Specific Product Development for a Target "User Group": Ocean Forecast Fields for Oregon Fishermen

Ted Strub, Flaxen Conway, Craig Risien, Jessica Kuonen, Ian Black
College of Earth, Ocean, and Atmospheric Sciences

Four Questions Posed:

- Q-2: Boundary Between Public/Private (add Academic) Product Developers: Taxpayers have already paid for the satellite and model development. They deserve a practical set of products to help them make their decisions. Private companies can always "add value" to the available public products. Publicly funded research should be published in journals or reports, available to all product developers

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Four Questions Posed:

- Q-1; Q-4: Challenges, Barriers
  - Only a few ocean parameters can be detected by satellites. Luckily these are useful.
  - Sampling is sparse in space and time due to orbits; clouds obscure higher-resolution IR and VIS, creating greater sparseness.
  - Only the surface is sampled, unlike atmospheric remote sensing.
  - Satellites can't see into the future.

SOLUTION (as with atmospheric remote sensing):

*****Assimilate satellite & in situ data into forecast models*****

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Four Questions Posed:

- Q-3; Q-1; Q-4: Opportunities, Challenges, Barriers
  - The opportunities are numerous but mostly unknown: all of those using the marine environment are making decisions based on sparse, uncertain or non-existent information regarding the environmental conditions (present and future).
  - The barrier/challenge is the problem of Mutual Ignorance:
    - Those with the data and model forecasts don't know what decisions are being made and what information would improve those decisions.
    - Those making the decisions don't know what information is available from the data and models.

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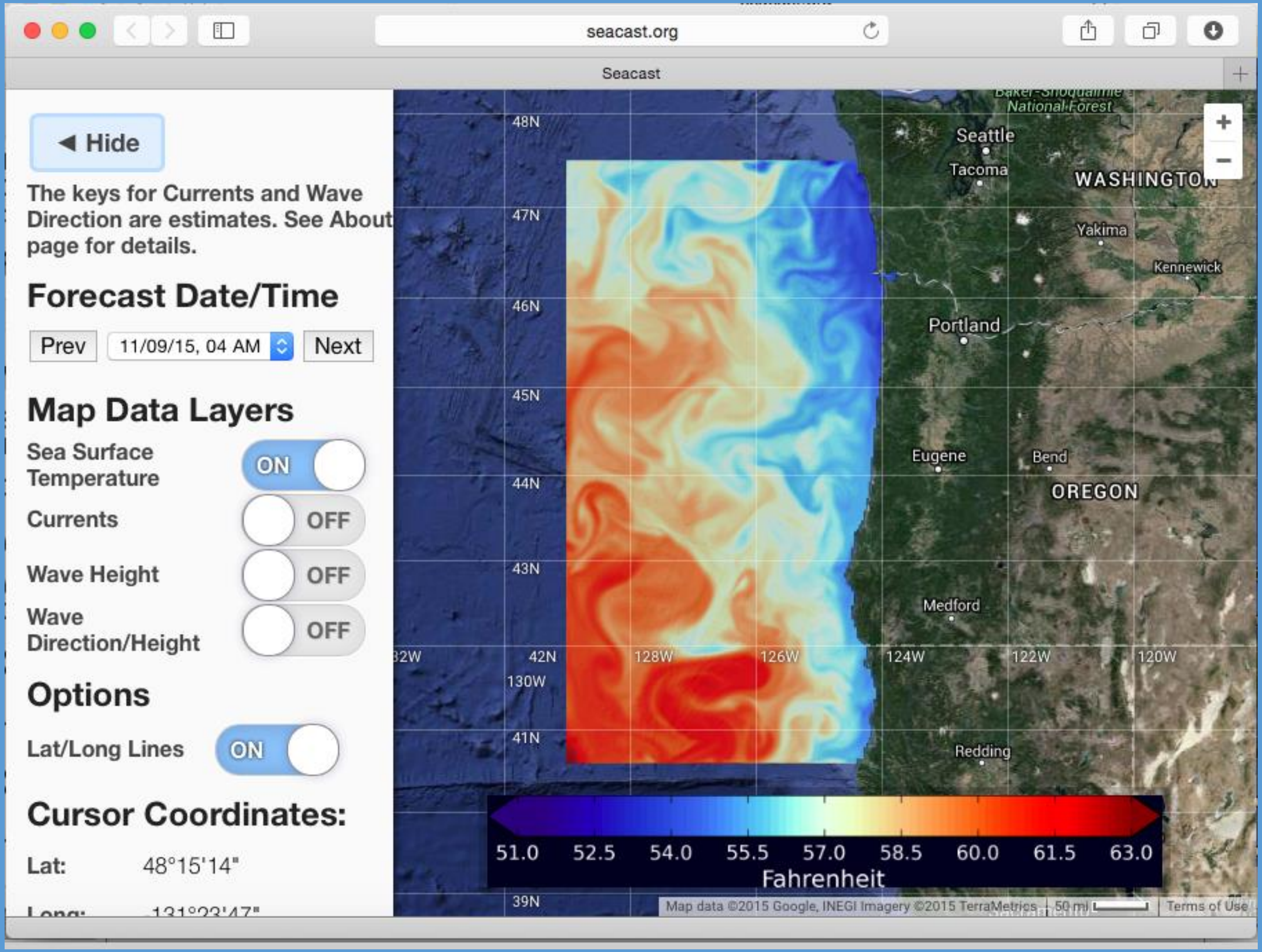
Collaborative Development, Working with Representative End Users

- Objective 1: (Practical) Make ocean forecast fields more "useful" and "accessible" to Oregon commercial fishermen.
  - "Useful" = The right data/information to improve decisions that reduce "risk and uncertainty" (safety, efficiency, profits)
  - "Accessible" = Easy to get data on land and near-shore far enough into the future to be useful when they are at sea later.
- Objective 2: (Research) Clarify similarities and differences in perceptions of "risk and uncertainty" between 'data providers' (modelers; web designers) and data users (fishermen; their families; others). We needed this objective to make a successful proposal for funding from Sea Grant.



SOLUTION: Develop a simplified web page (somewhat like NVS); make it available to the a 'small' group of Newport fishermen; meet and get feedback (also through email and other e-media); modify the website; iterate.

At some point, make it available to fishermen in other areas, using Newport fishermen also to present it.

Finally, find a more permanent platform.

Improvements and additions to seacast.org were made based on input from fishermen: Bottom temperature and salinity;Thermocline depth; Swell vs wind-wave height, direction and period; Wind speed and direction; Tidal information; Sea surface height.

Some Lessons Learned - General

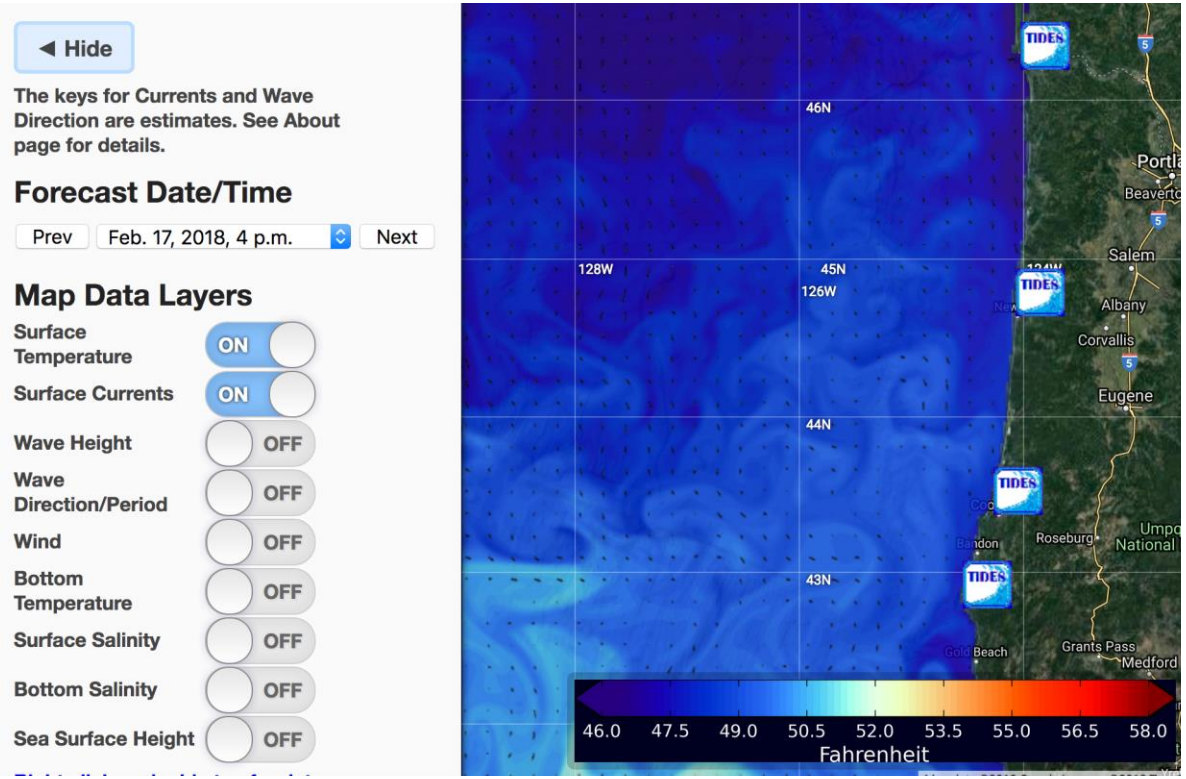
- The presence of many choices is initially a deterrent to use. Their activity at sea is hectic, stressful and dangerous.
- They prefer to look at forecast fields on land, under calmer conditions but this requires forecasts that include the later period of their activity – more than a couple of days into the future. They know that the uncertainty increases – they've learned from weather forecasts.
- Do *not* want fields depicting uncertainty or expected error, $\pm xx.x$ They will compare forecasts to their own experience, other sources of data (buoys, observed drift, wave fields, …).

Specific Lessons - Some Obvious, Some We Could Not Have Guessed

- Use of non-standard units, knots, fathoms, degrees F, …
- Distance and straightest path from port to XX degree water, SST and CHL fronts
- Maps of anoxia on bottom and low pH water
- Currents needed for laying out lines of gear, crab pots – especially direction
- Strong currents pull marker buoys under and gear can not be found
- Salinity – water below 20 psu kills crabs – they pump water into holds to keep crabs alive; pumping while travelling through river plumes can kill crabs; problems occur especially in bays while waiting to deliver full loads of crabs to the buyers. The models don't include bays.
- *SOLUTION:* With our final funds, we placed a real-time salinity station in one bay.

The End Game

Would another program take what had been learned and keep it going, keep improving it? NOAA is developing a West Coast Ocean Forecast System (WCOFS). How is that related?



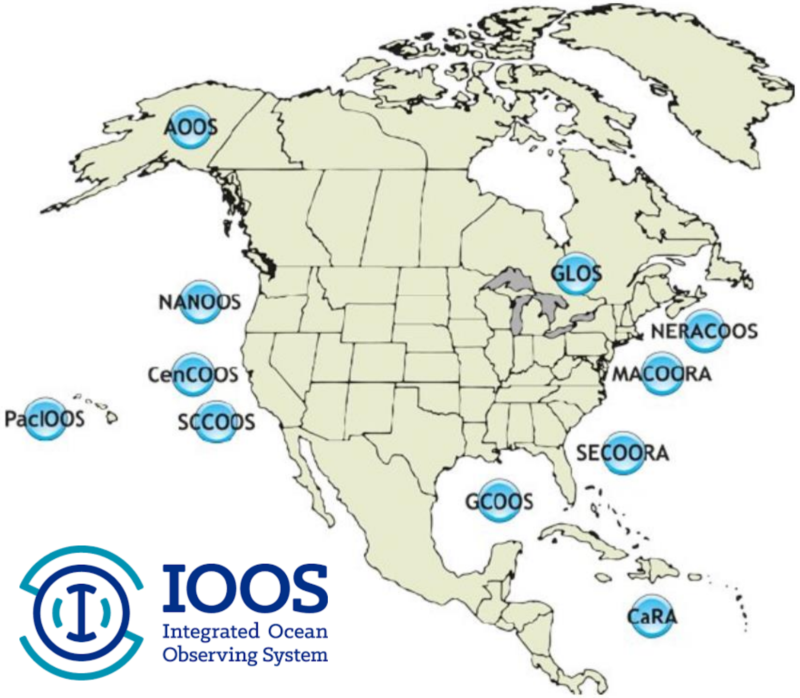
Seacast.org

Built with and for commercial fishermen

- NOAA CoOPS? They will develop their own web sites for the WCOFS and other 'regional' coastal forecast models.
- NOAA NWS Marine Forecast Offices – Medford and Portland were both approached. They forecast wind and waves and often run multiple models. Taking on 3-D ocean circulation models would require additional resources to be provided.
- Coastwatch Nodes: Some interest was shown but the West Coast node had other issues of reorganization at the time.

IOOS/NANOOS: *All these might still be possible, but the answer that worked in our case was the Pacific Northwest node of the Integrated Ocean Observing System, NANOOS, directed by Jan Newton. We had been in contact during our activities through Craig Risien (working on our project and for NANOOS). The NVS had evolved during our development.*

The Northwest Association of Networked Ocean Observing Systems (NANOOS)



NANOOS

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

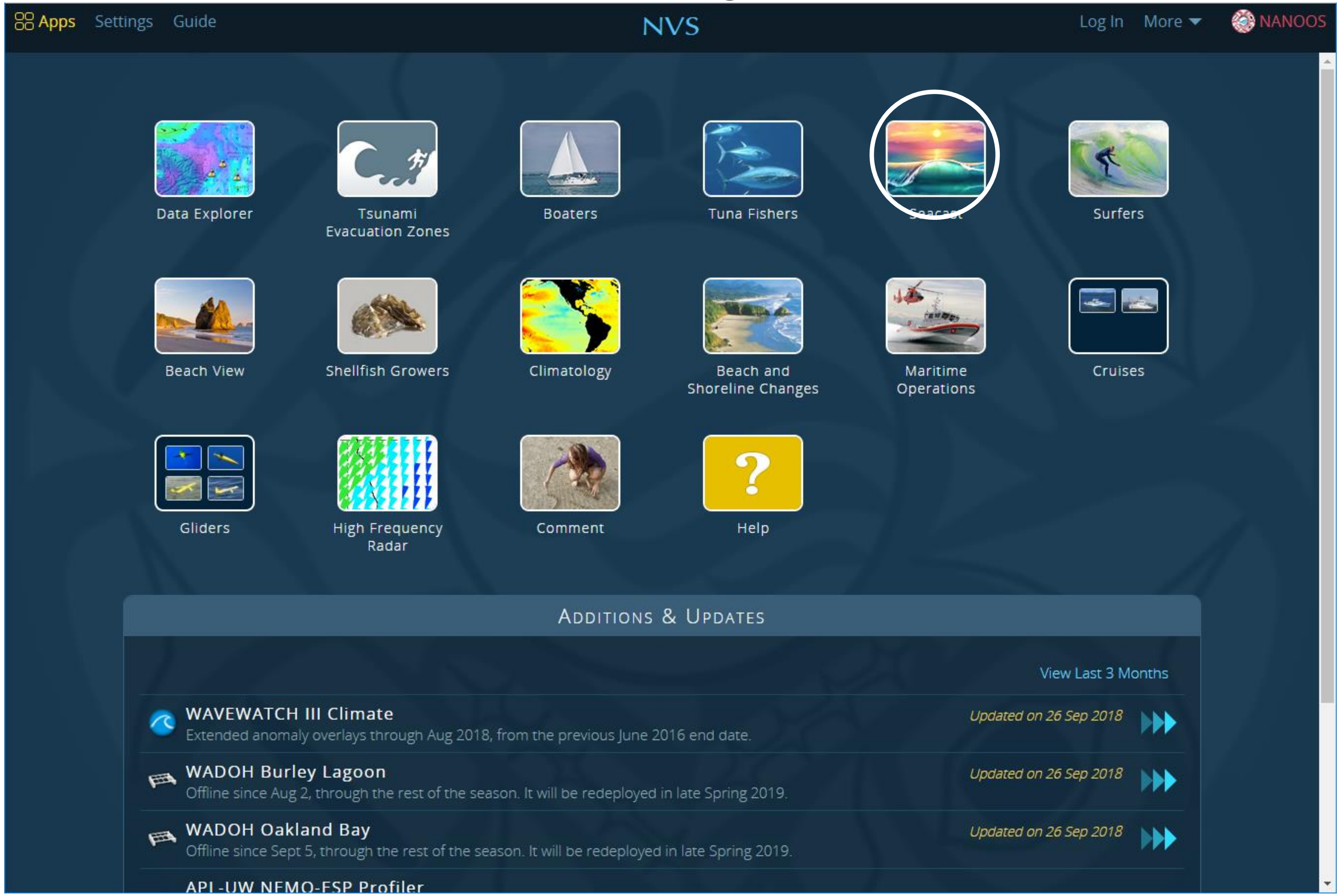
Major rivers:
Columbia River (~75% FW input to Pacific from US WC)
many rivers (e.g., Fraser, Skagit) via Strait Juan de Fuca
Dredging, water regulation, climate change

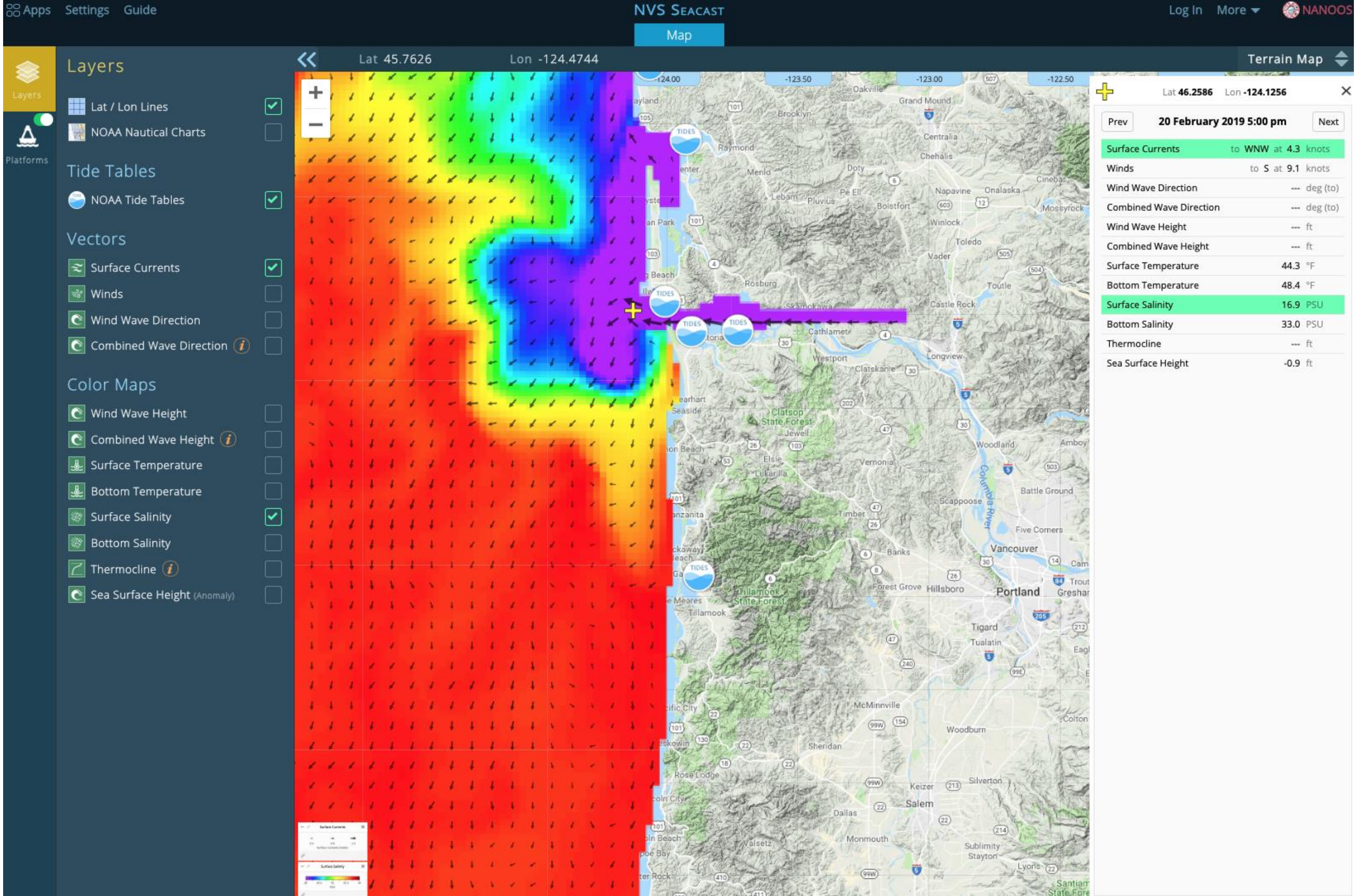
NANOOS Region User Groups:
Maritime: shipping, oil transport/spill remediation
Fisheries: salmon, shellfish, crab, groundfish, aquaculture
Environmental management: HABs, hypoxia
Shoreline: erosion, inundation
Hazards: Search and rescue, national security
Educators: formal, informal, research
Marine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

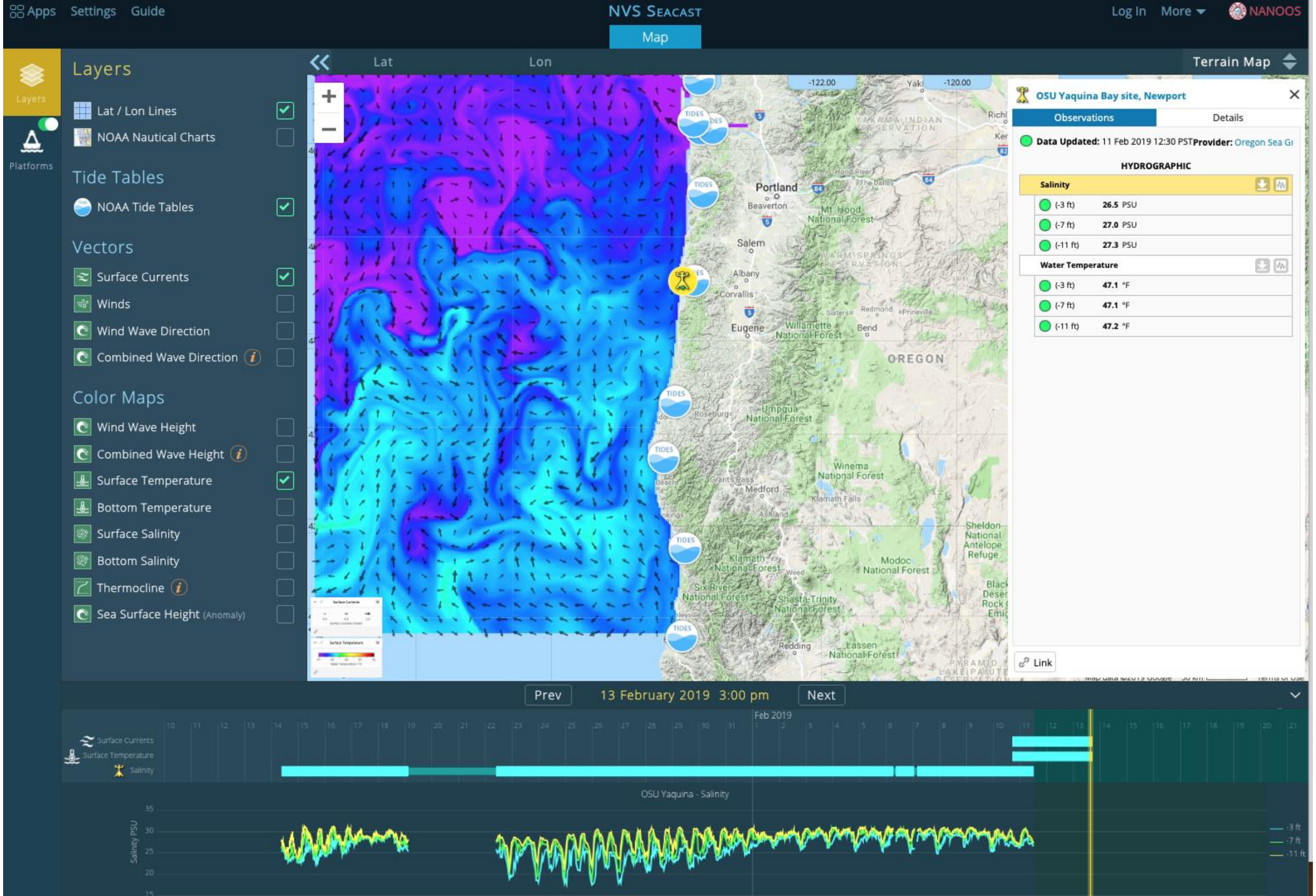
The End Game

The NANOOS Visualization System had moved toward providing simplified subsets of data for specific users. Seacast was a natural addition.

nvs.nanoos.org




Apps
Settings
Guide
NVS Seacast
Map
Log In
More
NANOOS
Layers
Platforms
Lat 45.7626
Lon -124.4744
Terrain Map
Layers
Lat / Lon Lines
NOAA Nautical Charts
Tide Tables
NOAA Tide Tables
Vectors
Surface Currents
Winds
Wind Wave Direction
Combined Wave Direction
Color Maps
Wind Wave Height
Combined Wave Height
Surface Temperature
Bottom Temperature
Surface Salinity
Bottom Salinity
Thermocline
Sea Surface Height (Anomaly)
Lat 46.2586 Lon -124.1256
Prev
20 February 2019 5:00 pm
Next
Surface Currents to WNW at 4.3 knots
Winds to S at 9.1 knots
Wind Wave Direction --- deg (to)
Combined Wave Direction --- deg (to)
Wind Wave Height --- ft
Combined Wave Height --- ft
Surface Temperature 44.3 °F
Bottom Temperature 48.4 °F
Surface Salinity 16.9 PSU
Bottom Salinity 33.0 PSU
Thermocline --- ft
Sea Surface Height -0.9 ft
Portland
Vancouver
Salem



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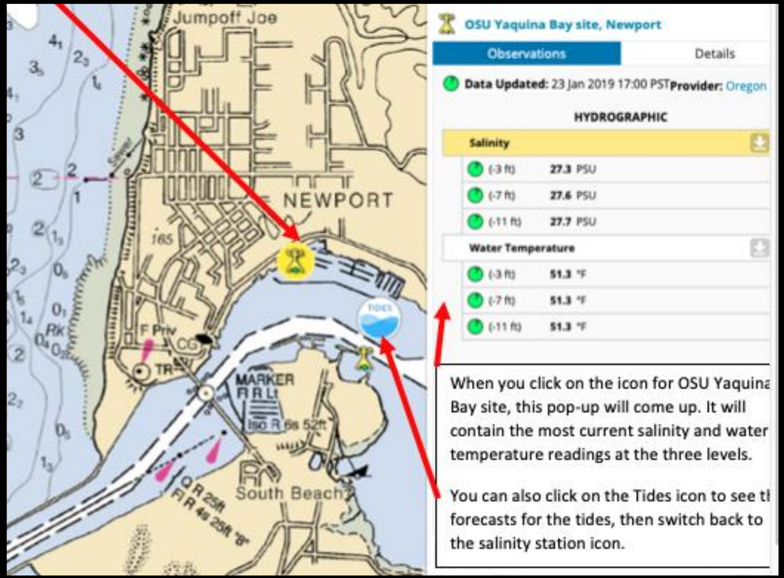
Winds
Wind Wave Direction
Combined Wave Direction
Color Maps
Wind Wave Height
Combined Wave Height
Surface Temperature
Bottom Temperature
Surface Salinity
Bottom Salinity
Thermocline
Sea Surface Height (Anomaly)
Lat
Lon
Terrain Map
Portland
Salem
Eugene
OREGON
OSU Yaquina Bay site, Newport
Observations
Details
Data Updated: 11 Feb 2019 12:30 PST Provider: Oregon Sea Gr
HYDROGRAPHIC
Salinity
(-3 ft) 26.5 PSU
(-7 ft) 27.0 PSU
(-11 ft) 27.3 PSU
Water Temperature
(-3 ft) 47.1 °F
(-7 ft) 47.1 °F
(-11 ft) 47.2 °F
Link
Prev
13 February 2019 3:00 pm
Next
Feb 2019
Surface Currents
Surface Temperature
Salinity
OSU Yaquina - Salinity
Salinity PSU
-3 ft
-7 ft
-11 ft

“Yesterday was perhaps the best example of the value of the new salinity station. Lots of rain prior and a short weather window.

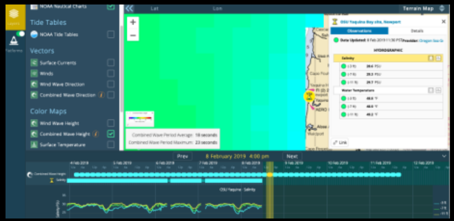
Many boats blown off the ocean at the same time and (this resulted in) many boats having to wait (sometimes several hours) to unload. Price just went up ($4.75/lb). ALL those that had to wait were deciding (whether to) re-circulate and/or provide aeration.

When we crossed (the bar) 2 hours after low water, the salinity was at 11%, 12% and 13% (at 3’, 7’, & 11’ depth): ***all toxic numbers for crab***. We shut off our pump and held the crab in good water until we could unload. Zero dead / lost. Zero weak crab. Excellent!”

Pilot Salinity Monitoring Station



HTTP://NVS.NANOOS.ORG/SEACAST



Thank You

Oregon State University
College of Earth, Ocean, and Atmospheric Sciences

Sea Grant
Oregon

Space Grant

Kuonen, J., Conway, F., Strub, T., 2019, Relating ocean condition forecasts to the process of end-user decision making: A case study of the Oregon commercial fishing community, *Marine Technology Society Journal, 53(1)*, 53-66, doi:10.4031/MTSJ.53.1.1

Kuonen, J., Conway, F., Strub, T., 2019, Navigating mental models of risk and uncertainty within the ocean forecast system: An Oregon case study, *Weather, Climate and Society, 11*:431-447. doi:10.1175/WCAS-D-18-0057.1.

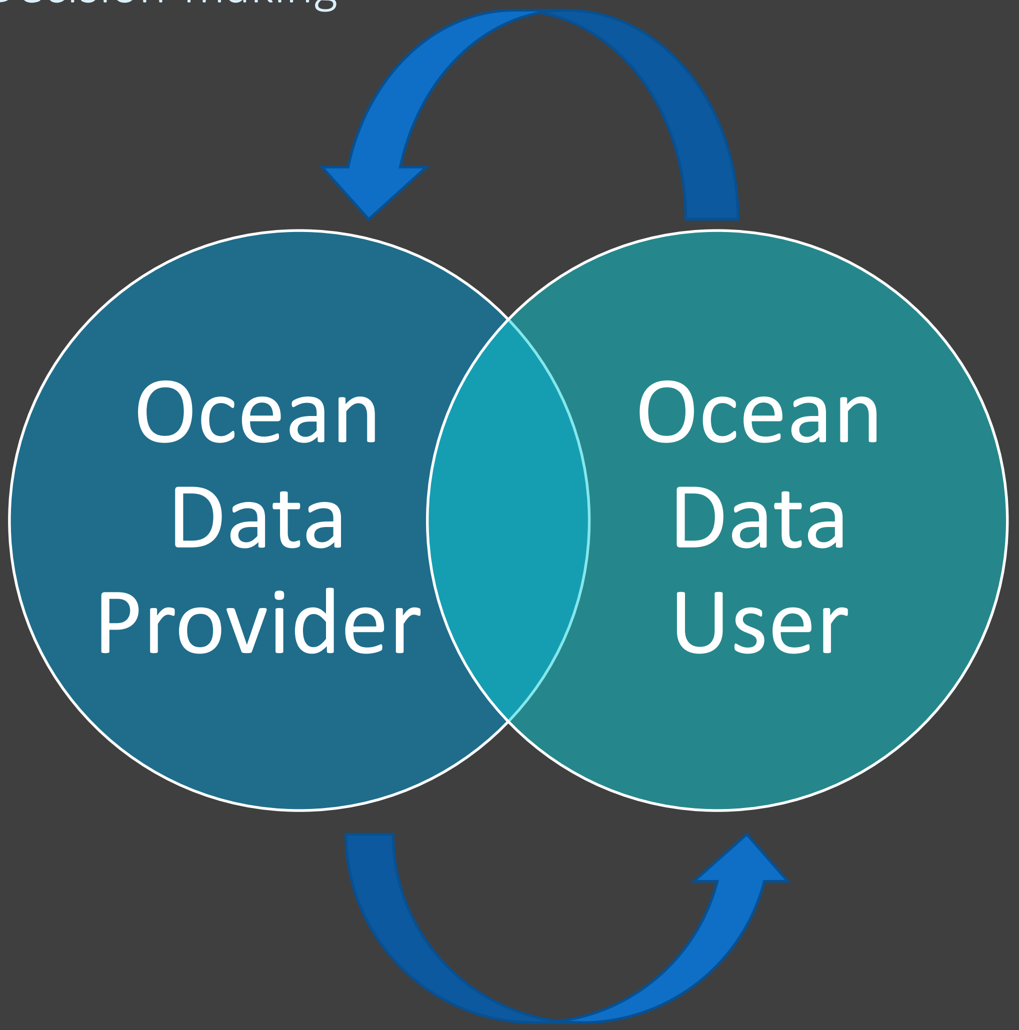
So what? → SAFE

Jessica Kuonen

Ocean Views: Characterizing Risk Perception, Uncertainty, and Decision-making Within the Ocean Condition Forecast System

Research Questions

- What are similarities and differences in risk perception & comfort with uncertainty (R&U)?
- How do these impact what forecasts are made available?
- How do the available forecasts impact fishermen's ability to make decisions?



Jessica Kuonen

Ocean Views: Characterizing Risk Perception, Uncertainty, and Decision-making Within the Ocean Condition Forecast System

- Fishermen face multiple, intersecting risks beyond ocean and weather conditions that factor into decision-making.
- Fishermen depend of forecasts, but they make decisions based on multiple information sources. They have processes in place to assess and cope with forecast uncertainty.
- For data providers, there is uncertainty regarding end-user needs but not a lot of resources to reduce this kind of uncertainty. Perceived risk of providing ocean forecasts to the public varies widely by individual and institution.
- Fishermen and data providers recognize ocean forecast information as imperfect but useful.
- Cooperation between data providers and end-user communities is key to successfully creating value added products and improving the models.

Kuonen, J., Conway, F., Strub, T., 2019, Relating ocean condition forecasts to the process of end-user decision making: A case study of the Oregon commercial fishing community, *Marine Technology Society Journal, 53(1),* 53-66, doi:10.4031/MTSJ.53.1.1

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Seacast.org Timeline (not to scale)

CIOSS support Satellite DA Regional Ocean Circulation Models 2003-2012

CIOSS/OSU Funding March 2012

Colin Duncan MRM Student Aug 2012

Undergrad CS Students Oct 2013

Undergrad CS Students Oct 2014

seacast.org Launched Nov 2014

Newport Meeting Jan 2015

SpaceGrant Funding June, 2015

Undergrad CS Students Oct 2015

Newport Meeting Dec 2015

Jess Kuonen MRM Student Jan 2016

SeaGrant Funding Feb, 2016

Undergrad CS Students Oct 2016

Newport Meeting Nov 2016

Coos Bay Meeting Jun 2017

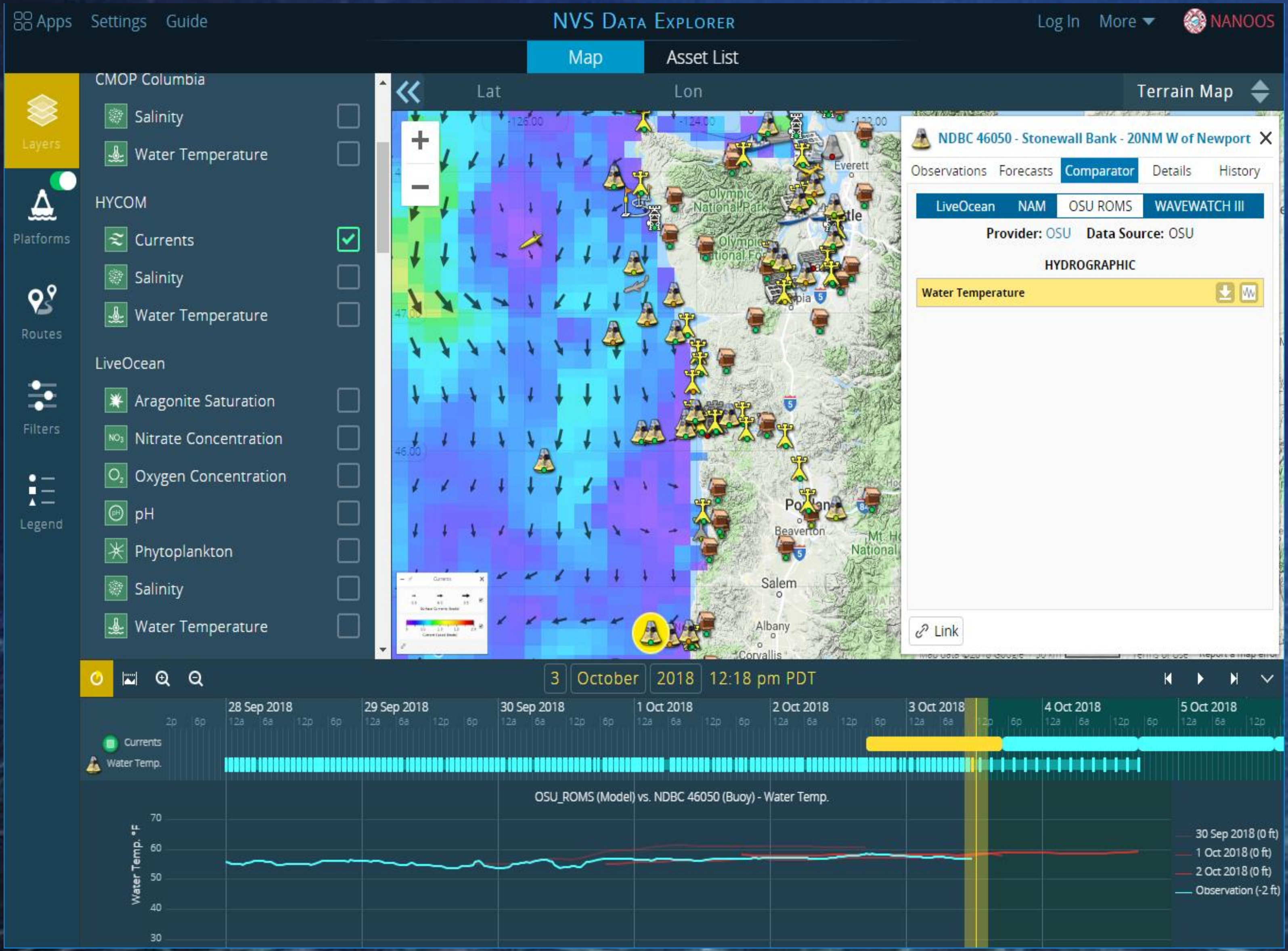
Astoria Meeting Nov 2017

Newport Meeting Dec 2017

UW/NANOOS Meeting Dec 2017

nvs.seacast.org Launched May 2018

Newport Meeting Jun 2018



INITIAL STRATEGY:

Get fishermen to suggest changes to the NANOOS Visualization System (NVS); Try out changes and get feedback; Iterate.

INITIAL PROBLEM: NVS is a quasi-operational system; Frequent changes are not allowed.

ADDITIONAL PROBLEM: Many fishermen found the large number of data sets and options on the complete NVS web page (now the "Data Explorer" too complex.

SOLUTION: Develop a simplified web page (somewhat like NVS); make it available to the a 'small' group of Newport fishermen; meet and get feedback (also through email and other e-media); modify the website; iterate.

At some point, make it available to fishermen in other areas, using Newport fishermen also to present it.

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