

**Progress Report for
Enhancing Northwest Association of Networked Ocean Observing Systems (NANOOS):
The Pacific Northwest IOOS Regional Association**

#NA08NOS4730290

1 June 2011 – 30 November, 2011

This progress report describes activities carried out in support of enhancing the Northwest Association of Networked Ocean Observing Systems (NANOOS). This report was compiled by Jan Newton, NANOOS Executive Director and David Martin, NANOOS Governing Council Board Chair; the co-PIs for this grant. Newton and Martin, in consultation with the NANOOS Governing Council and Executive Committee, execute the activities of this award. Per the imminent combining of RA Planning and RCOOS awards, NANOOS has begun to implement this NOAA-instituted end-state by submitting progress reports for this grant while noting outcomes from the NANOOS RCOOS grant that were enabled and accelerated by collaborative resource allocations from these complimentary Planning Grant efforts.

1) Project Summary

The goal of this project remains consistent: to foster and enhance Pacific Northwest (PNW) regional partnerships in order to grow constituencies and to implement a governance structure and business plan that permit official federal certification of NANOOS as the PNW Integrated Ocean Observing System (IOOS) Regional Association and allow for the installation and long-term maintenance of a PNW Regional Coastal Ocean Observing System (RCOOS).

Stated NANOOS objectives of the project are to:

- 1) **Continue to identify and engage the full and expanding spectrum of stakeholders** having significant interests in the waters of the Pacific Northwest to ensure their views and opinions are fully recognized and taken into account in all aspects of planning, science and governance, and that this partnership building effort takes advantage of their scientific, economic, social, cultural and operational expertise. [Completed and ongoing]
- 2) **Proactively engage the regional ocean science community** in this partnership-building project to ensure their expertise helps guide the eventual design and evaluation of the system. This approach will ensure that PNW Regional IOOS evolves to take advantage of new knowledge and technology as they are developed. [Completed and ongoing]
- 3) **Obtain input about sub-regional scale oceanographic concerns** by engaging with local stakeholders to ensure these factors are addressed at the Regional level. NANOOS will work within these smaller groups to build a sense of community and partnerships at the sub-regional scale and then translate this into strong regional partnerships through larger gatherings and workshops. [Completed and ongoing]
- 4) **Implement the results of the consensus agreement on the overall Governance structure for NANOOS.** [Completed, we are implementing our governance]
- 5) **Develop and implement a Business Plan** to guide NANOOS budget formulation, involvement of users, all aspects of linkages between observations and products, research and development decisions, training, and alternate funding opportunities. [Completed]
- 6) **Strengthen international and inter-Regional partnerships** by engaging with Canadian colleagues and other western Regional Association efforts to build bridges to these efforts and ensure seamless integration of these efforts. [Completed and ongoing]

- 7) **Continue to engage at the national level** to ensure the PNW activities of NANOOS are fully supportive of the national effort to implement and maintain an IOOS. [Completed and ongoing]

2) Progress and accomplishments

To achieve the above seven NANOOS Objectives, NANOOS Leadership interacts with the NANOOS Governing Council, the NANOOS Executive Committee (elected Governing Council sector representatives and Standing Committee Chairs), and three Standing Committees (Data Management and Communication = DMAC; User Products = UPC; Education and Outreach = EOC). Key highlights of NANOOS progress and accomplishments for this period that cumulatively address the objectives are listed below, with reports from each of the three standing committees and the requested additional programmatic updates following. This report encompasses efforts funded by this RA grant as well as our RCOOS grant, since all of these NANOOS activities are necessarily highly integrated.

a. Major activities:

- **“Pacific NW Waters – Gateway to our Future” NANOOS workshop** – This workshop, sponsored by IOOS working through Ocean Leadership and hosted at Microsoft in Redmond, WA, will bring together users and providers of marine information to explore how monitoring and forecasting the ocean, coast and estuaries can best deliver safety, economic and environmental benefits to industries, government and citizens of the Pacific Northwest. Newton has worked with Ralph Rayner and his staff to liaise with Microsoft and stand up an Organizing Committee to scope this major workshop to be held 2 February 2012. Newton, Martin, and ~ a dozen other members of the NANOOS and PNW community participate on the Organizing Committee’s biweekly calls.
- **West Coast IOOS RAs sign MOU** – In order to further the mission of the U.S. Integrated Ocean Observing System (IOOS) and serve the requirements for ocean observations, data, and information at the scale of the California Current Large Marine Ecosystem (CCLME), the three regional components of IOOS on the West Coast recently signed a Memorandum of Understanding (MOU) to expand and strengthen West Coast regional ocean observing collaboration. Through the MOU, the Southern California Coastal Ocean Observing System (SCCOOS), the Central and Northern California Ocean Observing System (CeNCOOS), and the Northwest Association of Networked Ocean Observing Systems (NANOOS) affirmed their commitment to jointly plan CCLME observations and share information that will mutually benefit each sub-region and the West Coast as a whole. The MOU represents a formalization of the commitment of SCCOOS, CeNCOOS, and NANOOS to work cooperatively with governmental and non-governmental entities in identifying and providing ocean and coastal information products that inform a broad range of scientific, economic and management activities in fisheries and water quality, climate variability and change, coastal hazards, marine commerce and safety, and other priorities identified by regional management groups. See the NANOOS website for a copy: http://www.nanoos.org/documents/key/mou_nanoos-cencoos-sccoos.pdf.
- **West Coast RAs respond to NOAA FFO on HABs** – NOAA issued a Federal Funding Opportunity (FFO) for its MERHAB (Monitoring and Event Response for Harmful Algal

Blooms) program in 2011. After a broadly attended regional call in June instigated by West Coast Governors' Agreement Sea Grant Fellow, Suzanna Stoike, it was identified that a Regional need was for an integrated and cohesive network for resource managers, public health departments, researchers, and various other organizations including the public to access current and past HAB monitoring efforts and observations. In response, collectively, NANOOS, CeNCOOS, and SCCOOS worked with NOAA NWFSC, NOAA PMN, and the Pacific Shellfish Institute (project lead) to submit a proposal to the FFO in August to build an integrated HAB network for the U.S. West Coast that will provide a consistent and common web portal to access and visualize HAB monitoring data streams collected over California, Oregon, and Washington, and will also provide news and updates on current and past HAB events, and general information about monitoring efforts and sampling sites. The objectives of the proposed project are to: 1) develop data management capabilities for existing plankton monitoring programs to report data directly into IOOS through the U.S. West Coast RAs: NANOOS, CeNCOOS, and SCCOOS) and through NOAA's Phytoplankton Monitoring Network (PMN), visualized and accessed through a singular West Coast HAB data portal; and 2) provide training to managers, citizen monitoring groups, and shellfish growers on how to report, access, and utilize IOOS data and visualization tools for phytoplankton and biotoxin monitoring and analysis.

➤ **NANOOS Governing Council meeting** – NANOOS held its annual Governing Council (GC) meeting on 15 June in Vancouver, WA at the WSU-Vancouver campus. The all-day meeting was attended by 30 people representing 25 GC institutional members. Following update reports regarding IOOS and NANOOS status and from the NANOOS standing committees (DMAC, User Products, Education/Outreach), the main agenda items were GC discussion of Y5-9 priorities with respect to feedback on planned vs. funded reality, and GC input on new strategies for user engagement. The GC provides both definition and affirmation of NANOOS' direction. A sub-group volunteered to form an ad-hoc Strategic Working Group.

➤ **NANOOS All PI meeting** – NANOOS held its annual all PI meeting on 23 August in Vancouver, WA at the WSU-Vancouver campus. This all-day event was attended by nearly all active NANOOS PIs. All PIs provided brief update presentations on their work and RCOOS component status and gave input for group discussion on issues or synergies. A major portion of the meeting was reserved to for PIs to provide input into the IOOS RA Build-Out Planning (BOP) exercise. At this meeting PIs defined the number and type of observing platforms envisioned for NANOOS as well as gave input to the many other BOP scoping templates.

➤ **NANOOS submits 10-year Build-Out Plan** – NANOOS submitted documentation for its 10-year horizon Build-Out Plan in early October, based on NANOOS PI and user input, and using the templates and guidance from this IOOS/NFRA- led exercise to fulfill the Congressional mandate to scope regional IOOS.

➤ **NANOOS attends NFRA Board and IOOS meetings** – Newton attended these two semi-annual meetings on 15-17 November in Portland, ME for NANOOS. Martin joined the NFRA Board meeting via phone. Newton was re-elected to the NFRA Board Executive Committee. The IOOS meeting this year, the "IOOS Regional Build-Out Workshop," was focused on RA and IOOS Program Office joint discussion of the Build-Out Plans. Newton was asked to facilitate the

discussion on “Products and Services: Climate and Ecosystems, Fisheries and Water Quality.”

b. Other activities:

NANOOS participates in National Ocean Council listening sessions – NANOOS was represented at both PNW events. Newton attended the National Ocean Council listening session held at Ocean Shores, WA, on 27 June. She was invited by NOAA NWFSC to be a subject matter expert on the National Ocean Policy’s “Observations and Infrastructure” priority at the session and also gave public testimony re the role of IOOS and NANOOS in fulfilling all of the NOC priorities. Mike Kosro (OSU; NANOOS GC Board member) attended the National Ocean Council listening session held in Portland, OR on 1 July. He emphasized PNW regional uses of HF radar and its home within IOOS and NANOOS as well as other IOOS/NANOOS contributions.

➤ **NANOOS and coordination on Ocean Acidification: C-CAN and WUN** – NANOOS continues efforts to play a role in coordinating efforts regarding this important issue:

1. Newton participated in a California Current Acidification Network (C-CAN) workshop in Costa Mesa, CA, on July 6-7, 2011 to develop a roadmap for integrating ocean acidification (OA) observing activities on the US West Coast that ensures balanced participation of academic, governmental, and commercial stakeholders. She was asked to speak about “Network Coordination” and what lessons learned for success from IOOS west coast RAs can be applied to C-CAN. Newton is on the C-CAN Steering Committee working to plan a Biological Workshop slated for December 2011, and on a pre-system design sub-committee working to clarify what capabilities are currently available and develop an inventory of buoys now capable of measuring to C-CAN desired standards.

2. Newton participated in the World University Network (WUN) workshop on OA at the University of Washington’s Friday Harbor Laboratories 29 Aug-1 Sep. This international workshop had invited participants from WUN universities in Australia, Europe and Asia. Newton’s talk, though locally based, focused on the importance of measuring OA over a variety of scales including the global ocean, coastal ocean, estuary and nearshore, and shellfish hatcheries, in order to understand OA dynamics and impacts.

Newton, J. “Pacific Northwest ocean acidification observing efforts (from coastal buoys and shellfish farms) and resultant data streams.” *World University Network Workshop on Ocean Acidification*, Friday Harbor Laboratories, University of Washington, Friday Harbor, WA, Aug.29, 2011.

➤ **NANOOS contributes to Coastal Zone 2011** – IOOS RAs participated in two panels at the Coastal Zone 2011 Meeting during 18-21 July in Chicago. Newton was invited to speak in the “IOOS and Water Quality” session, 20 July, discussing how buoys and the NANOOS infrastructure are leveraged to a multiplicity of uses, including information on hypoxia and ocean acidification.

Newton, J., A. Devol, C. Sabine, R. Feely, S. Alin, D. Fagergren, W. Palsson, and D. Hannafious. “Using real-time buoy and citizen monitoring data for measuring hypoxia and ocean acidification to aid decisions on aquaculture, fisheries management, and water quality in Puget Sound, Washington, through NANOOS/IOOS.” *Coastal Zone 2011 Meeting*, Chicago, IL, July 18-21, 2011.

➤ **NANOOS and IOOS** – In August, Martin and Newton met with Zdenka Willis, the Director of the National IOOS office, when she was in Seattle to attend the 2011 National Environmental

Monitoring Conference (NEMC) and visit a local IOOS-relevant industry (Sea-Bird Electronics). Martin and Newton's discussions with Ms. Willis at APL-UW centered on the PNW Regional perspective of present and likely future IOOS funding scenarios and how regional stakeholders could be of maximum benefit in carrying the IOOS message.

➤ **NANOOS/IOOS and Environmental Monitoring** – Zdenka Willis, the Director of the National IOOS office, attended the 2011 National Environmental Monitoring Conference (NEMC) in Bellevue, WA. She was joined by Newton, who was a Keynote Speaker at the NEMC conference. Newton's presentation introduced the attendees to Puget Sound, observing systems, NANOOS and IOOS, ending with national examples of IOOS contributions to environmental monitoring.

Newton, J. "Observing Puget Sound." *National Environmental Monitoring Conference 2011*, Bellevue, WA, Aug 18, 2011.

➤ **NANOOS contributions to Oceans '11** – In September, Martin and Newton attended the MTS/IEEE Oceans '11 conference in Kona, HI and presented papers discussing NANOOS. Martin's paper detailed how NANOOS uses web-based technologies and Facebook to provide information about tsunami hazards to the Pacific Northwest public. The Director of the IOOS Office requested a copy of this presentation for use at a EuroGOOS meeting that was held shortly after Oceans '11. Newton's paper discussed how entraining Native American students in STEM courses in marine science within the context of place-based learning methodologies was enabled by leveraging NANOOS Education/Outreach resources with NSF-funded Science and Technology Center funding to engage this underrepresented group of people. Newton also was an invited panel participant in the "Emerging Ocean Observing Technologies Forum" to discuss how to work as a community to know what technologies to field to observe our oceans in four dimensions and issues in the chain of development for new ocean observing technologies.

Martin, D.L., J.C. Allan, J. Newton, D.W. Jones, S. Mikulak, E. Mayorga, T. Tanner, N. Lederer, A. Sprenger, R. Blair and S.A. Uczekaj. "Using Web-based and Social Networking Technologies to Disseminate Coastal Hazard Mitigation Information within the Pacific Northwest Component of the Integrated Ocean Observing System (IOOS)." *Oceans '11 MTS/IEEE*, Kona, Hawai'i, Sept 19-22, 2011.

Newton, J. and J. Apple. "The Value of Peer-to-peer Knowledge Transfer for Engaging Pacific Northwest Tribes in STEM Education and Oceanographic Studies." *Oceans '11 MTS/IEEE*, Kona, Hawai'i, Sept 19-22, 2011.

➤ **UW Tribal Summit** – Newton attended the University of Washington's Tribal Summit on 10 September in Seattle. Her work leveraging NANOOS Education/Outreach resources with NSF-funded Science and Technology Center funding to engage NWIC and other Native American students in marine science was featured in the UW tribal programs directory.

➤ **NANOOS and PNW Climate Science** – In September, Newton attended the Second Annual PNW Climate Science Conference in Seattle, WA, on Sept. 13-14, 2011 and presented a talk on Ocean Acidification and a poster on coordinated marine observations to detect climate influence. Both discussed the value of NANOOS-IOOS in contributing to our scientific knowledge.

Newton, J., S. Alin, R. Feely, C. Sabine, A. Devol, A. Suhrbier, D. Cheney, B. Eudeline, J. Davis, B. Allen, B. Peabody, and C. Krembs. Ocean acidification in Puget Sound: Recent observations on water chemistry and implications for larval oyster success. *Second Annual PNW Climate Science Conference*, Seattle, WA, Sept. 13-14, 2011.

Newton, J., A. Devol, C. Krembs, and K. Stark. Observing Climate Influenced Variation in Puget Sound Marine Waters. *Second Annual PNW Climate Science Conference*, Seattle, WA, Sept. 13-14, 2011.

➤ **NANOOS and DHS** – In October, Martin visited with a number of principals in the DHS Science and Technology (S&T) directorate in D.C. Discussion topics relevant to IOOS included environmental support to SAR and other Maritime Domain Awareness (MDA) areas of interest. Martin highlighted the strong potential of the national IOOS efforts and NANOOS in serving as instrumented test-beds for the insertion and evaluation of new DHS technologies and research.

c. NANOOS Standing Committee updates:

NANOOS DMAC – Co-chaired by Steve Uczekaj (The Boeing Company) and Emilio Mayorga (APL-UW) this committee, composed of members from Boeing, OHSU, UW, OSU, and DOGAMI, has weekly “tag-up” calls to achieve consistent work efforts for NANOOS DMAC. Activities for this period included: 1) weekly NANOOS DMAC and User Products Committee (UPC) joint telecon; 2) reporting at annual NANOOS meetings (Governing Council and All-PI’s); 3) IOOS Regional DMAC Implementation (RDI) bi-weekly telecon; 4) IOOS DMAC Steering Committee monthly telecon; 5) IOOS SOS Reference Implementation working group bi-weekly telecon and associated activities; 6) IOOS Non-Federal Asset Inventory tiger team; 7) visit to NANOOS (Seattle) by IOOS DMAC lead, Derrick Snowden; 8) Coastal and marine spatial data networking workshops in Oregon (June) and Washington (July), and planning for a similar West-Coast meeting in December; 9) Open Geospatial Consortium (OGC) Technical Meeting (Boulder, CO); 10) planning for a new DMAC collaboration on animal acoustic tracking data with IOOS and the Pacific Ocean Shelf Tracking (POST) Project; and 11) Ocean Acidification Data Management Steering Committee participation. The NANOOS DMAC and UPC teams continue to work in an effective, integrated fashion towards the prioritization, development and evaluation of data services and user products.

The NANOOS Visualization System (NVS) was enhanced through an important new release to the online platform and mobile apps, and the development of new, customized applications focused on tsunami hazards; see the UPC Section for details on user functionality and tsunami applications. NVS enhancements also encompass continuous asset additions and updates reflecting platform, sensor, telemetry and model reconfigurations, including: in-situ monitoring assets from a new provider for NANOOS (CeNCOOS/Humboldt State University in Northern California); and new deployments, new offerings and re-deployments from existing NVS providers (CMOP, OSU, WADOE, UW, ICM-Mobilisa, King County, PSI, VENUS, CDIP, NOAA NDBC, USGS, CO₂ sensor data from NOAA PMEL leveraging NANOOS buoys), including new forecast model site time-series extractions and a new regional high-resolution wave forecast model from OSU based on the WaveWatch III code. NVS support for redistribution of information to external applications – including mobile apps – continues to be enhanced; the NVS system architecture was substantially improved via expansion of web services for programmatic access to NVS resources, including APL EIS overlay tiles; and strengthening and greater documentation of NVS data-access web services.

The DMAC Team continued **maturing the system architecture and implementation of IOOS DMAC data services and standards** through regular participation in IOOS RDI telecons and software and system enhancements. NANOOS DMAC is a leading and active participant in the

IOOS SOS Reference Implementation working-group. In coordination with this IOOS DMAC community support, NANOOS released in mid November a new SOS service connected to the NVS data store and providing access to in-situ data from regional providers. This service has been fully integrated into the IOOS Catalog, seamlessly joining an existing NANOOS SOS service from CMOP OHSU that provided the original Python code base. Challenges uncovered in implementing and deploying this service provided invaluable input to the IOOS SOS working group. Support for geospatial data via standard OGC web services (WMS, WFS, KML) was also enhanced through expanded use of the open-source GeoServer software. Finally, work continued on the ERDDAP-based NANOOS “NIDAS” data aggregation tool; in particular, a general Application Programming Interface (API) was developed to provide unified, consistent access to low-level ERDDAP services, for use by the NIDAS user interface that is under development.

The DMAC team continued to **advance partnerships and efforts for expansion into relatively new areas** of importance to both IOOS and regional stakeholders. These include regional and West Coast coordination for coastal and marine geospatial data (e.g., Mayorga 2011a); collaboration with IOOS and POST to start a pilot project addressing animal acoustic tracking data; collaboration with OBIS-USA to publish species occurrence data from a NANOOS dataset on the OBIS-USA node; collaboration with SCOOS, CeNCOOS and other organizations on a proposal addressing Harmful Algal Bloom data along the West-Coast; and data management and coordination at national and West-Coast scales regarding ocean acidification.

Presentations acknowledging NANOOS support:

Mayorga, E. 2011a. Regional sharing and integration of near-real-time coastal monitoring data in the Pacific NW: NVS, the NANOOS Visualization System (Regional network example, OOS Case Study). *Oregon Coastal & Marine Data Workshop*, Salem, Oregon, June 6-7, 2011.

Mayorga, E. and T. Tanner. 2011. The NANOOS Visualization System (NVS): Data aggregation, management and reuse for a coastal-monitoring user application in the Pacific NW. *CUAHSI Conference on Hydrologic Data and Information Systems*, Logan, Utah, June 22-24, 2011.

Mayorga, E. 2011b. Complex marine data visualization via GIS web services. *University of Washington GIS Day*, Seattle, Washington, Nov 16, 2011.

➤ **NANOOS UPC** – Chaired by Jonathan Allan (Oregon Department of Geology and Mineral Industries) this committee is composed of members from Boeing, OHSU, UW, OSU, NANOOS E&O, OR Sea Grant, and NOAA. NANOOS UPC chair Allan participates in weekly “tag-up” calls with a smaller sub-group comprised of members from DMAC, UPC, E&O, and Web development in order to facilitate consistent work efforts and improvements to product development and enhancements. Activities for this period included: 1) weekly NANOOS DMAC and User Products Committee (UPC) teleconferences; 2) reporting at annual NANOOS meetings (Governing Council and All-PI’s).

A core focus of the NANOOS DMAC-UPC-WEB sub-working group remains the provision of ongoing technical support to the NANOOS Visualization System (NVS). In addition, to this important task, the sub-working group has completed several important enhancements to the NANOOS web portal and developed a new Pacific Northwest Tsunami evacuation portal. Other tasks completed during this period included the development of a conference proceedings paper (Martin et al., 2011), which was presented at the Oceans 2011 conference in Hawaii. The paper

focuses on the role of 11 March, 2011 Japan tsunami, the impacts to the NANOOS region, and the role of social networking in disseminating ocean information.

NVS online platform and mobile apps: Version 2.6 of the NVS assets platform was released on 8 November 2011. Detailed documentation on the most recent public changes and version history is available online at http://www.nanoos.org/nvs/information/version_history.php. In brief, these enhancements include: the ability to create and display both common and user-generated place markers; overhaul of date and time to enable their display according to local settings on the user's computer; standardization of measurement labels and units across all assets; and additional usability improvements.

The general NVS mobile apps were also substantially enhanced during this period, to versions 2.0 and 2.1 for both iPhone and Android platforms. New features added based on user requests include asset favorites, searchable list of assets, user location, user settable preferences, the Plots for Tuna Fishers data product, and additional usability improvements.

Pacific Northwest Tsunami Evacuation Zones (PNWTEZ) online portal and mobile apps: Coincident with the release of NVS v2.6, NANOOS released a brand new *NANOOS visualization application* (NVAP), the Pacific Northwest Tsunami Evacuation Zones portal. The new tsunami portal displays evacuation zones for the states of Oregon and Washington for both distant and local earthquakes and tsunamis. Importantly, the PNWTEZ provides the user with the ability to search by street address in order to determine if they are in the inundation zone, and if they have a myNANOOS account save that information to their account for future retrieval. In addition, the portal contains a situational awareness feature that is linked to the West Coast and Alaska Tsunami Warning Center enabling *statements, advisories, watches* or *warnings* to be displayed both verbally and graphically on the PNWTEZ portal as they occur. The portal also contains links to evacuation brochures (PDFs) developed by the Oregon Department of Geology and Mineral Industries and by the Washington State Department of Natural Resources. As an important tool in preparing for a potentially catastrophic local or distant tsunami event for residents or visitors to the Pacific Northwest coast, the portal also displays the locations of places that will be of critical importance prior to, during, and following a tsunami event, including schools, bridges, assembly areas, and various local government buildings. Finally, the portal provides extensive links and information about preparedness, warnings, evacuation procedures, facts and tsunami travel times.

Accompanying the release of the new Pacific Northwest Tsunami Evacuation Zones portal, NANOOS UPC-DMAC released a brand new mobile application (TsunamiEvac-NW v1.0) for the iPhone. The TsunamiEvac-NW app brings PNWTEZ portal functionality to smart phones. It provides users an at-a-glance view of where the tsunami hazard zones are along the Oregon and Washington coast, and allows them to map whether their home, work, school, etc. are located in a tsunami evacuation zone or not. To help users develop and plan evacuation routes, the app enables saving the current position or points of interest via GPS or address look-up.

Website: The NANOOS website (www.nanoos.org) continues to undergo various enhancements and modifications to its functionality and usability. NANOOS web and E&O staff developed a Theme page focused on Coastal and Marine Spatial Planning.

➤ **NANOOS Education and Outreach Committee (EOC)** – Chaired by Nancee Hunter (Oregon Sea Grant), work during this period has primarily been completed by Amy Sprenger and Sarah Mikulak (APL-UW), with guidance and help from EOC members. Members of the EOC include representatives from CMOP, OR and WA Sea Grants, OSU, Hood Canal Salmon Enhancement Group, Ocean Inquiry Project, Padilla Bay National Estuarine Research Reserve, South Slough National Estuarine Research Reserves, Olympic Coast National Marine Sanctuary, and COSEE Pacific Partnerships. During monthly EOC conference calls members provide guidance on NANOOS EO efforts and share opportunities for collaboration.

Outreach to users: NANOOS EOC continues to reach out to different user groups including resource managers, shellfish growers, coastal community residents, and scientists. Major events during this 6 month period included the Pacific Coast Shellfish Growers Association Conference with over 200 attendees, the Salish Sea Ecosystem Conference with over 400 attendees and the Heceta Head conference with about 200 attendees. NANOOS also partnered with the other RAs in providing materials for the IOOS booth at Coastal Zone 2011 conference in Chicago, IL, and the IOOS booth at the IEEE/MTS Oceans '11 conference in Kona, HI.

Outreach products generated this 6 month time period include new theme pages on the NANOOS portal, newsletter and continuing to maintain the NANOOS Facebook page.

Education and Ocean literacy: NANOOS continues to work with regional informal learning centers, non-profit education organizations and classroom educators in both Oregon and Washington. In June, Sprenger and F. Stahr (UW; NANOOS EOC) presented at 3 different workshops for K-12 classroom educators, reaching 50 educators. In July, the NW Aquatic and Marine Educators (NAME), a NANOOS member, held its annual conference on the Olympic Peninsula. Sprenger was the conference chair for this 3 day event attended by more than 120 formal and informal educators from Oregon, Washington, British Columbia and Alaska. During the conference Newton gave a keynote address, Mikulak presented on ocean acidification, F. Stahr presented on Seagliders and Sprenger presented on using NVS. In August Mikulak presented at the Lincoln County Ocean Literacy Symposium, a day-long professional development symposium for all teachers in Lincoln County, OR, based around ocean literacy. Mikulak presented a tour of NVS, the NANOOS data portal and shared a session with Dr. Tawnya Peterson from CMOP, who presented about CMOP data for 20 K12 educators. Corinne Bassin (APL-UW) presented NVS to 15 community college educators attending the week-long COSEE Pacific Partnership WA Teacher workshop held in Anacortes, WA.

On the national scale, by invitation of C. Simoniello, Education Chair of the Gulf Coast Ocean Observing System (GCOOS), Mikulak attended the annual GCOOS education meeting held in New Orleans, LA in June 2011. Mikulak presented her experience with designing exhibits that utilize real-time NANOOS data and provided insight on GCOOS's exhibit design process. The collaboration between the two RAs was very positive for all, and has continued through the monthly IOOS/NFRA E&O calls. Mikulak and Sprenger assisted in the IOOS effort to support education and outreach, including compiling and creating content for the NANOOS specific IOOS one-pagers, providing content and feedback on the design of the IOOS education web portal and attending the monthly NFRA EOC conference calls.

Mikulak continues to work with Port Townsend Marine Science Center to develop and field test a modular inter-active computer exhibit focusing on helping visitors understand different parameters (salinity, temperature, dissolved oxygen and chlorophyll) coming from buoys in the NANOOS region.

NANOOS E&O Presentations:

Newton, J. Keynote Speaker: *Salish Sea Student Science Symposium*; Mountaineers Club, Seattle, WA; June 3, 2011.

Newton, J. *How NANOOS Can Help You: Providing Ocean Observing Data and Information to the General Public*; Improving Your Broader Impacts Workshop organized by COSEE OLC and WA Sea Grant, June 14, 2011.

Sprengr, A, and Stahr, F. Eyes on Washington Waters, Bringing Ocean Observing Data Into the Classroom. *Washington Watershed Education Teacher Training Program*: Bellingham WA, June 25 2011; Tacoma WA, June 28 2011

Mikulak, S. Ocean Acidification in the Pacific Northwest. *Northwest Aquatic and Marine Educators Association Conference*. Olympic Park Institute, Port Angeles, WA. July 14, 2011.

Stahr, F. Gliders Observing the Coastal Waters of Washington & Oregon, or “Robots Are Our Friends”. *Northwest Aquatic and Marine Educators Association Conference*. Olympic Park Institute, Port Angeles, WA. July 14, 2011.

Sprengr, A. Using authentic data to teach science concepts: MBARI’s EARTH Program, NEPTUNE CANADA and NANOOS. *Northwest Aquatic and Marine Educators Association Conference*. Olympic Park Institute, Port Angeles, WA. July 16, 2011.

Newton, J. Invited talk about NANOOS: Ocean observing systems: a matter of perspective. *Northwest Aquatic and Marine Educators Association Conference*. Olympic Park Institute, Port Angeles, WA. July 16, 2011.

Bassin, C. Use of NANOOS/NVS for incorporating real-time data into the classroom. *COSEE Pacific Partnership WA Community College Educator Workshop*. Shannon Point Marine Center, Western Washington University, Anacortes, WA. Aug 23, 2011.

Mikulak, S. OLS Tour of the NANOOS Visualization System (NVS). *Lincoln County Ocean Literacy Symposium*. Hatfield Marine Science Center, Newport, OR. Aug 30, 2011.

Sprengr, A. *Ocean observing data and products for informal and formal education and outreach*. Poster presented at Salish Sea Ecosystem Conference, Vancouver BC Canada, October 24 2011

Outreach Events:

Pacific Coast Shellfish Growers Association Conference, Salem, OR, September 2011 (200 attendees): NANOOS had a booth and Mikulak provided demonstrations of the NVS and the NANOOS shellfish growers’ site. She spoke with approximately 75 people, and made plans for incorporating a new datastream from Taylor Shellfish, Inc.

Salish Sea Ecosystem Conference, Vancouver BC, Canada, October 25-27 (>400 attendees): NANOOS had a display at the SSEC’s first Data Fair where Mikulak and Sprengr demonstrated NANOOS portal and NVS.

Heceta Head Conference, Florence, OR, October 28-30 2011. (200 attendees): NANOOS had a display where Mikulak demonstrated the NANOOS portal and NVS.

Improving Your Broader Impacts Workshop, Seattle, WA June 14, 2011 (80 attendees): NANOOS presented a short session on how NANOOS can help researchers with their education and outreach efforts. Newton addressed an audience on what NANOOS has to offer specifically regarding educational uses and resources as well as links to others. This event was sponsored by UW College of the Environment, COSEE OLC, and WA Sea Grant.

d. Ongoing IOOS-related activity:

- ***NANOOS participation in NFRA and IOOS***
 - Newton, Martin, and Kosro participate in the NFRA Board teleconferences.
 - Newton participates in NFRA Executive Committee teleconferences.
 - Sprenger and Mikulak participate in the NFRA-IOOS led Education and Outreach teleconferences.

- ***NANOOS participation in ACT***

Newton is the Co-Chair of Advisory Council of the Alliance for Coastal Technologies (ACT). She participates in scheduled meetings and teleconference calls. She is currently working with ACT's Mario Tamburri and NFRA's Josie Quintrell to have a joint NFRA Board/ACT Board teleconference call.

- ***NANOOS integration with CMOP***

Throughout the reporting period, Martin and Newton remained deeply involved with a complimentary research ocean observing effort in the Pacific Northwest, the NSF-funded Science and Technology Center (STC) for Coastal Margin Observation and Prediction, which NANOOS leverages heavily in the areas of DMAC and Education and Outreach. Martin serves as Co-Director for the Center and Newton directs the UW Education efforts for this multi-institution project.

- ***NANOOS programmatic status updates***
 - RA organizational structure:
Changes: None.

3) Scope of work – We had no changes to our statement of work. We neither anticipate changes to our statement of work, nor problems in meeting objectives of this effort.

4) Leadership personnel – No changes.

5) Budget analysis – As mentioned in our last progress report for this award, we applied for and were granted a no-cost extension (NCE) for this project which allowed us to carefully husband the financial resources in this grant to ensure we had no gaps in our ability to adequately address our proposed commitments. As NANOOS was successful in obtaining resources from new grants, we have since carefully expended resources in this grant to meet our stated goals. At the end of this reporting period (1 June 2011 through 30 November 2011) NANOOS has obligated over 99% of its anticipated expenditures in support of this project while we have expended 87.5% of our allotted time (including the NCE). This will allow us to go to closeout on this award on or before the 31 May 2012 end date.