

U.S. IOOS Advisory Committee

Public Meeting

October 10-12, 2016

Seattle, WA and La Push, WA

October 10, 2016

Day 1: Big Data Discussion

Seattle, WA

Committee members present: Conrad Lautenbacher (chair), Tom Gulbransen (vice-chair), LaVerne Ragster, Val Klump, Doug Vandemark, Justin Manley, Jennifer Hagen, Chris Ostrander, Tony Koslow, Tom Curtin, Tony MacDonald, Casey Moore, David Legler (ex-officio), Brian Melzian (ex-officio), Vicki Kromer (Committee Staff), Jessica Snowden (Designated Federal Official)

Committee members absent: Linda Lillycrop (ex-officio)

Public present: Zdenka Willis, Director U.S. IOOS office; Tiffany Vance, U.S. IOOS office; Josie Quintrell, IOOS Association; Nick Rome, Consortium for Ocean Leadership; Kruti Desai, Consortium for Ocean Leadership; Emilio Mayorga, University of Washington Applied Physics Lab; Virtual folks?

The Chair called the meeting to order at 9:00 am, and welcomed the committee. The opening session focused on Big Data and how it impacts the ocean observing community. J. Manley and T. Curtin introduced the panel.

Panel 1: Discussion on “Big Data” and Relating it to IOOS and Ocean Observing: Chitra Sivaraman, DOE Pacific Northwest National Lab; Ed Kearns, NOAA – Big Data Partnership; Aaron Marburg University of Washington Applied Physics Lab; Nazila Merati, Merati and Associates, PLLC; Felix Chen, Society Consulting; Robert Fatland, University of Washington Applied Physics Lab

Chitra Sivaraman (DOE PNNL) – Her role leading DOE observatory teams includes developing software products, focusing on machine learning for data quality. With 1,600 datasets collected every day, first work is done to train the algorithm and then automate the QA process. Second is to feed the models, third is the partnering with industry to bring down the costs of wind energy, in partnering with industry.

Robert Fatland (UW – APL) – His background is in ground sensor network, Microsoft ARC data, now at University of Washington. Focus now is helping people who walk in the door to use

data tools. Cloud computing is more than repository, the cloud is competitive- companies are competing for market share and providing more services.

Edward Kearns (NOAA) – He focuses on addressing the business side of big data through managing the big data industry partnership project within NOAA. Are current customers going to have to pay for data is the first question? NOAA’s customers are primarily on the research side. The project is attempting to expand the range of data into the private sector. Third party is the customer with the challenge, which NOAA is working to identify.

Nazila Merati (Merati and Associates, PLLC)– Her focus is on multiblogging, social media streams for achieving value. A way of validating model data to look at human impacts. What interests her about the problem in terms of business intelligence, is being able to have data that is user-friendly. Also looking in terms of accessibility services in the cloud such as analytic services and to share model results and bring in things like temperature data.

Aaron Marburg (UW – APL) - APL cables array—OOI UW is the science prime for that. Focal data set—130 instruments on array, but lots of streams HD camera. Bridging gap—take data for science and outreach. Want the best product for end users. His focus is on the future of data portals and if they make sense. Rutgers has been working hard on a cyber-infrastructure, but it’s a big lift. Ocean Networks Canada has invested majorly in user portal and has a nice interface.

Felix Chen (Society Consulting)-Data mining consulting company currently for Ernst and Young, but previously ran data for Walt Disney. The biggest fear for these companies is security. The brand name suffers if there is a data breach. This is not an issue here. Data should be open. They’re trapped in data centers; storing data is cheap; licensing charges are gone—people are moving quickly to be a part of it. It’s important to get people to WANT to brand IOOS, utilizing public data sets and take it to that next step. Cognitive and AI front is about image process and then tensor flow. Watson (IMB) petabyte scale is what we’re looking for, but storing data needs a strategy and centralizing that data to a single cloud location. It’s important to remember the SELLING aspect – data can’t be discarded, but will need to store and figure out what to do with it later.

Questions from agenda to guide discussion:

1. What analytical and computational breakthroughs can “Big Data” contribute toward maximizing access to ocean data, generating information of value, informing decision making, and stimulating economic and environmental benefits?
2. What is the potential value of Big Data techniques to the IOOS Regional Associations and Program Office, and what is the best way to extract that value?

3. Does exploiting Big Data and advance analytics require modifications to data acquisition and archiving that RA's and the Program Office need to aware of and plan for?
4. How can IOOS capitalize on the current NOAA experimental "Big Data Project" (NBDP)?
5. Which of the five partners (CRADAs) is most appropriate to work with in implementing a pilot data set demonstration? What are the candidate pilot data sets?
6. What kind of organizational change efforts have you seen which helped federated organizations like IOOS transform from traditional collect/manage/archive operations into being able to exploit advanced analytics and cloud based operations?

Discussion:

Q: How might the IOOS enterprise engage in big data efforts?

T. Gulbransen asked how we might consider ways to collect revenue while protecting intellectual property of codes and value-added algorithm data and products?

F. Chen raised the importance of the traceability on source of data, and how to push its value back onto the science community, something already happening in the corporate world.

N. Merati said, think of it as consumer vs the services industry, e.g. Dropbox.

Q: Can you license your application programming interfaces (APIs)? Pay by the year/month—sell algorithm market place. IOOS is looking to use that.

The value added product is in combining multiple observations to create one thing. Reaching out to obtain various algorithms is difficult—how do we know the data is being used? We need to look into the second generation of natural language processing. Commercial value is determined case by case. API-based services are likely to continue to grow relative to interactive portals.

Q: Applications—What is the smallest amount of money required to demonstrate a big data impact?

Discussion focused on raising more questions than answers. Should we find an audience that will utilize the information? Should we find cases that will build demand? We need to create demand and let market take its course. How do we create the money need all of this? Sell our data and potential retain property rights after that? How do you pay for the observing system?

Can we consider small business approach with a big data perspective? How do we learn from big data projects and convince private sectors to buy in? How do we network out? Should we bring in the people how have "signed" up already?

Public Comments: None

Actions: No specific actions, but to continue to work get a better understanding on this topic to figure out how to best advise NOAA and IOOC.

Meeting Adjourned: 12:00 p.m.

U.S. IOOS Advisory Committee

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October 11, 2016

DAY 2: Quileute Administrative Building

La Push, WA

Members Present: Conrad Lautenbacher (chair), Tom Gulbransen (vice-chair), LaVerne Ragster, Val Klump, Doug Vandemark, Justin Manley, Jennifer Hagen, Chris Ostrander, Tony Koslow, Tom Curtin, Tony MacDonald, Casey Moore, David Legler (ex-officio), Brian Melzian (ex-officio), Vicki Kromer (Committee Staff), Jessica Snowden (Designated Federal Official)

Speakers: Katie Krueger, Tribal Natural Resource Program; Jan Newton, NANOOS, Joe Schumacker, Quinalt Indian Nation; Dick Feely, NOAA Pacific Marine Environmental Laboratory; John Stein, NOAA Northwest Fisheries Science Center; Carol Bernthal, NOAA Olympic Coast National Marine Sanctuary, Jeff Hetrick, Alutiiq Pride Shellfish Hatchery; Josie Quintrell, IOOS Association

Public present: Zdenka Willis, Director U.S. IOOS office; Nick Rome, Consortium for Ocean Leadership; Kruti Desai, Consortium for Ocean Leadership

Chair called the meeting to order at 9:00 am, followed by welcome and remarks from Quileute Tribal Council.

Pacific Northwest Treaties: Presentation by Katie Krueger of Tribal Natural Resource Program

K. Krueger provided an overview of legal history, treaties, territories, and tribal rights. The natural resources program ensures tribal members have access to natural resources. Main program areas include: fisheries management; timber; hatcheries; water quality; shellfish; tribal enroll; fish and wildlife enforcement.

Remarks from Jan Newton, NANOOS Executive Director

J. Newton provided an overview of NANOOS, including stakeholder priorities, the governing council which contains over 60 institutions, gaps in the region, and their products. Their biggest challenge is the budget. NANOOS attributes its success to the people and their creativity; the spirit and cooperation of the people in the region; and being able to take concepts and collaborate with one another.

Panel: Pacific Northwest Ocean Observing: Current Successes, Future Challenges

Panel Members: Joe Schumacker, Quinault Indian Nation; Dick Feely, NOAA Pacific Marine Environmental Laboratory; John Stein, NOAA Northwest Fisheries Science Center; Carol Bernthal, NOAA Olympic Coast National Marine Sanctuary

Joe Schumacker (Quinault Indian Nation)

Thanks and Welcome. There are 4 treaty tribes in NW Washington. Many spend days out on the water. Hypoxia events were manifested by thousands of dead fish washing up on shore. Real time data is vital; but how do you accomplish the collection? NANOOS is great with data collection. But how do we send the data we collect to the RAs?

Dick Feely (NOAA Pacific Marine Environmental Laboratory)

IOOS plays an integral role in ocean acidification (OA) becoming a part of sustained observations. OA affects hatcheries; changes in ocean chemistry cause massive biological effects, especially felt on this coast. Each year the global ocean absorbs 27% of CO₂ emissions. Major issues arise with shellfish due to OA. We can develop a threshold to predict shell production. 2007/2008 crisis—OA problem, adding base to the water allowed us to balance and mitigate the effect on shellfish. Terapods can be used as a sentinel of OA. We're creating a multi-stressor observing network (west coast OA) using moorings and ships of opportunity. The fifth cruise was completed, and when combined with other data, contributes to RAs and IOOS network.

John Stein (NOAA Northwest Fisheries Science Center)

What can we do to enhance our current fisheries survey capabilities? Challenges: dealing with the unexpected, linking observations with process studies; transitioning research to operations; harnessing the power of “omics” i.e. eDNA. Successes: near real time offshore monitoring data (lab in a can); effective and sustained OA observations; use of fish and seal tags to display location, show migration, survival, and mortality hot spots; use of acoustics on the sea floor to monitor biomass. Large challenge is moving from proof of concept to sustained operations, putting technology in place for sustained use/benefit.

Carol Bernthal (NOAA Olympic Coast National Marine Sanctuary)-

This is one of 14 NOAA marine sanctuaries. These areas add to the network of the U.S. Marine Protected Areas (MPA). There are areas important for us to understand via research, education and outreach, and management. We are big supporters of NANOOS. IOOS has done a great job listening to what is important to the people. Strategic assessment of needs has worked and yearly assessments show progress and gaps. We still need more relevant data streams; together we have been able to do some, but need more. The biggest challenge is to make the MPAs sustainable instead of staying the same place. MPAs may act as a sentinel site for OA; NANOOS plays a part in that. The data visualization products from NANOOS show the progress and status of the MPA. We should be marketing MPAs for use as test beds for new technologies.

Discussion

AC: How can we help?

T. Koslow noted that the ecological and biological monitoring is being left behind vs physical observations. We need to add observations like phytoplankton pulls around buoys. It can help pick up trends in larval stages of shellfish.

J. Schumaker: The issue is systematic observations. We use ships of opportunity more than other method. We need expertise and we don't have ships during summer times when collection would be vital.

J. Newton.: We would love to help, but we have a flat budget. Could we utilize tribal boats? NANOOS does need to expand their biological observations.

J. Hagen: We have a staff boat and it can do some monitoring which is being discussed. But the issue is paying for people to be on the boat and follow up analysis. Staff support is a challenge. Our fishing boats are doing marine debris.

D. Feely: There is enough maturity in the observing networks to consider changing the overall message of IOOS to focus on observing areas. Near-shores and off-shore observations could be valid options. We have the opportunity to effect the next funding opp.

T. Gulbransen: With respect to operations and maintenance: how do we keep things going past initial state? Is there something we can do in the funding cycle to add in O&M to keep it up? Is there something in the budget ask to change that?

J. Newton: Agreed! The problem is not being addressed, we do five year asks, but there are no rules to differentiate between subgroups (DMAC, O&M). The costs have gone up, so there isn't really an answer.

T. Gulbransen: We're the integrators. We need to activate partners to do their part. We have the concept and then find the group who does the closest thing and engage them. We need to find a business approach that will move us out of our current rut.

T. MacDonald: We need to show how we will benefit society. How do we amplify the major needs?

D. Feely: Protein is important. We need to show the societal impacts, like fisheries, food security.

J. Schumaker: Food security is in jeopardy and needs to be addressed. The coastal economy is in danger as well. The Dungeness crab and other fisheries can be an issue.

J. Manley: We need other sources of money—you see big scales in gulf. What are other areas, besides food, that can draw funds? Shipping?

J. Schumaker: Recreational tourism

C. Bernthal: You have to tell compelling stories to get people toward action.

L. Ragster: We need creativity, collaboration, and personal message. What can we do with the information we have.

Presentation and Discussion - Ocean Observing and Industry: Supporting the NW Economy Jeff Hetrick, Alutiiq Pride Shellfish Hatchery; Jan Newton, NANOOS

Jan Newton (NANOOS)

Highlighted building a Pacific region portal for OA: IOOS Pacific Region Ocean Acidification Data Portal (IPACOA). IPACOA provides data relevant to ocean acidification from partners in the Pacific region. This portal provides data streams contributed by regional IOOS observing systems in Alaska ([AOOS](#)), Washington and Oregon ([NANOOS](#)), Central and Northern

California ([CeNCOOS](#)), Southern California ([SCCOOS](#)), and the Pacific Islands ([PacIOOS](#)) as well as through NOAA's Ocean Acidification Program ([OAP](#)) and Pacific Marine Environmental Laboratory ([PMEL](#)). Data presented here were funded through NOAA OAP, U.S. IOOS, or regional observing system collaborators. For further information about ocean acidification, follow these national and regional links, which include FAQs and videos on the basic understanding of and consequences from ocean acidification, as well as links to information on sensors (Alliance for Coastal Technologies, [ACT](#)) and practices (California Current Acidification Network, [C-CAN](#)) used to monitor ocean acidification status.

Jeff Hetrick (Alutiiq Pride Shellfish Hatchery)

West Coast OA and hypoxia asset inventory—IPCAOA—the portal is important for the shellfish industry. OA can be measured locally and also provides insight at the global level through the Global Ocean Acidification Observing Network (GAO-ON). This is a small part of what we do. “OA is a global condition with local effects.” We provide seed to farmers, do a lot of research, and enhancement programs. Shellfish industry brings in around 500 billion a year. Through NANOOS, getting sun system into Seward and started getting readings. We have a dedicated full time person to do OA work and strictly through NANOOS, we have been able to support that. Allutiq is in glacial water. The Seward line is important because it connects off-shore with near-shore. Water is stable most of the year, it's winter where at of whack.

We work with the Tribal Cooperative Landscape Conservation Program – Ocean and Coastal Management Program. In Alutiiq, there aren't benchmarks for blue and red king crab, sea cucumbers, and butter clams. Because they are funded by a tribal program, we have access to other funds that other people don't. Some challenges we face are high OA levels at Resurrection Bay, but we don't know what impacts are, and we just started running samples; getting similar levels to Seward. Expanding now to do statewide sampling because fishing industries need to know. There hasn't been king crab hatch in Kodiak in 30 years – not like how the show Deadliest Catch depicts. Populations of all butter clams, etc. are down. Overfishing, climate change, and OA may be the part of that, but don't know.

In commercial harvesting, including king crab, is 1/3 fisheries state industry. King crab that you get in Costco is normally from Russia.

Discussion:

AC discussed how there was agreement on the crisis facing the shellfish industry. It had economic impacts. They work directly with NANOOS, no intermediaries – to work with the end user on the ground. Political power cannot be understated, as they have associations.

T. Koslow: Has the NOAA aquaculture expressed interest in this?

J. Newton: Yes, we've sent proposals in, but no success but it we're getting more traction.

J. Manley: It seems that things moved faster and more effectively with OA. How? Why? Could this be a possible case study?

J. Stein: It was a huge crisis. Businesses were put at huge risk.

Josie: They wanted to collaborate with sensors. NOAA wanted that. Great test subjected.

T. MacDonald: How is this building on to an ongoing study? How do we keep it up?

J. Newton: IOOS is working on that. We're doing similar things with hypoxia and the PNW blob.

Presentation and Update from the IOOS Association (Josie Quintrell, Director)

Closing the Gaps campaign in FY17 continues to receive support and traction on the Hill. We asked for a targeted HF Radar increase. Based on our gaps analysis, there are 13 priority radars in 5 regions. We asked for \$3.1M and got \$2M from Congress.

ICOOS Reauthorization bill passed in the Senate. We do not expect it to pass the House until next session.

The IOOS Association has developed a one pager to the incoming administration on IOOS and priorities.

IOOS AC and IOOC Discussion: The Challenge of Integration (David Legler, IOOC Co-Chair)

Framing questions: How do we define integration? How do we advance it from the local to global scale? Consider integration exercise focused on one variable from the local to global scale.

D. Legler provided the AC an overview of the IOOC, background on The Framework for Ocean Observing processes (FOO) and the challenges with integration in which the AC could potentially advise. He spoke to the overlap of Essential Ocean Variables (EOVs) (WMO), Essential Climate Variables (GCOS), and by Essential Biodiversity Variables (GEOBON). Because of the overlap, there is a need for a consistent approach. Two potential areas for EOVC integrations could be Ocean Temperature/Heat Content (OHC) and Surface Currents.

He posed to the AC:

- To what extent could EOVC and FOO framework help to advance integration of observing activities and delivery of useful information?
 - Which EOVCs (if not temperature and currents)?
 - Which facets of integration?
 - Motivation/desired outcomes of such activities (use of integrated information)?
- If not EOVC/FOO and these EOVCs, what strategies would the IOOS AC advise the IOOC to support to encourage integration?

Discussion:

J. Newton - Using temperature as a variable to develop a product is a good area – it is a fertile field for integration and they do need to understand more the implications. RAs serving heat for people needs. They are doing climatology, but not good at blobs or ocean heat waves. There is a need to look at ocean and coastal signals, which also came up at Pacific Anomalies workshop). Currently not predicting now, but looking at what is happening.

C. Ostrander: Water temperature fits as food security and flooding. Surface currents is more local and regionally applicable. Wave height and water level are two suggested areas.

T. Gulbransen: For clarification asked if AC was needed to advise on a process for identifying the areas for integration or on the variables itself.

D. Legler: We need both. We have tried approaches but are open to others. There is a slide showing EOV readiness levels, where there a many variables listed.

T. Koslow: There are obvious areas: salinity (as we develop sensors), oxygen and nutrients.

D. Vandemark: With regard to the inter-agencies asked, how do we integrate money? Assets are shared in terms of leveraging.

T. Curtin: Interested in heat transport to integrate and show signals (also patterns of variability)

T. MacDonald: If regions use a variation of the FOO, then everyone can talk on the same page. Asked the group if we think there are elements of the FOO, we can enhance the efforts across other agencies other than NOAA – there are things in the FOO that illustrate that.

J. Manley: With salinity example, if you have an EOV funded by multiple agencies double-check to see if it is integrated in IOOS and then track the barriers to integration. Would propose this to IOOS PO (Derrick Snowden)

Z. Willis: We are also talking about federal assets, contributions to Argo (these are all part of IOOS), the AC is not about the regions only. The EOV process is not getting the program managers new money.

J. Newton: RAs process is comparable to FOO. Local to global scale interoperability. Air ocean interactions, open ocean. It's about knowledge gaps and the purpose isn't about becoming integrated for the sake of integration, it's for filling knowledge gaps. Temperature could be good for that (local to global).

1. Integration through DMAC – Salinity Data
2. Integration through Scale – Temperature
3. Integration through Variable – Wave Height and Water Level
4. Integration through Resources/Assets – Funding

Z. Willis: The perception is that integration from local to global can be stronger – debunking the perception or defining the problem from how the RAs handle it.

Action: D. Legler to develop a 1-2 pager expanding on the integration discussion with AC members.

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Day 3: Quileute Administrative Building

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Member Present: Conrad Lautenbacher (chair), Tom Gulbransen (vice-chair), LaVerne Ragster, Val Klump, Doug Vandemark, Justin Manley, Jennifer Hagen, Chris Ostrander, Tony Koslow, Tom Curtin, Tony MacDonald, David Legler (ex-officio), Brian Melzian (ex-officio), Vicki Kromer (Committee Staff), Jessica Snowden (Designated Federal Official)

Speakers: Dan Jordan, Columbia River Bar Pilots

Public: Zdenka Willis, Director U.S. IOOS office; Nick Rome, Consortium for Ocean Leadership; Kruti Desai, Consortium for Ocean Leadership

Presentation and Discussion - Navigating the Northwest (Dan Jordan, Columbia River Bar Pilots)

How is IOOS used in navigation? What gaps remain which IOOS could help fill?

Columbia River is a dynamic place. The river plume goes 11 miles out to sea. It dredges every summer. Coastal jets can have 20 knots narrow band of wind that goes along the coast. No container ships go to Columbia river; they now go to Seattle/Tacoma – no difference in costs. They lost the last container ship 1.5 years ago. Challenge: If fees increase, ships will move in bad weather to save on docking fees.

NDBC CDIP buoys give a big picture of what is happening. Bar pilots need to make a decision 10 hours in advance. They bought their own CDIP buoys through a OSU grant to help. NOAA PORTS shows you exactly what the tide is, and tracks wave height to determine when to allow ships in/out. IOOS models show how close the ship is to the bottom, such as the under keel clearance product.

Near-shore wave predictive system is the number one gap that needs to be filled. Question for the AC is how do we get modest sums of money to get things that make an impact?

Discussion:

J. Manley: Can you speak to the business model?

D. Jordan: We can't show revenue stream.

J. Newton: There is a success story; one of the intermediary buoys was taken away, and brought the coastal mooring plan into conversation and the buoy was redeployed.

J. Quintrell: What will make your life better?

D. Jordan: Near shore wave prediction system is #1 and need 60k to run.

T. Curtin: Can it run on the cloud?

Z. Willis and C. Ostrander: Too expensive.

There was further discussion on gaps – 60k vs 5 regions need HFR, modeling, and automation of modeling, funds & levying funds, and similarities to USVI.

J. Newton: Navigation is more of an issue on west coast vs east coast. Three thousand ships cross harbor per year – half that green exports.

T. Gulbransen: What would make port more competitive?

D. Jordan: The number of times that closed in winter bothers regulars.

J. Hagen: The economic value and safety issues for a port like this are primary. Safety is a big issue. Fisheries are moving further offshore.

Reprise of IOOC Challenge of Integration – Discussion

D. Legler: How can we best encourage integration?

Action: IOOS PO will create a one pager so show where/how IOOS sits in relation to other organizations.

Wrap-up:

Take-away items and suggestions for future discussions were compiled:

- Follow up on IOOC questions from David's presentation
- EOVS vs. value added product
- Sea level task team
- EPA scientific and legal requirements for indicators will be sent to David
- Regional indicators of ocean health
- How to engage private sector with O&M, surveying potential partners
- Permittee fees
- How to get people to pay for "analysis"?
- How do we get what we do paid for by someone else?
- Integration of watershed data with coastal ocean data
- Need to incorporate fisheries data into David's presentation (integration/EOVs)
- Increased ecological monitoring
- More research for creative marketing for increased demand
- New administration, partner agencies, industry customers, private value added re-salers (4 categories of people – different types of marketing)
- Anecdotal feedback to David
- Do more on big data product
- Recycling past work (ex. Ann's work – "Raising the Visibility...")

- Looking for products that can access without hurting budget
- Look at FOO and examine recommendations in document and how relates to IOOS

Transition Letter Review: AC members read the letter and asked for the following to be added/clarified:

- POINT out that we’re mature and ready for the next step—and include budget recommendations.
- POINT out that this is not just about IOOS but overall good for NOAA/US*
- There needs to be a stronger connector/lead to the strategy. (Text)
- POINT out that our success has us asking for these operational requirements.
- We need to see continued collaboration in the role of the regions* The RAs need to be highlighted. (6 principles)
 - Expansion principle—needs to be more substantive

Public Comments:

Comments from Quileute marina staff/issues the marina faces.

Meeting Adjourned at 2:00 p.m.

Complete List of New Actions:

Action:	Due Date:
No specific actions from big data discussion, but to continue to work get a better understanding on this topic to figure out how to best advice NOAA and IOOC.	N/A
D. Legler to develop a 1-2 pager expanding on the integration discussion with AC members.	3/30/2017
IOOS PO will create a one pager so show where/how IOOS sits in relation to other organizations.	3/30/2017
Hold public meeting to finalize the transition letter for the new administration.	11/22/2016