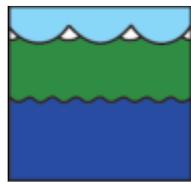


An analysis of marine spatial planning for Washington's outer coast

June 10, 2013



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Rationale for topics

- Economic and social importance
 - Fisheries
 - Transportation
- Poorly understood
 - Ocean observation and research
 - Ocean energy development

Our Assignment

- Data source: state data inventory (WAMP)
- Goals
 - Identify data sets needed
 - Identify and assess quality of important existing data sets
 - Identify and prioritize data gaps
 - Work with science experts

Challenges

- Current state of data catalogue
- 10 weeks
- Proprietary data
- Progress being made

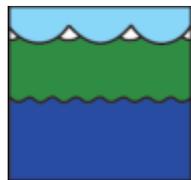
Opportunities

- Workshops
- Address data gaps important to state economy
- Improve data sharing from government to public

An analysis of fisheries and marine spatial planning in Washington State

Barbara Clabots
Kyle Masters
Courtney Sergent

June 10, 2013



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Objectives

- Predict necessary data layers for fisheries related management
- Note current uses and predict future conflicting interests
- Analyze existing data sets for
 - Quality
 - Utility
- Supplement spatial data

Data sources

- WAMP
- Paul Dye (TNC)
- Flaxen Conway (OSU)
- Dave Fluharty (UW SMEA)
- Tim Essington (UW SAFS)
- Penny Dalton (WA Sea Grant)
- Miles Logsdon (UW Oceanography)
- Ed Melvin and Troy Guy (WA Sea Grant/ UW SAFS)
- Scott Pearson (WDFW)

Fisheries recommendations

- Contextualize and make fully accessible the data catalog
- Support data sharing
 - Public/private/tribal
- Commit to a transparent process to capture stakeholder uses and interests

Most important layers

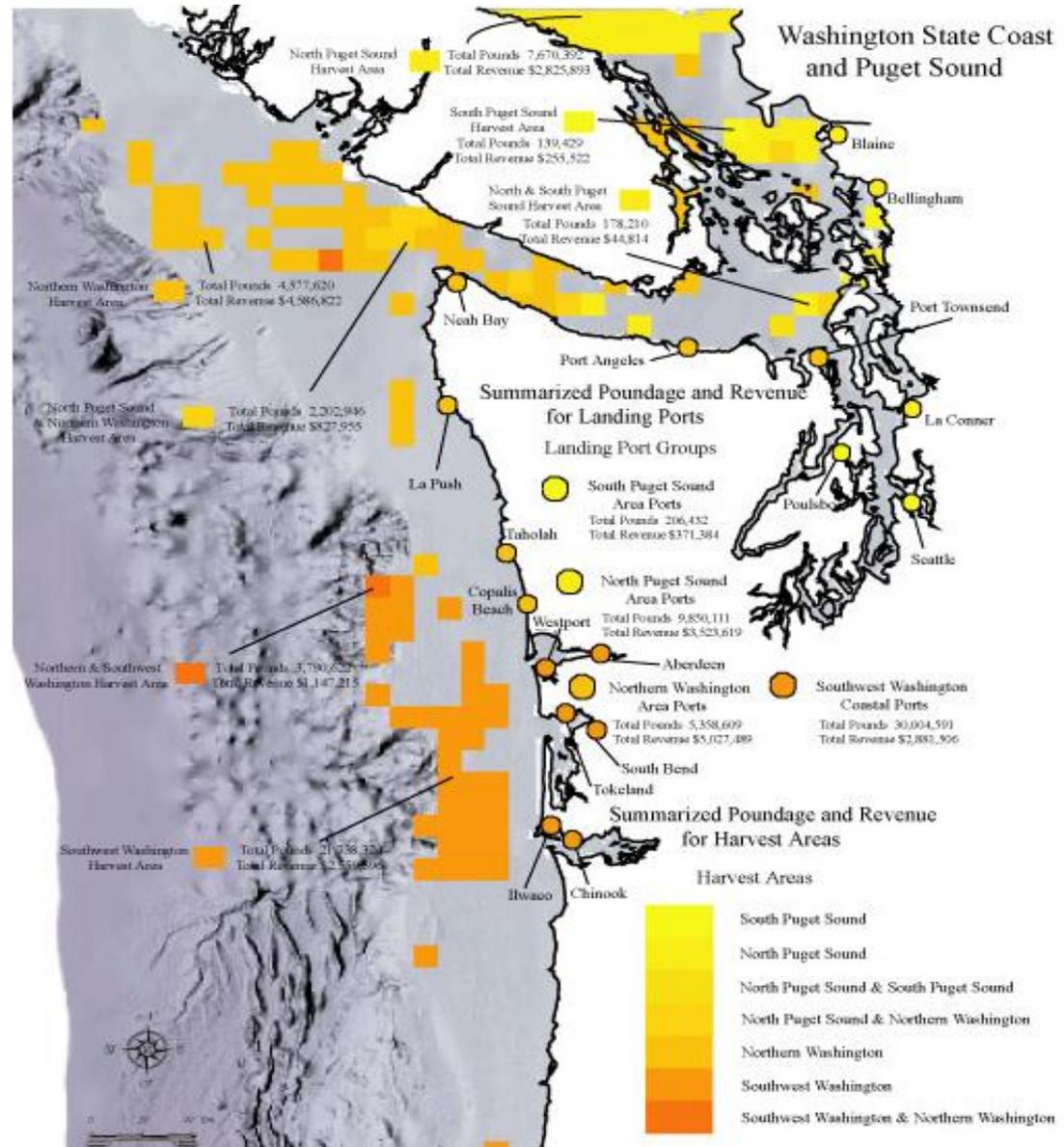
- Ecological
 - Populations – spatial, temporal, density distributions
 - Dungeness crab
 - Salmon
 - Groundfish
 - Pacific halibut
 - Shellfish aquaculture
 - Essential Fish Habitats

Most important layers

- Regulatory
 - Restricted areas, protected areas
 - Tribal Usual & Accustomed Areas
- Economy
 - Fishing grounds
 - Ports
 - Other existing and potential uses (renewable energy, infrastructure, transportation, ocean observation)

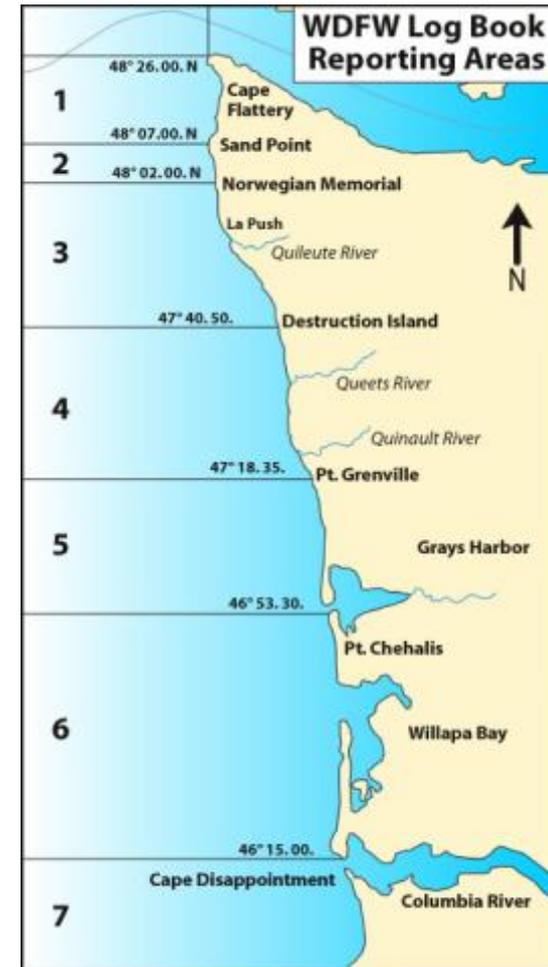


Harvest Areas of Each Landing Port Group for Groundfish Fleet



Challenges for fisheries & MSP

- Secrecy of data
 - Affects accuracy of logbooks/reports
 - Causes time delays
 - Lack of inter-agency sharing
- MSP should be inclusive
 - Lessons learned from Rhode Island and others
 - Ex: how can the process validate fisher's concerns
- Co-management with treaty tribes
 - Ex: validate traditional/cultural uses of marine resources
- Decision-making with best available information
 - Ex: ocean acidification's impact on shellfish



Challenges for fisheries & MSP

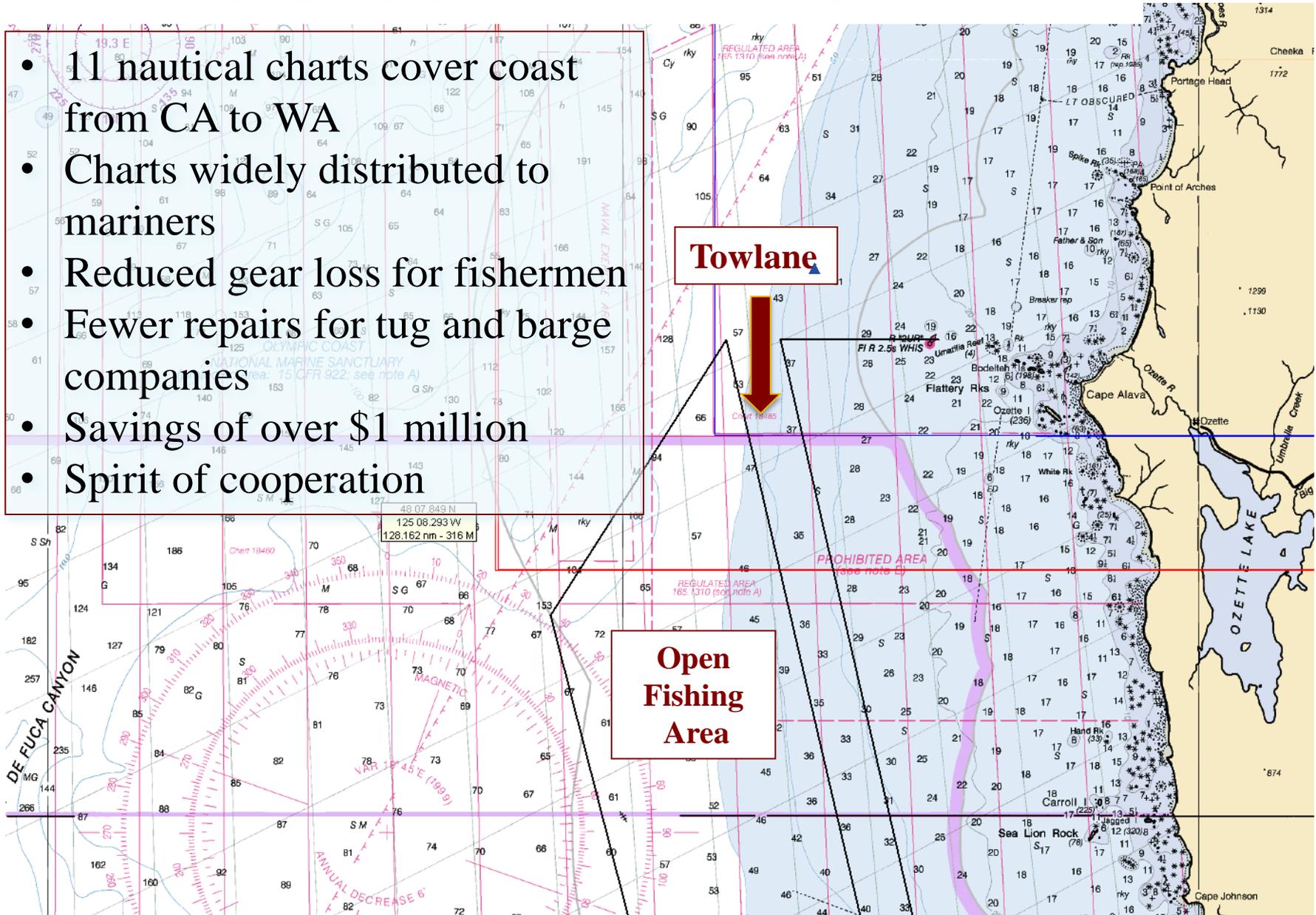
- Protect and preserve sustainable existing uses
 - Equity between user groups
 - Costs/benefits
- Integrating land-based planning
 - Ex: salmon conservation efforts by Forterra

Sources of conflict

- Ecological
 - Non-targeted species bycatch
 - Marine mammal interactions
 - Changing migration routes
- Human Use
 - Competition among fishers, gear types
 - Conflicts among industries/uses
 - Example: Coastal crabber/towboat conflicts

Pacific Coast Towlane Charts

- 11 nautical charts cover coast from CA to WA
- Charts widely distributed to mariners
- Reduced gear loss for fishermen
- Fewer repairs for tug and barge companies
- Savings of over \$1 million
- Spirit of cooperation



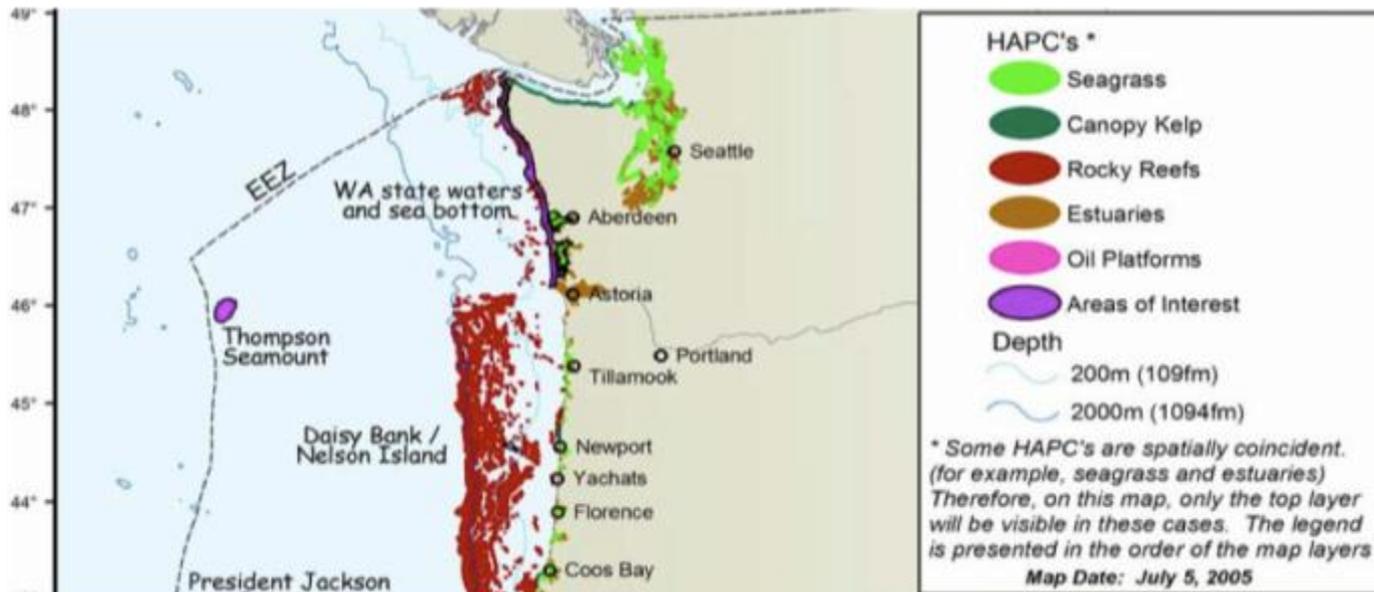
Data gaps

- Human
 - Fishing vessel logbooks: highly variable; need vetting
 - Fishing ports: unclear from data description how ranked & how often assessed
 - Aquaculture: No data on location of species or EFH
- Ecological
 - Inter-species interactions are not in existing layers
 - ex: eagles predating on seabird colonies
 - Lack of Dungeness crab data
 - Ex: no current stock assessment
 - Essential fish habitat: too broad to be useful

Essential Fish Habitat



Habitat Areas of Particular Concern



126°W

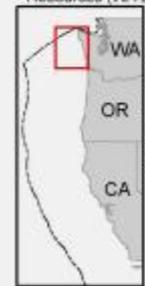
125°W

124°W

Washington [Commercial Fishing]

-  Tribal
-  Spot Prawn
-  Sablefish
-  Halibut
-  Groundfish
-  Tuna
-  Salmon
-  Crab
-  Shrimp
-  Aquaculture
-  Other fishing activity

Sources: BOEM/NOAA, CA Ocean Uses Atlas, California Department of Fish and Game, California Wreck Divers, Coast Guard, Dr. Flaxen Conway and Dr. Carrie Pomeroy's Interviews, ESRI, iBoattrack, Marine Map, MPA.gov, National Atlas, NOAA ENCDirect, NOAA Marine Protected Areas Center, NOAA NMFS, NOAA NWFSC, NOAA ORR, Oregon Coastal Atlas, Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Land Conservation and Development (OR LCD), Oregon Geospatial Enterprise Office (GEO), Oregon SeaGrant, Pacific Coast Marine Habitat Program, Pacific States/British Columbia Oil Spill Task Force, PaCOOS, PSMFC/PacFIN, The Nature Conservancy, US Army Corps of Engineers, US Navy, Washington Department of Ecology, Washington Department of Fish and Wildlife (WDFW), Washington Recreation and Conservation Office (WA RCO), Washington State Department of Natural Resources (WA DNR)



Projection: GCS North American 1983

Produced by Colleen Sullivan, OSU

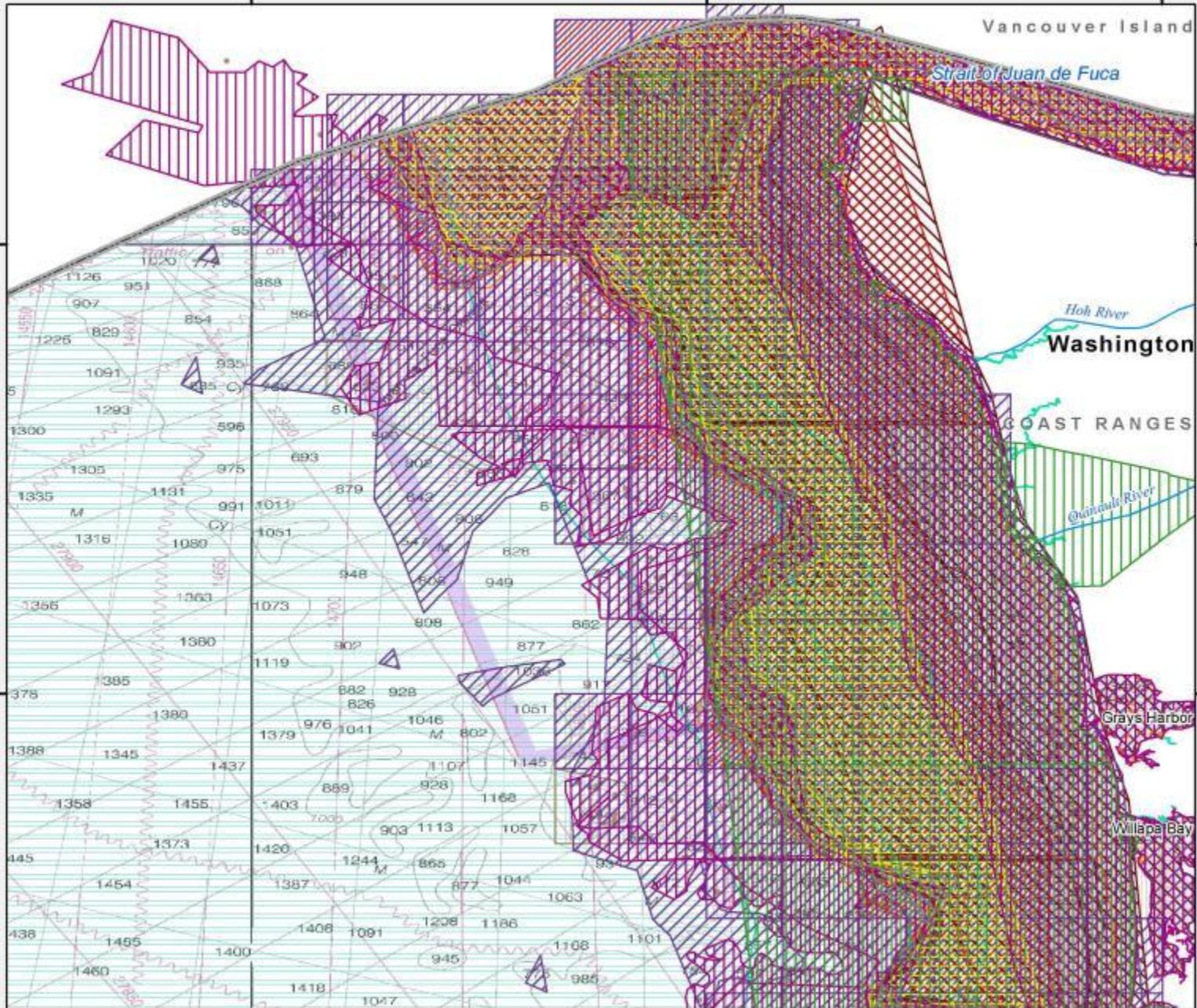


48°N

47°N

48°N

47°N



126°W

125°W

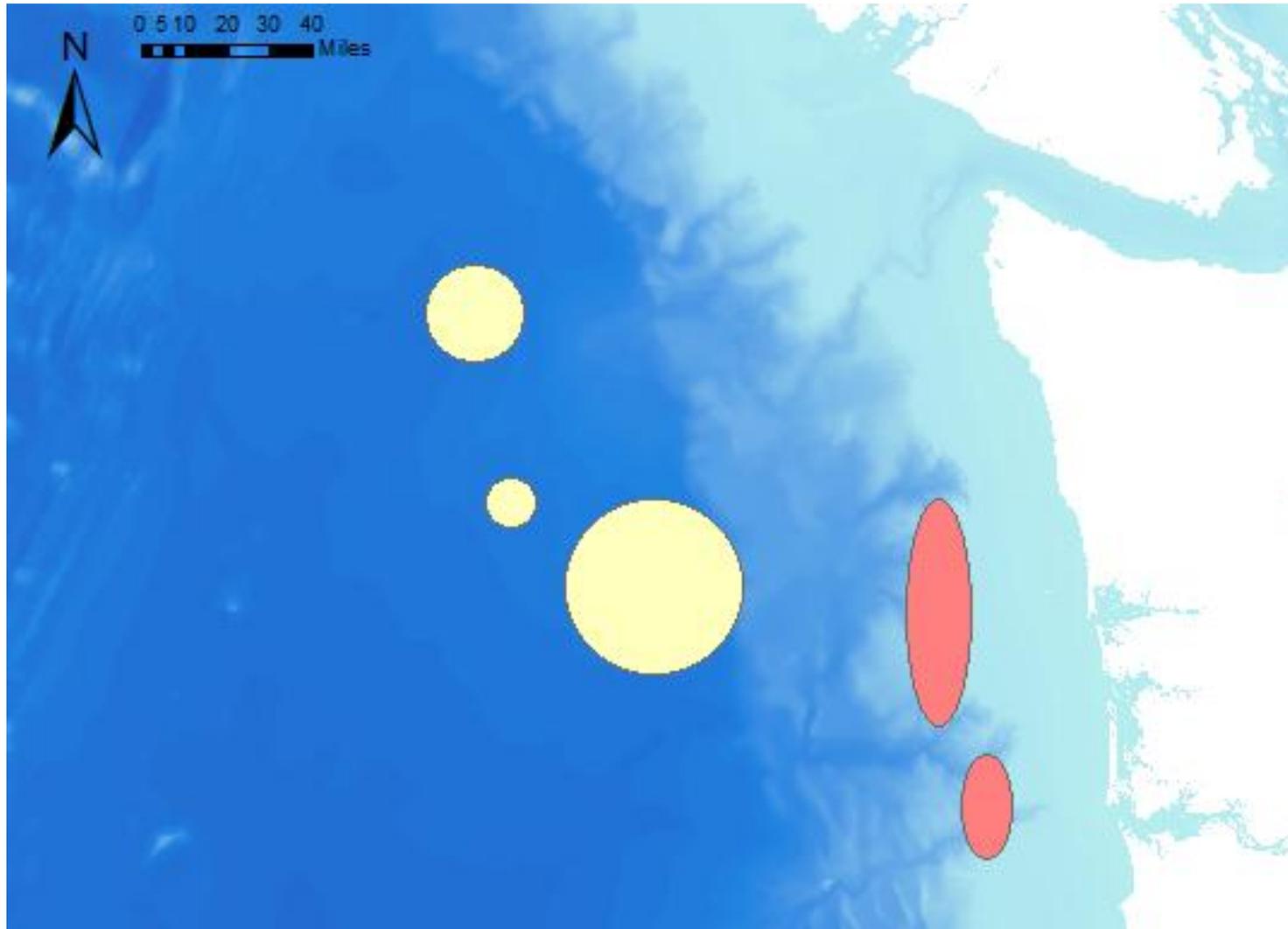
124°W

0 5 10 20
Nautical Miles

Not for Navigation. Draft Product for Discussion Purposes Only - Aug 23, 2011

1:1,323,960

Potential density-based maps of fishing grounds



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Moving forward

- Prioritize data collection for species lacking time and spatial distributions
 - Unnecessary for all marine species
- Necessary to include abundance distributions when possible
- Necessary to communicate clearly with fishers as to how the information will be used
 - Can we blur the scale to aid the process?
- Make decisions about sensitive information and what to share with the public
 - Ex: how will public viewing tool influence behavior and expose the ‘sweet spots’

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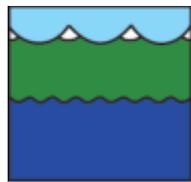
References cont.

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Washington State Coast Marine Spatial Planning

Transportation, Dredging, and Sediment

B. Antonius, R. Barnea, K. Graziano, W. Whiteaker
June 2013

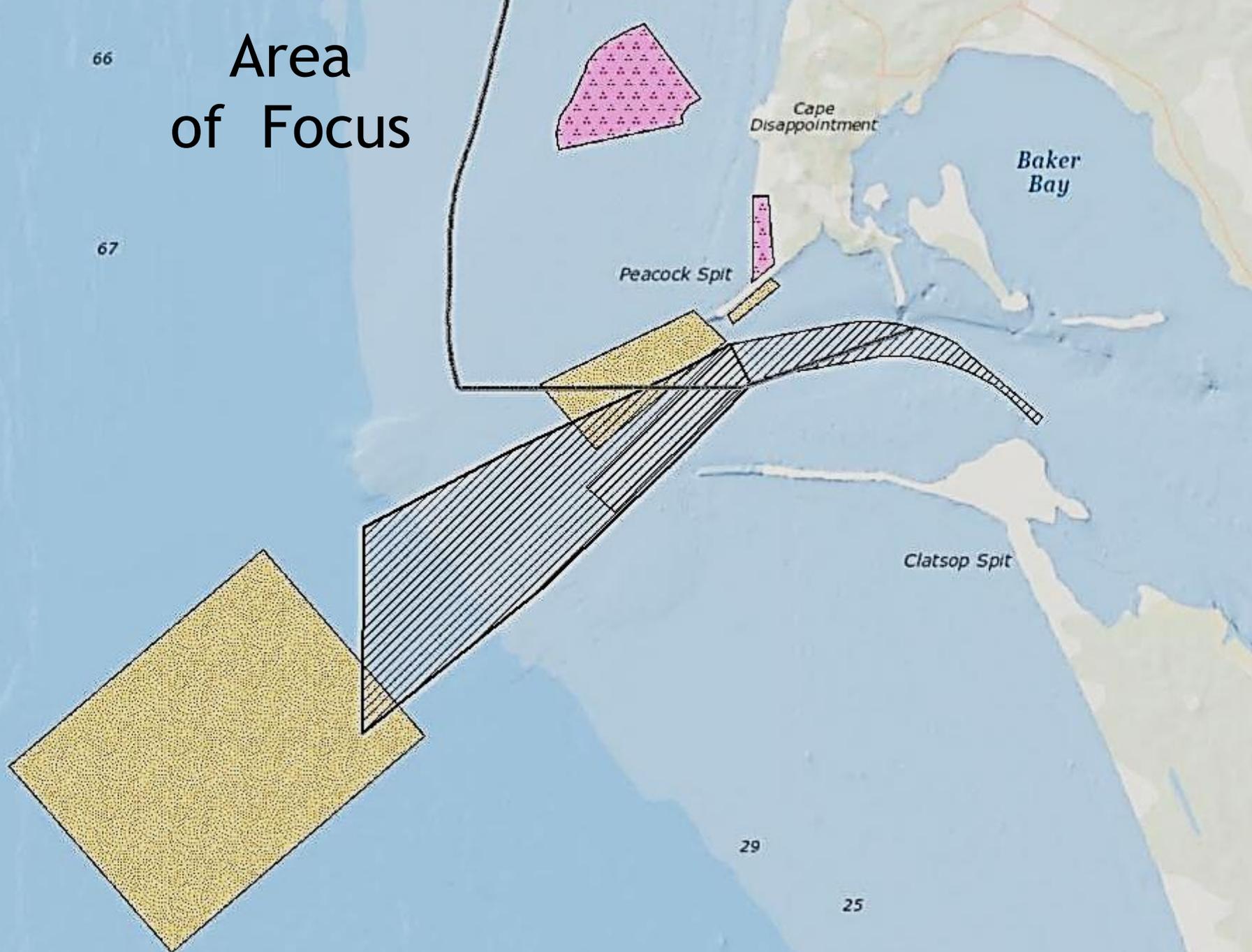


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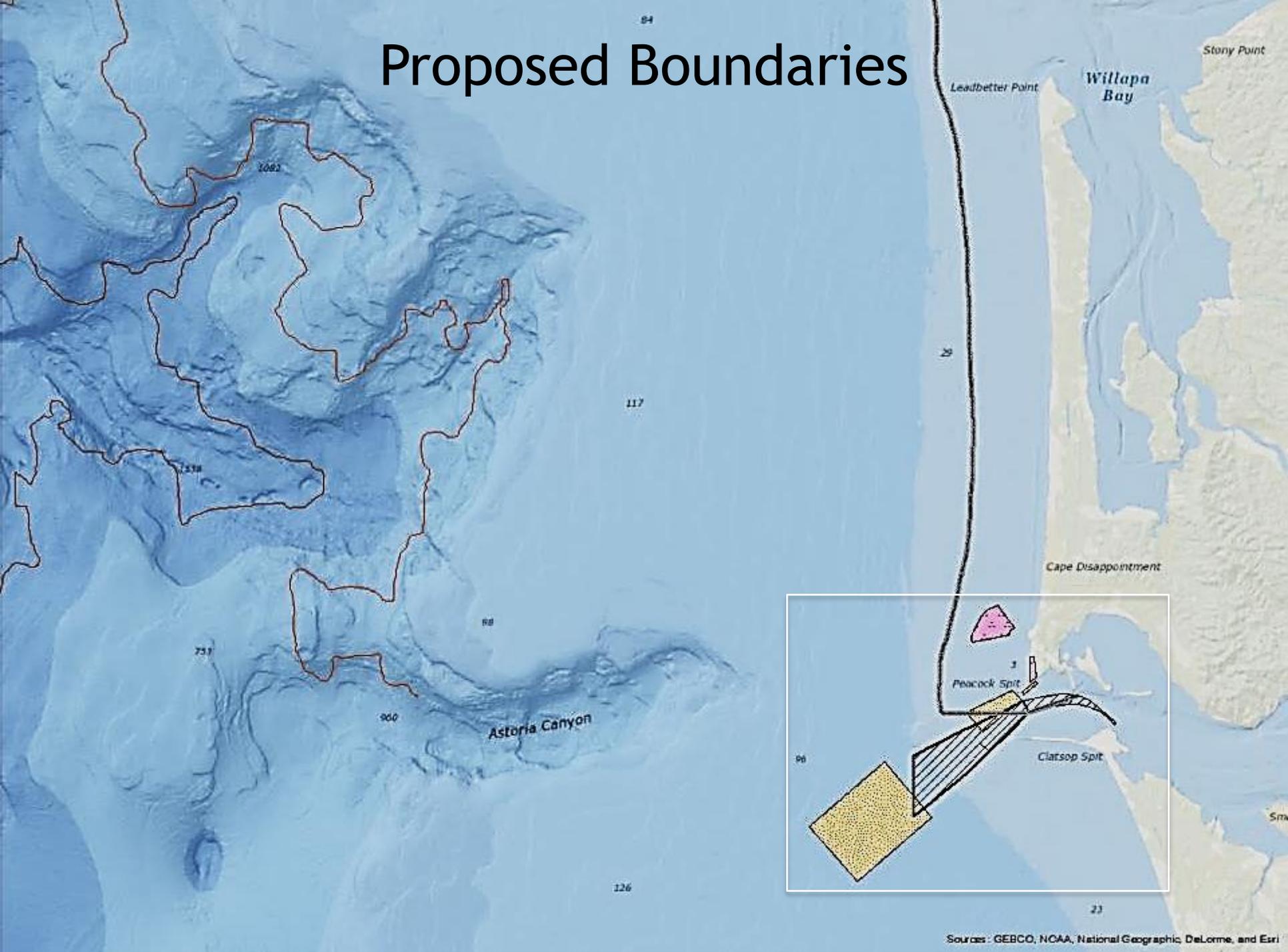
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Area of Focus

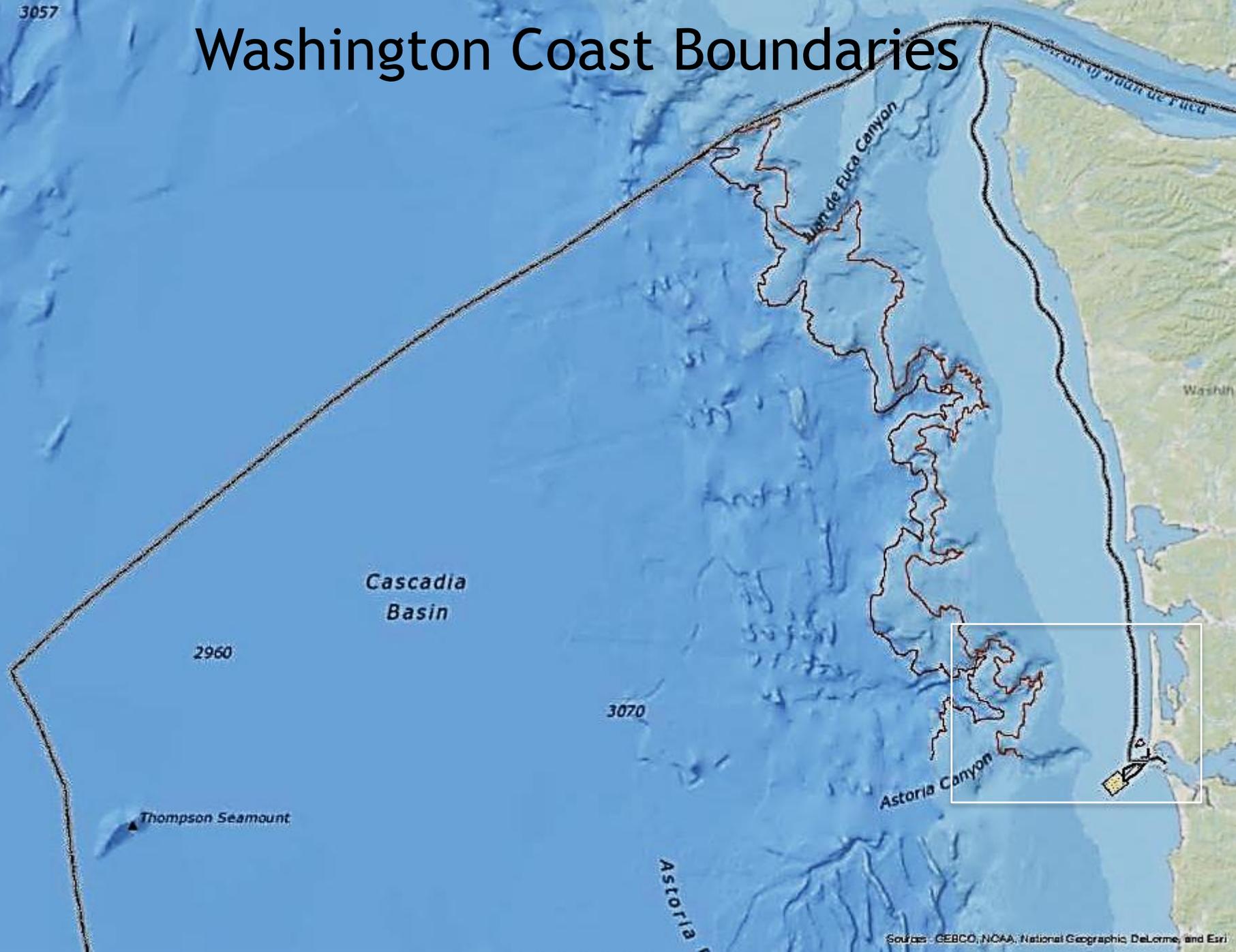


Proposed Boundaries



3057

Washington Coast Boundaries



“The Graveyard of the Pacific”



Source: Columbia River Maritime Museum

Unpredictable weather and huge swells make it one of the most dangerous passages in the world

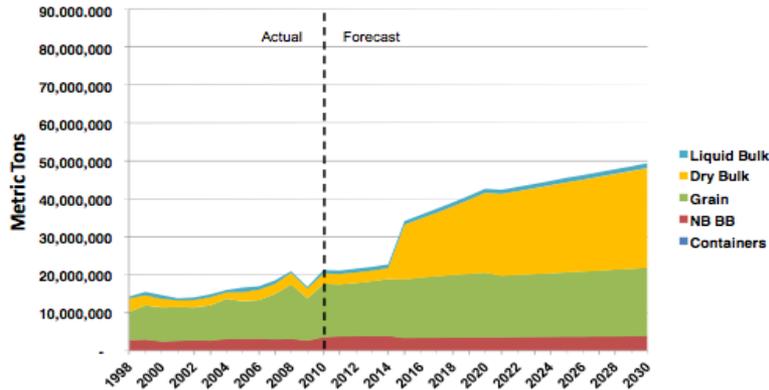
More than 200 ships have gone down “crossing the bar”



Source: Columbia River Maritime Museum

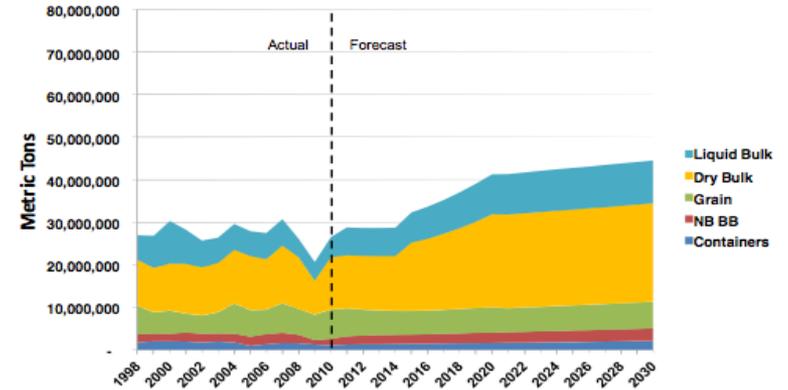
Expected Vessel Traffic Increase

**Figure 2-8: Lower Columbia Washington Forecast
Moderate Growth Scenario**



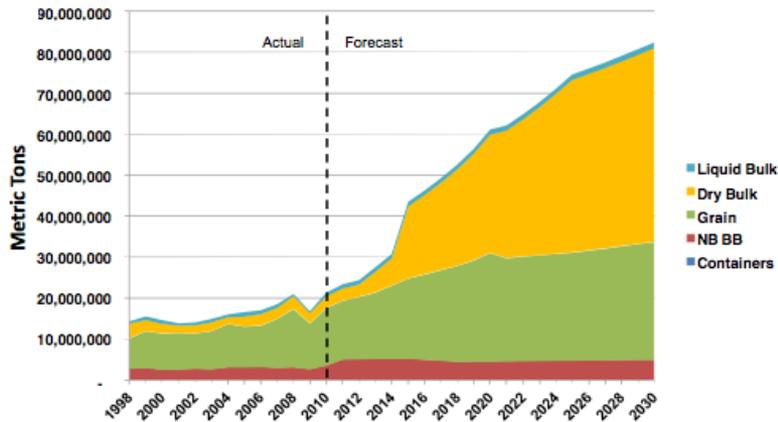
Source: BST Associates

**Figure 2-6: Lower Columbia Oregon and Oregon Coast Forecast
Moderate Growth Scenario**



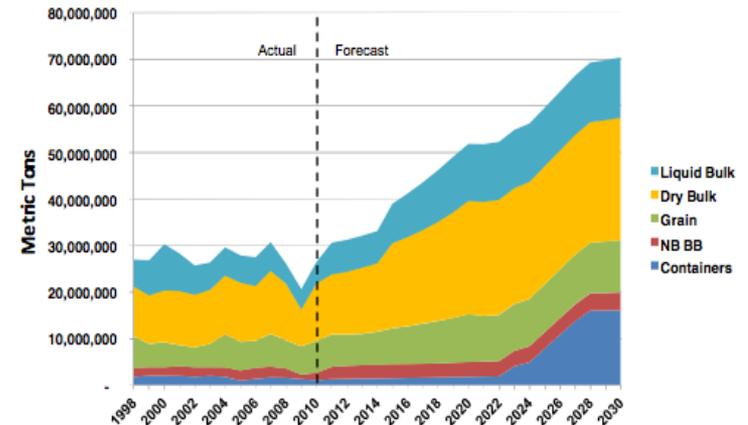
Source: BST Associates

**Figure 2-9: Lower Columbia Washington Forecast
High Growth Scenario**



Source: BST Associates

**Figure 2-7: Lower Columbia Oregon and Oregon Coast Forecast
High Growth Scenario**



Source: BST Associates

Data Analysis: Siting sediment management activities

- Dredging is already well-defined, understood
- Disposal is not
 - Navigation concerns?
 - Can harm benthic organisms
 - Benefits are variable



Source: Brent Wojahn, The Oregonian

Understanding navigation hazards

- Risk of physical hazard
 - Monitor immediately after disposal
- Risk from wave amplification
 - No predictive model
 - Need disposal data
 - Monitor wave action
- Where are the navigators?



Biological impacts

- Primary concern is Dungeness crab
 - Need population densities
 - Need life cycle data
- Prioritize habitat
 - Non-biological factors
 - Better understand response to burial
 - Thin-layer or conventional disposal



Source: NW Limited



Variable benefits

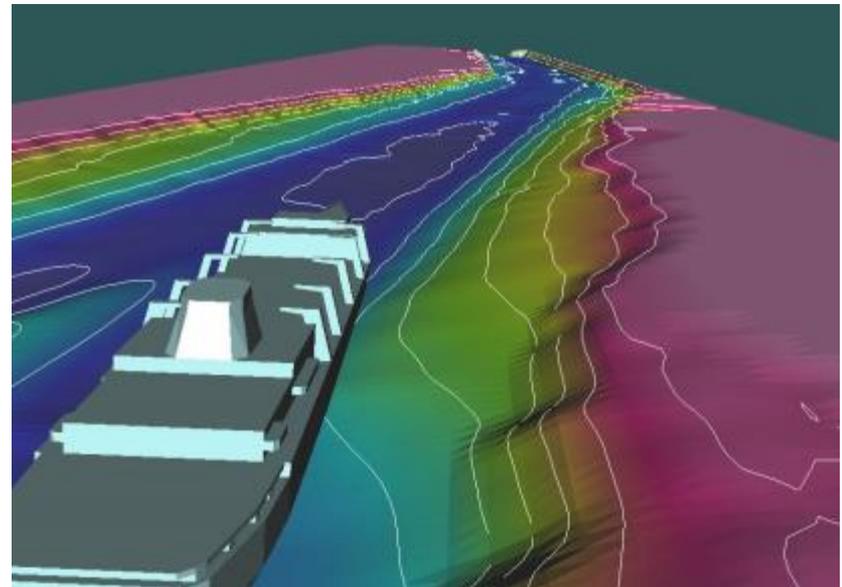
- Is shallow water better than deep water?
- Are some shallow water sites better than others?
 - Drift cell data



Source: The Engineer UK

Conclusions and Recommendations

- Monitoring Ships for traffic patterns
- Biological information
 - Dungeness Crab
- Fishing locations



Source: ScienceGL.com

Renewable Ocean Energy in Washington



http://commons.wikimedia.org/wiki/File:Barrow_Offshore_wind_turbines_NR.jpg

Christopher Oliver, Saiontoni Sarkar & Britta Timpane-Padgham

Renewable Energy in WA MSP Law

The marine interagency plan must include a framework for

“the timely review and action upon renewable energy development proposals while ensuring protection of sensitive resources and minimizing impact to other existing or projected uses in the area...”

Offshore Energy Technology



<http://www.aos.org/hydrokinetic-energy-meeting-anchorage/>



<http://upload.wikimedia.org/wikipedia/commons/2/26/Optbuoy.jpg>



<http://www.boem.gov/Renewable-Energy-Program/Renewable-Energy-Guide/Offshore-Wind->

Offshore Wind Technology



http://commons.wikimedia.org/wiki/File:Agucadoura_WindFloat_Prototype.jpg

PRINCIPLE
renewable energy delivered

Wind Farm and Interconnect Layout

Dominant Wind Direction
Onshore Grid
Support Platform
1500 meters
1500 meters

Column Stabilization and Closed Loop Active Ballast System

Active Ballast Reservoir
Static Ballast Reservoir

Integrated Column/Tower

Turbine Lighting
Turbine Nacelle
Turbine Blades

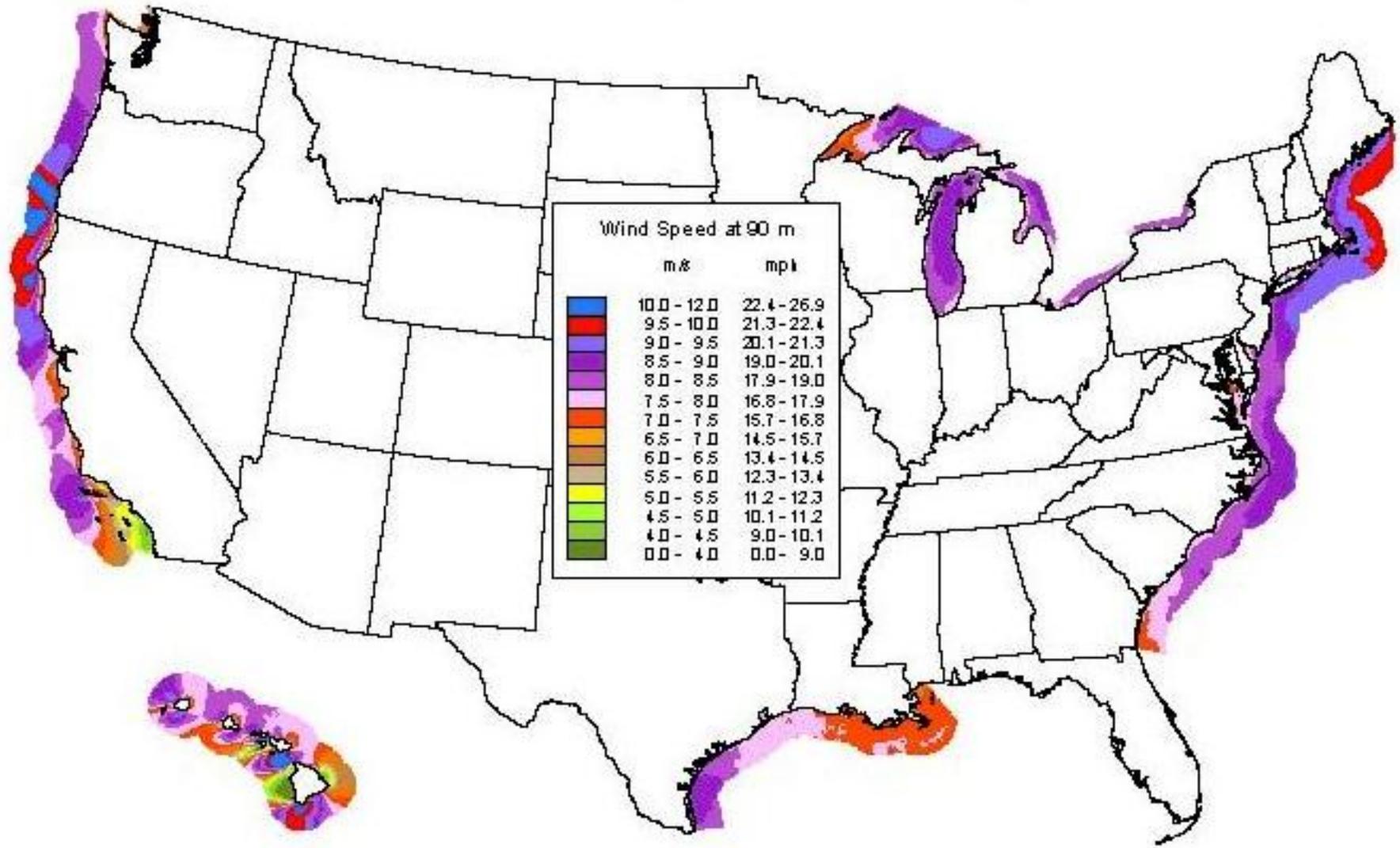
Boat Landing and Safety Equipment

Gangways
Mooring System and Anchors
Heave Plates and Stiffeners

<http://www.principlepowerinc.com/images/PrinciplePowerWindFloatBrochure.pdf>

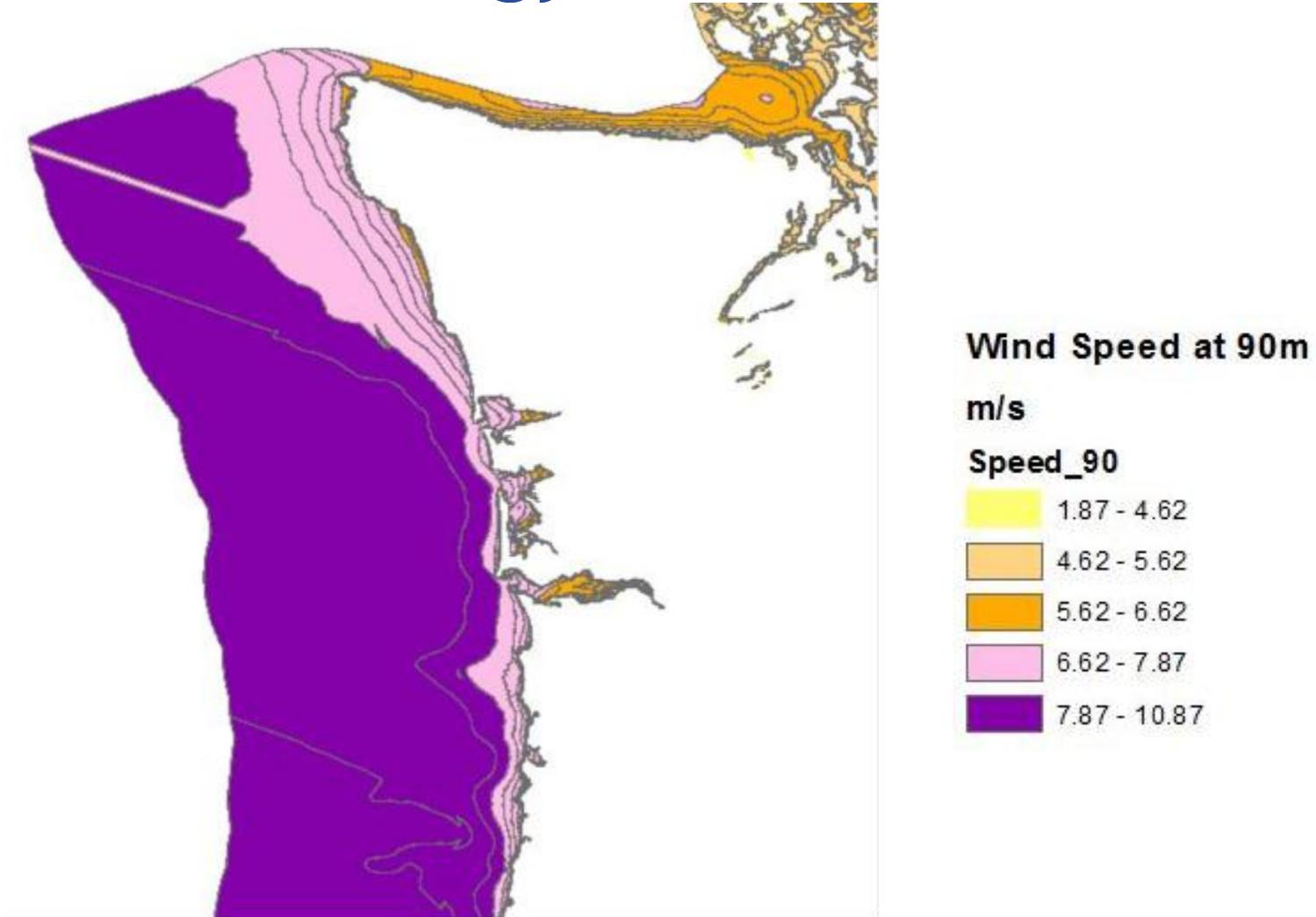
The complex block contains a central 3D cutaway diagram of the wind turbine and its floating platform. The turbine is white with three blades and a nacelle. The platform is red and white, with a central column. Labels point to various parts: Turbine Lighting, Turbine Nacelle, Turbine Blades, Gangways, Mooring System and Anchors, Heave Plates and Stiffeners, and Boat Landing and Safety Equipment. To the left, a diagram shows the wind farm layout with a 1500m radius and dominant wind direction. Below that, a diagram shows the ballast system with active and static reservoirs. To the right, a diagram shows the integrated column/tower. The PRINCIPLE logo is at the top.

United States - Annual Average Offshore Wind Speed at 90 m



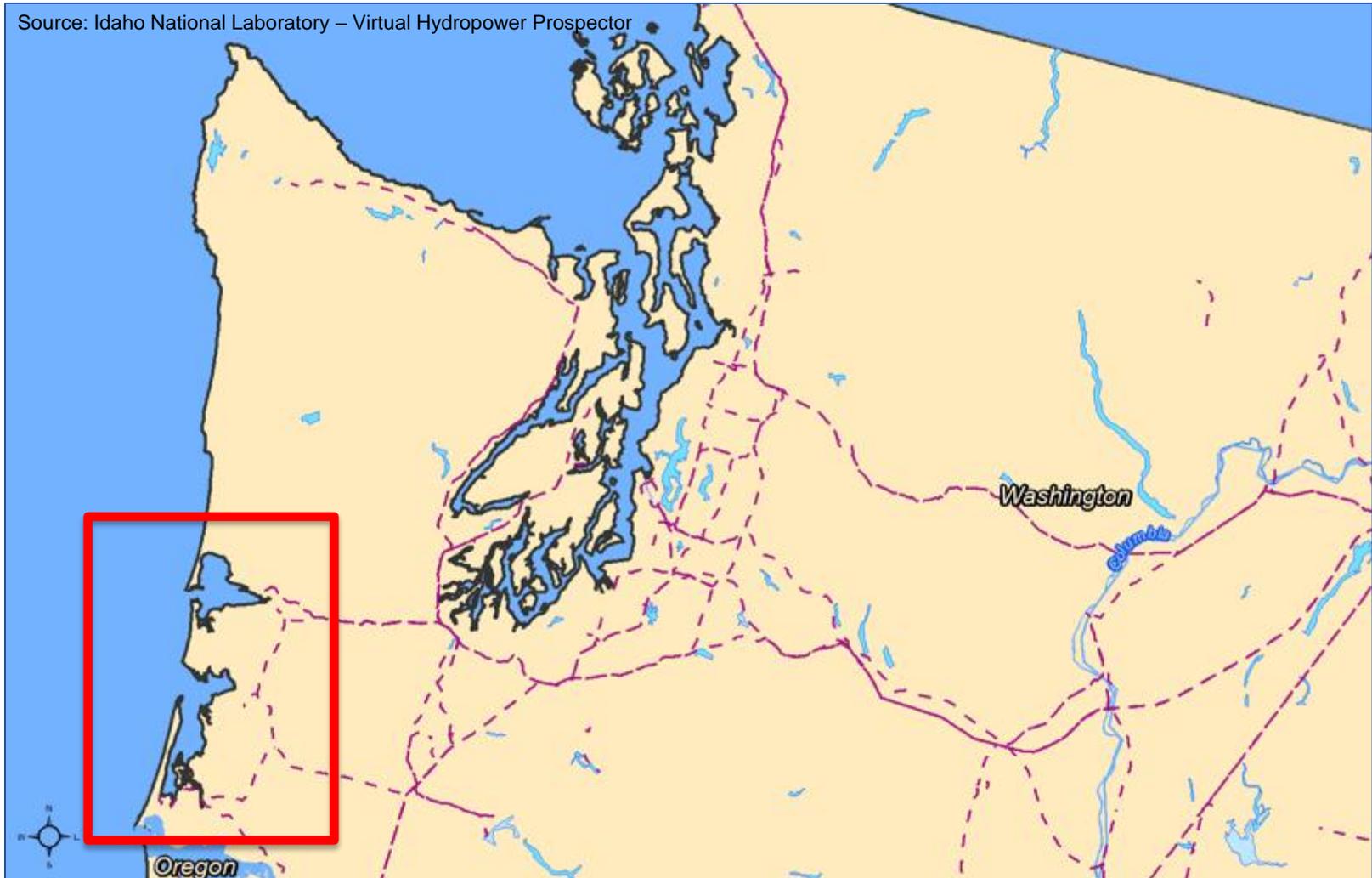
NREL: <http://www.nrel.gov/docs/fy11osti/51332.pdf>

Wind Energy Potential for W.A.



Infrastructural Challenges

Source: Idaho National Laboratory – Virtual Hydropower Prospector



Potential Conflicts



http://upload.wikimedia.org/wikipedia/commons/c/c3/Sanfran_2_bg_032605.jpg

http://upload.wikimedia.org/wikipedia/commons/9/94/Port_of_seattle.jpg

<http://commons.wikimedia.org/wiki/File:Sakhalin-gray-whale-small.jpg>

http://commons.wikimedia.org/wiki/File:Post0055_-_Flickr_-_NOAA_Photo_Library.jpg

<http://digitalmedia.fws.gov/cdm/singleitem/collection/natdiglib/id/4852/rec/1>http://commons.wikimedia.org/wiki/File:Fisherman_holds_fish_silver_coho_salmon.jpg

[http://commons.wikimedia.org/wiki/File:Short-tailed_Albatross_\(Phoebastria_albatrus\).jpg](http://commons.wikimedia.org/wiki/File:Short-tailed_Albatross_(Phoebastria_albatrus).jpg)

<http://nwifc.org/>

http://commons.wikimedia.org/wiki/File:Weather_Buoy_MDS.jpg



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Prioritizing Conflict Areas for MSP

Tier 1: commercial fishing, ESA-listed protected species

Tier 2: transportation/shipping lanes, essential fish habitats (EFH)

Tier 3: recreation/aesthetic values, energy transmission to populated areas, research & observation

Spatial Scale of Impacts



Large-scale

- Acoustic effects
- Alteration of currents
- Alteration of species migrations



Mid-scale

- Habitat alterations
- Blockage of areas to ships and fishing
- Scenery effects

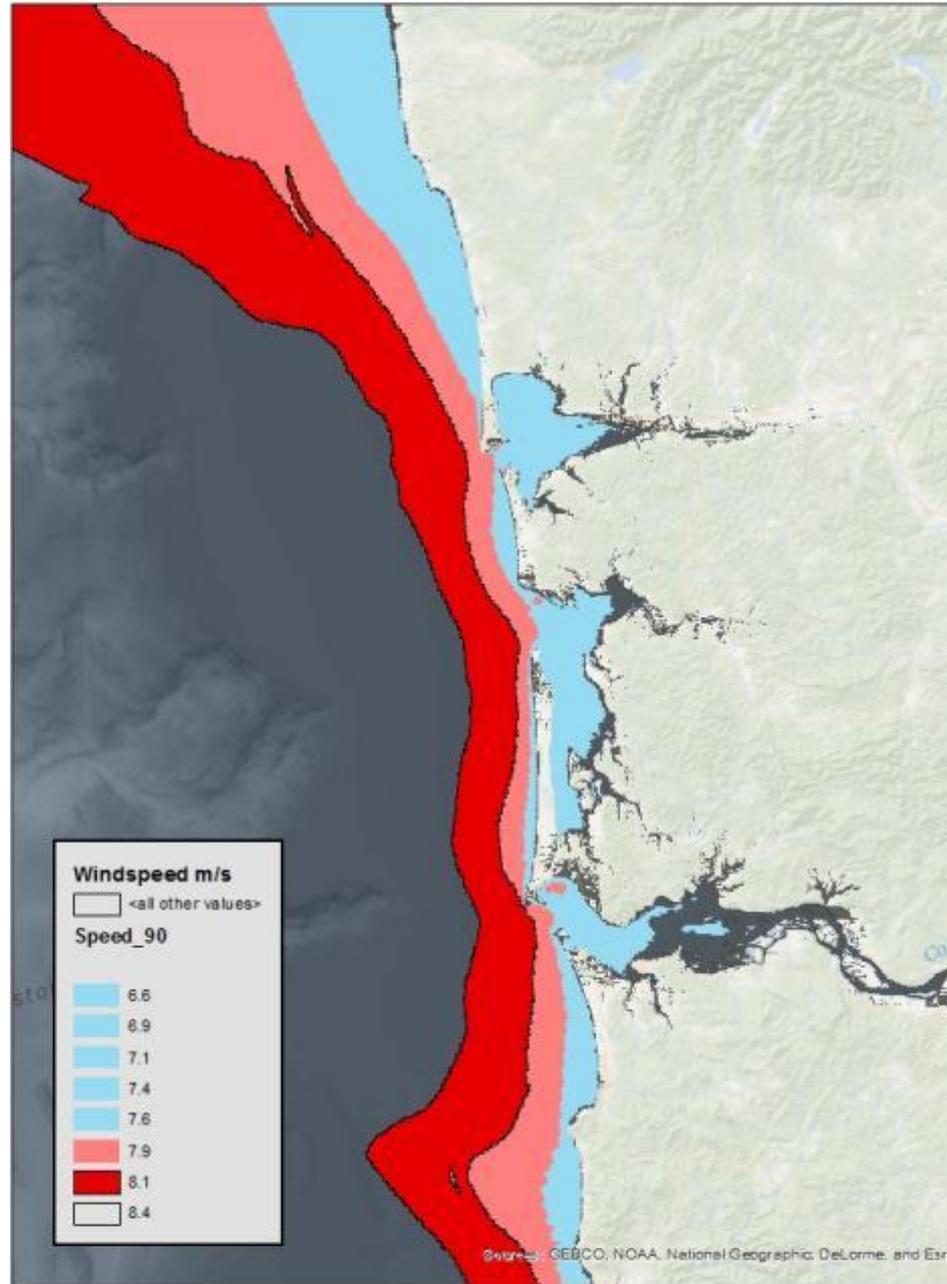


Small-scale

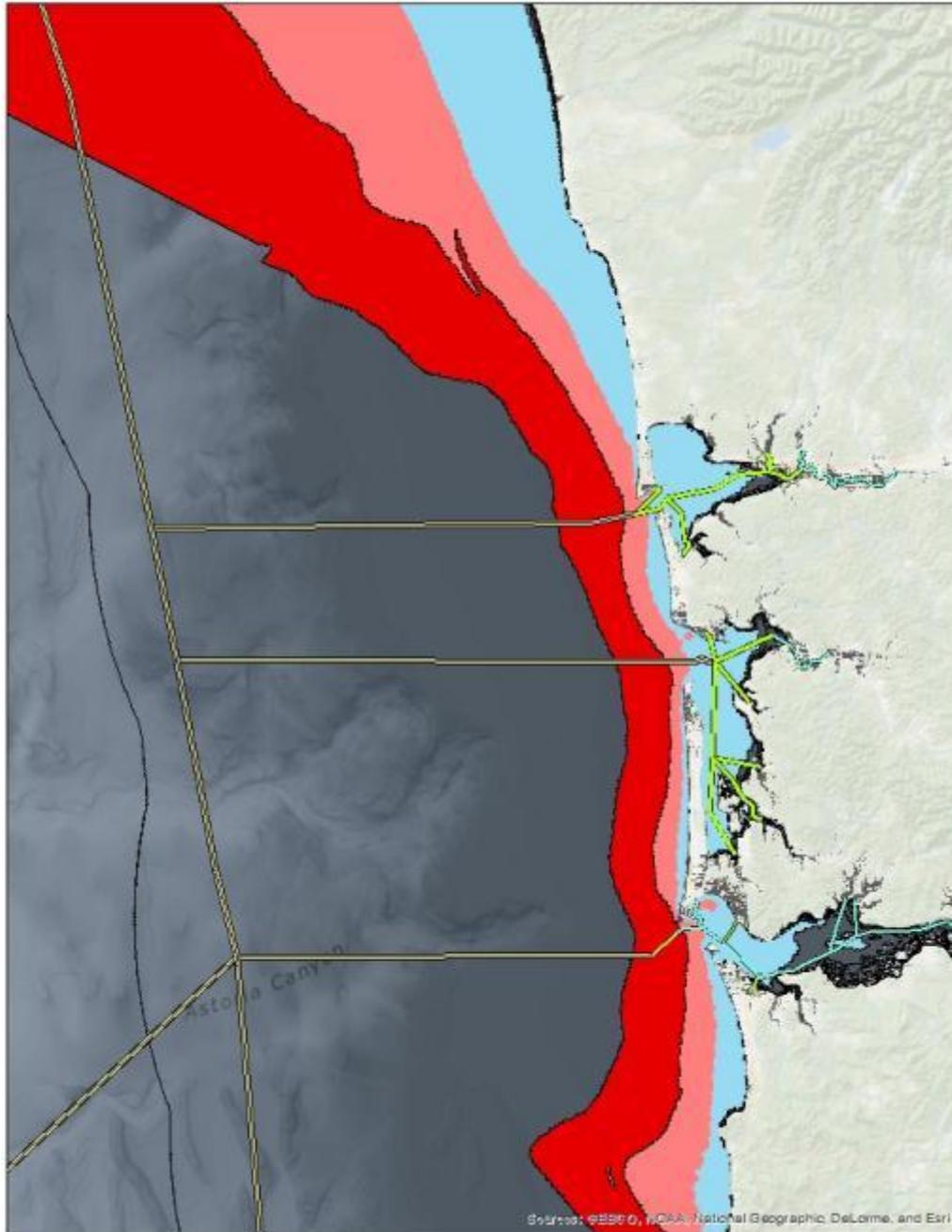
- Death or injury from turbine structures
- Destruction of property (ships, fishing gear)
- Affects to benthos



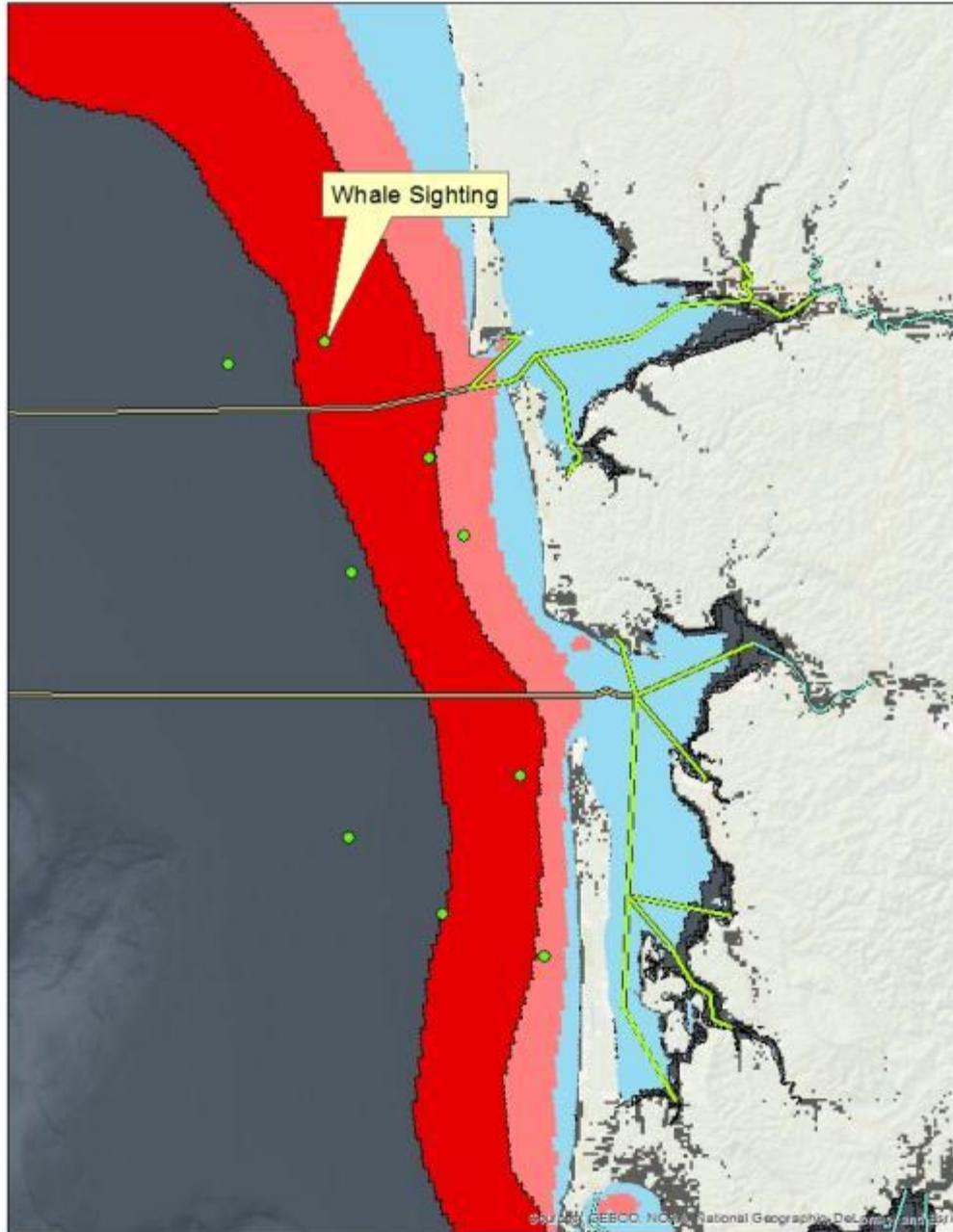
Optimum Zone for Wind Farm Development



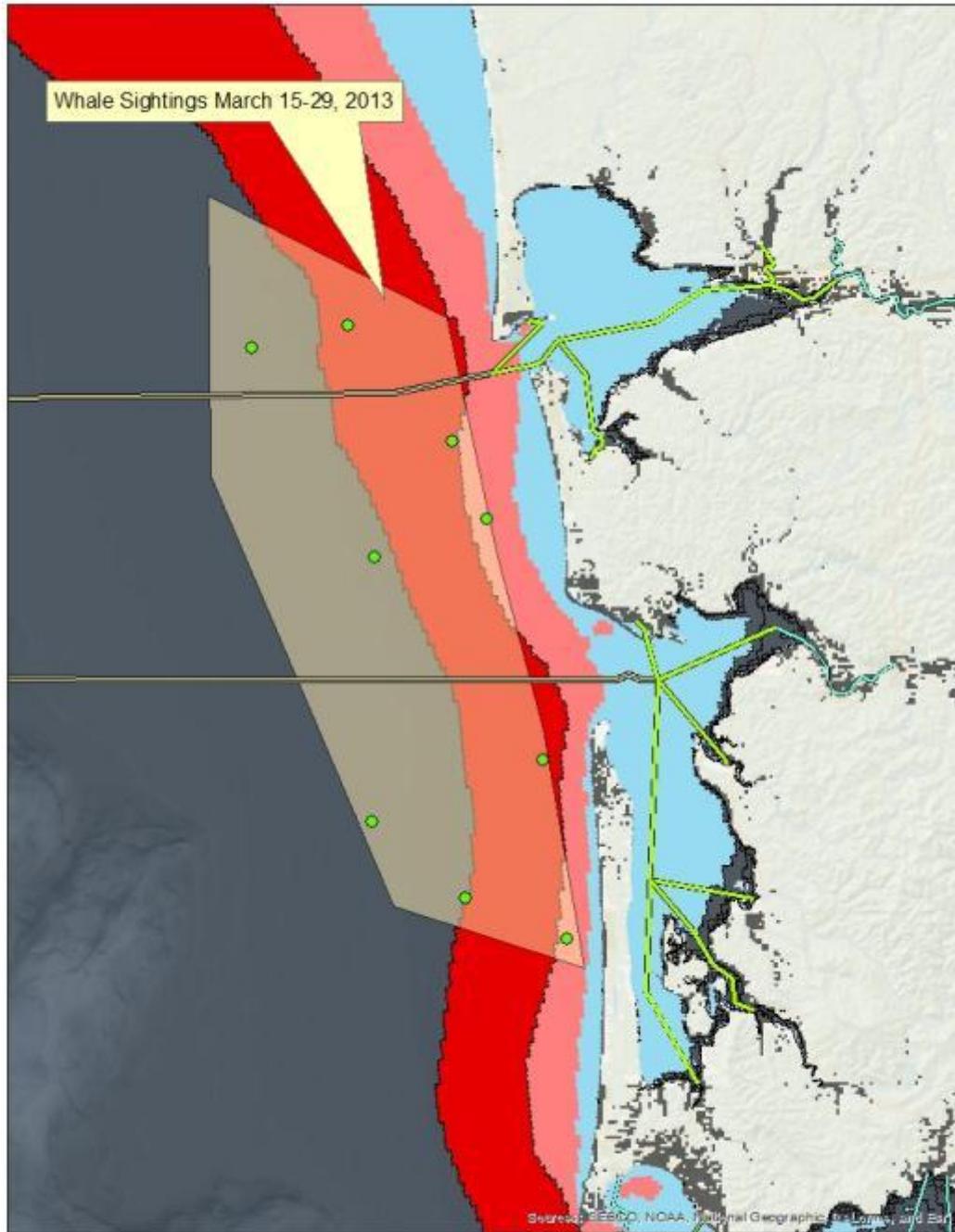
Commercial Shipping Lanes



Whale Sightings: point data



Whale Sightings: High Frequency Area



Data Quality Findings

- Recreational Uses
 - Sport fishing and bird watching data are not sufficient
- Infrastructure and Transportation
 - Much information exists, but a great deal of it is currently outdated
- Fisheries
 - Much of the available information is outdated
 - Catch location data, which would inform possible ROE siting, are rarely available

Data Quality Findings

- Research and Management
 - Land ownership information is outdated
 - Jurisdictional information is poorly organized and is not agency-specific
- Other Development
 - This category, primarily concerning oil and gas development, is relatively thorough
 - One notable exception: OCS leases are no longer current
- Biological and Physical Data
 - Major portions of this category are not accessible
 - Some key information is also missing, such as migration data for seabirds, Pacific tuna, and marine mammals

Recommendations

- Probable future development projects
- Organized jurisdictional boundary information
- Critical habitat for ESA-listed species
- Spawning and migration areas for commercially and recreationally important species
- Updated fisheries information, particularly for Dungeness crab, pink shrimp, rockfish, and tuna
- Popular locations for recreational bird watching

Acknowledgements

- Dr. Brian Polagye
- Dr. Penny Dalton
- Bridget Trosin
- Dr. Dave Fluharty
- Dr. Miles Logsdon
- Dr. Tim Essington
- Washington Sea Grant MSP Workshop
- And all other sources who helped us understand these issues more thoroughly

http://commons.wikimedia.org/wiki/File:Barrow_Offshore_wind_turbines_NR.jpg

Marine Spatial Planning for Ocean Observation, Exploration, and Research

Katherine Peet , Erin Costello & Brit Sojka



Photo: Brit Sojka

June 10, 2013: Washington Department of Ecology

Data-Collecting Assets Requiring Spatial Consideration

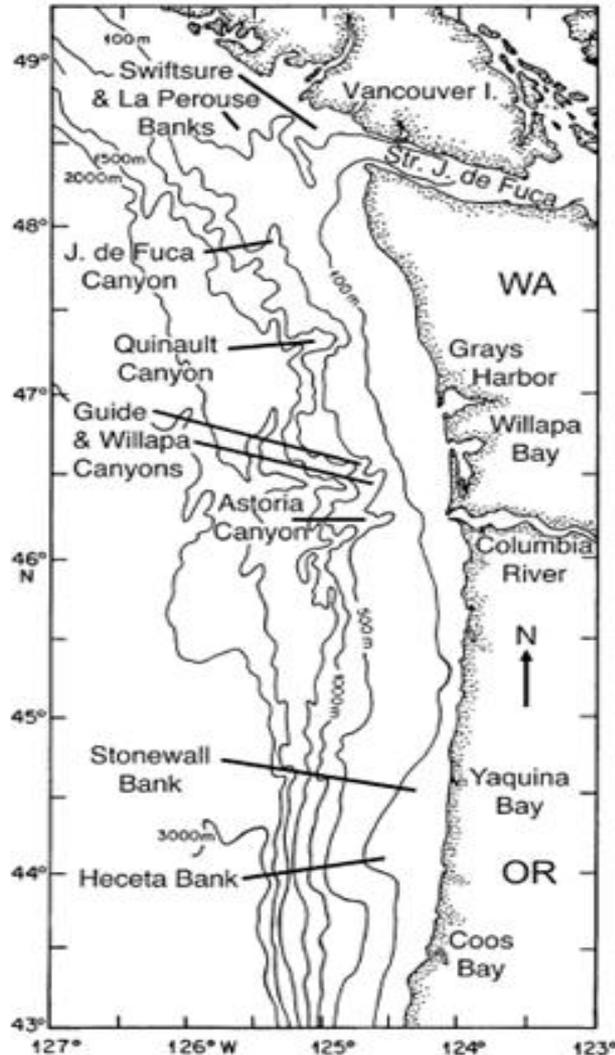
- Data-Collecting Assets Requiring Spatial Consideration
 - Research Vessels
 - Buoys/Moorings
 - Gliders
 - Autonomous Underwater Vehicles
 - Satellites
 - Field Researchers



Image Source: www.nanoos.org

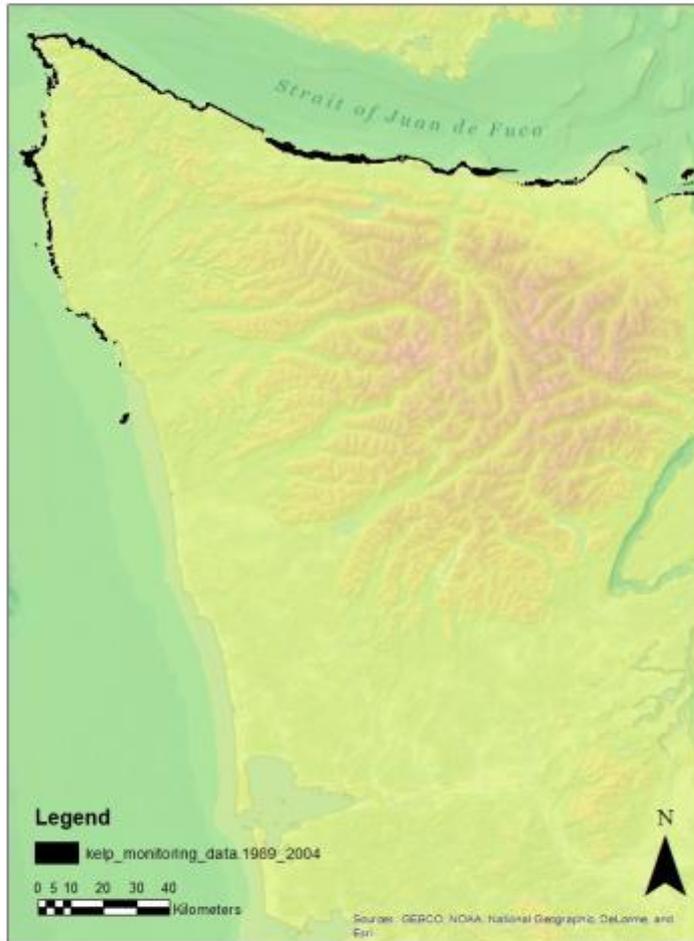
Where Will Future Study Occur?

Understanding the natural processes important to each scientific discipline will help planners predict where/how research is likely to occur



(Image Source: Hickey & Banas, 2003)
Important submarine canyon's and banks along Washington's continental shelf

Historic areas of kelp presence along the Washington Coast



Is this map
useful?

Does it turn scientific
data into *information*
useful for planning?

Critical Habitat Monitoring in the Tidal Zone

- Essential Elements
 - Physical conditions
 - Species compositions
 - Community interactions
 - Habitat loss in response to human activities
 - Major freshwater inputs
 - Pollutant sources
 - Sediment transports
- MSP Opportunities
 - Research coordination
 - Communicating trade-offs



Photos: Brit Sojka



Unique Benthic Habitats in the Neritic Zone

- Essential Elements
 - Location, spatial extent of coral, glass sponge reefs and other unique benthic communities
 - Contributions to commercial fisheries
 - Degree of damage inflicted by human activity (i.e. trawling)
 - Species compositions, dynamics & endemism
 - Life-cycle relationships to surrounding environment and natural processes



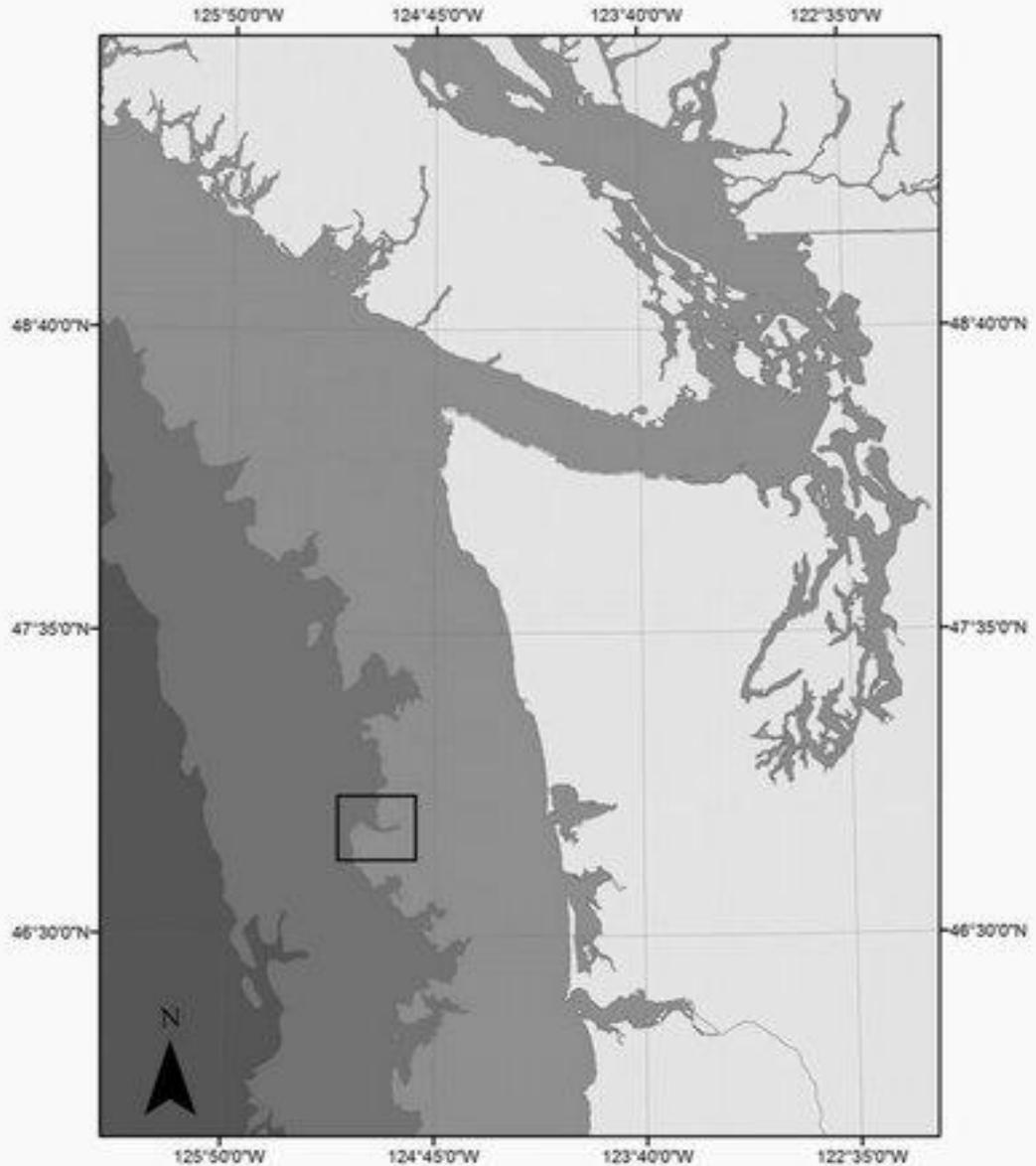
Photo: Paul Johnson



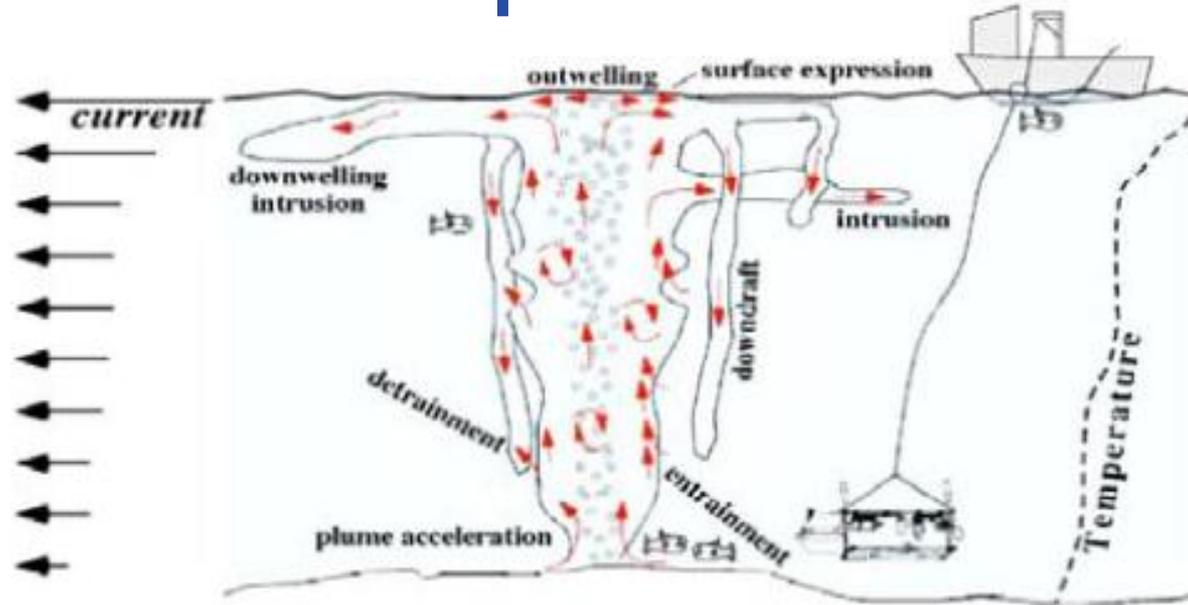
Photo: Olympic Coast National Marine Sanctuary

Glass Sponge Reefs

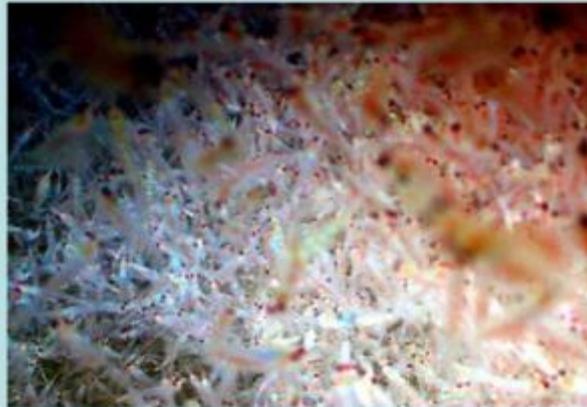
Images/Photo Source: Paul
Johnson, UW School of
Oceanography



Methane Seeps + Krill Swarms

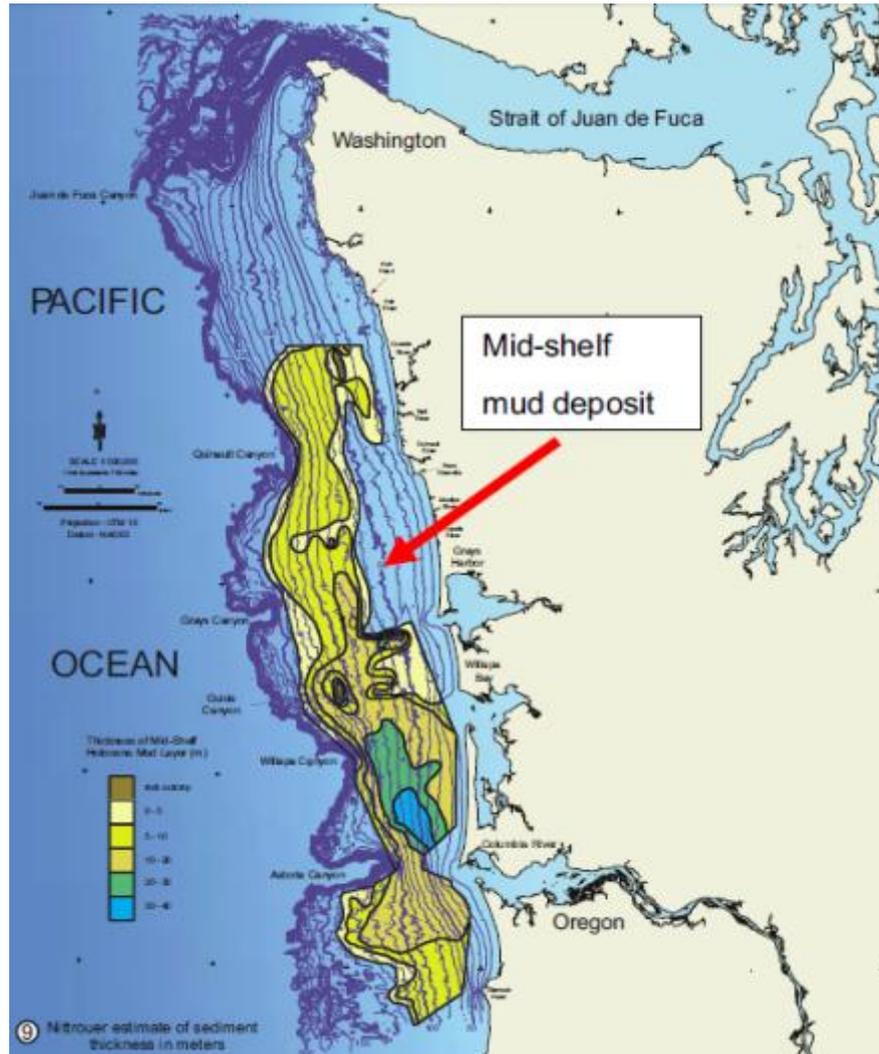


Krill swarm near methane bubble plume



Images/Photo Source: Paul Johnson, UW School of Oceanography

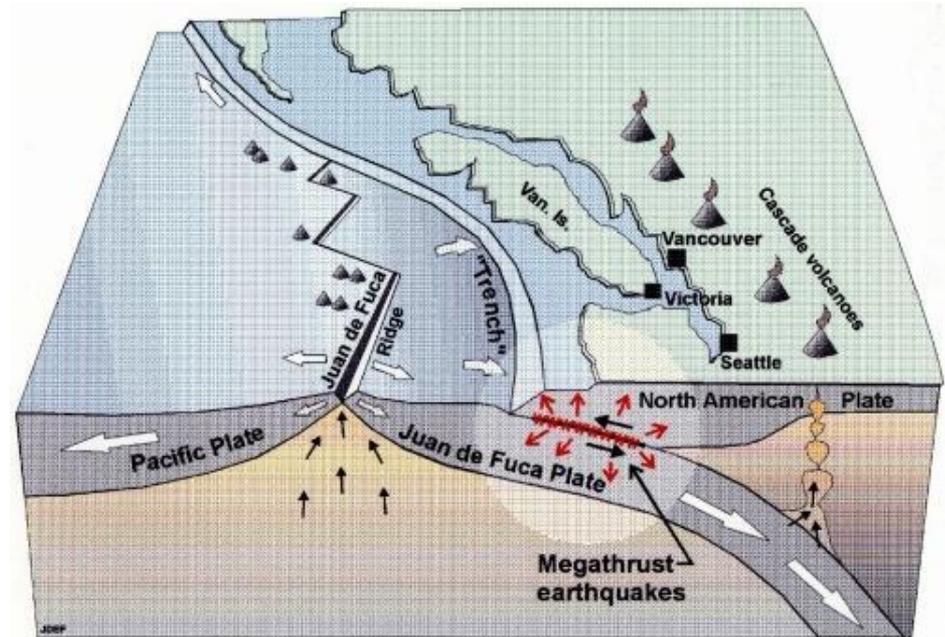
Dynamic Linkages



Images/Photo Source:
Paul Johnson, UW School
of Oceanography

Oceanic Fault Lines & Seismic Activity in the Oceanic Zone

- Essential Elements
 - Locations of tectonic plates and faults
 - Nature and locations of “hot spots” of seismic activity
 - Coastal area vulnerabilities (earthquakes, tsunamis)



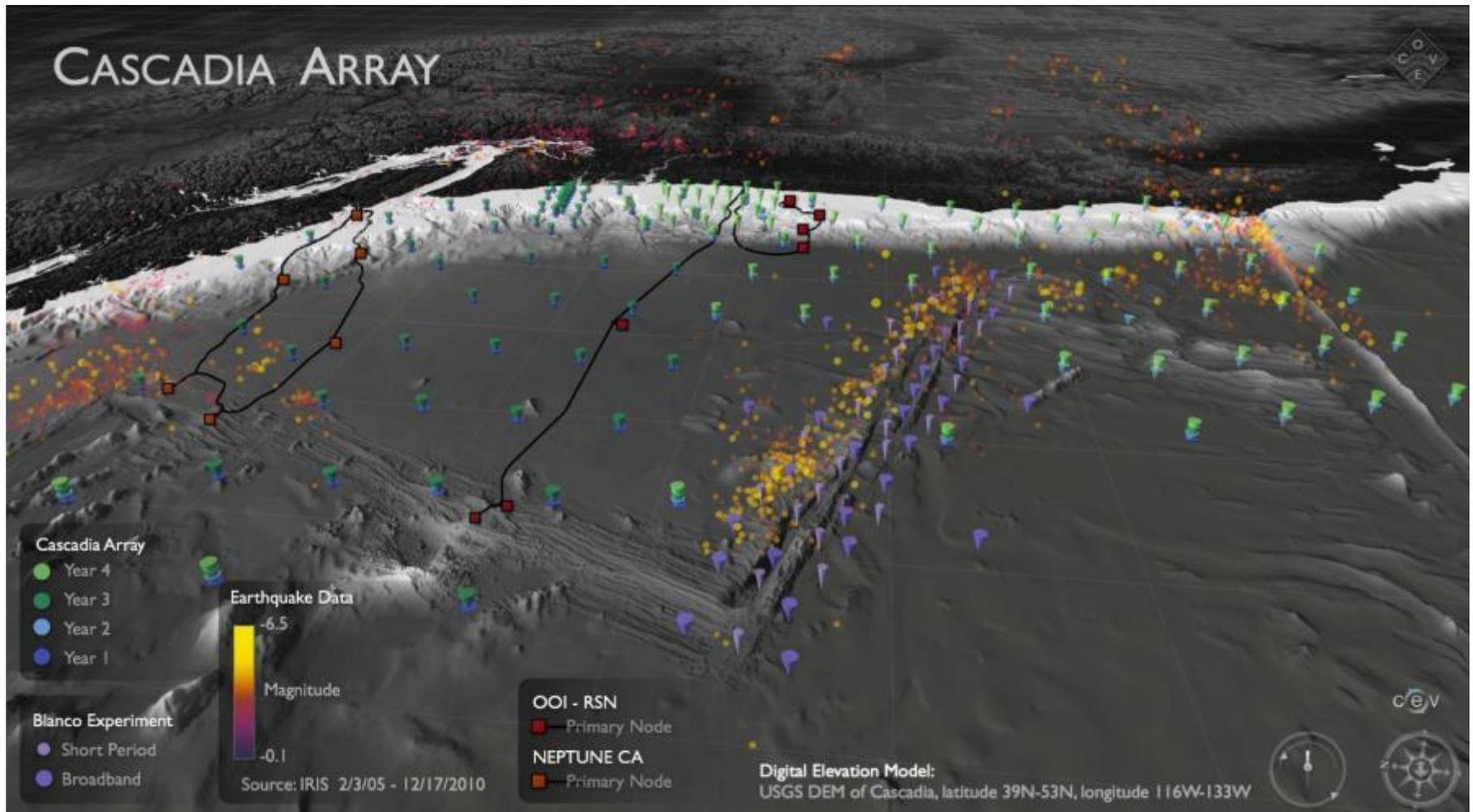
<http://www.earthquakescanada.nrcan.gc.ca>

Oceanic Fault Lines & Seismic Activity in the Oceanic Zone

- Gaps
 - Detailed information identifying faults and seismic “hot spots”
 - Seismic activity data derived from Cascadia Array sensors (GeoPRISMS program)

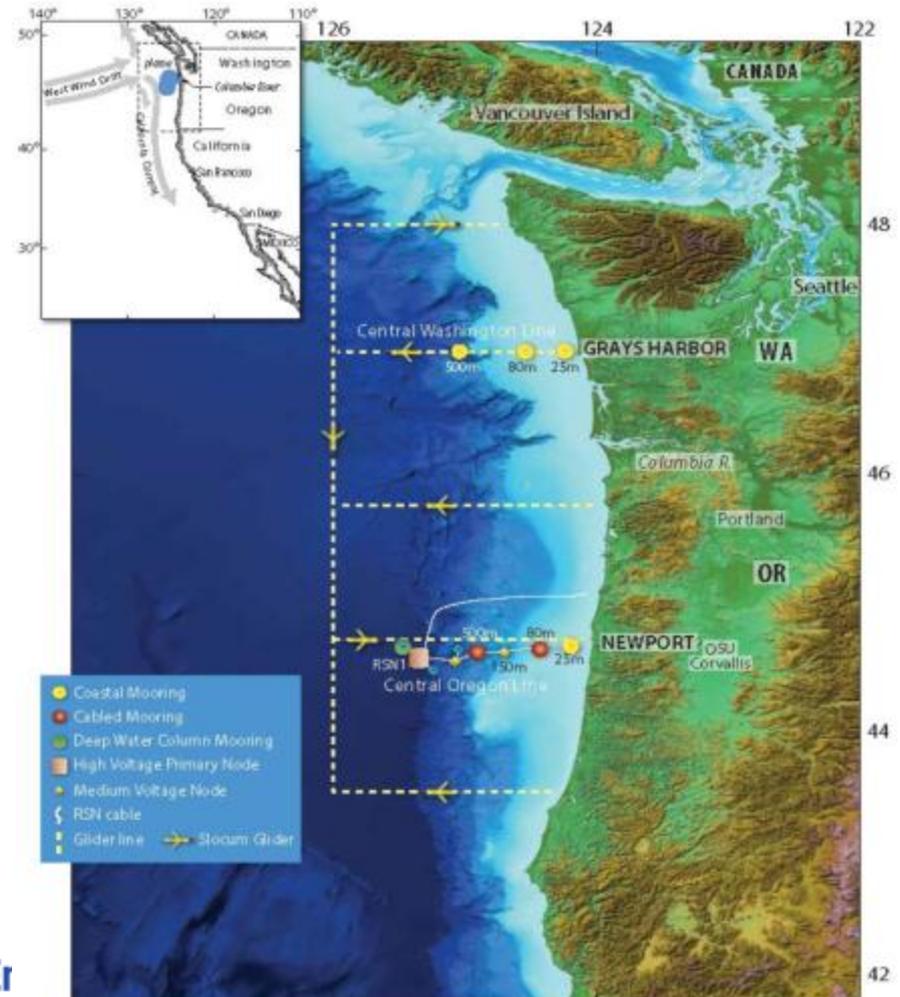


Oceanic Fault Lines & Seismic Activity in the Oceanic Zone

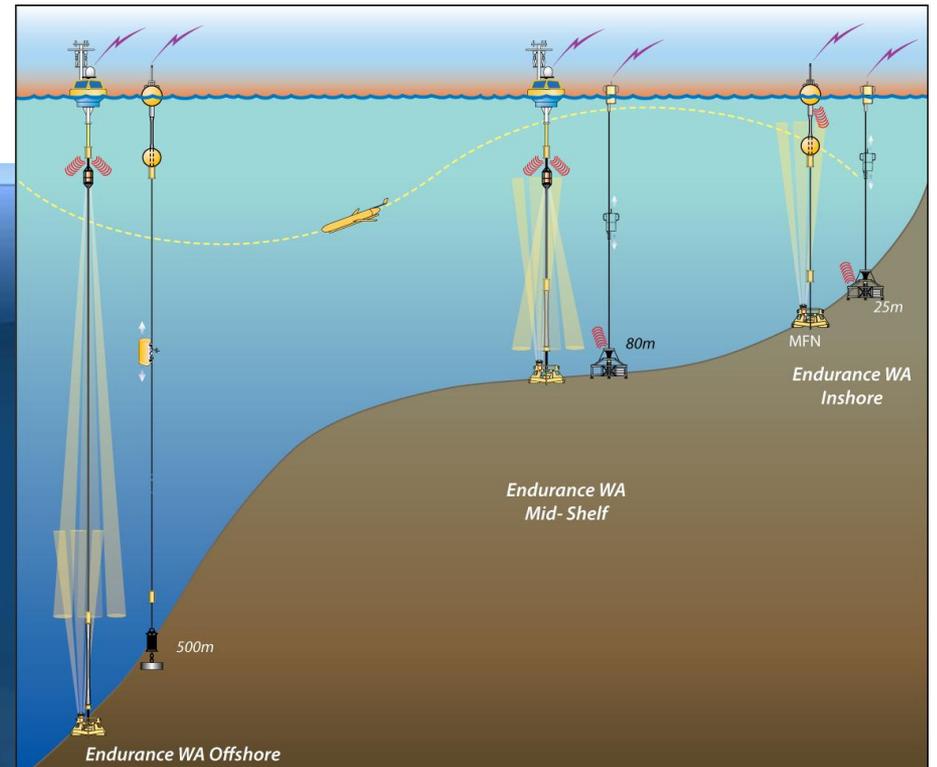
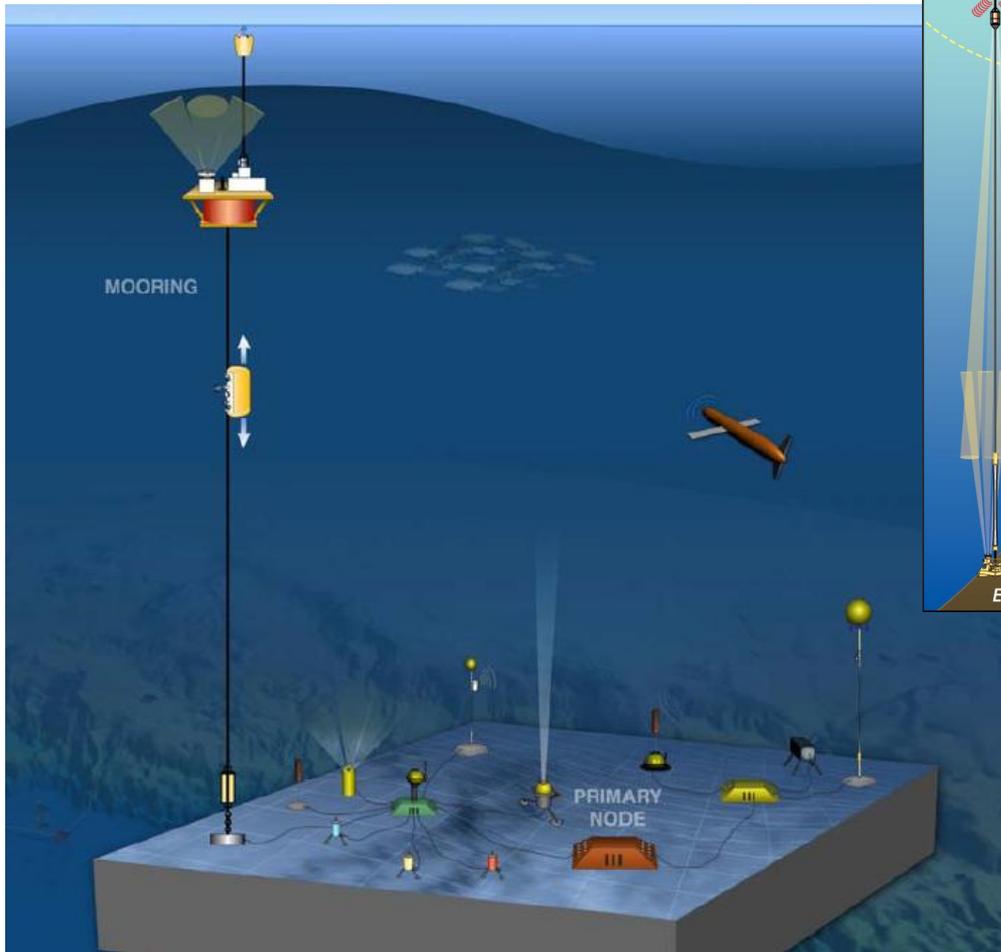


Future Ocean Monitoring Assets: Ocean Observatories Initiative “Endurance Array”

- 3 fixed moorings along the 47°N line, extending across the shelf out to 500m
- 3 gliders, running cross-shelf and along-shelf transects
- Deployed assets will monitor upwelling and current regimes, dissolved oxygen, temperature, pH, dissolved organic matter, plankton profiles, etc.



Endurance Array Resources



Consortium for Ocean Leadership 2010



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Constant Change

- Scientific processes, research requirements, and ocean-observing technologies are constantly evolving, requiring a high degree of planning flexibility
- Climate change will likely compound or introduce significant new change to already-dynamic processes
- These changes are likely to affect all ocean uses, including:
 - Commercial shipping
 - Commercial and recreational fishing
 - Tourism
 - National defense
 - Homeland security
 - Natural resource management
 - Ocean energy development



<http://www.oearth.com/ocean-sensors/earth-observing-satellites/>

Final Considerations

To ensure sustainability of these ocean uses, planners must :

1. Remain cognizant of continually changing conditions
2. Develop enhanced, adaptable MSP tools that are able to:
 - Track and model highly dynamic, three-dimensional processes
 - Select and apply appropriate spatial and temporal scales
 - Translate data derived from both existing and new technologies

AND

3. Embed these considerations into MSP efforts, emphasizing adaptive management of Washington coastal and offshore waters

Conclusion

Progress made

- 11 current projects filling gaps
- Existing agreements
 - Ex: regional sediment management plan
- Signs of partnerships

Conflict or cooperation?

- Opportunities for synergistic uses
- Facilitate and reward cooperation and data sharing
- Flexible boundaries
- Prioritize areas of highest potential conflict

Building up the data catalogue

- Meta data should answer relevant questions
- Designation of slow, medium, fast changing variable to determine frequency of updates needed
- Collect needed data intentionally
 - How accurate and specific does data have to be?
 - Is the update frequency we desire feasible?
 - Ex: not every fishing boat's exact coordinates
- Plan for integration between layers and upcoming decisions

Priority data gaps

- Updated species dense areas (spawning and migration) for important fisheries
 - Dungeness Crab, Pink Shrimp, Rockfish, Tuna
- Density distributions of fishing efforts
- More specific aquaculture layers
- Critical Habitat for ESA listed species
- 3-d models with ocean observation
- Non-spatial data
 - ex: impact of dredging on crab, inter-species interactions
- High resolution bathymetry
- Actual marine traffic patterns