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

Jennifer Hennesey
Washington Dept. of Ecology
Grays Harbor College
Programming
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  
      John Pierce, WDFW
      •  Questions about Marxan tool

1:30 – 2:00  Updated Scenarios  
      John Pierce, WDFW
      •  Clarifying questions about scenarios

2:00 – 2:30  Small group discussion and input on scenarios  
      All
      •  Refining existing scenarios
      •  Additional scenarios

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

**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**

The study area is 700 fathoms offshore and includes federal waters and estuaries.
MSP Context
The marine management plan must include but not be limited to...

- Maps of Key Ecological Areas, Human Uses, and Appropriate Locations for Renewable Energy
- Ecosystem Assessment
- Recommendations for Use Priorities and Limitations, Siting Criteria, and Protection of Unique and Sensitive Biogenic Features
- Implementation Strategy Using Existing State and Local Authorities
- Coordination Framework for Review of Renewable Energy Projects

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
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
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”

Marxan Results

High Use - Hot Spots
Number of Subsectors

- 0
- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 14

Estuaries considered high value, not included in these analyses
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

<table>
<thead>
<tr>
<th></th>
<th>Tug/tow lane – avoid on all scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitive Species/ Habitats</td>
<td>Crab Fisheries: High Use &amp; Medium Use</td>
</tr>
<tr>
<td>High Use</td>
<td>Add Special Management Area</td>
</tr>
<tr>
<td></td>
<td>(as avoid)</td>
</tr>
<tr>
<td>Subsector High Use/ Hotspot</td>
<td>Subsector High Use/ Hotspot</td>
</tr>
<tr>
<td></td>
<td>Run with Sanctuary avoidance</td>
</tr>
<tr>
<td>Sector Fisheries High Use</td>
<td></td>
</tr>
</tbody>
</table>

| Wind – Nearshore              | X  | X  | X  | X  | X  |
| Wind Mid-depth                | X  | X  | X  | X  | X  |
| Wind Deepwater                | X  | X, +SI 95 | X  | X  | X  |
| Wave Nearshore                | X  | X  | X  | X  | X  |
| Aquaculture                   | X  | X  | X  | X  | X  |

All scenarios run at Energy SI >= 75, except noted above
Use Areas Associated with Scenarios

### Subsector Hotspot Scenario

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

### Sensitive Areas Scenario

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

Hotspots = number of individual layers with high use
## Scenario Penalty Factor Table

### Avoid High Use Fisheries

<table>
<thead>
<tr>
<th>Hex_ID</th>
<th>Count of High Use Fisheries</th>
<th>Penalty</th>
<th>Avoid Sanctuary Penalty</th>
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</tbody>
</table>
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 Species
- 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

Sensitive Area Map includes all EIA species noted in bold and italics.
**Scenario: Avoid Sensitive Areas**

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

### Shipping (4)

- Cargo
- Passenger
- Tanker
- Tug and Tow

### Recreational Activities (4)

- Diving
- Shore-Based
- Surface Water
- Wildlife
- Viewing
- & Sightseeing

### 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

### Aquaculture (1)

Aquaculture Districts

### Fish and Wildlife (EIA: 8)

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

**Number of subsector layers in ()**

**SUBSECTORS COMBINED**

- **High Use - Hot Spots**
  - **Number of Subspots**
    - 0
    - 1 - 2
    - 3 - 4
    - 5 - 6
    - 7 - 8
    - 9 - 10
    - 11 - 14

- Estuaries considered high value, not included in these analyses
**SCENARIO: AVOID SUBSECTOR HOTSPOTS**

With nearshore wind, mid-depth wind and deepwater wind suitability models
**Dungeness Crab Fisheries with Special Management Areas (SMA)**

- **Commercial Dungeness Crabbing (WDFW)**

- **Crab Special Management Areas (WDFW)**

- **Tug/Towboat Crabber Lanes**

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**CRAB FISHERIES COMBINED**
**SCENARIO: AVOID CRAB FISHERIES**

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

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**Wave Nearshore**

**Wind Mid Depth**

**Wind Deep Water**
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
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?