cove, and Benson Beach. In both August and December, the CMAP team and Coastal Engineers conducted detailed topography surveys of the 700 ft-long constructed dynamic revetment fronting the Westport by the Sea condominiums and the 3.7 km (2.3 mi)-long shoreline of the North Cove community on the north shore of the mouth of Willapa Bay. At North Cove, the team also collected digital photos of the surface sediments at different elevations across the revetment and beach to assess how sediments have changed over time. Our team periodically provides data & monitoring results to these local communities to help inform their winter preparation and maintenance efforts. In September and December, CMAP and the Coastal Engineers continue to collect condition surveys at Benson Beach to obtain baseline beach and dune topography data before the construction of a dynamic revetment north of the Columbia River North Jetty. The data is presented to the US Army Corps of Engineers at biannual Lower Columbia Solutions Group meetings and informs their practices on the Beneficial Use of Dredged Material.



As a comparison to the constructed dynamic revetments at the North Cove and Westport sites, the CMAP team continues to collect seasonal topographic surveys near the South Beach campground south of Kalaloch on the Olympic Peninsula to monitor the cobble berm found on this natural composite beach. During this reporting period, surveys were conducted in July and October. Metrics derived from observing a natural cobble berm can inform engineering design and dynamic revetment construction or maintenance requirements. Results from this work were presented by one of our Coastal Engineers at the International Conference on Coastal Engineering in Rome, Italy in September.

Starting at the end of summer 2024, Ecology has taken on a new project with Washington State Department of Transportation to study the performance of a new cobble berm to be installed by February 2026 on Graveyard Spit near Tokeland. The project will help protect Graveyard Spit, State Route 105, the North Cove estuary, and the Shoalwater Bay Tribe Reservation. A pre-construction survey was conducted by Ecology at the end of summer 2024 and another will be done in February 2025 to document current conditions on the Spit prior to construction. Ecology plans to monitor post-construction at the end of summer and winter from October 2026 through February 2028.

CMAP, in collaboration with the Coastal Engineers, are engaged with the City of Ocean Shores to address severe erosion challenges along the Oyhut Bay shoreline. CMAP has conducted post-construction monitoring for an emergency cobble berm installed in December 2024 and plans to continue to monitor the berm's performance to inform adaptive management and design in future project phases.

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 updating the dataset and preparing a standard data format. Once a data repository has been chosen, it will be accompanied by a data descriptor that can be cited.

**Accomplishments/successes:** Data collected by the CMAP team continue to be used by the USACE and consultants (e.g., Mott MacDonald at Oyhut and North Cove, Herrera for work with WA State Parks along the Pacific coast) to assess local and regional coastal changes on Washington beaches, particularly at locations with dynamic revetments. Our growing 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.

Staff presented at several scientific conferences and community meetings/workshops during this reporting period. In August, G. Kaminsky presented at the American Shore & Beach National Coastal Conference in Galveston, Texas, on beach restoration using gravel-cobble sediments on U.S. Pacific Northwest lake and ocean shores (Kaminsky and Lorang, 2024). In September, one of our Coastal Engineers presented at the International Conference on Coastal Engineering in Rome, Italy, on results from monitoring a natural cobble berm to inform nature-based solutions for high-energy coasts (Gostic et al., 2024). In September, results from our monitoring work at Benson Beach were presented to the U.S. Army Corps of Engineers and others at the Lower Columbia Solutions Group meeting. In October, one of our Coastal Engineers presented to a group of coastal planners at Ecology on how our coastal monitoring data is used to increase coastal resilience and inform communities on winter storm preparation (Gostic, 2024). In December, several staff presented at the American Geophysical Union Annual Meeting in Washington, DC, sharing results from our monitoring work on nature-based solutions and applications to engineering of dynamic revetments (Kaminsky et al., 2024; Sumaiya et al., 2024), and how lithology can influence erosion rates of Puget Sound coastal bluffs (Alampay, et al. 2024).

Two new GNSS receivers were acquired in July, which allowed us to retire one old system and add an additional system to increase efficiency in the field during data collection, taking

advantage of newer technology and using more satellite constellations to increase our survey accuracy and reliability. Our team hired a new Section Manager as well as two new Coastal Engineers, increasing our capacity to provide technical assistance and advance research on nature-based shoreline protection.

**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 spring 2023. Attention has been given to sites with dynamic revetments to assess performance for providing technical guidance. Plans will be made to focus on updating this dataset in early 2025.

We continue to look at options to increase efficiency and surveyor safety using Structure from Motion or lidar collected using unmanned aerial systems (UAS). We are waiting on the arrival of a small UAS (Anzu Robotics Raptor) that will allow us to collect high-resolution imagery and generate topographic data via photogrammetry.

A broken sieve shaker put a halt to sediment sample processing for the better part of 2024. New parts were purchased and installed the end of December 2024. Sediment sample processing to resume in early 2025. We are also doing research on a new sediment sample processing instrument (Camsizer 3D) that will allow us to process samples with tremendous efficiency, improved accuracy, and the ability to analyze particle shape.

Plans to purchase new equipment and hire additional staff to help with data processing, data collection, and analysis have been delayed due to a State-spending freeze issued in early December, halting the use of state funds for hiring, non-essential travel, and equipment.

### ***Oregon Beach and Shoreline:***

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

**Status:** Complete for the season

**Summary:** The Oregon Beach and Shoreline Mapping Analysis Program (OBSMAP) efforts are led by J. Allan and his team at the Oregon Department of Geology and Mineral Industries (DOGAMI). Beach profile data – summer and fall surveys – were successfully collected in the Rockaway littoral cell (25 sites), along the Clatsop Plains (6 sites), and along the Neskowin cell (15 sites); terrestrial scanning of a dynamic revetment cobble beach adjacent to the south Columbia River jetty were also collected. Surveys were undertaken in October and December 2024. 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 successfully used the TLS scanner to collect additional change information on the Columbia River dynamic revetment and foredune, adjacent to the south jetty. An initial baseline scan was completed in December 2023, with follow-up scans collected in March and October 2024. Post-processing of these data successfully demonstrated the utility of this approach at this location for documenting changes on the cobble berm and foredune. Over this period, we completed development of a script to be able to extract meaningful morphologic change data from the scans for each of the transects sites. These results have been posted to the NANOOS beaches and shoreline portal. The latest scanning confirmed the natural foredune immediately south of the cobble berm structure has continued to erode slightly and could breach over the 2024/25 winter season. Field observations of a [long-term monitoring site](#) located in the same area, indicates that the foredune continues to retreat and is approaching a point where overtopping and inundation is a strong possibility. Were breaching to take place, this could have significant repercussions for the viability of the dynamic revetment.

**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. PI Allan presented to the community of Netarts and Oceanside on coastal geologic hazards, beach processes, and NANOOS coastal monitoring underway in the Netarts littoral cell and elsewhere in Tillamook County.

**Problems/delays:** None

***Washington and Oregon Bathymetry:***

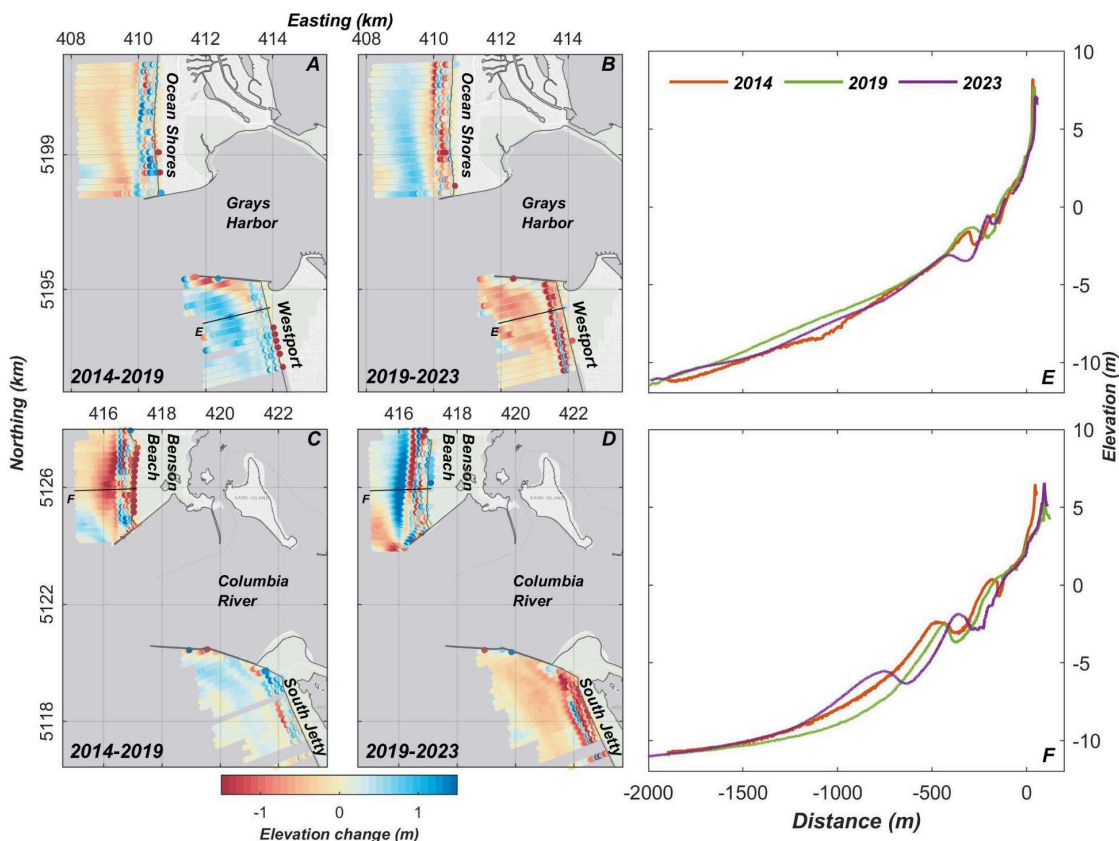
- *Maintain nearshore bathymetric observations of beach and shoreline morphodynamics in WA and OR at existing levels [Ruggiero]*
- *Deliver data via NVS [Ruggiero]*
- *Bring all data QA/QC to meet Certification standards [Ruggiero]*

**Status:** Complete for the season

**Summary:** In collaboration with the Washington State Department of Ecology and the U.S. Geological Survey, P. Ruggiero's group at Oregon State University collected nearshore bathymetry data along the four sub-cells of the Columbia River littoral cell (CRLC). Over 220 individual cross-shore profiles were collected during summer 2024 extending from the lower inter-tidal to ~12 m of water depth (~2000 m from the shoreline). Approximately 400 kilometers of nearshore mapping took place within ~6 days of field data collection. These data have been processed from their raw format into deliverable text files and have passed a rigorous quality assurance process. In all cases, these nearshore bathymetry measurements have been combined with topographic measurement collected by Ecology developing complete maps of the nearshore planform. Ruggiero's group also collected nearshore bathymetry along the Newport littoral cell in Oregon to support field experiments and modeling efforts focused on the influence of the region's basalt reef on wave propagation. This collaborative field campaign is benefiting the US Army Corps of Engineers and other regional stakeholders.

**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. During this time period Ruggiero's group finalized the development of a new generation Coastal Profiling System with two new Personal Watercraft. This new equipment was used for all data collection during summer 2024. Figure PR.1 from Stevens, A., Ruggiero, P., Parker, K., Vitousek, S., Gelfenbaum, G., and Kaminsky, G., 2024. Climate controls on wave-drive sediment transport and coastal morphology adjacent to engineered inlets, Coastal Engineering, <https://doi.org/10.1016/j.coastaleng.2024.104617>

**Problems/delays:** None



**Figure PR.1.** Maps of measured elevation change adjacent to engineered inlets Grays Harbor (A-B) and the Columbia River (C-D) for two time periods including 2014-2019 (A,C) and 2019-2023 (B,D). Example combined bathymetric and topographic profiles from Westport and Benson Beach are shown in E-F, respectively.

## **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 bio-geochemistry 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 domain 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 completed a 12 year hindcast with the latest version of the LiveOcean model and merged it with the ongoing daily forecast. The longer hindcast allows analysis of several marine heatwaves and other extreme environmental conditions of interest to our stakeholders. We formed a climatology of monthly means and monthly anomalies from the long hindcast. An example of Sea Surface Temperature anomalies is shown in Figure PM.1. At the request of stakeholders who monitor Harmful Algal Blooms near Willapa Bay we developed a new interactive particle tracking web tool which can be accessed here:

[https://faculty.washington.edu/pmacc/LO/tracks2\\_wgh.html](https://faculty.washington.edu/pmacc/LO/tracks2_wgh.html). We also developed new interactive tools to allow the public to explore the last decade of regional water property observations (<https://faculty.washington.edu/pmacc/LO/obs.html>), and another to explore how those observations compare with the modeled fields

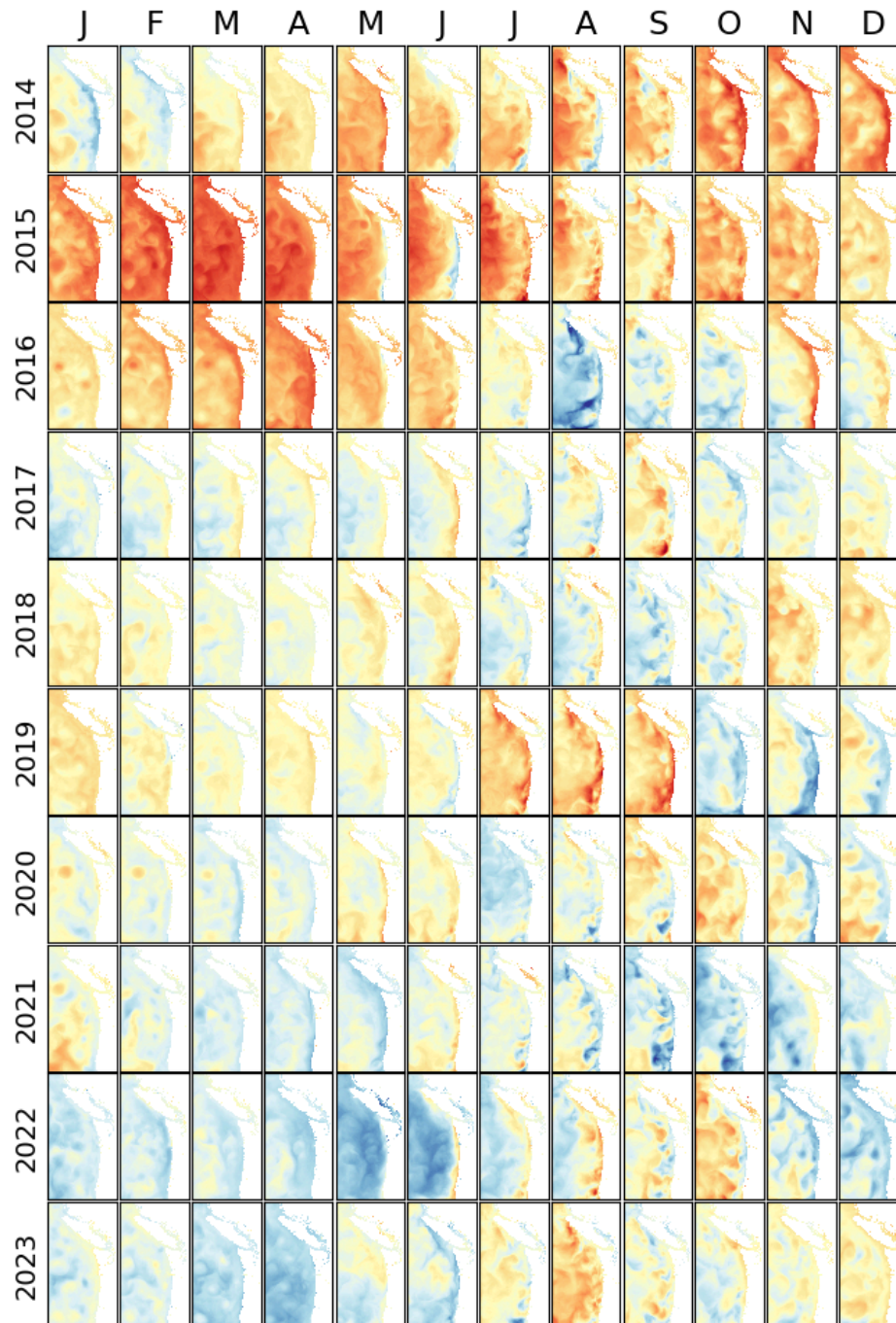
(<https://faculty.washington.edu/pmacc/LO/obsmod.html>). In an effort to create new capabilities relevant to Puget Sound shellfish growers, we created a new high-resolution (100 m grid size) nested sub-model of South Puget Sound, Figure PM.2, including highly productive Totten Inlet. An example movie from the daily forecast is here:

[https://faculty.washington.edu/pmacc/LO/p5\\_oly\\_temp\\_top.html](https://faculty.washington.edu/pmacc/LO/p5_oly_temp_top.html). Working on our PI transition plan, we created a new version of the forecast Operators Manual, aimed at transferring Dr. MacCready's experience to his successor Dr. Xiong and other model operators,

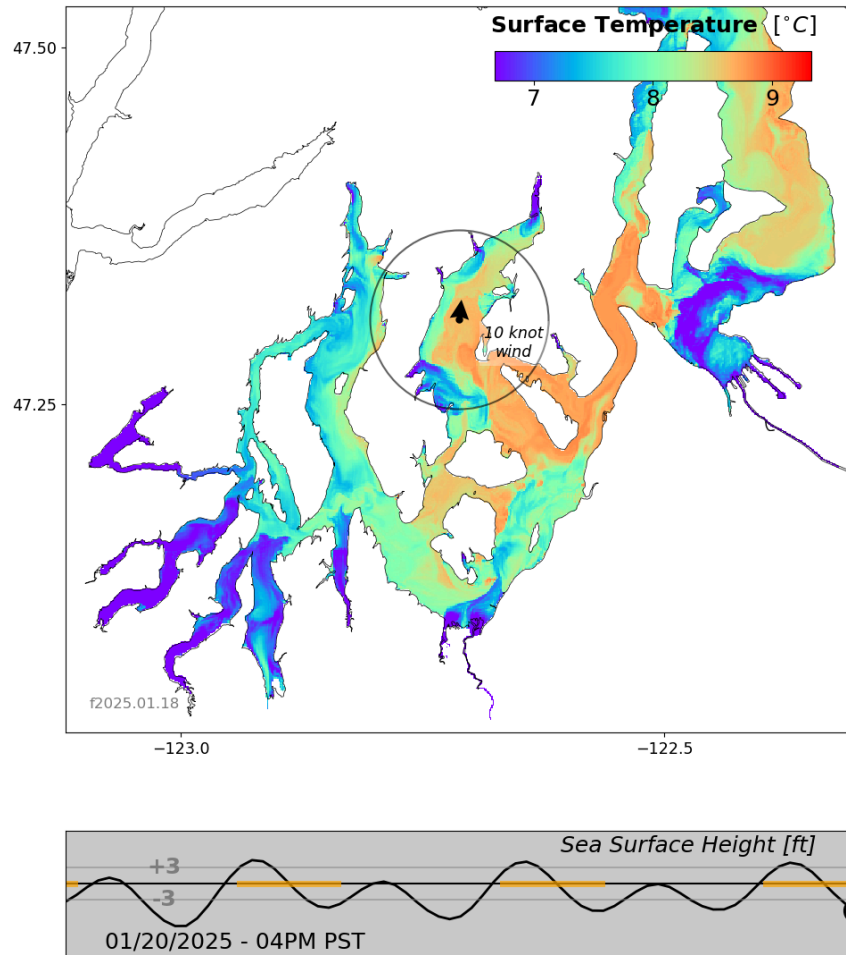
[https://github.com/parkermac/LO/blob/main/notes/Forecast\\_Operators\\_Manual\\_PRO\\_VERSION.md](https://github.com/parkermac/LO/blob/main/notes/Forecast_Operators_Manual_PRO_VERSION.md). Finally, significant improvements were made by the NANOOS web team (Tanner and Dioso) in the LiveOcean overlays in NVS.

**Problems/Delays:** None

Surface Temp. (deg C): Monthly Anomaly: (Range = -3, 3)



**Figure PM.1.** Monthly mean Sea Surface Temperature anomalies from the LiveOcean long hindcast. The Marine Heatwave called “The Blob” is clearly visible in 2014-2016. A monthly anomaly is calculated as the monthly mean in a given year minus the mean of that month from all 10 years.



**Figure PM.2.** Snapshot of Sea Surface Temperature from the new high-resolution nested submodel of South Puget Sound. This is run routinely as part of the daily forecast.

**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. Results of model calibration were presented at Fall AGU meeting in Dec 2024. Modeling capabilities supported by NANOOS underpinned a successful grant proposal to NOAA-NMFS-HCPO which will support further model development which will feed back into operational VCR forecasts and hindcasts, and support coastal resilience efforts in Pacific and Wahkiakum County (WA).

**Problems/Delays:** None

***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 are working with OCS-CSDL to develop a three-dimensional coupled ice-ocean forecast system for the coastal waters of Alaska (STOFS-3D-Alaska). As part of this task we have built a 3-D SCHISM Bering Sea ocean circulation model to simulate ice-free seasons and undertaken validations with observations and other established models. Model-observation validations have been performed with satellite sea surface temperature and coastal sea level data so far. We have developed a standalone CICE (sea ice model) application for the Bering Sea as well, again validating model results with observations and established models. Simulations have been performed and validations made for both years with normal and record low ice coverage. As a first step in coupling SCHISM to CICE, we have migrated the CICE application for the Bering Sea to the Unified Forecast System (UFS-Coastal), with data layers for both atmospheric and oceanic forcing provided through data layers using CMEPS.

**Accomplishments/successes:** The Bering Sea SCHISM model accurately represents both sea surface temperature evolution and sea surface height evolution on tidal to seasonal time scales for the ice free season. The UFS-Coastal implementation of CICE with CMEPS data layers successfully reproduces standalone CICE sea ice characteristics both in typical and extreme low-ice years in the Bering Sea. These accomplishments set the stage for full two-way coupling of the ocean model to the sea ice model, for all-season simulations in the Bering Sea. Results presented at OceanPredict 2024 and the Fall AGU meeting. Manuscript on CICE standalone modeling of the Bering Sea is being submitted for publication February 2025.



**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 second half of 2024, we: a) upgraded tidal analysis methods to replace a deprecated tidal analysis package and remove a dependency on licensed software (matlab); b) incorporated fresh water discharge from the GLOFAS global flood model, which provides historical and forecast discharge along the entire Pacific rim; c) developed and tested a new vertical coordinate scheme for the Columbia River estuary (CRE) that provides greater stratification and allows a higher timestep for the model. The high-energy Columbia River estuary had previously been a limit for the usable model timestep, so the new vertical coordinate scheme for the CRE will allow improved model performance throughout the Pacific. Hand off of a new version of the model to CSDL is planned for early 2025, with operationalization of STOFS-3D-Pacific planned for late 2025.

**Accomplishments/successes:** Improved model inputs and handling of CRE in preparation for development of operational NOAA storm surge model STOFS-3D-Pacific. Presented at Fall AGU in Dec 2024.

**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.

**Accomplishments/Successes:** Updated or created harvesters for Bellingham Bay - Se'lhaem buoy, Quileute Landers, NWIC Bellingham Bay, ORCA Twanoh, ORCA Dabob Bay, Chaba, NEMO, CB-06, PSI Totten, ORCA Carr Inlet, and Backyard Buoys Sofar Spotter buoys.

**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:** Added CDIP Tillamook Buoy to NVS. Added Quileute South Sofar buoy to NVS. Converted LiveOcean overlays to dynamic overlays. Updated UUV code to support Lightfish Glider. Added climate data and real-time data buttons to NVS Climatology sites. Improved NVS timeline time-series plots when displaying unconnected data. Created add platform history service to NVS. Updated WA brochures, markers, and elevation markers in TsunamiEvac app. Updated Oregon tsunami brochure URLs in NVS TsunamiEvac app. Added new video to TsunamiEvac. Updated contents of Fishers App Plots section. Updated NWEM site info in NVS.

**Accomplishments/Success:** Converted LiveOcean to dynamic overlays. Added new platforms to NVS. Updated TsunamiEvac app.

**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. 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:** 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.

**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. Backyard Buoys mobile app (iOS and Android) are in beta testing. Development of Backyard Buoys ERDDAP.

**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. Created NANOOS Video Page. Added April 2024 J-SCOPE Forecast. Updated J-SCOPE Publications Page. 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. Update OA Week 2024 site. Add new "Affiliated Projects" page to OARS. Added new Gulf of Guinea and Southern Ocean hub pages. Start work to ingest metadata from OCADS.

**Accomplishments/Successes:** Maintained GOA-ON website.

**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:** Converted LiveOcean to dynamic overlays. Updated HABs bulletins. Added new J-SCOPE forecasts. Added and updated Salish Cruise data and plots.

**Problems/delays:** None

**EDUCATION & OUTREACH (E&O)**

**Sustain and diversify NANOOS engagement to the extent possible:** Continue ongoing engagement with diverse stakeholders and the public, increasing ocean awareness and literacy; to diversify the ocean and coastal workforce; to improve our ability to provide relevant ocean and coastal data and information to underserved or underrepresented 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 (Pacific Coast Shellfish Growers Association, North Pacific Coast Marine Resources Committee, Technology Access Foundation, Quileute Tribal School, South Whidbey School District, First Lego League and Future City student teams), mentored 10th graders at the Maritime High School, mentored an undergraduate Earthlab intern to develop a new curriculum that brings NVS data into the classroom, maintained content on social media, newsletters, website slideshow, etc., and regularly participated in IOOS Outreach Committee meetings.

**Accomplishments/Successes:** “Multiple Stressors” middle school curriculum, “NVS Fishers Tuna Overlays” video tutorial

**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:** LiveOcean 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]*

**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, presented OA to students at TAF@Saghalie, mentored students at the Maritime High School

**Problems/Delays:** None

**D. Non-Core Funded Activities:**

Reported throughout the "Core Funded Activities" sections, wherever thematically relevant. Each activity is labeled as "Non-core Task #".

## **E. 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, Rome & Carini, UW]
- Assure these bodies are engaged in NANOOS prioritization of regional needs, work effort, and product development [Newton, Rome & Carini, UW]
- Assure balance of stakeholders represented in NANOOS reflects the diversity found in PNW [Newton, Rome & Carini, UW]
- Conduct annual GC meeting [Newton, Rome & Carini, 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. Executive Committee meetings were held virtually bi-monthly to advise NANOOS on its strategy and priorities.

**Accomplishments/Successes:** The Annual NANOOS *Governing Council (GC)* and *Principal Investigator (PI)* meetings were held 13-14 August 2024 in Vancouver, WA with 33 and 34 attendees, respectively.

NANOOS held an election for two open EC seats.

**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 Committee (EC) calls and activities. She aided the Secretariat to produce another OA Week in November.

**Accomplishments/Successes:** Over the period, she aided the following activities:

Newton was invited to a Capacity Development Workshop by UNESCO in Paris, France, on 14-18 October. She participated in the workshop representing GOA-ON.

On 16 October, she gave a presentation virtually to the XV International Carbon Symposium in Mexico; she was [recognized](#) as the International Recognition awardee by the members of the Mexican Carbon Program for her outstanding scientific career and invaluable contribution to the development of binational research between Mexico and the United States of America to strengthen the capacities of researchers in the study and knowledge of ocean acidification, contributing to understanding its effects on marine ecosystems.

On 13 September, Newton participated virtually with a short GOA-ON speech to formally launch the Gulf of Guinea sub hub, taking place in Liberia.

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, Rome & Carini, UW]
- Engage at a regional level at meetings and workshops affecting PNW stakeholders and NANOOS [Newton, Rome & Carini, UW]

**Status:** On track

**Summary:** Newton participated in IOOS Program Office and IOOS Association calls. Newton is a member of the IOOS Association Executive Committee and participated in their teleconferences during the period.

**Accomplishments/Successes:** Newton, Carini, and Rome attended the IOOS Fall Meeting in Juneau, AK on 2-7 September. Newton presented at the meeting on the Ecosystem Change effort of the IRA project, which she has co-lead with Henry Ruhl (CeNCOOS) and Clarissa Anderson (SCCOOS). Newton served on the CLIVAR Steering Committee for and attended the workshop on Optimizing Ocean Observation Networks in Boulder, CO, on 23-25 September 2024. She gave a talk and moderated a panel, assuring IOOS voice at that workshop. Newton spoke on the Backyard Buoys project at the PICES annual meeting in Honolulu, HI, on 28 Oct - 1 Nov.

“Backyard Buoys: Meeting community needs for wave data through co-design and co-production”. Throughout the period, Newton continued representing NANOOS and IOOS at various meetings.

**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 were held in Vancouver, WA, 13-14 August.

**Accomplishments/Successes:** The Annual *Principal Investigator (PI)* meeting held 14 August 2024 in Vancouver, WA, had 33 attendees and featured talks by most all PIs to relay information about the data they are observing. Significant discussions helped to highlight synergies and reinforced how the IRA activities will aid our efforts.

**Problems/Delays:** None

***Coordination:***

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

**Accomplishments/Successes:** See below for additional activities.

- Newton was invited to give a talk at the Hoh Tribe Community Dinner on 15 August on ocean acidification and NANOOS data access.
- Newton and Carini planned the Backyard Buoys All-Hands Meeting in La Push, WA, to be held in February 2025.
- Newton served on the Blue Ventures Advisory for NOAA Climate Accelerator, attending the in person and virtual Advisory Committee meetings.

**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](https://www.nanoos.org/about_nanoos/documents.php)

**Problems/Delays:** None

**Additional NANOOS coordination and representation included:**

- In coordination with Washington state agencies, tribes, industry, and others, Newton represented NANOOS at the Marine Resources Advisory Council virtual meetings on 16 July and 1 November.
- NANOOS provided updates on oceanographic conditions in the Pacific Northwest for the NOAA *WestWatch* webinar series on 20 August, 15 October, along with the other two west coast RAs.
- NANOOS made contributions to *PSEMP Puget Sound Marine Condition Updates* bi-monthly throughout the period (20 Aug, 18 Sept, 21 Nov, .
- NANOOS continued work on the development of OA indicators for the West Coast Ocean Data Portal.
- 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.
- 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 attended virtual OASES meetings, relaying NANOOS support for their website.
- Carini represented NANOOS on the Community Advisory Council of the Cascadia CoPes Hub in a meeting on 16 Sep 2024.
- Barth attended the PICES Annual Meeting in Honolulu, Hawaii, on 25 Oct to 3 Nov and represented NANOOS ocean observing. He also attended the NANOOS (August) and Central and Northern California Ocean Observing System (CeNCOOS) annual PI/GC meetings.

**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 meeting virtually on 19 November.
- 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 attended the annual PICES 2024 meeting in Honolulu and gave the talk “Backyard Buoys: Meeting community needs for wave data through co-design and co-production” on 31 October.
- Representing GOA-ON, Newton was invited to and attended the UNESCO Workshop on Capacity Development held in Paris on 15-17 October.
- 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 serves on the National Academy of Sciences, Engineering and Medicine’s “Standing Committee on Environmental Science and Assessment for Ocean Energy Management” that advises the Bureau of Ocean Energy Management in its efforts to manage development of the nation's offshore energy resources in an environmentally and economically responsible way.
- Barth is the academic representative on the North Pacific Marine Science Organization’s (PICES) Governing Council.

#### **F. Presentations & Publications Acknowledging NANOOS Support:**

***Presentations:*** underline indicates NANOOS PI

Alampay, G., Kaminsky, G.M., Dietrich, J., Hacking, A., Drummond, H., and Weiner, H., 2024. Analyzing the Influence of Lithology in Erosion of Coastal Glacial Bluffs. American Geophysical Union Annual Meeting, Washington, D.C. 9 December 2024.

Barth, Pierce, Auth, Carter, Chan, Fisher, Feely, Jacobson, Keller, Morgan, Pohl, Rasmuson and Simon, 2024. Widespread and increasing near-bottom hypoxia in the coastal ocean off the United States Pacific Northwest. Eastern Pacific Ocean Conference, September 2024, Timberline Lodge, Oregon.

Barth, Erofeev, Pierce, Mendes, Wells and Huff, 2024. Using passive and active acoustics from an underwater glider over the Pacific Northwest continental shelf. PICES Annual Meeting, October 2024, Honolulu, Hawaii.

Gostic, M., 2024. Coastal erosion studies and winter storm preparation. Coastal Hazards Organizational Resilience Team (COHORT) Winter Storms Forum, Washington State Department of Ecology, Olympia, WA. 28 October 2024.

Gostic, M., Kaminsky, G.M., Weiner, H., Hacking, A., Alampay, G., and Maran, H., 2024. Monitoring a natural cobble berm to inform nature-based solutions for high-energy coasts. International Conference on Coastal Engineering, Rome, Italy. 12 September 2024.

Kaminsky, G.M., Gostic, M., Sumaiya, Weiner, H., Alampay, G., Hacking, A., Drummond, H., Maran, H., and Selden, K., 2024. Natural and Nature-Based Features for Coastal Resilience on High Wave-Energy Coasts. American Geophysical Union Annual Meeting, Washington, D.C. 12 December 2024.

Kaminsky, G.M., and Lorang, M., 2024. Beach Restoration Using Gravel-Cobble Sediments on U.S. Pacific Northwest Lake and Ocean Shores, American Shore & Beach Preservation Association National Coastal Conference, Galveston, Texas, 28 August 2024.

MacCready, P., K. Hewett, J. Xiong, A. Leeson, D. Mascarenas, Erin Broatch 2024 “The LiveOcean Model” Invited talk for the Willapa-Grays Harbor Estuary Collaborative (WGHEC) Quarterly Meeting, Tokeland WA, 7/2024.

MacCready, P., K. Hewett, J. Xiong, A. Leeson, D. Mascarenas, Erin Broatch 2024 “The LiveOcean Model” Invited talk for the Pacific Coast Shellfish Growers (PCSGA) Conference, Lynnwood WA, 9/2024.

MacCready, P., 2024 “NANOOS Webinar: The LiveOcean Model”, <https://youtu.be/uBpJWyAUXS0>, 12/2024.

Mohsen, T., Ruggiero, P., Vitousek, S., Graffin, M., Allan, J.C., Kaminsky, G.M., and Vos, K., 2024. The relative contribution of El Niño-Southern Oscillation in driving short- and long-term shoreline position anomalies in the U.S. Pacific Northwest. American Geophysical Union Annual Meeting, Washington, D.C. 9 December 2024.

Newton, J. et al., 2024. “What is ‘Backyard Buoys’?” University of Washington Summer Intern Program, Seattle, WA, 19 July 2024.

Newton, J. et al., 2024. “The Olympic Coast as a Sentinel: *An Integrated Social-Ecological Regional Vulnerability Assessment to Ocean Acidification & data from NANOOS.*” Hoh Tribe Community Dinner, Moclips, WA, 15 August, 2024.

Newton, J. et al., 2024. [Bringing a focus to the nearshore: A case for refining projections to aid coastal communities.](#) US CLIVAR Optimizing Ocean Observing Networks for Detecting the Coastal Climate Signal Workshop, Boulder, CO, 24 September, 2024.

Newton, J. 2024. “Observing ocean acidification from local to global scales” Keynote talk, XV International Carbon Symposium, Mexico, virtual, 16 October, 2024.

Newton, J. et al., 2024. “Backyard Buoys: Meeting community needs for wave data through co-design and co-production.” PICES Annual Meeting, Honolulu, HI, 31 October 2024.

Seaton, C., Swirsky, M, Baptista, A. 2024. The Influence of Bathymetry in Modeling Estuary-Ocean Exchange in the Columbia River (OS41G-0529). presented at AGU24, 9-13 Dec 2024

Sumaiya, Kaminsky, G.M., Weiner, H., Alampay, G., and Hacking, A., 2024. Performance Evaluation of a Nature-Based Dynamic Revetment on the High-Energy Shoreline of North Cove. American Geophysical Union Annual Meeting, Washington, D.C. 12 December 2024.

Swirsky, M, Baptista, A., Moghimi, S., Myers, E., Pe'eri, S., Seaton, C., Seroka, G., Shi, L., Yang, J., Yang, Z., Yu, D., Zhang, J.. 2024. Research-to-Operations Transition of a 3D Tidal Baroclinic Model for the Pacific Ocean (OS41D-0472). presented at AGU24, 9-13 Dec 2024

Xiong, J., P. MacCready, and A. Leeson 2024 “Impact of estuarine exchange flow on multi-tracer budgets in the Salish Sea” Unifying Innovations in Forecasting Capabilities Workshop (UIFCW) 7/2024.

Xiong, J., P. MacCready, and A. Leeson 2024 “Impact of estuarine exchange flow on multi-tracer budgets in the Salish Sea” Physics of Estuaries and Coastal Seas (PECS) Meeting, 9/2024.

***Publications:*** underline indicates NANOOS PI

Barth, J. A., S. D. Pierce, B. Carter, A. Y. Erofeev, J. L. Fisher, R. A. Feely, K. C. Jacobson, A. A. Keller, C. A. Morgan, J. E. Pohl, L. K. Rasmuson, and V. Simon, 2024. Widespread and increasing near-bottom hypoxia in the coastal ocean off the United States Pacific Northwest. *Nature Sci. Rep.*, **14**, 3798, <https://doi.org/10.1038/s41598-024-54476-0> ,

Newton, J., S. Wisdom, M. Iwamoto, R. Carini, J. Watson, S. Boulay, D. Mactavish, J. Hagen, J. Schumacker, D. Rudolph, D. Kattil-Debrum, P. Tuaua, E. Brown, J. Hopson Jr., and J. Evans. 2024. Backyard Buoys: Meeting needs of coastal, indigenous communities through co-design and co-production, *Oceanography Magazine*. <https://doi.org/10.5670/oceanog.2025.105>

Newton, J.A., S. Widdicombe, K. Isensee, S. Dupont, S. Flickinger, K. Grabb, E.F. Keister, K. Schoo, A. Kenworthy, A. Valauri-Orton. 2024. Ocean acidification capacity at all levels for a multistakeholder ocean acidification action platform, *Oceanography Magazine*. <https://doi.org/10.5670/oceanog.2025.101>