Marine Spatial Planning for Washington's Pacific Coast: Spatial Analysis Workshop

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Grays Harbor College

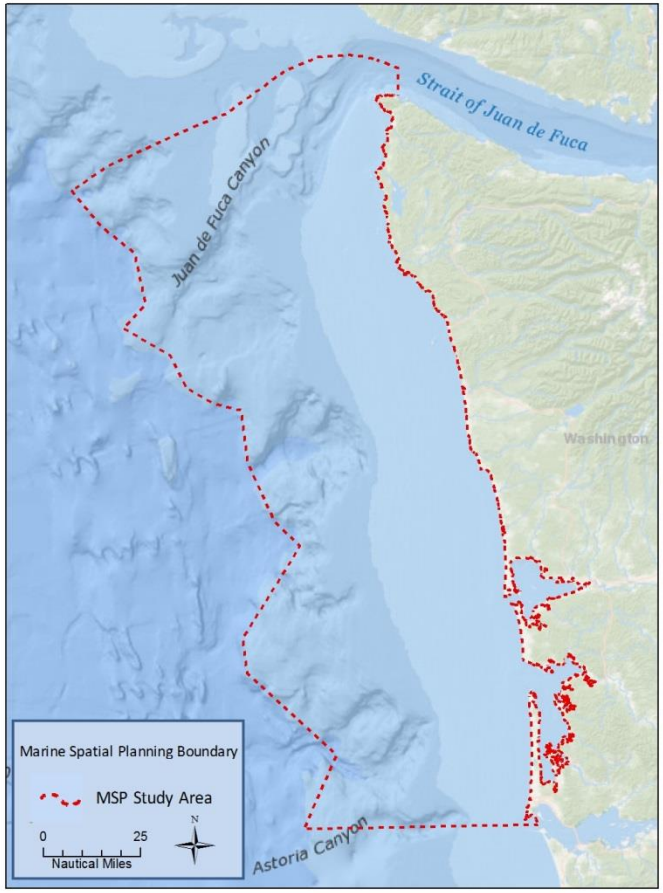
Goals for Today's Workshop

1. To familiarize WCMAC members and other interested parties with features of Marxan in more detail and allow to ask more questions.
2. To allow WCMAC members and other interested parties to explore Marxan outputs and variability through additional scenarios, and prioritize additional scenarios/alternatives.
3. To lay groundwork for subsequent WCMAC discussions about spatial recommendations.

Agenda

1:00	Welcome and Overview	Jennifer Hennessey, Ecology
1:15 – 1:30	Marxan Overview • Questions about Marxan tool	John Pierce, WDFW
1:30 – 2:00	Updated Scenarios • Clarifying questions about scenarios	John Pierce, WDFW
2:00 – 2:30	Small group discussion and input on scenarios • Refining existing scenarios • Additional scenarios	All
2:30 – 2:45	Report out and discussion of input	Small groups
2:45 – 3:45	Discussion and live Marxan/scenario runs	John and group
3:45 – 4:00	Conclusion and transition to recommendations	Jennifer Hennessey, Ecology

Scope of Marine Spatial Planning



The study area is 700 fathoms offshore and includes federal waters and estuaries.

INTENT:
Address location of potential new marine uses.

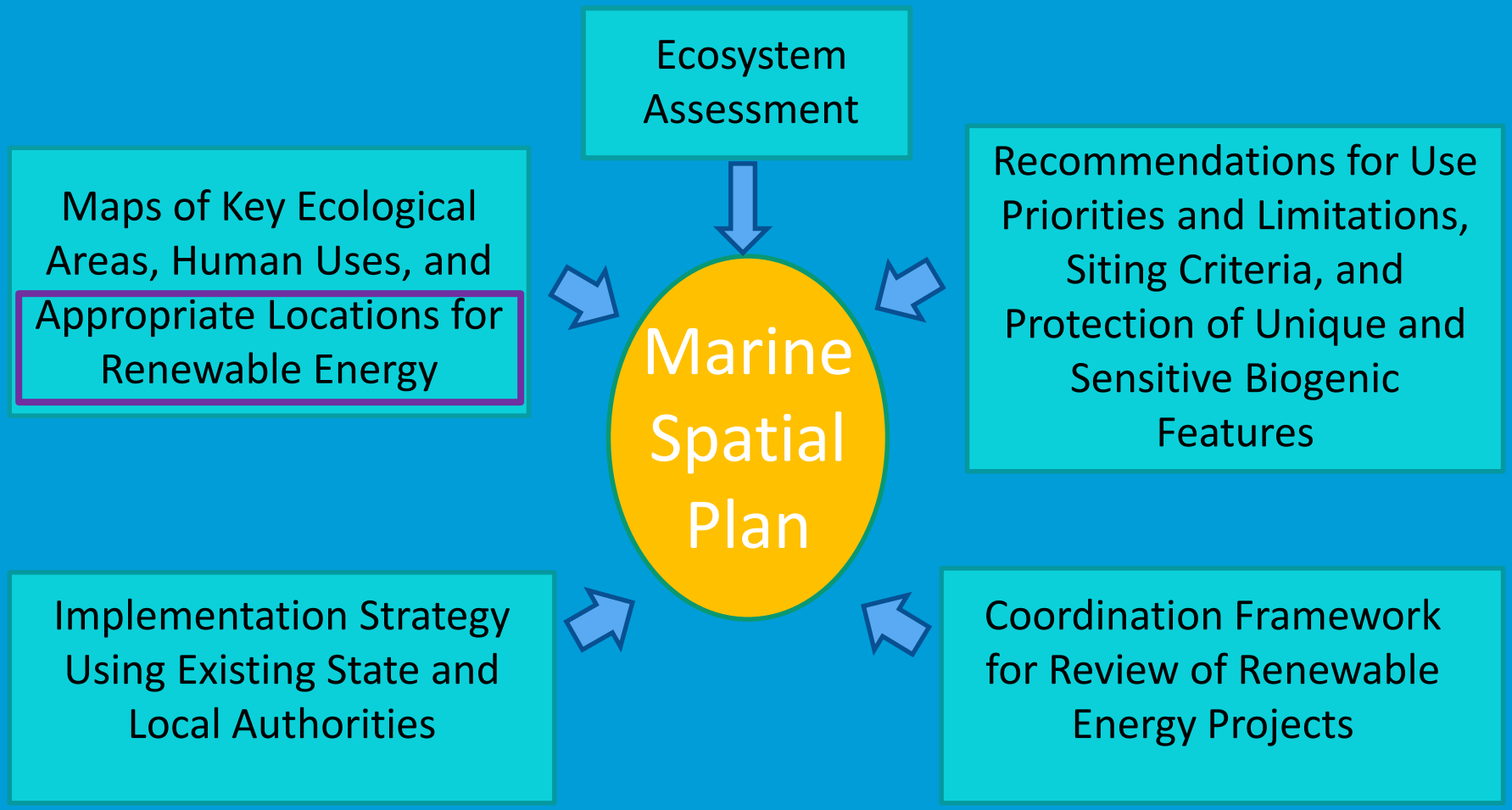
PLAN GOALS/OBJECTIVES:

- Protect existing uses
- Protect cultural uses/resources
- Preserve environment
- Integrate decision-making
- Provide new economic opportunities

NON-REGULATORY PLAN

MSP Context

The marine management plan must include but not be limited to…



RCW 43.372.040(6)

(6) The marine management plan must include but not be limited to:

. . .

(c) **A series of maps** that, at a minimum, summarize available data on: The key ecological aspects of the marine ecosystem, including physical and biological characteristics, as well as areas that are environmentally sensitive or contain unique or sensitive species or biological communities that must be conserved and warrant protective measures; **human uses of marine waters, particularly areas with high value for fishing, shellfish aquaculture, recreation, and maritime commerce**; and appropriate **locations with high potential for renewable energy** production **with minimal potential for conflicts with other existing uses or sensitive environments**;

-RCW 43.372.040

Spatial Analysis Process

Final Products:

1. Maps that provides general sense of where higher levels of conflict *may* occur with new uses.

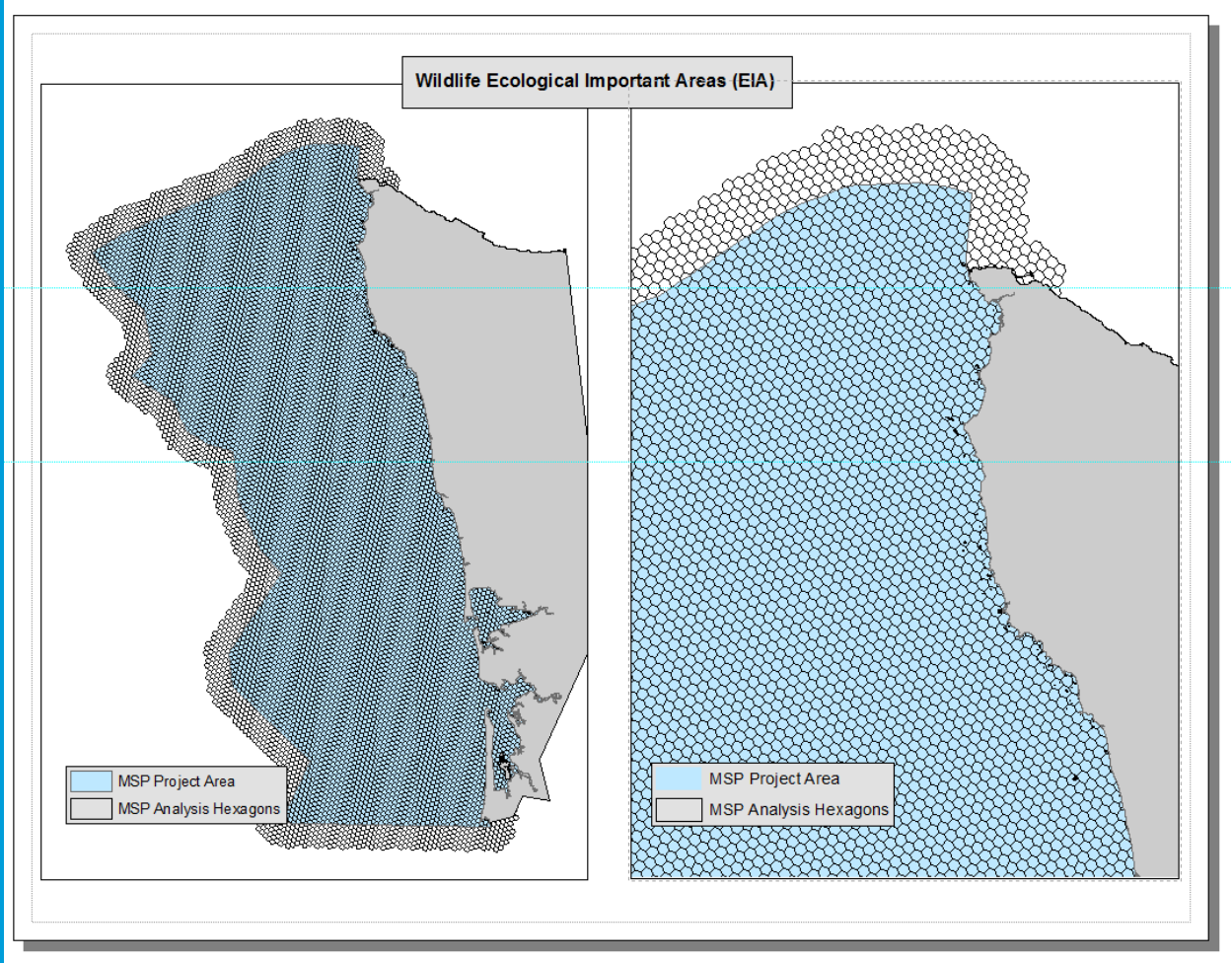
2. Recommendations for planning regarding new uses (space use)

Spatial Analysis Approach

1. Produce maps for existing uses by sector:
   - Intensity of uses
   - Number of uses present
2. Overlay all sector maps to produce map of all existing uses
   - Intensity of uses
   - Number of sectors
3. **Overlay renewable energy maps for comparison: MARXAN tool**
4. Develop recommendations

Analysis Unit = 1 Sq Mile Hexagons

Use Analysis Grid



There are 8,272 hexagon cells in the grid within the boundaries of the planning area.

Sector Data: Human Activities and Marine Life & Habitat

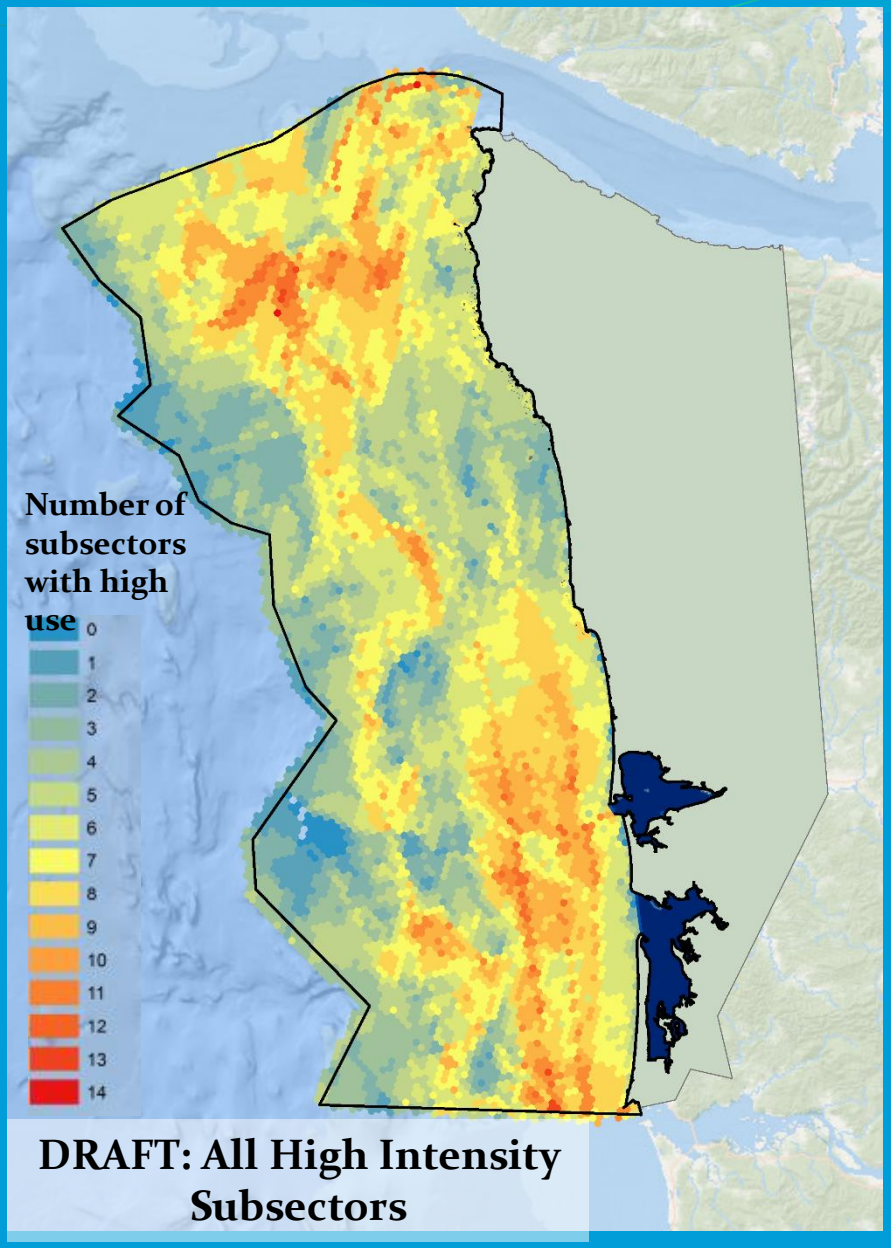
- Fishing (non-tribal):
  - 12 types: commercial/recreational
- Shipping
  - 4 types: cargo, tug/tow, tanker, passenger
- Aquaculture
- Ecologically Important Areas: Fish and Wildlife
  - Habitats and species
- Recreation:
  - 4 categories: shore-based, surface-water sports, diving, and wildlife viewing/sightseeing
- Archaeological & Historic

DRAFT: All High Intensity Use Areas

*includes Ecologically Important Areas "hotspots" with subsector groupings

&

estuaries of importance



Marine Spatial Planning Use Assessment

Renewable Energy Example

John Pierce
Washington Department of Fish & Wildlife

Marxan Workshop May 26, 2016

Marxan Overview

- First Developed in Queensland Australia, 2000
- Used to create Great Barrier Reef marine protected area
- Other Marine Spatial Planning Projects include:

  Channel Islands of California , Gulf of Mexico, Galapagos Islands, South Australia , British Columbia, Connecticut/New York, Central Coast of California, Baltic Sea

Washington Marine Spatial Planning Approach

- Map Ecological and Human High Use Areas
- Map areas of potential new renewable (e.g. deep water, mid-depth and nearshore renewable energy)
- Run Marxan for several scenarios to identify areas where potential new development could occur that:
    1) Avoid areas that have been identified as important Use Sectors
    2) Meet suitability needs of the development and achieves goals
- End Product is a map showing areas where potential development might be located that minimize overlap with use areas in selected scenario

Human/Ecological Use Sectors**

- 1 subsector/sector for culture/archaeological site potential
- 4 subsectors for shipping
- 4 subsectors for recreation
- 1 subsector/sector for aquaculture
- 11 subsectors for fisheries
- 8 subsectors for Fish and Wildlife ecologically important areas (EIA)

** Military and Dredge Use Sectors not considered in the Marxan Analysis

U.S. DEPARTMENT OF ENERGY

PNNL-22554

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Geospatial Analysis of Technical and Economic Suitability for Renewable Ocean Energy Development on Washington's Outer Coast

FB Van Cleve*
C Judd*
A Radil†
J Ahmann†
SH Geerlofs*

June 2013

* Pacific Northwest National Laboratory
† Parametrix

Pacific Northwest
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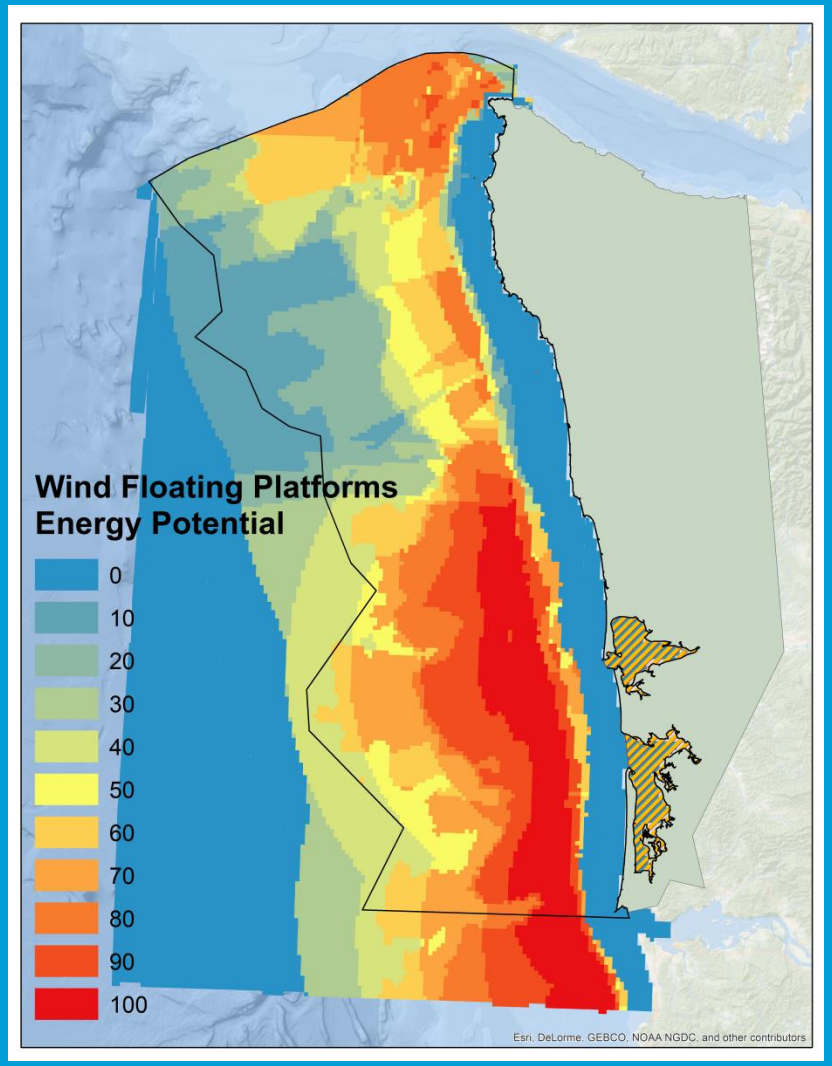
Energy Suitability

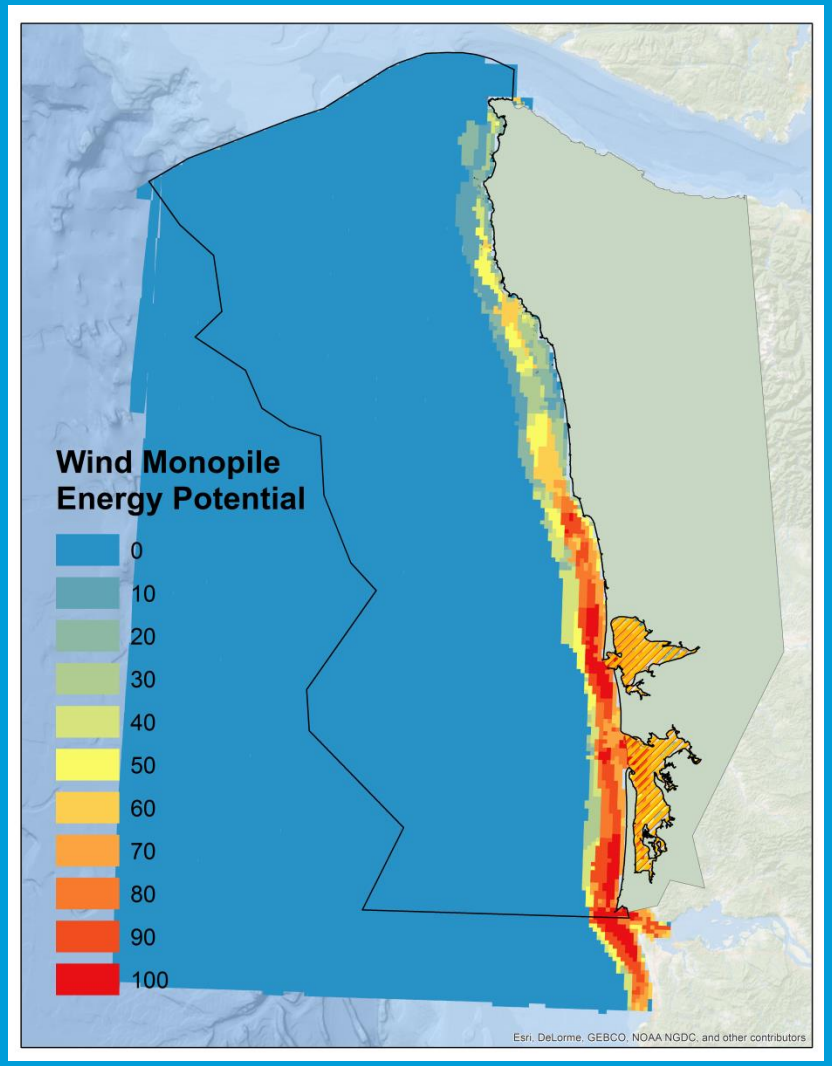
Suitability for fundamental economic and technical feasibility considerations included:

- energy potential
- water depth
- proximity to shore, ports, and transmission infrastructure

Energy Suitability

(Scaled from 0-100, least to most suitable)





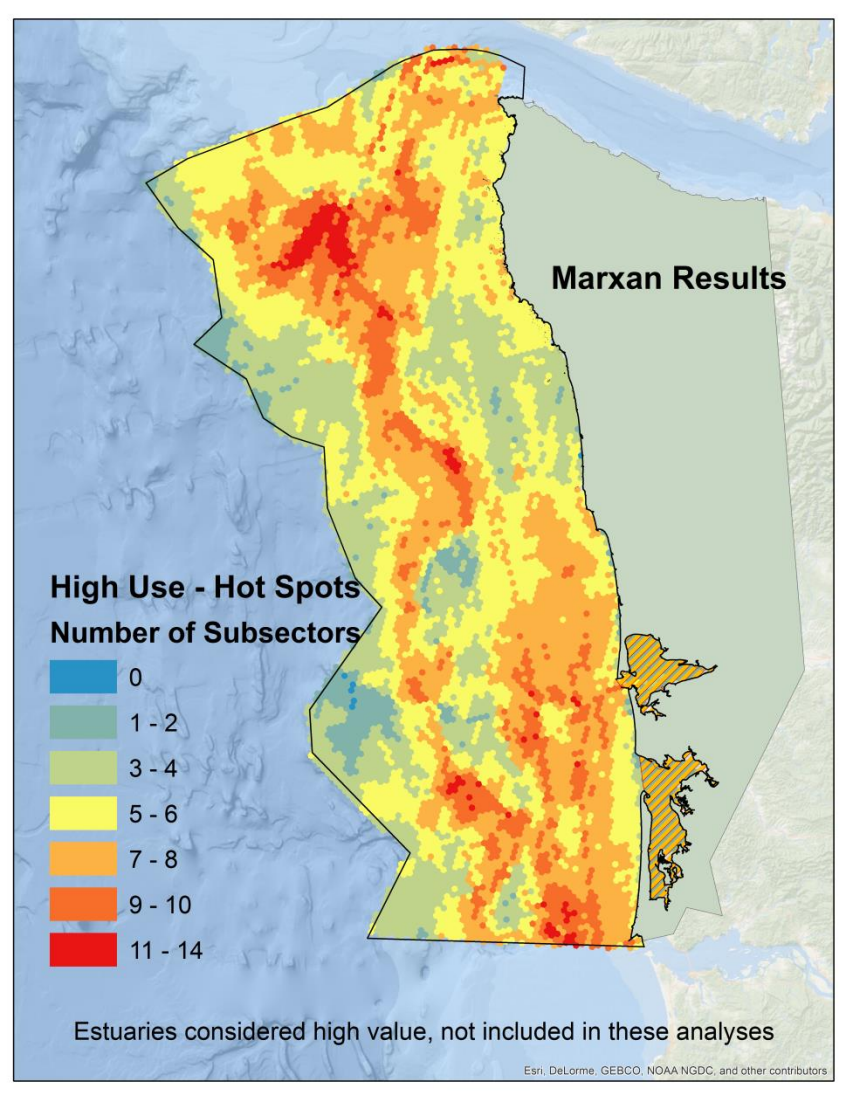
Use Sector Scenarios

- All Subsectors High Use “Hot Spot” Areas
- Sensitive Ecologically Important Areas
- Important Crab Fishing Areas
- Important Fisheries Areas

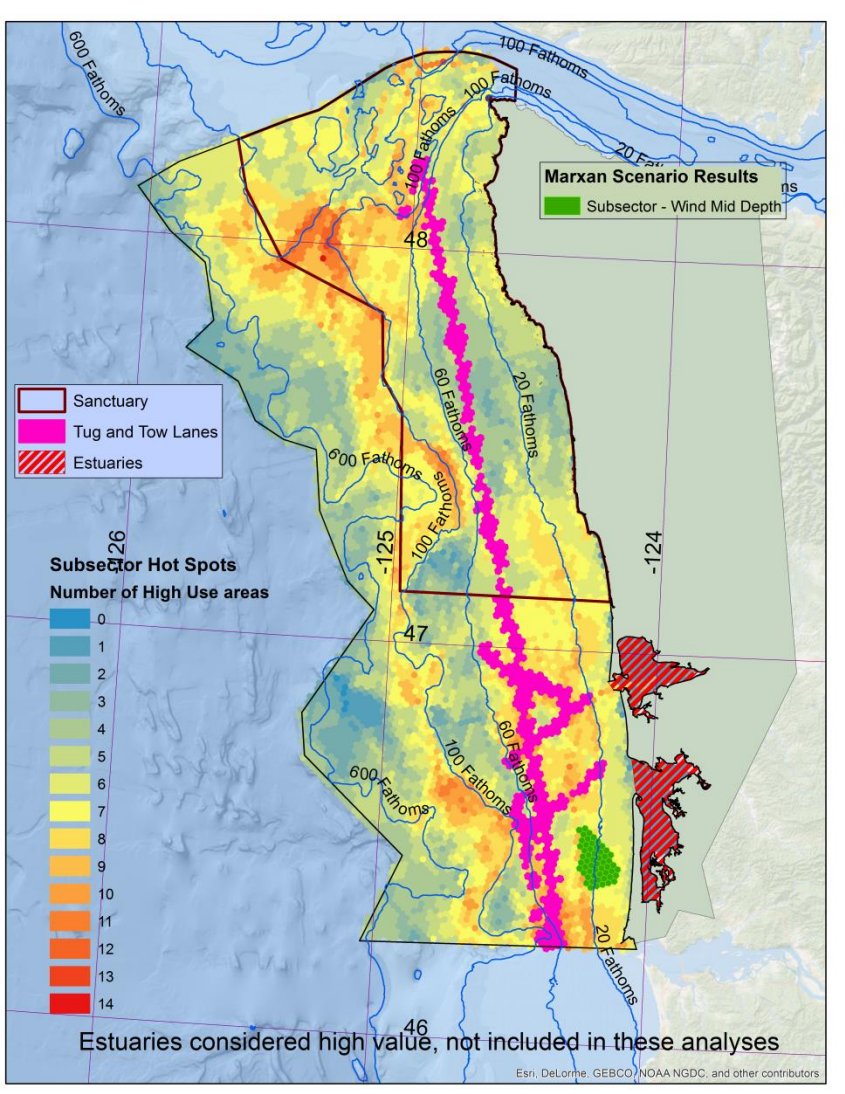
Potential Renewable Energy Scenarios (> 75 Suitability)

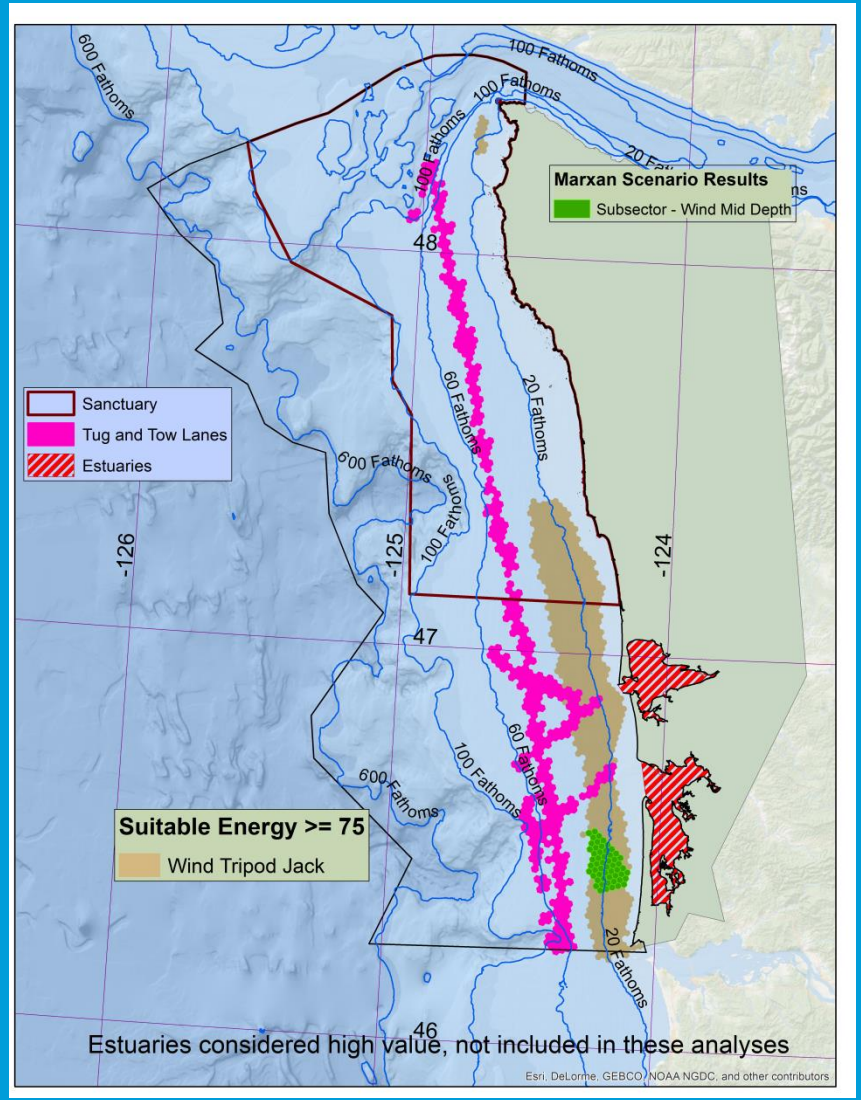
- Floating Platform Wind Turbines (Deep Water)
- Mid-Depth Tripod Platforms
- Monopile Turbines (Nearshore)
- Nearshore Wave

Use Subsector "Hot Spots"



Subsector Hotspots – Wind Mid-Depth Scenario (SI >= 75)





Marxan Use Assessment Summary

- Ability to run different scenarios: e.g. all uses equal, avoid Crab, seabird colonies, Federal-State listed, …
- Can identify finer scale marinescapes for potential development
- No one answer, depends on policy interests and scenario
- Breakout groups

Marxan Scenarios

	Tug/tow lane – avoid on all scenarios				
	Sensitive Species/ Habitats High Use	Crab Fisheries: High Use & Medium Use Add Special Management Area (as avoid)	Subsector High Use/ Hotspot	Subsector High Use/ Hotspot Run with Sanctuary avoidance	Sector Fisheries High Use
Wind – Nearshore	X	X		X	X
Wind Mid-depth	X	X	X		X
Wind Deepwater	X		X, +SI 95		X
Wave Nearshore		X			
Aquaculture				X	

All scenarios run at Energy SI >= 75, except noted above

Use Areas Associated with Scenarios

Subsector Hotspot Scenario

Use
Nearshore seabird at sea surveys
Seabird Colonies
EIA
Marine Mammals
Shorebirds
Forage Fish (surf smelt, night smelt, pacific sand lance) Spawning Grounds
Pacific Hake
Chinook Salmon
Groundfish
Marine Inverts
Habitat
Archaeological Sites/Historic Resources
Recreation
Aquaculture
Fisheries
Shipping/Transportation - Tug and Tow

Sensitive Areas Scenario

Use
Tufted Puffin
Marbled Murrelet
Humpback Whale
Dall's Porpoise
Harbor Porpoise
Gray Whale
Steller Sea Lion
Harbor seal
Sea otter
Marine Mammal Haulouts
Snowy Plover
Streaked Horned Lark
Seabird Colonies
Deep sea Coral
Habitat - Rocky Substrates
Habitat - Kelp beds
Yelloweye Rockfish
Forage Fish (surf smelt, night smelt, pacific sand lance) Spawning Grounds
Archaeological Sites/Historic Resources

Hotspots = number of individual layers with high use

Scenario Penalty Factor Table Avoid High Use Fisheries

Hex_ID	Count of High Use Fisheries	Penalty	Avoid Sanctuary Penalty
85980	2	2000000	200000000
4938490	3	3000000	3000000
5027718	3	3000000	300000000
5010592	4	4000000	400000000
4964989	1	1000000	1000000
4925415	2	2000000	2000000
4905091	2	2000000	2000000
4905073	2	2000000	2000000
4905055	2	2000000	2000000
4920503	3	3000000	3000000
4920521	4	4000000	4000000
4938516	4	4000000	4000000
4938498	1	1000000	1000000
4938480	1	1000000	1000000
4958798	2	2000000	2000000
4958816	2	2000000	200000000
4981237	1	1000000	100000000

Ecologically Important Areas (EIA) with Sensitive Species and Habitats

Seabirds

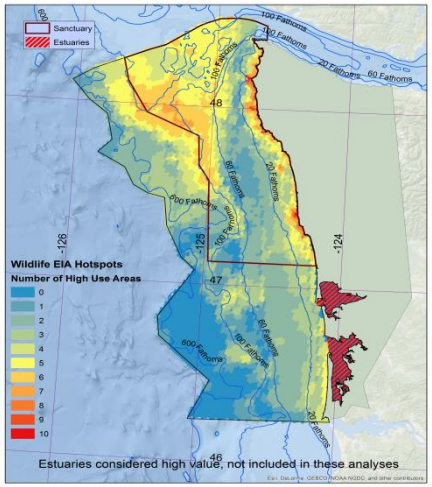
- Black Footed Albatross
- Common Murre
- ***Marbled Murrelet***
- Northern Fulmar
- Pink Footed Shearwater
- ***Snowy Plover***
- Sooty Shearwater
- **Streaked Horned Lark**
- ***Tufted Puffin***
- ***Seabird Colonies***

Marine Mammals

- ***Dall's Porpoise***
- ***Gray Whale***
- ***Harbor Porpoise***
- ***Harbor Seal***
- ***Humpback Whale***
- ***Marine Mammal Haulouts***
- ***Sea Otter***
- ***Steller Sea Lion***

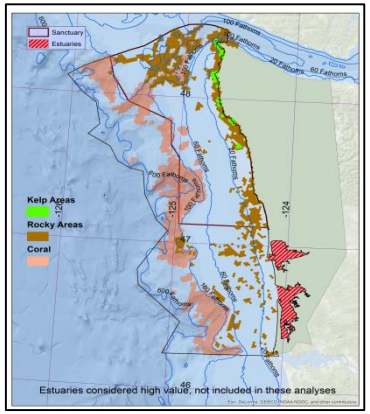
Fish and Invertebrate Specie

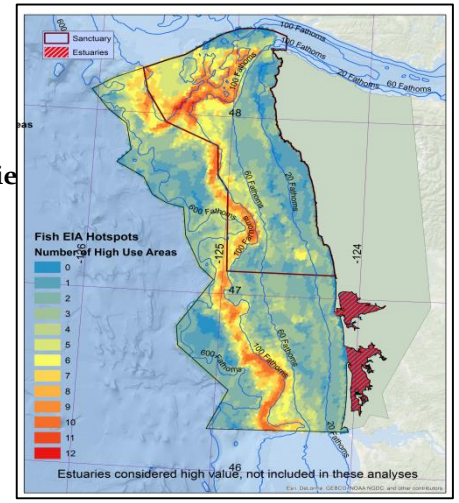
- Razor clam
- Pink shrimp
- Dungeness Crab
- Chinook
- Darkblotched Rockfish
- Dover Sole
- ***Forage Fish***
- Greenstriped Rockfish
- Pacific Whiting
- Longspine Thornyhead
- Pacific Ocean Perch
- Petrale Sole
- Sablefish
- ***Yelloweye Rockfish***



Habitat

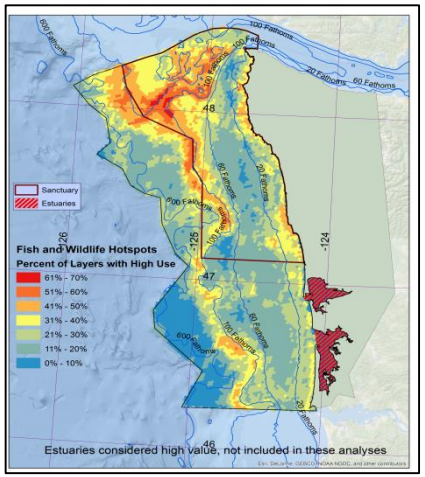
- ***Coral***
- ***Kelp areas***
- ***Rocky areas***



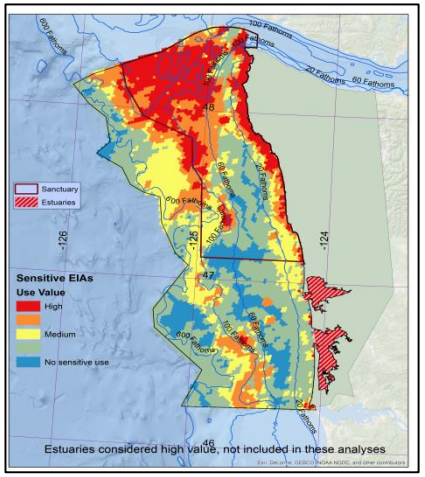


Sensitive Area Map includes all EIA species noted in bold and italics.

EIA Hot Spot Combined



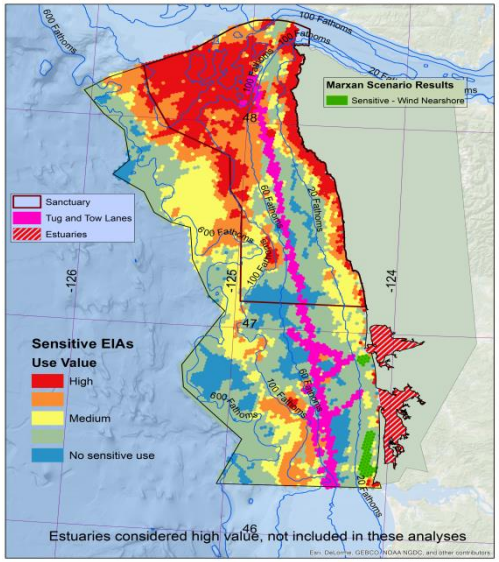
Sensitive Areas Combined



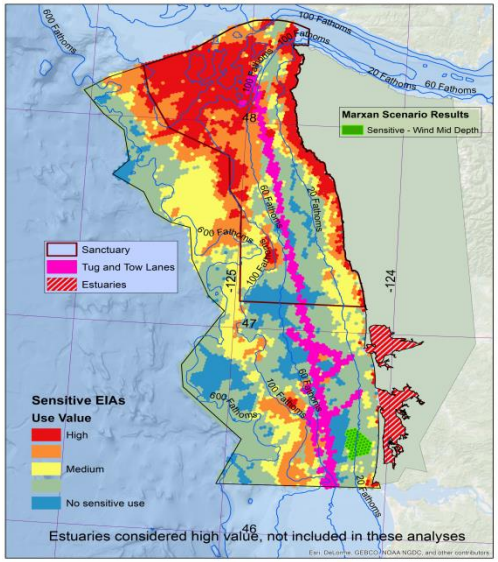
Scenario: Avoid Sensitive Areas

With nearshore wind, mid-depth wind and deepwater wind suitability models

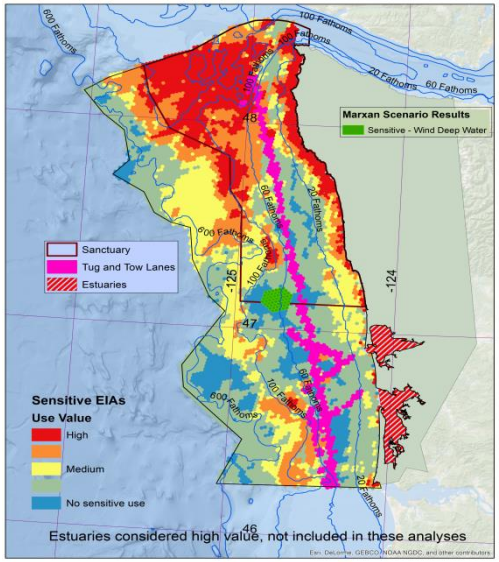
Energy Potential Maps with Marxan Results Important Use Area Maps with Marxan Results



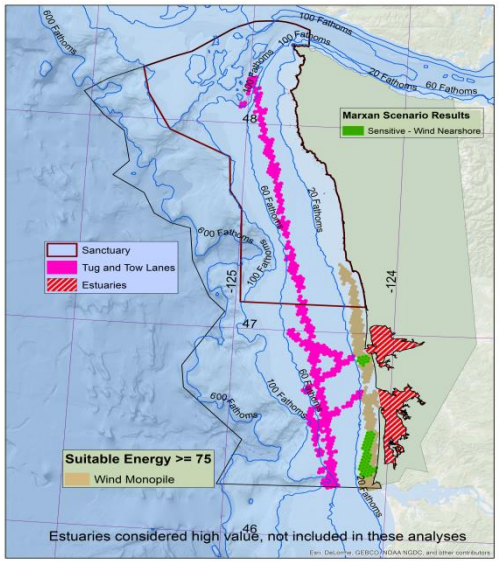
Wind Nearshore

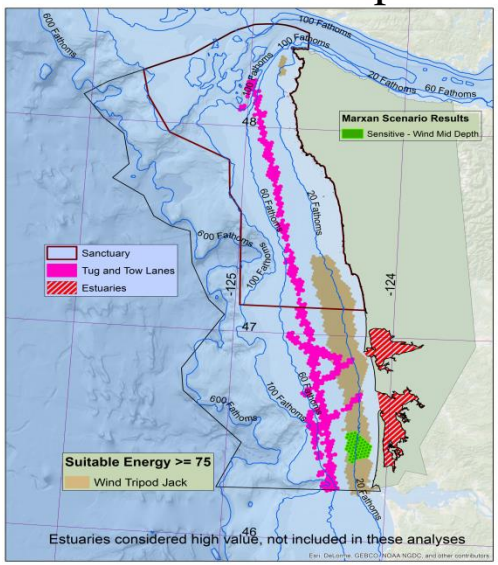


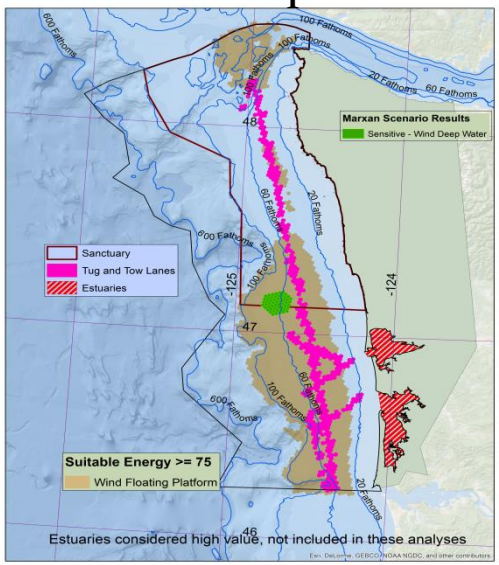
Wind Mid Depth



Wind Deep Water



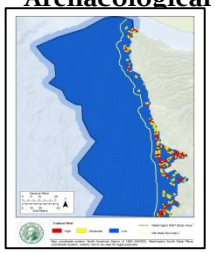




Scenario: Use Subsectors (high use)

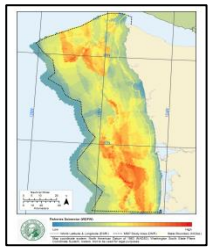
With mid-depth wind, deepwater wind, and nearshore wave suitability models

Cultural and Archaeological Risk



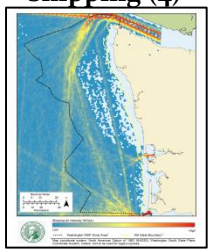
These sites are recorded by Department of Archaeology and Historic Preservation to have a high risk of containing culturally sensitive materials.

Fisheries (12)



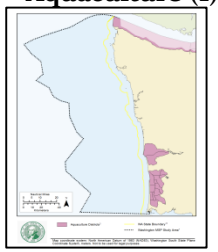
C. Albacore
C. Bottomtrawl
C. Crab
C. Hake/Whiting
C. Sablefish
C. Salmon
C. Sardine
C. Shrimp
R. Albacore
R. Bottomfish
R. Pacific Halibut
R. Salmon

Shipping (4)



Cargo
Passenger
Tanker
Tug and Tow

Aquaculture (1)

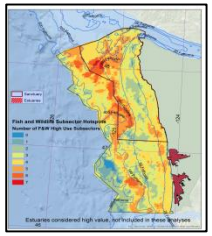


Aquacultur
e Districts

Recreational Activities (4)

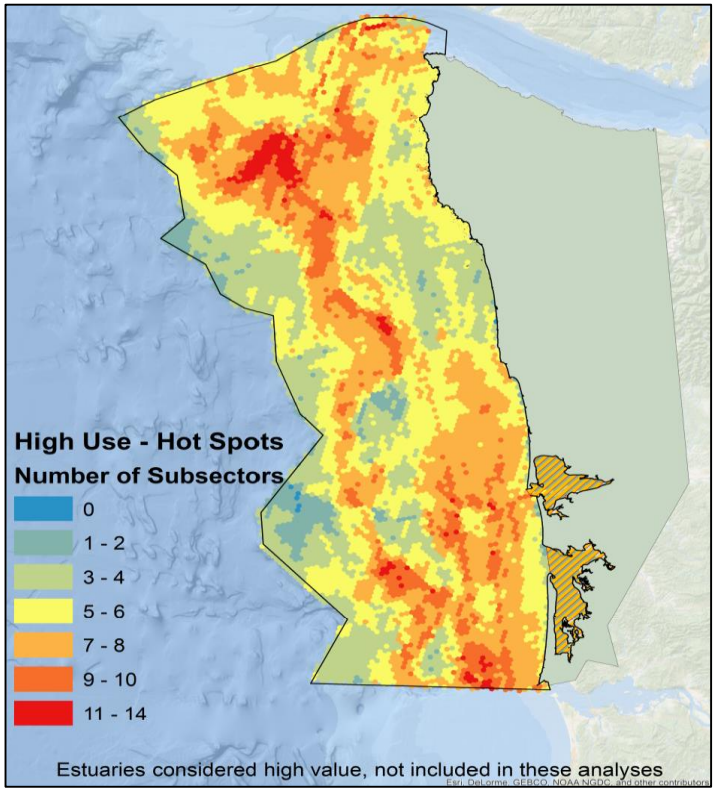
Diving
Shore-Based
Surface Water
Wildlife
Viewing
& Sightseeing

Fish and Wildlife (EIA: 8)



Habitat
Shorebird Areas
Marine Mammals
Sea Lion/Seal
Haulouts
Seabird Abundance
Seabird Colonies
Invertebrates
Fish Abundance

Subsectors Combined

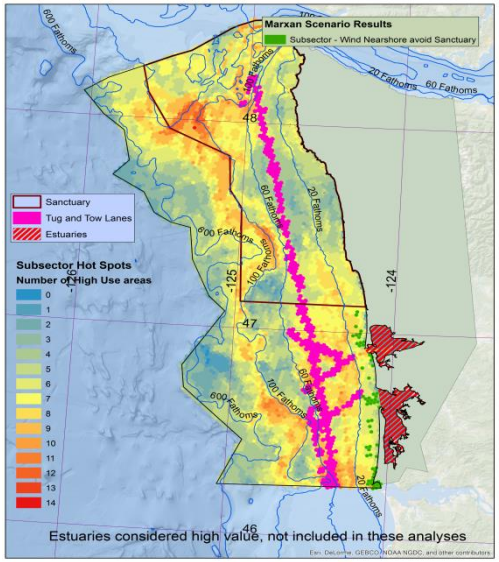


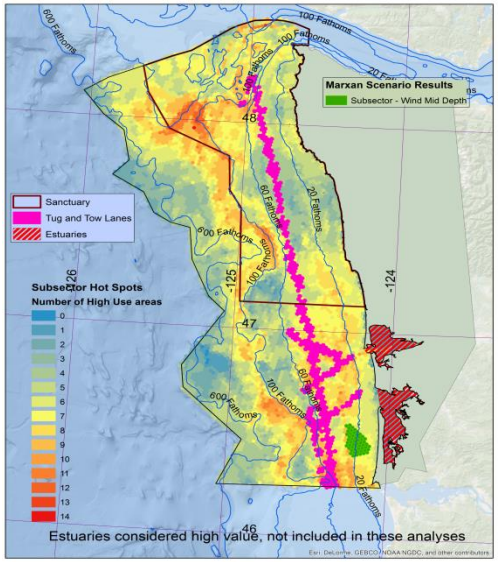
Number of subsector layers in ()

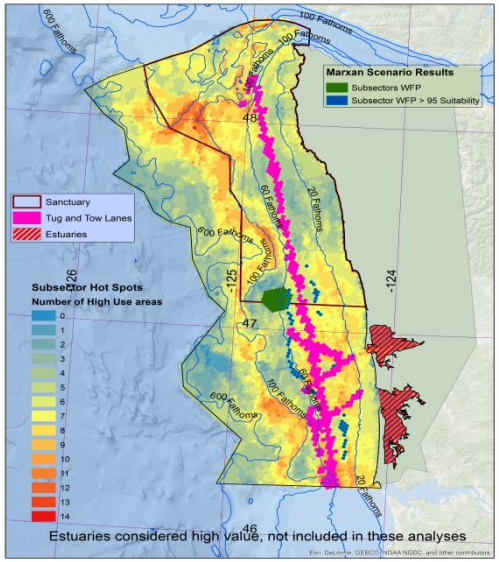
Scenario: Avoid Subsector Hotspots

With nearshore wind, mid-depth wind and deepwater wind suitability models

Important Use Area Maps with Marxan Results





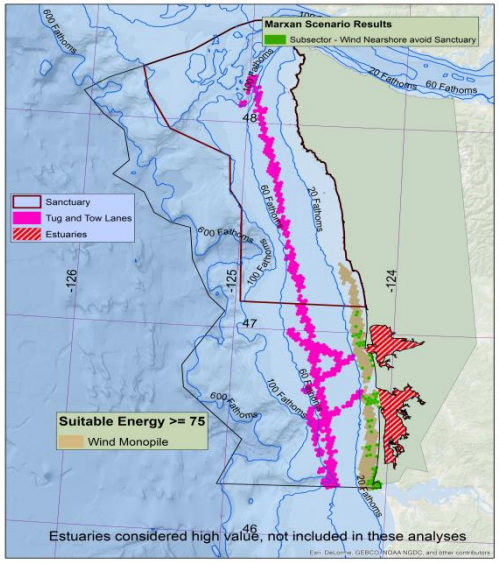


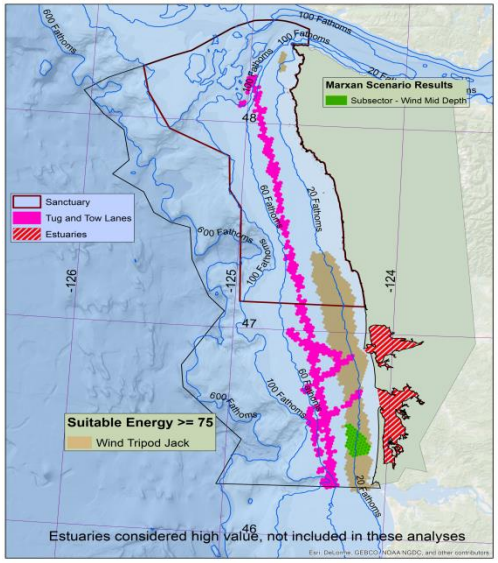
Wind Nearshore

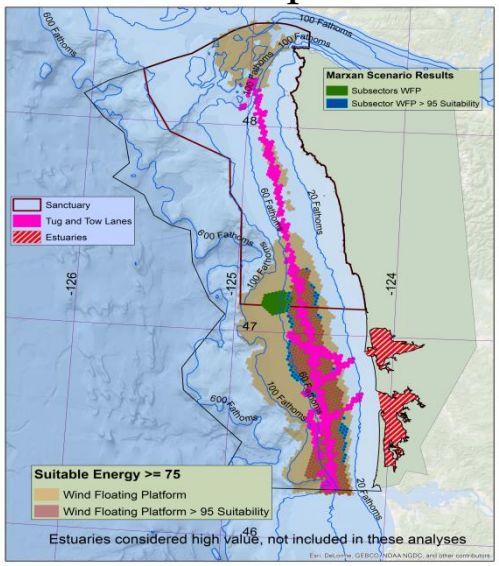
Wind Mid Depth

Wind Deep Water

Energy Potential Maps with Marxan Results

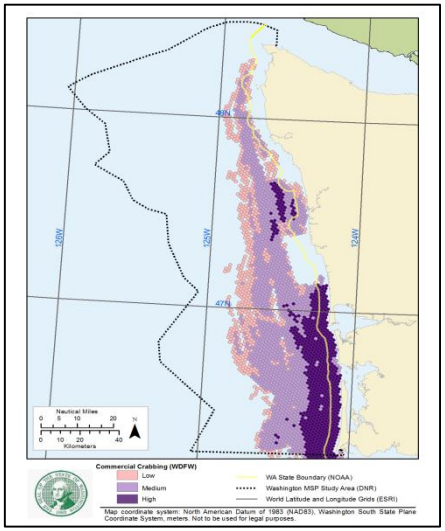




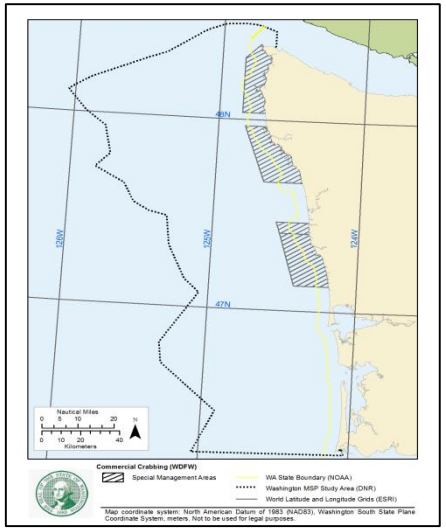


Dungeness Crab Fisheries with Special Management Areas (SMA)

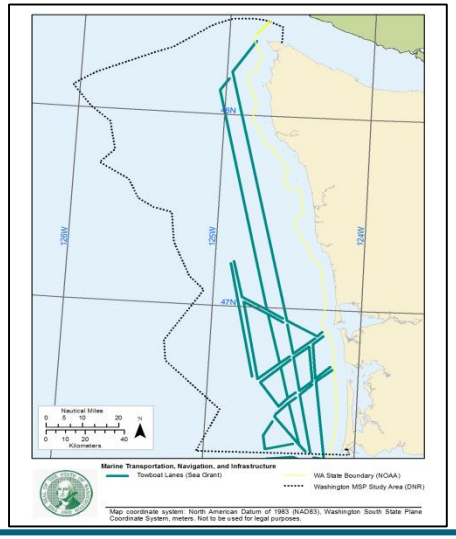
Commercial Dungeness Crabbing (WDFW)



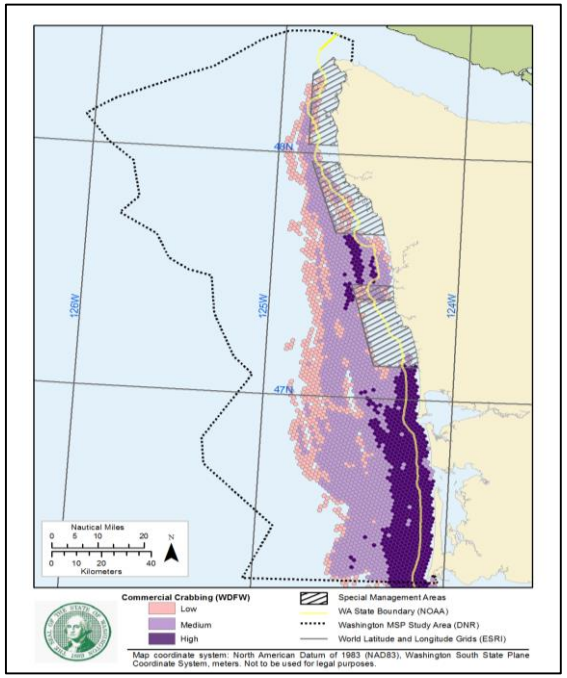
Crab Special Management Areas (WDFW)



Tug/Towboat Crabber Lanes



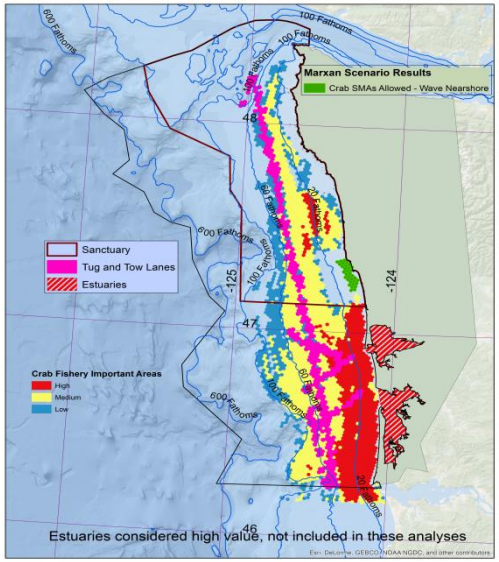
Crab Fisheries Combined



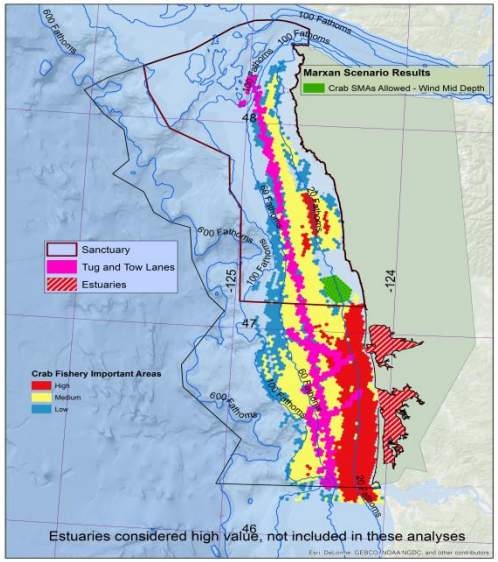
Scenario: Avoid Crab Fisheries

With nearshore wave, mid-depth wind and deepwater wind suitability models

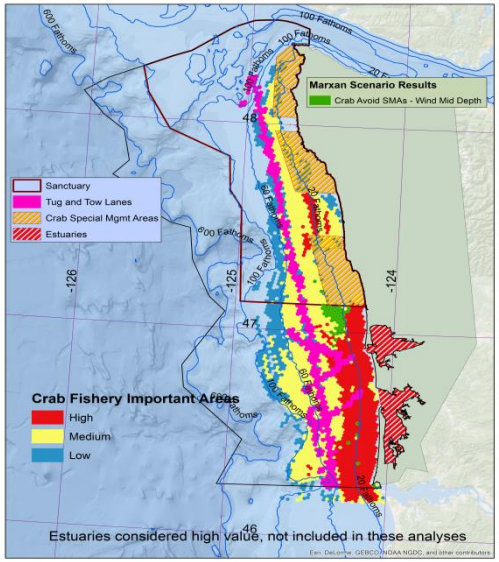
Energy Potential Maps with Marxan Results Important Use Area Maps with Marxan Results



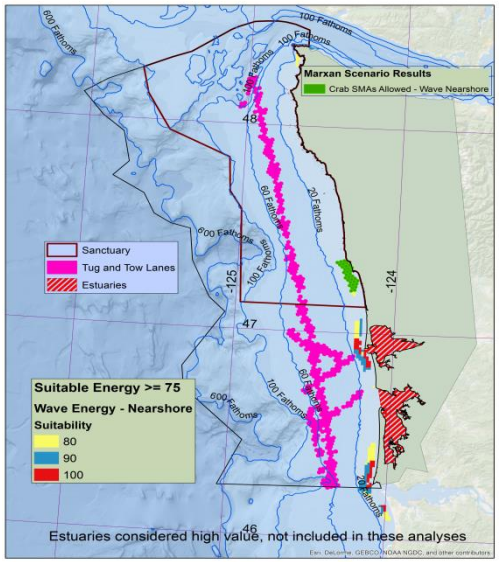
Wave Nearshore

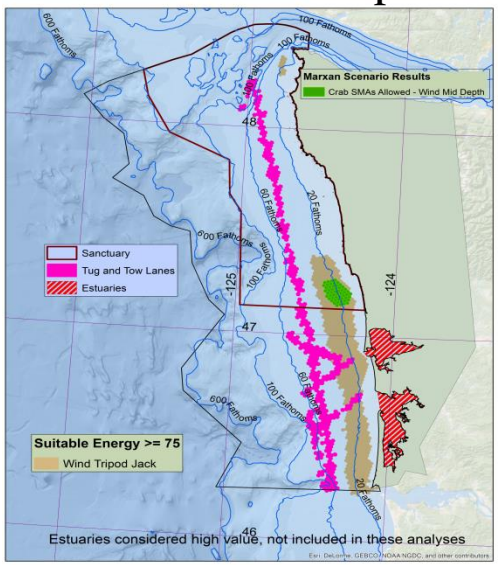


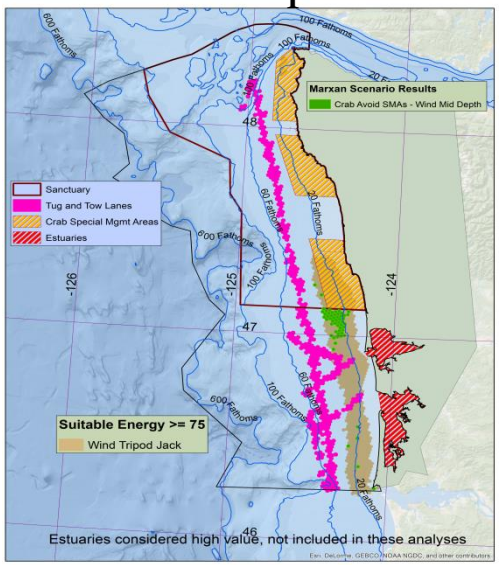
Wind Mid Depth



Wind Deep Water



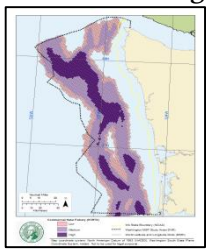




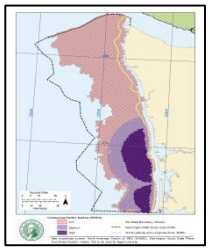
Non-Tribal Fisheries

Commercial Fishing

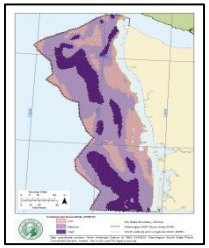
Pacific Whiting



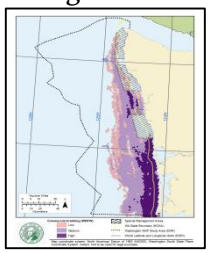
Sardine



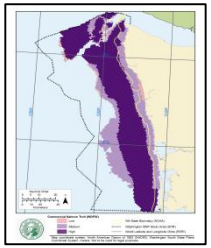
Groundfish (Bottom Trawl)



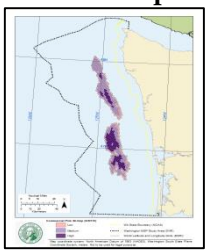
Dungeness Crab



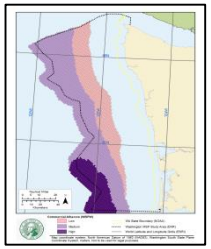
Salmon



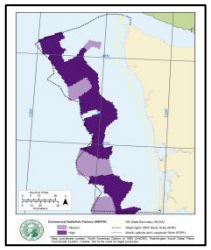
Pink Shrimp



Albacore Tuna

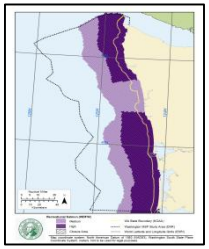


Sablefish

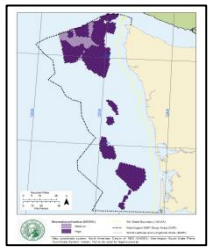


Recreational Fishing

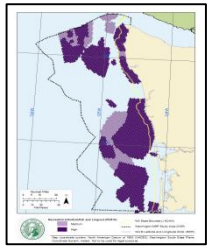
Salmon



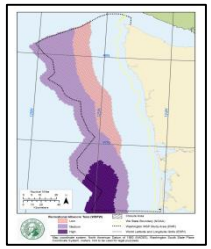
Halibut



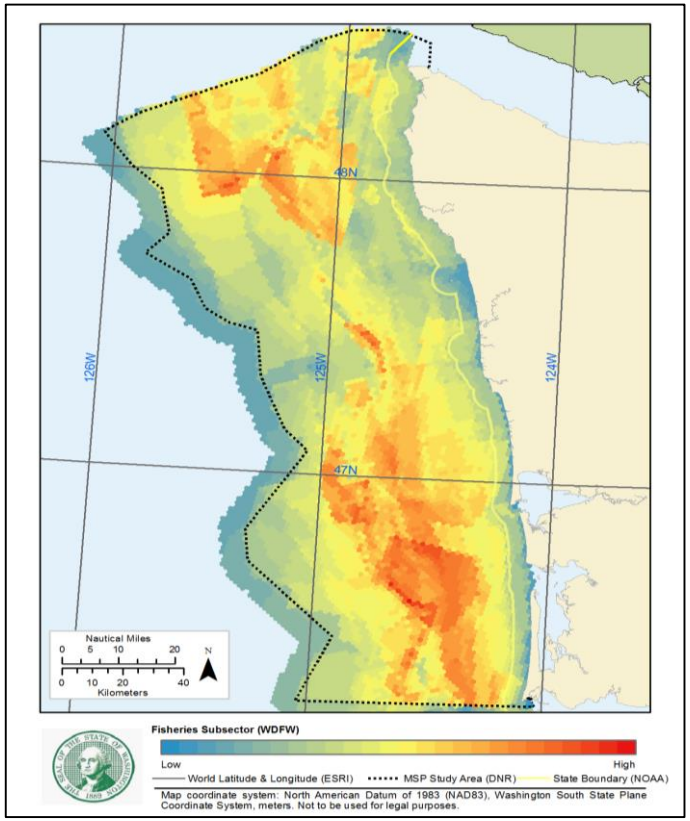
Bottomfish



Albacore Tuna



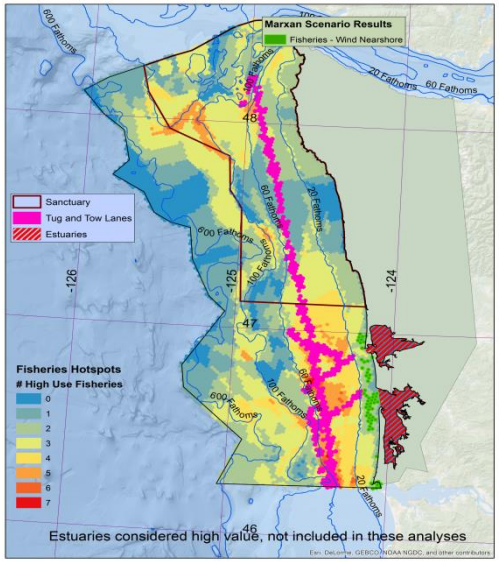
Non-Tribal Fisheries Combined

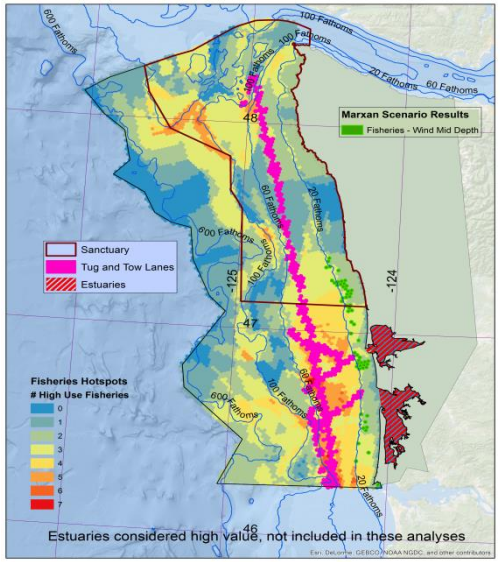


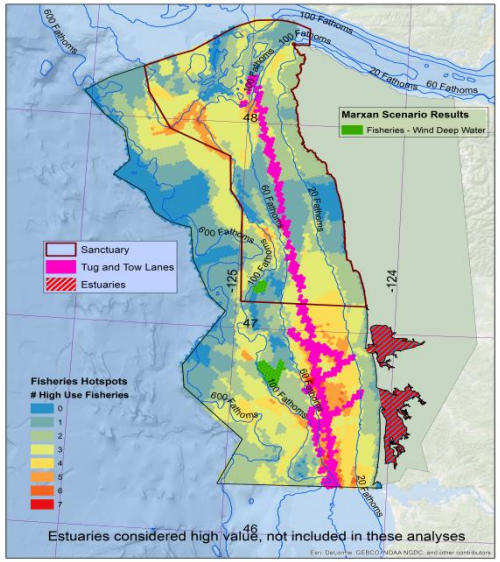
This output includes all high use fisheries. It does not include any tribal fisheries.

Scenario: Avoid High Use Fishery Areas

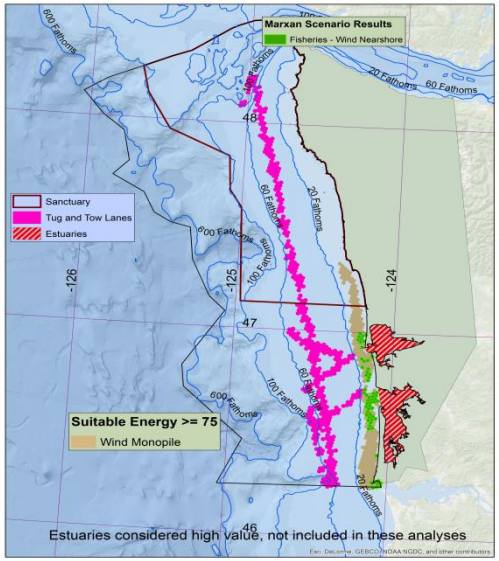
With nearshore wind, mid-depth wind and deepwater wind suitability models



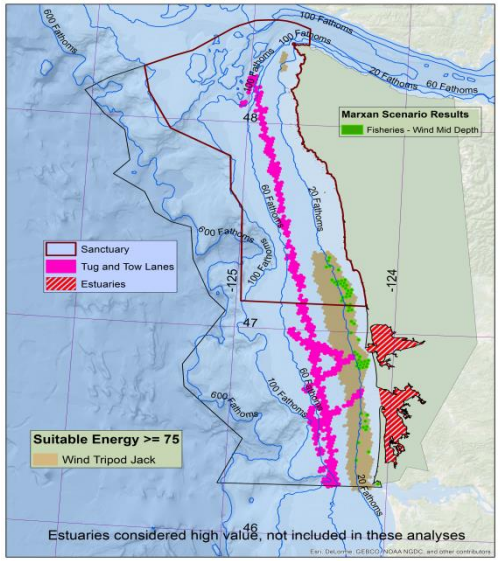




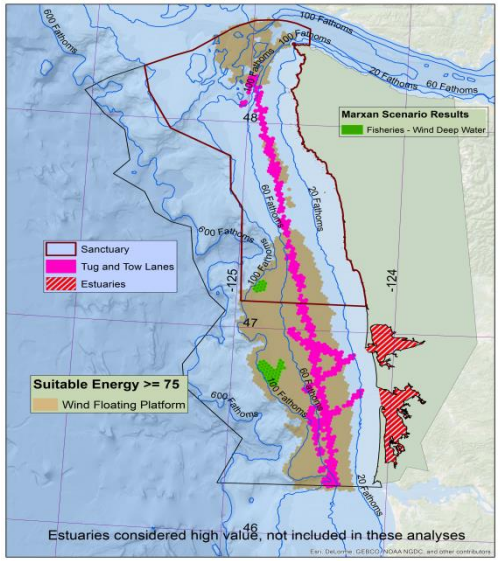
Wind Nearshore



Wind Mid Depth



Wind Deep Water



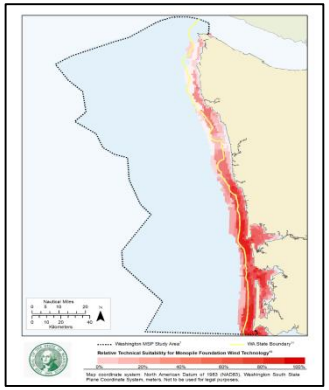
Energy Potential Maps with Marxan Results Important Use area maps with Marxan Results

Scenario Variables

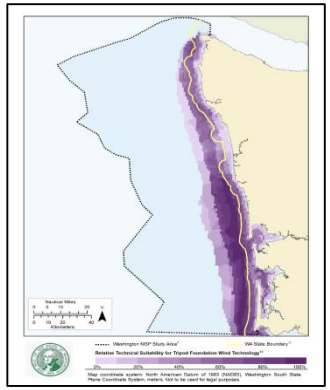
These data can run as variables in the Marxan analysis which can include a high percentage of potential suitability with potential future uses, or restrictions in specific marine boundaries.

Potential Future Uses

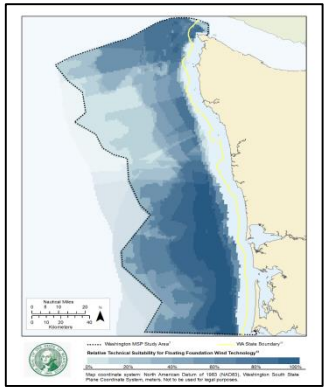
Nearshore Wind Monopile



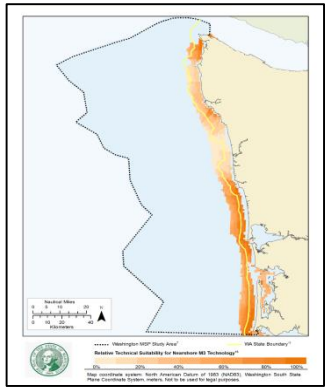
Mid-depth Wind



Deepwater Wind Floating Platform

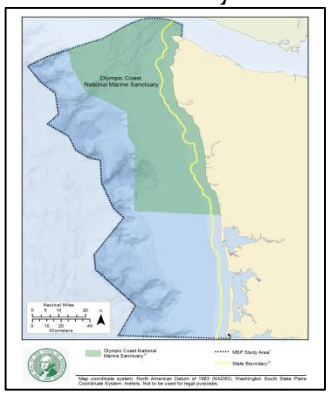


Nearshore Wave M3 Device

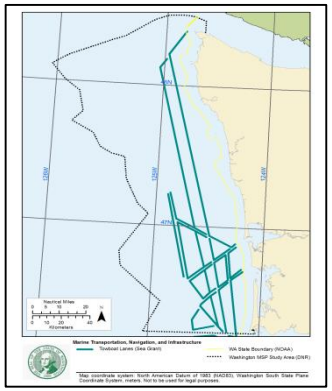


Potential Marine Boundaries to Include

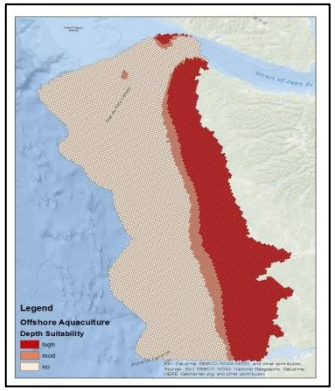
Olympic Coast National Marine Sanctuary

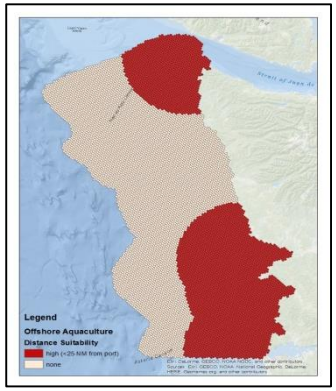


Tug/Towboat Crabber Lanes



Offshore Aquaculture Depth and Distance from Ports





Questions?

Small Groups

The purpose of this time is for you and your group to consider and discuss:

- What revisions you'd like to see illustrated for existing scenarios?
- What additional scenario(s) you'd like to have illustrated today?
- What is the most important scenario that you haven't seen?
- What dataset do you want included?