Northwest Association of Networked Ocean Observing Systems

The Integrated Ocean Observing System (IOOS)
Regional Association for the Pacific NW

www.nanoos.org
1. Call to Order
Welcome, Charge for the Day,
Introductions

David Martin
NANOOS GC Board Chair
2. Dr. Kathryn Sullivan
NOAA Administrator
3. IOOS Update

Jenifer Rhoades
NOAA US IOOS Office
US IOOS®

Jen Rhoades
US IOOS, OTT Project Manager
NANOOS annual meeting
U.S IOOS By The Numbers

17 Federal Partners
  Providing a Federal Backbone for IOOS

11 Regional Associations
  Observing Assets and Data Feeds

1 Alliance for Coastal Technologies
  A partnership supporting sensor evaluation and verification

1 Coastal Ocean Modeling Testbed
  COMT - a conduit for research models to transition to operations

1 Marine Biodiversity Observing Network
  MBON integrates marine biodiversity and ecosystem data

697 National Platforms
  Buoys, Water level guages, Coastal and Estuary stations at the National level

254 Regional Platforms
  Buoys, Water level guages, Coastal and Estuary stations at the Regional level

9 Ocean Technology Transition Projects
  OTT supports transition of marine sensors to operations

15 Animal Telemetry Projects
  Providing data on animal responses to the ocean and environment

140 HF-Radar Installations
  High-Frequency Radar measures speed & direction of ocean currents

41,820 Glider Days
  1 Glider in the water collecting data for 1 day

8 QARTOD Manuals
  Realtime Oceanographic Quality Assurance

>15,000 Datasets
  Oceanographic Datasets available in the IOOS Catalog

42 Servers
  Top-level domains hosting data access

1 IOOS Integrated Ocean Observing System
Programmatic - 2016

Budget History FY10-FY16

$ in M

5 year Awards

Administration Transition


- External Federal/Private
- Other NOAA
- IOOS Regional Observations
- IOOS National Program
MAY 2016 Staffing and Leadership Update
ioos.us Project

Outcomes:
- Single landing page/entry point for DMAC access.
- Full Capacity in June
- New Glider DAC

New/Updated Manuals 2015
Dissolved Nutrients Observations
Ocean Optics Data
In-situ Temp. and Salinity Data
In-Situ Current Observations
In-Situ Surface Wave Data
Dissolved Oxygen Observations

New/Updated Manuals - 2016
Glider
HFR Currents
Water Level
DMAC – Environmental Sensors & Model Access

- THREDDS, WMS access to all model output
- ASA
- Released 16 May 2016

- 2 week cache of ALL known, available real-time observations
- AOOS & Axiom
- Release June 2016

Blizzard 2016: CBOFS winds at 1/23 17:00 EST. Time-series of model output and buoy observations (1/20 - 1/23)
HF Radar FY16 Outlook

- Refinement of O&M costs
- **At your local WFO**
- Significant Wave Height
- Tsunami detection – partner with NWS
- Global HF Radar – GEO/GOOS
- BOEM: CODAR understand offshore wind turbines impact to HFR
- Archiving continues every month
Interagency support:
• $15M: NASA, NOAA (IOOS & OER), BOEM – FY14-18
• In-kind from USGS on DMAC, ecological mapping units
• MarineGEO/Tennenbaum is an MBON partner

MBON goals:
• Increase efficiencies and fill gaps in biodiversity monitoring
• Integrate biological and environmental observations
• Integrate remote sensing with in situ
• Develop methods for automated sampling of marine biodiversity
• Lead global development of marine biodiversity indicators and variables
• Develop a U.S. MBON
• Advance global MBON

Credit: MBARI
IOOS advances technology through the transition of ocean, coastal, and marine sensors and platforms to operations

- Sponsors the transition of emerging marine observing technologies;

1. Basic principles observed and reported.
2. Technology concept and/or application formulated.
3. Analytical/experimental critical function or characteristic proof of concept.
4. Component validation in laboratory environment.
5. Component validation in relevant environment.
6. System model or prototype demonstration in a relevant environment.
7. System prototype demonstration in an operational environment.
8. Actual system completed and qualified through test and demonstration.
9. Actual system proven through successful mission operations.

Figure 1: An Overview of TRL Values
IOOS advances technology through the transition of ocean, coastal, and marine sensors and platforms to operations

- Sponsors the transition of emerging marine observing technologies;
- Where there is an existing operational requirement; and
- A demonstrated commitment to integrate into operations mode.
Ocean Technology Transition

Transitioning innovative marine observing technology to operations is critical for helping us understand our ocean, coastal, and marine environments and improve environmental intelligence for environmental decision making.

“Toxic algae bloom in Pacific Ocean could be largest ever” CBS News, June 17, 2015

“Oyster farmers worried as climate change lowers ocean pH” SF Chronicle, August 14, 2015

(Credit: Washington State Department of Health)

The “Burk-o-lator” – developing low cost OA sensors
Ocean Technology Transition

- Innovative proven tech
- Proof of Concept
- Proof of Operational Need
- Committed Sponsor
- Seeking New Partnerships
Communicating

**New Web Site**
- Dynamic, Interactive; Streamlined
- May 2016

**Getting our Story Out**

**New outlets:**
- **NOAA.GOV:** New! Web stories 200-400 words in length, always with photos.
- **New NOS Site:** Photos, photos, photos; reinforced by close NOS Comms cooperation.
- **Social Media:** Regular posts create visibility with peers, partners, general public.
- **IOOS Blog:** Coming soon! Highlight projects, RA successes, events, topics, and more.
Background

**PROVIDERS**
- observations

**INTERMEDIARIES**
- value-added products

**END USERS**
- emergency managers, developers, city planners, private sector

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**Study focus**

- Public, Private, Non-Profit, Research, Academia

**Information, Services, Infrastructure**

**ISSUES: Oceans – Ecosystems – Climate**

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THE OCEAN ENTERPRISE
A study of US business activity in ocean measurement, observation and forecasting

Prepared by
ERISS Corporation
The Mentoia Alliance
February, 2016

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IOOS | EYES ON THE OCEAN
Overall Revenue: $58b
- Maritime Revenue: $14b
- Ocean Enterprise Revenue: $7b

410 Companies, $7B annual revenue

36 States
81% of the companies we surveyed were providers.
36% were Intermediaries.
## Market Sectors

Represents ‘overall’ activities of firms

Shows provider, intermediary split

<table>
<thead>
<tr>
<th>Sector</th>
<th>Percentage (Provider/Intermediary)</th>
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<tbody>
<tr>
<td>Environmental Monitoring</td>
<td>65% (provider/intermediary = 65%/42%)</td>
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<tr>
<td>Academic Research</td>
<td>61% (provider/intermediary = 61%/37%)</td>
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<tr>
<td>Oil &amp; Gas</td>
<td>52% (50%/42%)</td>
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<tr>
<td>Ports &amp; Harbors</td>
<td>41% (39%/31%)</td>
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<tr>
<td>Hydrographic Surveying</td>
<td>36% (35%/27%)</td>
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<tr>
<td>Engineering</td>
<td>35% (27%/37%)</td>
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<tr>
<td>Coastal Protection</td>
<td>34% (28%/35%)</td>
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<tr>
<td>Defense</td>
<td>31% (50%/42%)</td>
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<tr>
<td>Weather &amp; Ocean Forecasting</td>
<td>30% (32%/17%)</td>
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<td>Water &amp; Water Quality</td>
<td>27% (27%/33%)</td>
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<tr>
<td>Renewable Energy</td>
<td>26% (25%/23%)</td>
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<tr>
<td>Fishing Industry</td>
<td>25% (21%/33%)</td>
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<tr>
<td>Maritime Security</td>
<td>24% (23%/19%)</td>
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<tr>
<td>Construction Surveying</td>
<td>19% (17%/19%)</td>
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<tr>
<td>Cargo Shipping</td>
<td>15% (13%/17%)</td>
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<tr>
<td>Cruise or Passenger Ships</td>
<td>9% (8%/10%)</td>
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<tr>
<td>Biotechnology</td>
<td>3% (2%/4%)</td>
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0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
IOOS is a Team Sport

Interagency Oversight IOOS Task Teams

Programmatic Operational Capacity Partnerships Champion Regional

IOOS Office

IOOS Association

IOOS Advisory Committee

Congress OMB Sponsor Events RA Coordination

Official Advice Recommendations
Questions

Enables decision making
Fosters Advances in Science and Technology

www.noaa.ioos.gov
https://www.facebook.com/usioosgov
@usioosgov
4. NANOOS Update

Jan Newton
NANOOS Executive Director
Northwest Association of Networked Ocean Observing Systems

The Integrated Ocean Observing System (IOOS)
Regional Association for the Pacific NW

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<td>Ocean Inquiry Project</td>
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<td>Surfrider Foundation</td>
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<td>Oregon State University</td>
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<td>6.</td>
<td>Oregon Sea Grant</td>
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<td>Puget Sound Partnership</td>
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<td>Humboldt State University</td>
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<td>Marine Exchange of Puget Sound</td>
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<td>17.</td>
<td>Pacific Northwest National Laboratory</td>
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<td>18.</td>
<td>Port of Newport</td>
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<td>Puget Sound Harbor Safety Committee</td>
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<td>21.</td>
<td>Council of American Master Mariners</td>
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<td>22.</td>
<td>Pacific Northwest Salmon Center (&amp; HCSEG)</td>
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<td>23.</td>
<td>Northwest Indian Fisheries Commission</td>
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<td>25.</td>
<td>Western Association of Marine Laboratories</td>
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<td>Science Applications International Corporation</td>
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<td>King County Dept Natural Resources &amp; Parks</td>
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<td>29.</td>
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<td>Western Resources and Applications</td>
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<td>41.</td>
<td>The Nature Conservancy</td>
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<td>Portland State University</td>
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<td>NOAA Olympic Coast National Marine Sanctuary</td>
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<td>Grays Harbor Historical Seaport Authority</td>
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<td>50.</td>
<td>Pacific Coast Shellfish Growers Association</td>
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<td>51.</td>
<td>US Army Corps Engineers</td>
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<td>52.</td>
<td>Olympic National Park</td>
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<td>53.</td>
<td>Oak Harbor Middle School</td>
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<td>54.</td>
<td>Vancouver Island University</td>
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<td>55.</td>
<td>Ocean Networks Canada</td>
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<td>56.</td>
<td>Lower Columbia Estuary Partnership</td>
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<td>Raincoast GeoResarch</td>
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<td>59.</td>
<td>WA Dept of Health</td>
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<td>60.</td>
<td>Say Yes to Life Swims</td>
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<td>61.</td>
<td>NOAA PMEL</td>
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<td>62.</td>
<td>Hakai Institute</td>
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<td>63.</td>
<td>Salish Sea Expeditions</td>
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</tbody>
</table>

**KEY:**
- ⚡ Tribal Government
- 📈 Industry
- 🌐 NGO
- 🧪 Academia/Research
- 🇺🇸 Federal/State/Local Government
New NANOOS members

• NOAA PMEL
• Hakai Institute
• Salish Sea Expeditions

Welcome!
Coastal ocean:
Northern extent of California Current
Winds, topography, freshwater input, ENSO & other climate cycles

Major inland basins:
Puget Sound-Georgia Basin, Columbia River
Urban centers, nearshore development, climate variation

Coastal estuaries:
Willapa Bay, Grays Harbor, Yaquina Bay, Coos Bay, +20
Resource extraction, development, climate

Shorelines:
Rocky to sandy, dynamic: storms, erosion
Winds, development, climate

Major rivers:
Columbia River (~75% FW input to Pacific from US WC)
many rivers (e.g., Fraser, Skagit) via Strait Juan de Fuca
Dredging, water regulation, climate change

NANOOS Region User Groups:
Maritime: shipping, oil transport/spill remediation
Fisheries: salmon, shellfish, crab, groundfish, aquaculture
Environmental management: HABs, hypoxia
Shoreline: erosion, inundation
Hazards: Search and rescue, national security
Educators: formal, informal, research
Marine recreation: boating, surfing, diving
NANOOS budget:

FY07-09: $1.4M + 0.4M = $1,800,000
Year 1, 2, 3

FY10: $1.7M + 0.4M = $2,100,000
Year 4

FY11: $2,087,500 (w/ new start date)
Year 5 or 1 of new 5-y award

FY12: $2,428,291 ($2,288,000 base; ~$140K for DMAC, OA workshops)
Year 6 or 2

FY13: $3,089,477 ($2,392,136 base; ~$700K for MSI on OA plus OAP)
Year 7 or 3

FY14: $2,818,441 ($2,442,136 base; $109K HF; $217K OAP; $50K glider)
Year 8 or 4

FY15: $2,771,890 ($2,462,136 base; $309K OAP obs/adds)
Year 9 or 5

FY16: $2,774,532 ($2,452,552 base; $317K OAP obs; $5K adds) + $74K
Year 10 or 1 = $2,848,900
NANOOS budget:

FY16: $2,774,532 ($2,452,552 base; $317K OAP obs; $5K adds) + $74K
Year 10 or 1

= $2,848,900

- $5,000 for System Advisory Committee Meeting travel
- $192,543 for NANOOS Ocean Acidification Monitoring and Prediction in Oregon Coastal Waters
- $99,437 NANOOS UW OA observatories
- $25,000 NANOOS UW OA observatories: Closing the data Gap Enhancing the Cha'ba Mooring Program to Allow Year-Round Deployments
- $30,000 for GOA-ON portal
- $11,409 for UW support of NOAA PMEL prawler testing
- $32,959 for modeling and RS for synoptic time-series and nowcast maps of OA variables
OTT: HABs

“Operational ecological forecasting of harmful algal blooms in the Pacific Northwest using an environmental sample processor”

- ESP on Cha’ba at La Push
- UW, NOAA NWFSC, MBARI, NOAA CCEHBR, NWIC, Spyglass, WHOI
- Detects *Pseudo-nitzschia* cells, species, toxicity
- Strong support from coastal tribes
- Tested in PS 2013; NANOOS served data
- Tested off coast in May 2016
ESP detected Domoic Acid

With funding from the IOOS Ocean Technology Transition project, the Subsurface mooring was modified to integrate a real-time harmful algal bloom detection system called the Environmental Sample Processor (ESP).

23 May 2016

Domoic acid

Credits: IOOS, NOAA, UW, NANOOS, MBARI, etc.
OTT: OA

“Turning the headlight on 'high': Improving an ocean acidification observation system in support of Pacific coast shellfish growers.”

- New “ACDC” $pCO_2$ sensor
- UW, OSU, Sunburst, AOOS, CeNCOOS, SCCOOS, NOAA PMEL, PCSGA
- Lower cost $pCO_2$ for “weather” grade data
- Strong support from shellfish industry
- Builds on existing Burke-o-lators in hatcheries and the IPACOA portal
Burkeolator

ACDC
Partnerships

- Alutiiq Pride Shellfish Hatchery
  Seward, AK

- Taylor Shellfish Hatchery
  Quilcene, WA

- Whiskey Creek Shellfish Hatchery
  Tillamook, OR

- Hog Island Oyster Company
  Tomales Bay, CA

- Carlsbad Aquafarm
  Carlsbad, CA
Partnerships

Alutiiq Pride Shellfish Hatchery
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Carlsbad Aquafarm
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Science-Grower Partnerships

- Alutiiq Pride Shellfish Hatchery, Seward, AK
- Taylor Shellfish Hatchery, Quilcene, WA
- Whiskey Creek Shellfish Hatchery, Tillamook, OR
- Hog Island Oyster Company, Tomales Bay, CA
- Carlsbad Aquafarm, Carlsbad, CA

- Wiley Evans, Hakai Institute
- Tessa Hill, UC Davis
- Todd Martz, SIO
- Burke Hales, OSU
- Simone Alin, NOAA PMEL

QA
This partnership will expand, has to BC thanks to Hakai, and other places: From Ron Zebel: “Fantastic job Wiley. At the OceansAlaska hatchery, we learned more about our water quality in 7 hours of Burke-O-Lator data than we did in 7 years of monitoring with off the shelf instrumentation. We have adjusted our soda ash injections upward and are going forward with expanded kelp bioconditioning.”
Real-time aragonite saturation state data from shellfish hatcheries!!
Real-time aragonite saturation state data from shellfish hatcheries as well as coastal buoys.

IPACOA: IOOS Pacific Region ocean acidification data portal
Other NANOOS activity

- **Predictions**: hypoxia, OA corrosivity, HABs
- **Synthesis**: Pacific Anomalies Workshop 2
- **Science**: Ocean Sciences 2016, etc.
- **Tribes**: Bellingham Bay buoy Se’lhaem via CMOP
- **Data**: NVS demo video; upgrade to 4.6; OOI etc.
- **Public**: "Seafood 101" flyer in Seattle Times
- **Synergies**: Slides for NOAA Western Regional Environmental Conditions & Impacts Coordination
- **Education/Engagement**: Quileute Tribal Summer school and other education workshops
From NANOOS to the world…
3rd workshop, Hobart, TAS

130 scientists from 37 nations
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Northern extent of California Current
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New award

- 5-years
- PIs submitted ‘sustain’ and ‘new’ LOIs
- Used NANOOS GC and ExCom to identify and prioritize activity
- Translated that input well: scores of 97, 97, 88 out of 100
NANOOS Stakeholder Priorities

The NANOOS Governing Council selected five areas from results of numerous regional workshops as the highest regional priorities because “these issues represent those having the greatest impact on PNW citizenry and ecosystems and, we believe, are amenable to being substantively improved with the development of a PNW Regional Coastal Ocean Observing System:”

- Maritime Operations
- Ecosystem Assessment
- Fisheries and Biodiversity
- Coastal Hazards
- Climate
NANOOS focus areas:

Coastal Ocean
Estuaries and Bays
Shorelines
# NANOOS "Effort versus Application" Map for Observing and Modeling

<table>
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<tr>
<th>APPLICATIONS</th>
<th>Coastal Ocean</th>
<th>Estuaries</th>
<th>Shorelines</th>
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<td>EFFORTS:</td>
<td>mar ops</td>
<td>ecology</td>
<td>hazards</td>
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<td>Multivariable assets:</td>
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<td>WA shelf glider line</td>
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<td>Columbia shelf, glider tracks</td>
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<td>OR shelf buoy</td>
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<td>WA nearshore OAH</td>
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<td>Puget Sound estuary buoys</td>
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<td>Puget Sound estuary ferrybox</td>
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<td>OR shelf plankton timeseries</td>
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<td>Surface currents:</td>
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<td>Oregon coastlines HF</td>
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<td>Washington coastlines HF</td>
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<td>Critical coastal ports X-band</td>
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<td>Forecast models:</td>
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<td>PNW circulation forecasts</td>
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<td>Puget Sound circulation forecasts</td>
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<td>Columbia circulation forecasts</td>
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<td>PNW biogeochem forecasts</td>
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<td>Puget Sound biogeochem forecasts</td>
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<td>Coastal wave forecasts</td>
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<tr>
<td>Flood/erosion forecasts</td>
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</tbody>
</table>

**KEY:**
- *Italicized efforts indicate new investment*
- Currently directly supports
- Proposed to directly support
- Currently indirectly supports
- Proposed to indirectly support
- Text explains the current gap the proposed activities fill
- Not applicable
NANOOS new efforts proposed

- Need WA HFR
- Need forecasting of:
  - Waves
  - Flood & erosion
- Need coastal nearshore OA and Hypoxia observations
  - PNW hypoxia via crab pots
  - Central Oregon OAH
  - Washington Olympic Coast NMS OAH
- Need biological observations on plankton
  - Estuarine phytoplankton monitoring
  - Shelf plankton monitoring
- Need to strengthen more human connections
  - Indigenous Water Network
  - West Coast Governors’ Alliance collaboration
Existing assets to be sustained in partnership:
- Existing coastal and estuarine buoys
- Existing fixed mooring estuarine buoys
- Existing glider tracks
- Existing long-range (180 km range) HF radar site
- Existing standard-range (50 km range) HF radar site
- Port X-band wave radar
- Beach and shoreline assessment. Includes multiple sites where nearshore bathymetry is being collected
- Puget Sound ferry box
- Existing glider tracks (OOI)

Federal assets:
- NDBC buoys
- CDIP buoys
- NOS Tide gauges

Proposed for new support to be sustained in partnership:
- Proposed long and short-range radar site
- Proposed support for estuarine and nearshore sites
- Crab pot moorings
NANOOS Objectives for FY2016

1) Maintain NANOOS as the U.S. IOOS PNW Regional Association
2) Maintain surface current and wave mapping capability.
3) Sustain existing buoys and gliders in the PNW coastal ocean, in coordination with national programs.
4) Maintain observation capabilities in PNW estuaries, in coordination with local and regional programs.
5) Maintain core elements of beach and shoreline observing programs.
6) Provide sustained support to a community of complementary regional numerical models.
7) Maintain NANOOS’ Data Management and Communications (DMAC) system for routine operational distribution of data and information.
8) Continue to deliver existing and, to the extent possible, create innovative and transformative user-defined products and services for PNW stakeholders.
9) Sustain NANOOS outreach, engagement and education.
NANOOS remains vital!

“Why is NANOOS so good?”

– The people: creativity
– The spirit: cooperation
– The concept: collaboration

– New capabilities in all sectors
Accomplishments:

NANOOS sets bar high
NANOOS is supporting the region
NANOOS is relevant nationally
NANOOS leadership visible internationally
NANOOS uses its governance; is growing
Challenges

- Sustaining infrastructure on ~level funding
4. IOOS Association Update

slides from: Josie Quintrell
IOOS Association Executive Director
IOOS Association

Observing our oceans, coasts and Great Lakes

Providing information to those who need it, when they need it

- Advocacy
- Common Issues
- IOOS federal/non-federal partnership
  - Administration
  - Congress
  - National Partners
- Emerging Issues
CLOSING THE GAPS CAMPAIGN

- Scalable campaign
- Tangible outcomes
- Initial focus
  - Water levels
  - Precision navigation
  - HAB forecasting
  - Ocean acidification
- Defining IOOS niche - Federal/Non-federal partnership

TECHNOLOGIES
- Gliders
- Moorings
- HFR

THEMES
- Resilience
- Eco Forecasting
- Ocean Acidification
- Blue Highway

Double IOOS funding in 5 years to fill key gaps in the nation's coastal, ocean and Great Lakes observing systems.

- 2018, $32M
- 2019, $37M
- 2020, $42M
- 2021, $48M
- 2022, $53M

Change in Administration
Regional System Request: $33.9 m

$24.3 million for the national network of 11 regional coastal observing systems

$1.5 million for upgrades and repairs for aging regional systems

$3.1 million to install 12 high frequency radar systems, to close key gaps and make the U.S. surface current mapping system the most reliable, efficient and comprehensive in the world

$5.0 million for research and development, including competitive grants, modeling and verification to develop new products and systems to ensure comprehensive coverage

National System Request- $6.7 m

These funds will support the IOOS Program Office, to help:

- Integrate federal and non-federal data
- Develop the nation’s first quality control standards for real-time data
- Coordinate across NOAA and the 12 Federal IOOS agencies and
- Certify the regional systems.
US IOOS FY 17 High Frequency Radar Request

$3.1 million to install 12 high frequency radar systems

- Safeguarding the Arctic Marine Highway
  - 2 remote radars needed

- Protecting Lives and Public Health in the Pacific Northwest
  - 3 radars needed

- Cleaning up the Great Lakes
  - 3 radars needed

- Saving Lives off Florida’s Coast
  - 2 radars needed

- Saving Millions in the Gulf of Mexico
  - 3 radars needed
<table>
<thead>
<tr>
<th></th>
<th>FY11 Spend Plan</th>
<th>FY 12 Spend Plan</th>
<th>FY 13 Spend Plan</th>
<th>FY 14 Enacted</th>
<th>FY 15 Enacted</th>
<th>FY 16 Enacted</th>
<th>FY 17 Pres Bud</th>
<th>FY 17 Senate</th>
<th>FY 17 House</th>
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<tbody>
<tr>
<td><strong>Regional IOOS Total</strong></td>
<td>$21.9m</td>
<td>$23 m</td>
<td>$26.5m</td>
<td>$28.5m</td>
<td>$29.5m</td>
<td>29.5m</td>
<td>29.5m</td>
<td>31.5m</td>
<td>31.5m</td>
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<tr>
<td>Competitive funding for the national network of regional systems, including surface currents</td>
<td>$20m</td>
<td>$22 m</td>
<td>$23.5m</td>
<td>$24.3m</td>
<td>$24.5 m</td>
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<tr>
<td>Marine Sensor Innovation Grants, Modeling Test bed, Sensor Verification</td>
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<td>$1m</td>
<td>$3m</td>
<td>$4.2m</td>
<td>$5 m</td>
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<tr>
<td><strong>U.S. IOOS Program Office</strong></td>
<td>$6.5m</td>
<td>$6.4m</td>
<td>$5.9m</td>
<td>$6.6m</td>
<td>$6.6m</td>
<td>$6.6m</td>
<td>$6.6m</td>
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<tr>
<td><strong>Total U.S. IOOS</strong></td>
<td>$28.4m</td>
<td>$29.4m</td>
<td>$32.4m</td>
<td>$35.1m</td>
<td>$36.1 m</td>
<td>$36.1 m</td>
<td>$36.1 m</td>
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</tbody>
</table>

* Starting in FY 14 included in the Navigation, Observations and Predictions budget line
FY 18 likely gliders
NANOOS request:
- Make Columbia and La Push gliders operational
- More gliders for swapping
- New Cape Blanco line

Beyond:
- HABs
- Water level
- Navigation
ICOOS Act Reauthorization

**Senate**
Wicker  
R-MS  
Cantwell  
D- WA  

**S 1886**  
Thru Committee Mark Up  
Report Completed

**House**
Young  
R-AK  
Sablan  
D- MPO  

**HR 2744**  
In Water, Power and Oceans Subcommittee  
McClintock, La Malfa, Denham  
Huffman, Napolitano*, Costa, Ruiz,  
Lowenthal*, Torres
5. NANOOS Standing Committees reports
NANOOS
User Products

Jonathan Allan, Mike Kosro, Emilio Mayorga,
Jan Newton, Craig Risien, Charles Seaton,
Amy Sprenger, Troy Tanner, and Rachel Vander Giessen
Why have a NANOOS visualization system?

- **Disparate suite of web sites available to the public** (serving a wide range of data).

- **Regional needs:** seamless delivery of coastal, estuarine and ocean data to stakeholders within the NANOOS domain (+external partners, other RCOOS, and national/international programs).

- **NANOOS currently provides access to 47 different types of variables, and in total 226 ‘assets’ & 19 model/forecast overlays.**

  Effective delivery of these data and product feeds can lead to:
  - greater situational awareness (local and regional scales);
  - improved access to and understanding of environmental variables/conditions; and,
  - enable development and access to short- and long-term time-series.

- **Overall goal:** to aid our understanding of **climate variability, safety, operations**, and lead to **improved resource management** and **regional productivity**.
A Challenge - Many Stakeholders

- State agencies (e.g. ODFW, WADOE, DSL, etc.)
- Federal agencies (NOAA, NWS, FEMA, US Coast Guard, etc.)
- Cities and Counties
- Ocean engineering (instruments, wave energy, telecommunication)
- NGO’s
- Ports
- Bar pilots
- Fishers (recreational and commercial)
- Shellfish growers
- Recreational boaters
- Tribes
- Geotechnical consultants
- Universities/researchers
- Schools (K-12)
- Public-at-large
- Scientists
- and many others...
A Challenge - Many Data Types & How to Display Complex Data Effectively

Overlays (Satellite, Models, & other geospatial data)

Shelf moorings & gliders

Shorelines & Bathymetry

Existing assets to be sustained in partnership:
- Existing coastal and estuarine buoys
- Existing fixed mooring estuarine buoys
- Existing glider tracks
- Existing long-range (180 km range) HF radar site
- Existing standard-range (50 km range) HF radar site
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- Existing glider tracks (OOI)
- OOI moorings

Federal assets:
- NDRC buoys
- CDIP buoys
- NOS Tide gauges

Proposed for new support to be sustained in partnership:
- Proposed long and short-range radar site
- Proposed support for estuarine and nearshore sites
- Crab pot moorings
NVS History and Status:

Nov. 2009 - v1.0 released

May 2010 - v1.6 released (added access to various map image overlays e.g. HF radar, satellite imagery, and ocean models). v1.0 iPhone NVS mobile app released

Jun 2011 - v 2.0 iPhone NVS released (Android Sep 2011)

Nov 2011 - v2.6 released (Tsunami evacuation zones web app)

Nov 2011 - v. 1.0 iPhone TsunamiNW-Evac app released (Android Jan 2012 – BROKEN)

Mar 2013 - v3.0 – Major overhaul of interface; move to Google Maps 3 API; move to dedicated web apps.

Apr 2014 - v3.2 – Major overhaul of NANOOS database and harvesters

Oct 2014 – v3.8 – Climatology web app released

Jul 2015 – v4.0 – New timeline, plotting tool, and depth control for overlays released

Aug 2016 – v4.6 – Updated GUI enhancements in NVS platform; data from mobile assets now available; retired asset panel added; variables now grouped by type, mobile friendly...
Welcome to the NANOOS, the Northwest Association of Networked Ocean Observing Systems. NANOOS is part of IOOS and provides information and products related to weather and ocean data.

NANOOS Visualization System
NVS provides easy access to observations, forecasts, data, and visualizations.

Bloom seen from space!
A recent phytoplankton bloom in Hood Canal, Washington was seen from space! NASA's satellites recorded images of a rare bloom of coccolithophores occurring this summer in Hood Canal and Dabob Bay, Washington. Coccolithophores are phytoplankton with calcium carbonate plates that reflect light, showing up as a milky turquoise color. Washington Sea Grant, a NANOOS partner, observed the bloom from the beach.

More Info from NASA
SG187 NANOOS Jun15
Temperature vs Depth (Section 3)

Map data ©2016 Google, 30 km

Temperature (°C)

Depth (m)

Dive (2015/07/05 - 2015/07/18)
How are we doing & which apps?

<table>
<thead>
<tr>
<th>Apps</th>
<th>Pageviews</th>
<th>%</th>
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<tbody>
<tr>
<td>Tunafish</td>
<td>61997</td>
<td>25.06</td>
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<tr>
<td>TsunamiEvac</td>
<td>55618</td>
<td>22.48</td>
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<tr>
<td>Explorer</td>
<td>38021</td>
<td>15.37</td>
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<td>Shellfish Growers</td>
<td>3359</td>
<td>1.36</td>
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<td>Climatology</td>
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<td>Boaters</td>
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<td>1.18</td>
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<td>BeachMapping</td>
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<td>1.01</td>
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<td>Prism Cruise</td>
<td>2423</td>
<td>0.98</td>
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<td>Maritime Ops</td>
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<td>Gliders</td>
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<td>HF Radar</td>
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<td>3.07</td>
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<tr>
<td>Misc (settings etc)</td>
<td>64102</td>
<td>25.91</td>
</tr>
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</table>

247366 pageviews in NVS as of 08/08/16
+ 607491 in NANOOS
Future Goals

1. Roll out situational awareness capability;
Future Goals

1. Roll out situational awareness capability;
2. Improvements to the tsunami evacuation app. New layers that include:
   a. Detailed evacuation routes
   b. Evacuation communities
   c. Make your own evacuation map (print to pdf). Funding from NTHMP in 2016
Future Goals

1. Roll out situational awareness capability (very soon);
2. Improvements to the tsunami evacuation app. New layers that include:
   a. Detailed evacuation routes
   b. Evacuation communities
   c. Make your own evacuation map (print to pdf). Funding from NTHMP in 2016
3. NVS Explorer mobile app for iPhone and Android (very soon)
   • Update TsunamiEvac app (2017?)
4. Create plotting tool for dealing with variable/depth/time plots
5. Continue with NVS updates and enhancements (e.g. user route maps, bathy contour overlay, lat/long graticules, visualization of mobile platforms, etc.)
6. Hold a stakeholder meeting in 2017 (anticipate holding such a meeting on the central Oregon coast (probably Newport) and/or Coos Bay. Goal:
   a. Inform our stakeholders… we have much to show!
   b. We need input on what’s working and what’s not;
Questions?
NANOOS
Data Management and Communications (DMAC)
presentation to NANOOS Principal Investigators & Governing Council
August 11, 2016

NANOOS DMAC chair:
Emilio Mayorga –
UW-APL
NANOOS DMAC Focus Team:

Emilio Mayorga – UW/APL, Chair
Craig Risien – OSU
Charles Seaton – OHSU/CMOP
(Don Setiawan – UW/APL)

Part of broader DMAC-UPC-Web-Outreach team. But with focused interactions to give sustained attention to “low-level” DMAC issues and IOOS DMAC compliance.

- Close interactions with: Jon Allan (DOGAMI) & Troy Tanner (UW/APL)
- Also: Sky Bradley & Alex Dioso – UW/APL (System Administration, software development support); and others, ad hoc
DMAC Events, Broader engagement

• (Monthly) NANOOS DMAC calls (Emilio, Craig & Charles)

• Annual NANOOS “Tri-Com” meeting (March 2016, Seattle)

• IOOS DMAC Workshop (June 2016)

• Community engagement:
  – QARTOD: DMAC Implementation Working Group; QA/QC workshop at CERF (Nov, Portland); Glider DAC Manual for T & Salt. Data (Beth Curry)
  – MEOPAR Data Management Forum (“Canadian IOOS”, Nov, Montreal)
  – Global Ocean Acidification Observation Network meeting (May, Australia)
  – OOI (Craig & Emilio; data integration engagement)
  – Continued WCGA Ocean Data Network engagement
New or Enhanced Assets

http://nvs.nanoos.org/AssetHistory

• **In situ, fixed**
  • Quilcene, Dabob Bay (Penn Cove Shellfish, WA DNR & UW FHL)
  • Se’lhaem Bellingham Bay (NANOOS, NWIC)
  • CDIP buoy at Humboldt Bay
  • Quadra Island, Strait of Georgia (“Burkolator” from Hakai Institute)
  • NEMO ESP, HABs monitoring (NANOOS, NOAA NWFSC, UW)
  • 3 new WADOH sites, Puget Sound
  • OOI Coastal Endurance Array, 6 moorings

• **Mobile platforms**
  • Port Townsend - Coupeville Ferry, overlays (WA Ecology/DOT, UW; new capability)
  • Victoria Clipper, plots (WA Ecology; new capability)
  • La Push Seaglider, via greatly enhanced App

• **Overlays (remote sensing, models, reanalysis)**
  • Many updates – new variables, extended temporal and spatial domains, anomalies, recalculated climatologies
  • OSU ROMS enhancements
  • WaveWatch3 climatology, anomalies, means
Ocean Acidification Data Activities

- **IPACOA** ([http://www.ipacoa.org](http://www.ipacoa.org))
  - NERRS sites across the region.
  - Integrated CariCOOS OA assets in Puerto Rico (PMEL, NERRS)
  - Ongoing maintenance, extension. Engagement and technical support, collaboration, with SCCOOS, CeNCOOS, AOOS.
- Ongoing support for OA monitoring in NANOOS region.
- NANOOS lead role in **international** “GOA-ON” global adaptation of IPACOA approach, tools.
NANOOS DMAC presence

- NVS!
- Active code collaborations and discussions via “github” open-source code engagement system
- Centralized services: http://data.nanoos.org. Consistent, stable organization of web services for programmatic access
  - http://data.nanoos.org/52nsos/sos
  - http://data.nanoos.org/geoserver
  - http://data.nanoos.org/metadata
  - More coming, including more user friendly presentations
- Distributed services: Compliant THREDDS services at OSU and OHSU/CMOP. Currently mainly model output, but expanding soon to in-situ observations.
- At National & Regional Catalogs, Resources
  - IOOS Registry, Catalog and new Viewers (but changing systems ...)
  - NOAA SWFSC CoastWatch ERDDAP
  - NDBC
  - WCGA Ocean Data Portal catalog
  - IPACOA
IOOS Catalog

- Expanding, improved NANOOS registration, metadata for IOOS DMAC compliant data services for **observations** (“NVS-based” SOS service, at UW/APL), **models** (OSU ROMS model and CMOP SELFE model, at OSU & CMOP THREDDS servers), and **climatologies/anomalies** (OSU/NOAA SWFSC).

- Glider DAC:
  - OSU NANOOS-CeNCOOOS glider (current and previous deployment)
  - CMOP glider (complete archive submitted in 2015)
  - UW-APL La Push glider: development work, ready to submit deployment archive **next week**
“Old” IOOS Catalog, Now “IOOS Monitoring”?

Northwest Association of Networked Ocean Observing Systems

The Northwest Association of Networked Ocean Observing Systems (NANOOS) is the Regional Association of the national Integrated Ocean Observing System (IOOS) in the Pacific Northwest, primarily Washington and Oregon. NANOOS has strong ties with the observing programs in Alaska and British Columbia through our common purpose and the occasional overlap of data and products.

NANOOS has 11 services over 4 servers producing 79 datasets.
IOOS DMAC, Changing Landscape of Visible Resources, Applications

Integrated Ocean Observing System

DATA - VIEWERS - DACS - REGIONAL ASSOCIATIONS - ABOUT -

EDS Model Viewer

IOOS By The Numbers

Profiling Gliders

Data Discovery

Coastal and Ocean Modeling Testbed

Environmental Sensor Map
Welcome to the IOOS Catalog

IOOS Catalog statistics

1.8k  20  0

datasets  organizations  groups

AOOS
Alaskan Ocean Observing System http://acos.org/

Aquarius Level 3 Wind Speed Standard Mapped Image Weekly Data V3.0
IOOS Environmental Sensor Map
Expanding DMAC capabilities, compliance

• **Ongoing enhancements to NANOOS web services, registration with IOOS Catalog.** Expand integration of observation data, models, data products.

• **Long time series.** Big push last 12 months to develop data storage conventions for multiple use. *Goal to make data available via IOOS DMAC services and accessible to NVS.* Initial implementation within next 6 months.

• **Data Archiving with NCEI.** Pilot project with CMOP, to be completed this Fall.

• **Glider data:**
  – Expanded Glider DAC presence (La Push glider soon)
  – Distribution via IOOS DMAC services, accessibility to NVS as standardized data and via new Glider App.

• **QARTOD near-real-time QA/QC.** Ongoing participation in IOOS QARTOD webinars, discussions. Pilot NANOOS implementation next 6-12 months.
Geospatial and other web services in action

[Image of a map showing water temperature data with labels and markers, including a pop-up showing location details and temperature data.]

- **Location:** lat:lon: 47.38434, -123.01138
- **Water Temperature Daily Average, Upper 3 meters (NANOOS)**
- **NANOOS Situational Awareness Maps**
- **ORCA-UW monitoring site (Salish Sea): Profiling Buoy at Twanoh - Hood Canal**
  - **Value:** 18.0 °C (n=12)
  - **Interval mid-point:** Aug 8, 2016 12:00:00 PM
Geospatial and other web services in action
Geospatial and other web services in action

“CMOP Data Explorer with NANOOS/NVS Data”
NANOOS Education & Outreach Update

NANOOS Joint PI and Governing Council Meeting
August 11, 2016

Amy Sprenger, Education & Outreach Coordinator
Rachel Wold, Outreach Specialist
## Scope of Work

<table>
<thead>
<tr>
<th>Product Development</th>
<th>Work with DMAC and User Products Committees on tailored product development, increase usability of NVS</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Engagement</td>
<td>Conduct outreach and trainings to select user groups as resources permit</td>
</tr>
<tr>
<td>Networking</td>
<td>Maintain existing and build new relationships with NANOOS priority area users and the education community</td>
</tr>
</tbody>
</table>
Education: NANOOS goal remains increasing ocean literacy

- NW Aquatic & Marine Educators Conferences
- Classroom Visits
- Educators and UG students on OA & Buoy cruises
- “Oregon Coast Education Program” Teacher Workshops
- MS & HS Summer Science Camps
- Outreach @ informal learning centers
Oregon Coastal Education Program (OCEP)
Teacher Workshops and Curriculum Modules

Cha’ba & NEMO cruise volunteers
Field experiences for undergraduates and educators

South Whidbey Ocean Observing Station (SWOOS)
Student participation in ocean observing
Quileute Tribal School
Summer School with Northwest Indian College and NANOOS
28-29 June 2016
Outreach: targeted user groups

NANOOS goal to link user groups with data products

- Coastal & Estuarine Research Federation Conference
- Salish Sea Ecosystem Conference
- Pacific Coast Shellfish Growers Association Meeting
- Saltwater Sportsman’s Show
- Pop-up Science Ocean Acidification event
- Coastal Marine Resources Summit
- Pacific Anomalies Workshop 2
Outreach: public

NANOOS Observer May 2016

NANOOS Visualization System Updates
An updated version of NANOOS’s data portal, the NANOOS Visualization System (NVs), was released May 3rd. Improvements and data stream additions from three NANOOS members include:

Data from Hakai Institute at Quadra Island, BC:
A new data stream from a shore station on Quadra Island, British Columbia from NANOOS member Hakai Institute is now available on NVs. This new suite of sensors monitors ocean acidification conditions in near real-time using “Burke-o-lator” sensors located at the Hakai Institute’s Field Station at Hysanich Point. 

View data from Quadra Island | Read Hakai’s blog article

AVL Data Viewer for the UW La Push Glider:
A new data visualization tool for data collected via autonomous underwater vehicles (AUV) such as a glider is available. Trajectory data collected during 2014-2015 and 2015-2016 by the NANOOS partner University of Washington’s La Push Seaglider can be viewed via the LaPushGlider tool.

New Overlays from the Washington Department of Ecology
New data visualizations of surface currents collected via the Port Townsend/Couleeville YAK Data Ferry and surface water temperatures

Tour of the Data Explorer App
Join us for a virtual tour of the Data Explorer App. Demonstration of various features and applications, and introduces other NANOOS resources.

Data Explorer Overview

Total Page Likes as of Today: 460
Plan for Upcoming Year

Education Efforts
• Continue to support NANOOS education partners
• Continue to support student built buoy and similar STEM projects

Outreach Efforts
• Continue to assist with development of web and mobile apps
• Continue outreach to current users groups, adding recreational boaters
6. GC Business
NANOOS business

• Fill vacancies/changes re elected NANOOS GC Board

• Identify how NANOOS pays annual $500 non-federal dues to IOOS Association
  – We thank Sea-Bird Scientific for $500 commitment, but dues went up to $1000
2013-17 NANOOS GC Board

Status prior to 2016 GC meeting:

Academic:
• David Martin, Governing Council Board Member for UW (CHAIR)
• Mike Kosro, Governing Council Board Member for OSU (VICE CHAIR)
• Antonio Baptista, Governing Council Board Member for OHSU

State:
• Carol Maloy, Governing Council Board Member for Washington State Agencies
• Jon Allan, DOGAMI, Governing Council Board Member for Oregon State Agencies

Tribes:
• Paul McCollum, Governing Council Board Member for Tribes
• Joe Schumacker, Governing Council Board Member for Tribes

Federal:
• John Stein, Governing Council Board Member for Washington Federal Offices
• Andy Lanier, Governing Council Board Member for Oregon Federal Offices

Industry:
• Margaret Barrette, PCSGA, Governing Council Board Member for Industry
• Andrew Barnard, WetLabs, Governing Council Board Member for Industry

NGO:
• Fritz Stahr, Governing Council Board Member for Non-Governmental Organizations
• Paul Dye, TNC, Governing Council Board Member for Non-Governmental Organizations

At Large:
• Vacant, Governing Council Board Member At-Large
• Chris Mooers, Governing Council Board Member At-Large
2013-17 NANOOS GC Board

Status after 2016 GC election:

Academic:
- David Martin, UW, Governing Council Board Member for UW (CHAIR)
- Mike Kosro, OSU, Governing Council Board Member for OSU (VICE CHAIR)
- Antonio Baptista, OHSU, Governing Council Board Member for OHSU

State:
- Carol Maloy, WA Ecology, Governing Council Board Member for Washington State Agencies
- Jon Allan, DOGAMI, Governing Council Board Member for Oregon State Agencies

Tribes:
- Paul McCollum, Port Gamble S'Klallam Tribe, Governing Council Board Member for Tribes
- Joe Schumacker, Quinault Indian Nation, Governing Council Board Member for Tribes

Federal:
- John Stein, NOAA, Governing Council Board Member for Washington Federal Offices
- Andy Lanier, ODLCD Governing Council Board Member for Oregon Federal Offices

Industry:
- Margaret Barrette, PCSGA, Governing Council Board Member for Industry
- Andrew Barnard, WetLabs, Governing Council Board Member for Industry

NGO:
- Fritz Stahr, OIP, Governing Council Board Member for Non-Governmental Organizations
- Gus Gates, Surfrider, acting Governing Council Board Member for Non-Governmental Organizations

At Large:
- Paul Dye, WA Sea Grant, Governing Council Board Member At-Large
- Chris Mooeres, PSU, Governing Council Board Member At-Large
7. Round Table for announcements and feedback from GC members
8. Wrap-up and Adjourn