Fishery Data Available for Marine Spatial Planning (MSP) Efforts

WCMAC Meeting

October 22, 2014

Current State Law

- **RCW 42.56.430 exempts some commercial fishing data from public disclosure:**
  - ***Section 1: Commercial fishing catch data from logbooks required to be provided to WDFW when the data identifies specific catch location, timing, or methodology and the release of which would result in an unfair competitive disadvantage to the commercial fisher providing the catch data…***
  - ***Section 4: Information that WDFW has received or accessed but may not disclose due to confidentiality requirements in the Magnuson-Stevens Act.***

Magnuson-Stevens Act (MSA)

- Authorizes Secretary of Commerce to regulate domestic fisheries within the 200-mile U.S. EEZ
- Conservation and management of fish stocks is done through Fishery Management Plans (FMPs)
- West Coast FMPs:
  - Salmon (Chinook & coho primary and includes pink in odd-numbered years – applies throughout range)
  - Groundfish (Includes all rockfish, lingcod, some flatfish, except halibut)
  - Coastal Pelagic Species (e.g., sardines, mackerel, anchovy)
  - Highly Migratory Species (e.g., albacore tuna)

MSA Data Confidentiality

- **The Secretary must maintain the confidentiality of any information that is submitted in compliance with the Act and any observer data**
  - ***Some limited sharing of confidential information with specific entities provided the information is kept confidential***

- **The National Marine Fisheries Service issued a proposed rule to provide guidance (May 2012)**
  - ***Includes financial and operational information, fishing locations, time of fishing, type and quantity of gear used, catch by species in numbers or weight, number of hauls, number of employees, estimated processing capacity***
- **To date, a final rule has not been published**

WDFW Policy

- WDFW worked with Attorney General's Office to interpret federal and state laws to ensure compliance
- Need for consistent interpretation and application of state and federal laws

- In general, WDFW:
  - Releases exempted commercial fishing catch location data in an aggregated, summarized form
  - Works with requestors for exempt data to explore alternative ways of displaying information to protect data confidentiality
- Need for coordination among federal and state agencies for MSA confidential data

Fisheries Data Availability and Uses

- Data in Viewer: Fishing intensity maps to give the public a general sense of where different non-tribal commercial and recreational fishing activities take place on the coast
  - *In compliance with federal and state laws, these data are aggregated in a manner that protects confidentiality*

- Data for Analyses: All available data at the highest resolution possible to: 1) characterize status and contribution of fisheries to local communities, state, and nation; and 2) assess potential impacts from proposed new uses in broad areas

- Data Not Available: Catch location data is not recorded for all fisheries, and data for some fisheries is collected by other entities and cannot be accessed

Fisheries Data in Viewer

- All fisheries with catch location data that can be displayed in a manner that protects confidentiality: Dungeness crab, groundfish (Pacific whiting and non-whiting separately), pink shrimp, and sardine; and recreational albacore, bottomfish, and salmon
- Includes NMFS commercial albacore aggregated data *(in queue)*
- Includes all federal and state closed areas that pertain to those fisheries (either year-round or time-specific noted)
- Does not include commercial hagfish and spot prawn data to protect confidentiality
- Does not include commercial halibut fishery data—requested from International Pacific Halibut Commission, but not provided
- Do not collect commercial salmon catch locations (troll and gillnet); propose use recreational salmon fishery data as a proxy

MSP Analyses vs. Impacts Analyses

MSP Analyses

- **The Plan Will Describe Existing Uses and Assess the Potential Effects from Five Specific Potential New Uses on a Broad Scale Within the Study Area**
  - **Provide Justification to Apply Coastal Zone Management Act Authority to Federal Waters.**
- ***If NOAA Approves of the State's Changes to its Coastal Zone Management Program, then the State Will be Notified and Can Comment on Federal Permitting Actions for Those Five New Uses in Federal Waters.***

Impacts Analyses

- **Additional, More Detailed Analyses, Including Economic Impacts, Will be Done on Any Specific Proposals**

Fisheries Data for Analyses

- **The Federal and State Fisheries Data Available Include:**
  - NMFS Groundfish Trawl Survey Data (Annual Survey on Shelf and Slope)
  - State Commercial Fisheries Harvest Data (Amount Landed and Revenue): All Commercial Fisheries
  - State Commercial Fisheries Logbook Data (Fishing Location): Dungeness Crab, Groundfish, Hagfish, Pink Shrimp, Spot Shrimp, and Sardine
  - NMFS Commercial Groundfish Observer Program Data (for Shoreside and At-Sea Groundfish Trawl, and Fixed Gear Sablefish Fisheries)
  - State Recreational Port Sampling Data (Amount of Fish Caught by Marine Catch Area by Trip Type: Salmon, Halibut, Bottomfish; Charter and Private)
- ***The Potential Effects on All Fisheries Will be Qualitatively Discussed in the MSP Analyses Even if the Impacts to Those Fisheries Cannot be Quantified***
- **WDFW Has Requested Permission from NMFS for Limited Release of MSA Confidential Data for Economic Analysis**

Fisheries Data Not Available

Requested, but Not Provided:

- **NMFS vessel-specific commercial albacore logbook data**
- **International Pacific Halibut Commission commercial halibut fishery logbook data**

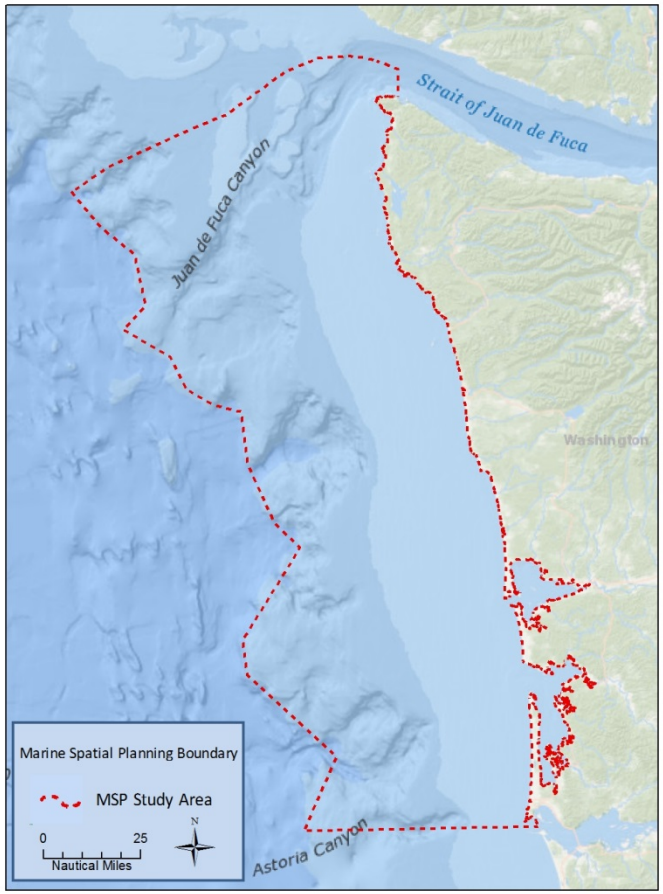
Does Not Exist:

- **Commercial fishery logbook data for: Salmon troll and gillnet, fixed gear groundfish (including sablefish), and anchovy/baitfish**
- **Charter or recreational fishery logbook data (other than charter albacore)**

The Potential Effects on All Fisheries Will be Qualitatively Discussed in the MSP Analyses Even if the Impacts Cannot be Quantified

Questions?

Scope of MSP



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

INTENT:
Address location of potential new marine uses.

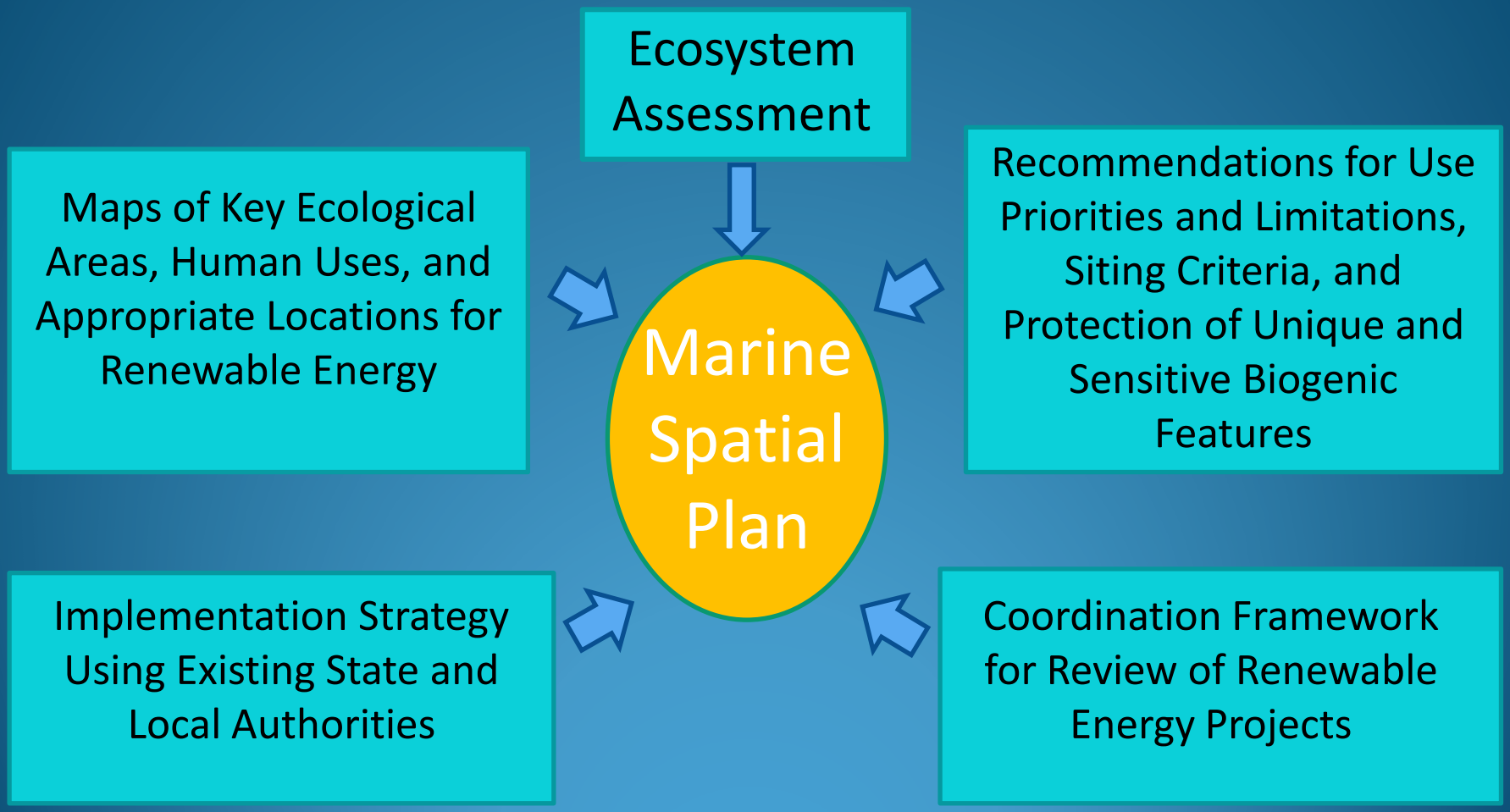
PLAN GOALS/OBJECTIVES:

- 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)

Use Analysis Process

Assess Use Data (Fall 2014)

- Agencies develop list of data for each use category.
- For uses with little to no data, agencies contact appropriate source and experts and verify user/sector data. If needed, refine use data or adjust display of data.

Spatial Use Analysis (Spring-Dec. 2015)

- WCMAC input on use assessment matrix and spatial analysis process.
- DNR performs GIS analysis: using standardized grid & evaluating existing use data against areas for potential new uses (PNNL data for renewable energy) - categorize use data (unknown; low, medium, or high use)
- Output categorizes areas: most existing uses/fewer uses, fixed infrastructure, with no conflicts, etc.

Identify Alternatives & Recommendations (Spring 2015 – Winter 2015)

- Agencies identify, for each existing use category, the recommended actions if a project were proposed for that area.
- WCMAC members review and provide their recommended actions for each of the new uses (alternatives).
- Agencies identify pros/cons for alternatives and next steps – get feedback from WCMAC.

Spatial Use Data

- Existing Uses
  - Shipping, Fishing, Aquaculture, Recreation, Military, etc.
  - <u>Includes</u> Ecologically Important Areas

- Potential New Uses data
  - PNNL renewable energy layers
  - Spatial data on other potential new uses, *if available*.

Presentation
by Dale Beasley
WCMAC Commercial Fishing Seat

Legacy Decisions

First & Foremost
DECISIONS are about IMPACTS to PEOPLE

Their lives, health and safety
Their economic security
Their quality of life
Their very FREEDOMS

JOBS
JOBS
JOBS

PROTECTING AND PRESERVING COASTAL

SUSTAINABLE WATER DEPENDENT JOBS

SUSTAINABLE WATER DEPENDENT JOBS

NEED to be SEPARATED
from the CLUTTER

BROUGHT into specific **FOCUS**
to be
PROTECTED AND PRESERVED

ESB 5603 –

Washington Coastal Marine Advisory Council SHALL consider:

Sec.2 (2) (b)

"The protection and preservation of existing sustainable uses for current and future generations, including the economic stakeholders reliant on marine waters to stabilize the vitality of the coastal economy."

ESB 5603 Sec.2 (2) (b)

"Existing sustainable use" is an inclusive phrase

FISHING is an "Existing Sustainable Use" and includes all fishing sectors

ESB 5603

Specifically requires economic stability and vitality of marine water stakeholders to be protected and preserved

FISHING participants are marine water stakeholders

WCMAC which includes the SOC

has a LEGAL

RESPONSIBILITY

WE CANNOT CONTINUE TO IGNORE

FISHING

Needs to become a current focus
because
FISHING
has the potential to receive the
LARGEST IMPACT
from cumulative loss of
marine space negatively affecting coastal
economic stability and vitality

HOW

CAN THE WCMAC
FULFILL
LEGAL RESPONSIBILTY
to
PROTECT AND PRESERVE FISHING

NETWORK of FISHING PRESERVES

currently the only alternative on the table to stabilize and protect the vitality of the coastal economy for current and future generations

ASK

Series of Coastal Workshops

dedicated to

POSITIVE SOLUTIONS

to secure

Fishing's economic stability and viability

as a dedicated outcome of Washington CMSP as required by law

These workshops need to include convening the COASTAL fishing industry so that those most affected can sort through and work from a **bottom up perspective** what is the best way to "PROTECT AND PRESERVE FISHING" as a significant part of the Washington CMSP

MARINE SPATIAL PLANNING
Economic Analysis Scope of Work

Prepared for:
Washington Coastal Marine Advisory Council

Presented by:
Cascade Economics LLC

Purpose

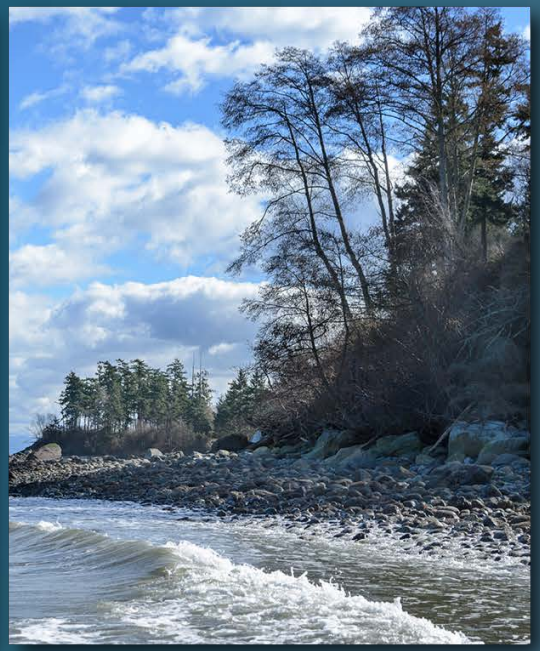
- To update the WCMAC on the Scope of Work for the Economic Analysis that:
  - Considers comments and feedback received from the WCMAC at the Workshop and in writing
  - Incorporates initial feedback from the Science Panel
- Final Scope of Work is still in progress

Overview of Scoping Process

- Initial Menu of Approaches
- Public Scoping Workshop – Oct 7
- Written Comments
- Proposed Scope of Work
- Science Panel Review
- Economists Present Recommended Scope of Work

Levels of Analysis

Level I	Level II	Level III
Region-wide analysis	County-level analysis	Community-level analysis
Data already exists	Most data exists, some interviews necessary	Requires many direct interviews
"Off the shelf" models	Some model refinements	Considerable model refinements
Generalized results	County-level results	Most precision, some site-specific results



Summary of Component Investigations

Economic Profile of the Coast

- Level III analysis
- Research and provide economic base: coast-wide, and by county.
- Socioeconomic data from US census, REIS, BEA, WA Employment Security.
- Trends affecting coastal economy; near-term economic conditions for major sectors.

Economic Profile of Tribal Communities

- Level II analysis
- Research and provide socioeconomic profile of the five communities.
- Published sources, plus direct interviews with the Tribes.
- Trends affecting coastal economy; near-term economic conditions for major sectors.

Commercial Fishery Profile of the Coast

- Level III Analysis
- Develop profile of commercial fisheries by species, ports of landing, processors, market forms, and markets. Include discussion of trends, including data by port.
- Profile of tribal fisheries and ports; published information and interviews with tribal fisheries managers.
- Estimate economic contribution and quantitative impacts by location of proposed uses.

Commercial Fishery Profile of the Coast

- Conduct key informant interviews, for expenditure patterns and market flows.
- Attempt to account for "distant fisheries" income in profile.
- No statistically significant survey will be conducted.

Shellfish Aquaculture on the Coast

- Level III analysis
- Develop profile of aquaculture production, processing, and markets, including future trends. Conduct key informant interviews.
- Update IMPLAN models to incorporate new data; updatable in the future.
- Estimate economic contribution of aquaculture by location.

Ecosystem Services Values

- Level II analysis
- Discuss general concepts, and identify coastal sites that are providers of relatively high level of ecosystem services.
- Incorporate examples of valuation from within the coast and the rest of the state.

Recreational Fishing

- Level II analysis
- Develop profiles of recreational fishing activity by mode of fishing (shore, charter-boat, and private boat).
- Incorporate published participation rates, spending profiles by activity type, and trends.
- Estimate economic contribution.

Recreation and Tourism

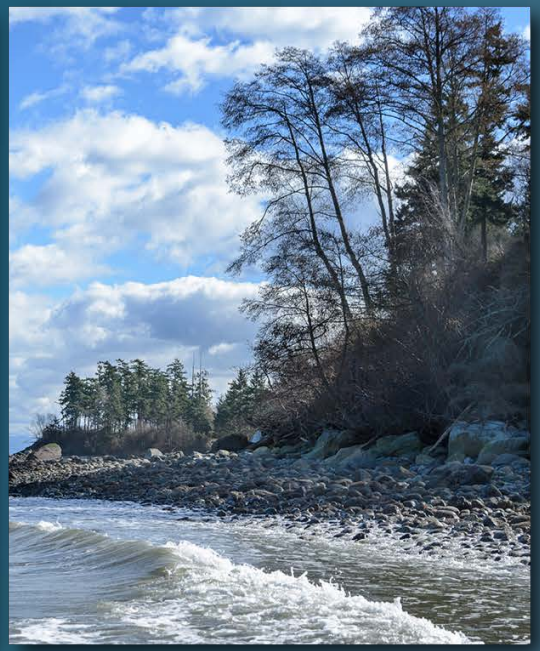
- Level II-1/2 Analysis
- Develop profile of recreation, including activities and participation rates and trends.
- Incorporate Surfrider study on participation.
- Review and utilize published spending profiles by activity type.
- Research future trends, incorporating broader regional or national research on participation.
- Estimate economic contribution.

Social and Cultural Profiles

- Level II analysis
- Provide social impact information based on NOAA research, addressing effects by port or community and reservation.
- Conduct community level interviews.
- Coordinate with Social Indicators Development Process for MSP – NFSC.

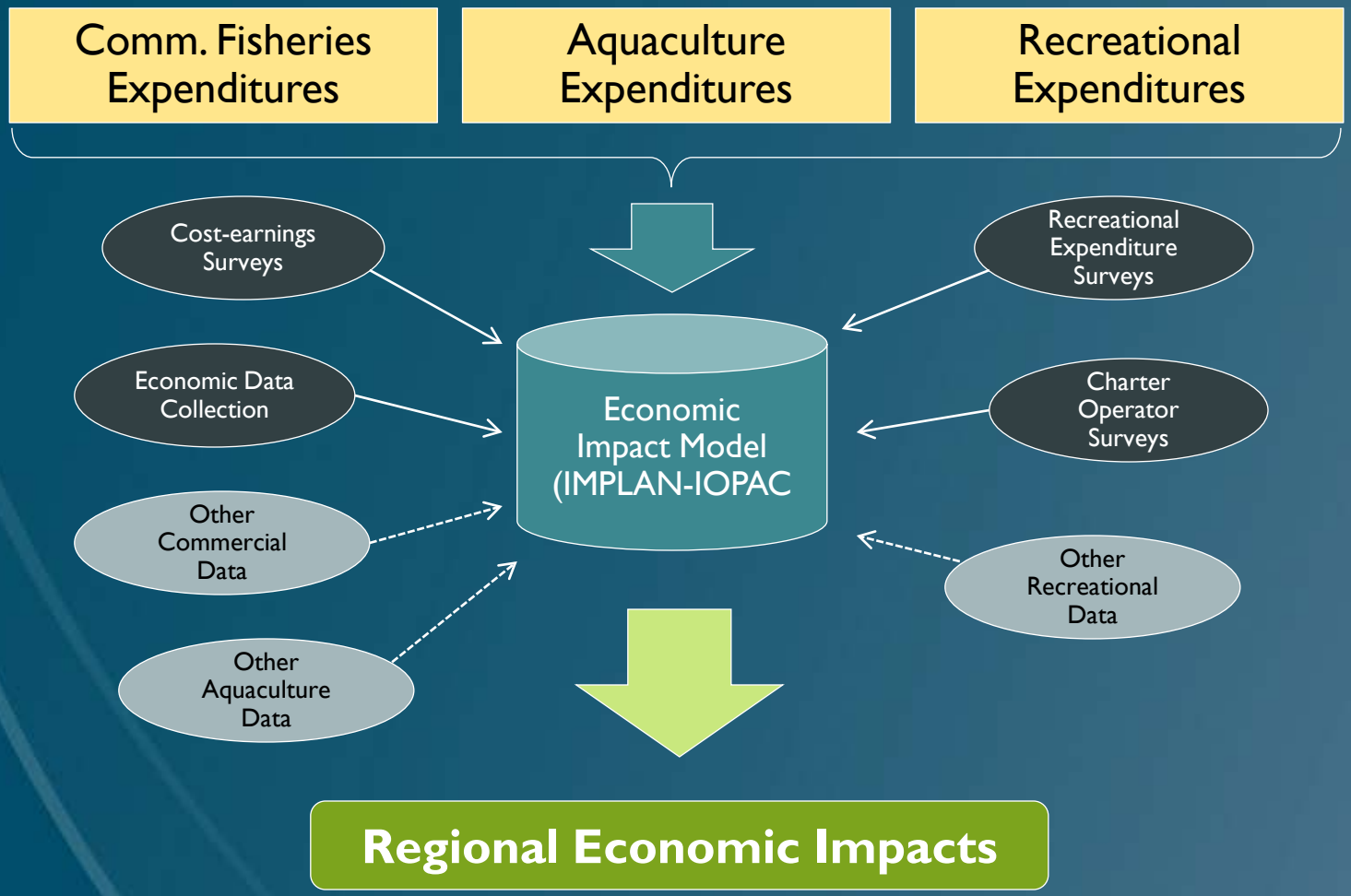
Risk and Vulnerability Analysis

- Level II analysis
- Qualitative assessment of resiliency and vulnerability of (1) commercial fishing and (2) aquaculture sectors to "catastrophic events."
- Industry research, key informant interviews, and identify sources of financial relief.



Economic Impact Measurement

Data for Economic Impact Modeling



Regional Impact Models

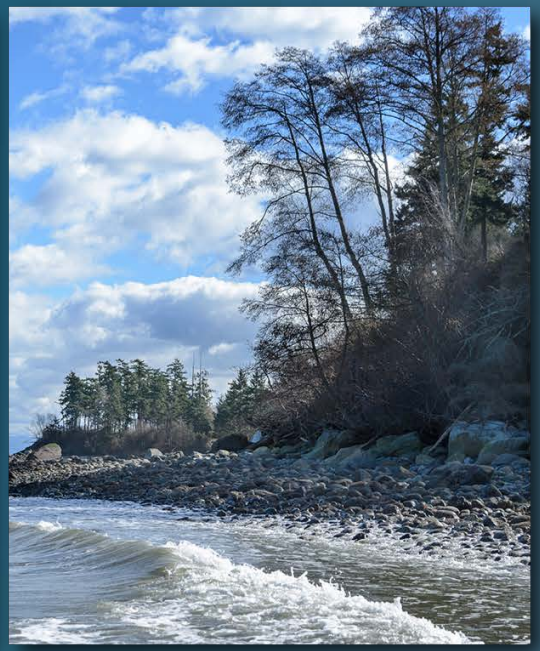
- Coast-wide Model
  - Pacific, Grays Harbor, Jefferson, Clallam combined
  - Post-processing can identify community or sub-area impacts
- State-wide Model
  - Captures effects of coast activity within larger area

Scenarios for Impact Analysis

- Scenarios refer to potential new uses of Washington's coastal waters
  - Marine Renewable Energy (Wind, Wave, Tidal)
  - Aquaculture (new types, locations)
  - Mining
  - Bioextraction
  - Dredge Disposal (in new locations)
- Coordinate with the State on project specifics

Post-June 2015 Opportunities for Additional Analysis

- Tribal Economic Profile: additional interviews and data analysis (six months)
- Commercial Fishing: statistical survey (one year)
- Commercial Aquaculture: statistical survey of growers and processors (six months)
- Recreational Fishing and Recreation: incorporate Surfrider results (three months), and conduct county-level analyses (six months)
- Ecosystem Services: site-specific valuations (six to twelve months)
- Social and Cultural Values: additional interviews (six months)



Wrap Up & Next Steps

"Total" Economic Impacts

- Direct Effects
  - Original round of expenditures
- Indirect Effects
  - Spending by businesses that sell to the directly-affected businesses (subsequent rounds)
- Induced Effects
  - Additional economic activity generated by local households' spending of wages and profits

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Understanding the Environmental Effects of Ocean Renewable Energy

Simon Geerlofs
Andrea Copping
Luke Hanna
Jonathan Whiting
Pacific Northwest National Laboratory

Pacific Northwest National Laboratory

Washington Coastal Marine Advisory Council Meeting—October 22, 2014

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Ocean Energy Sits Within a Context of Multiple Uses and Values

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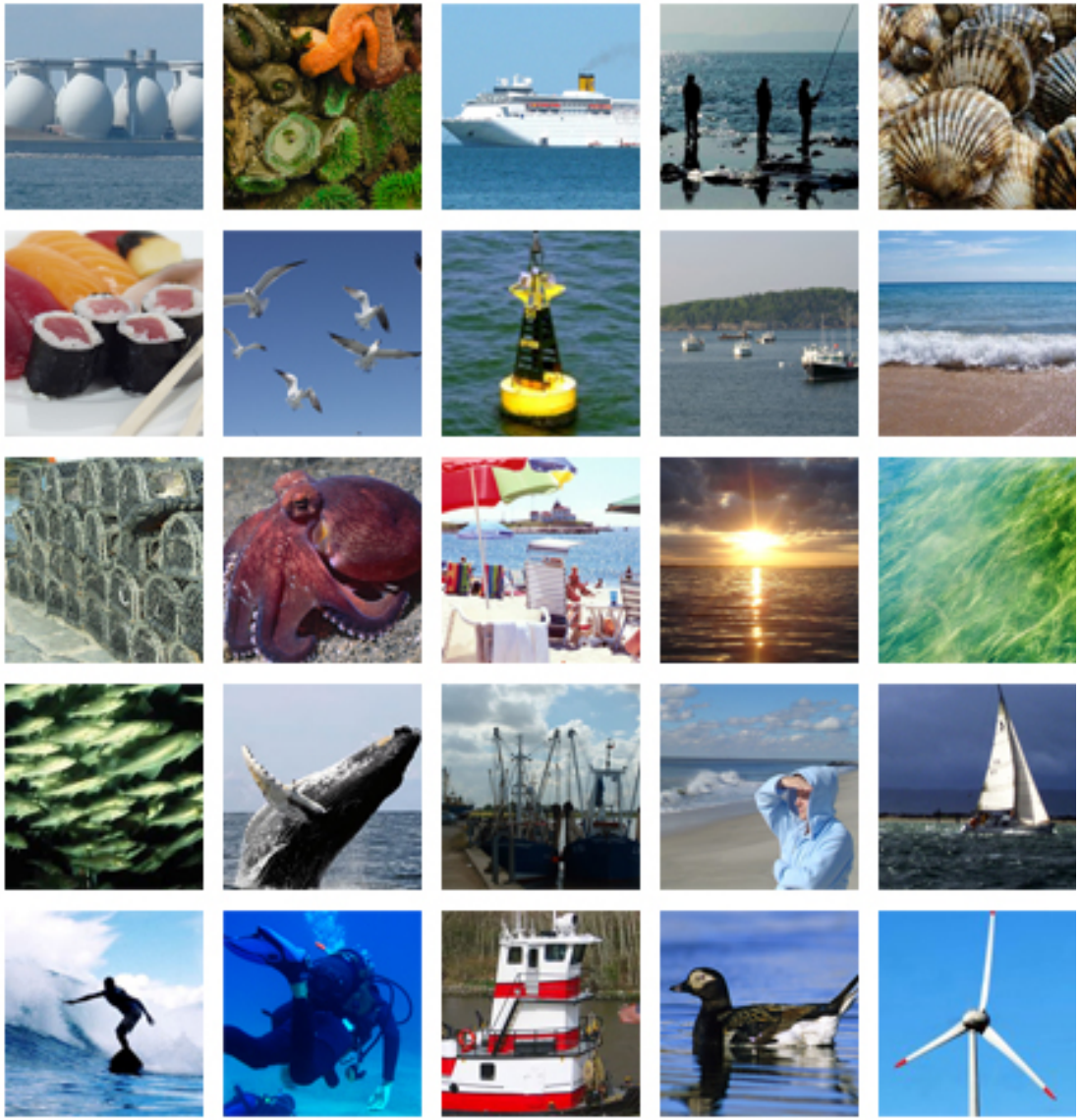
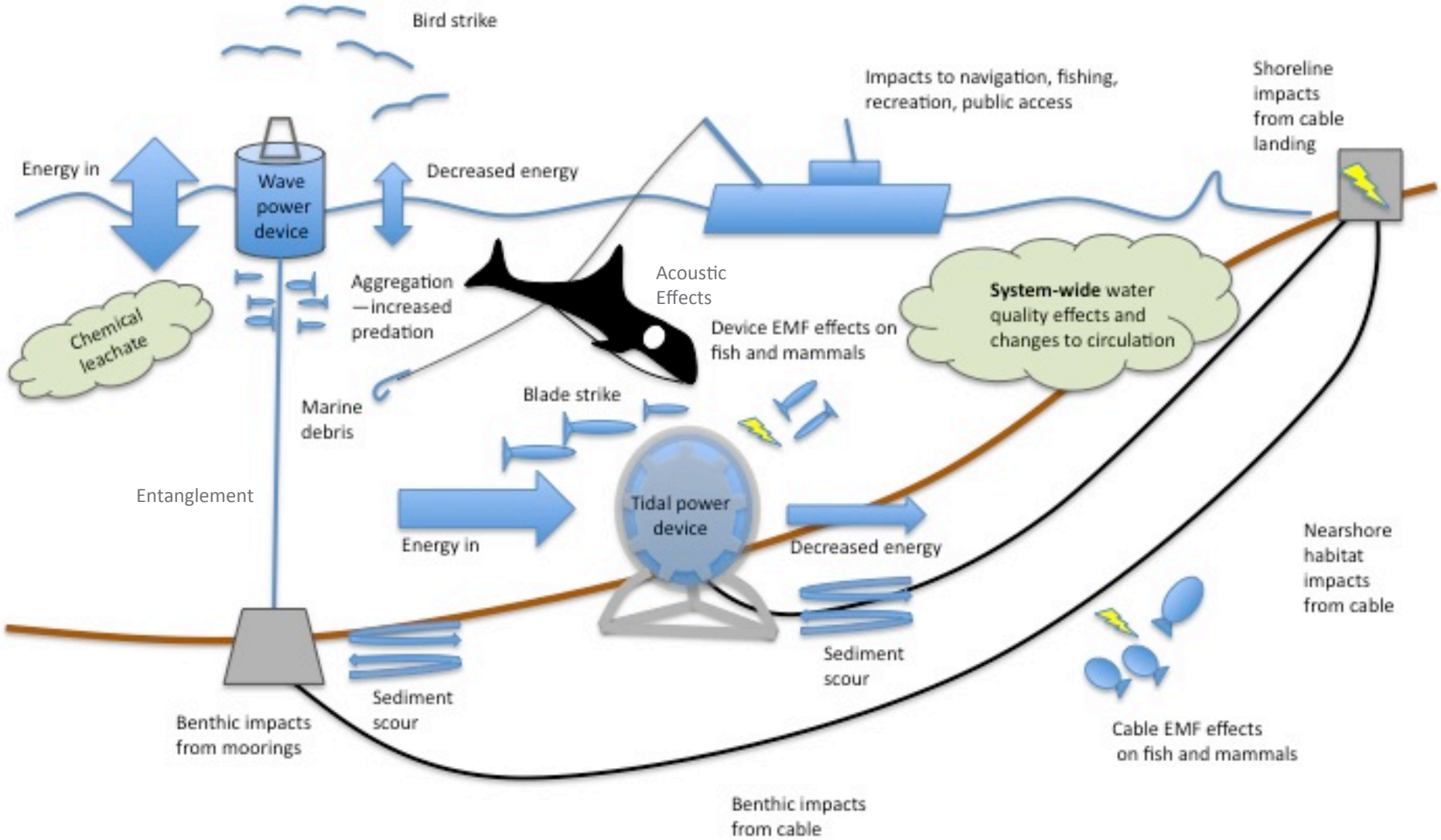


Potential Environmental Impacts of Marine and Hydrokinetic Energy Devices



Many potential issues, how can we understand and mitigate risks?

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- How do we prioritize scarce research dollars to understand and resolve priority or relevant risks?
- Hard questions=high degree of regulatory risk, low probability of occurrence, little or no existing data.
- How do we avoid duplication of effort and learn from research happening beyond WA?
- How can we maximize learning during initial demonstration projects?
- How do we scale our understanding from pilot to commercial projects?

Identify and Address Environmental Risks

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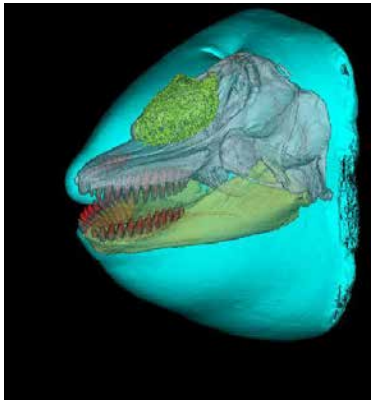
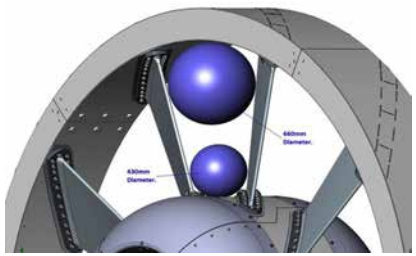
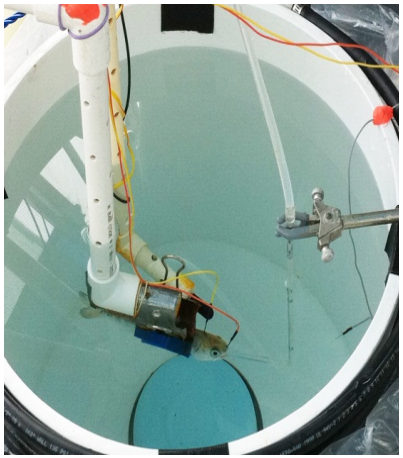
Generalized Approach:

- Assess risks based on scientific understanding and regulatory requirements
- Identify critical gaps
- Bring research to bear to fill gaps
- Advanced computational modeling to predict impacts where studies are impractical
- Connect stakeholders to knowledge
- Collaborate and mitigate







Today….Access to Information, Update on Research, Demonstration Projects, Discussion

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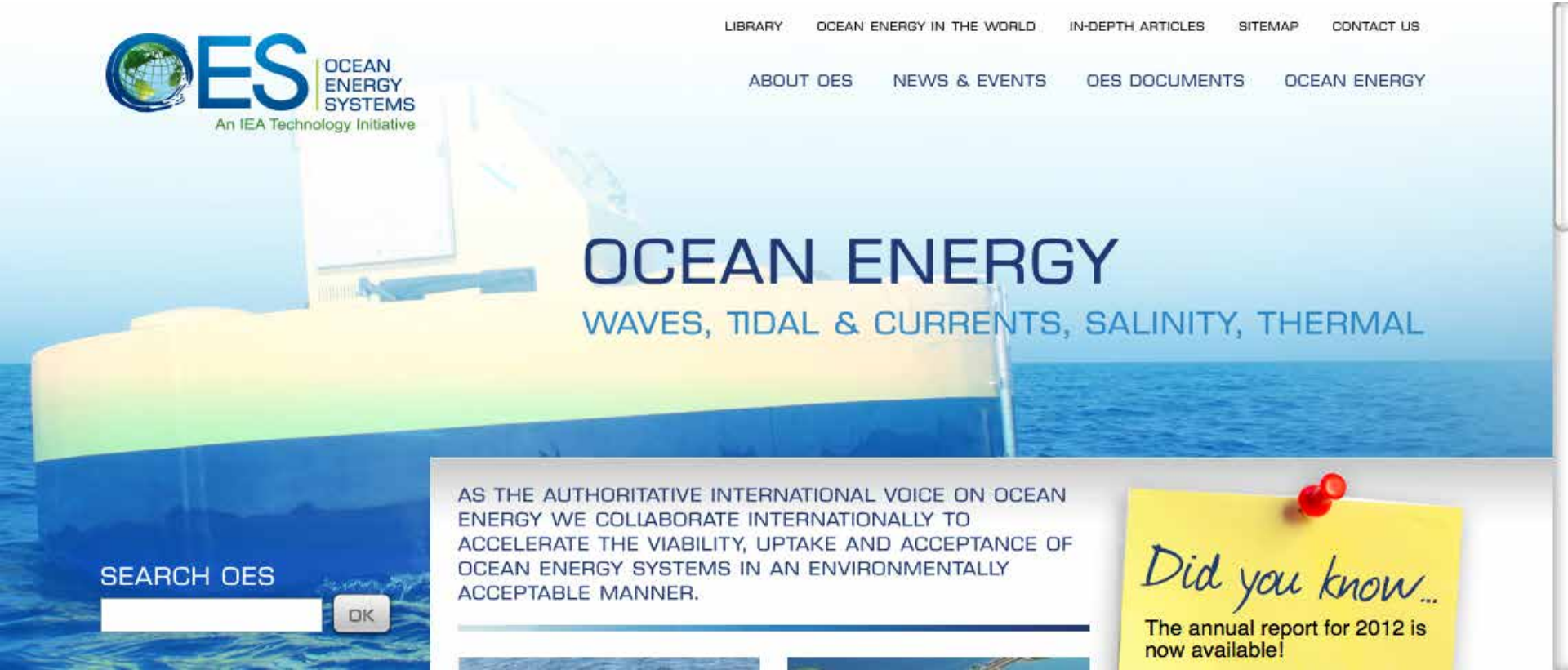
- Access to information and international connections: Annex IV (MHK) and Task 34 (Wind)
- Information available on *Tethys*: a tour of the website
- Recent PNNL Research on OSW and MHK Effects:
  - Marine Mammal Strike
  - Entanglement
  - Acoustics
  - EMF
  - Navigation Risks
  - Birds and Bats
- Learning by doing: Principle Power's WindFloat Pacific project
- Other resources

Annex IV – A Concept in Sharing Information and Analyses Internationally

- OES ExCo approved Annex IV phase 1 in 2009 (now in phase 2)
- Proposed by US; US Dept of Energy as Operating Agent
- Other US federal partners: BOEM, FERC, NOAA
- Twelve Annex IV member nations: US, New Zealand, Canada, Sweden, Spain, Ireland, Portugal, China, Japan, United Kingdom, Norway, and South Africa



Purpose of Annex IV Database

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- Annex IV is designed to:
  - "*Facilitate efficient government oversight of ocean energy systems development by expanding our baseline knowledge of environmental effects and monitoring methods;*
  - *"Ensure that existing information and data on environmental monitoring are more widely accessible to those in the industry; national, state, and regional governments; and the public; and*
  - *"Facilitate knowledge and information transfer"*.

- The Annex IV database, housed in *Tethys* provides the basis for bringing together information from international sources on:
  - Monitoring results from deployed wave and tidal devices and arrays;
  - Results of research studies in the field, laboratory, and modeling; and
  - Provides a searchable, accessible, source of that information.

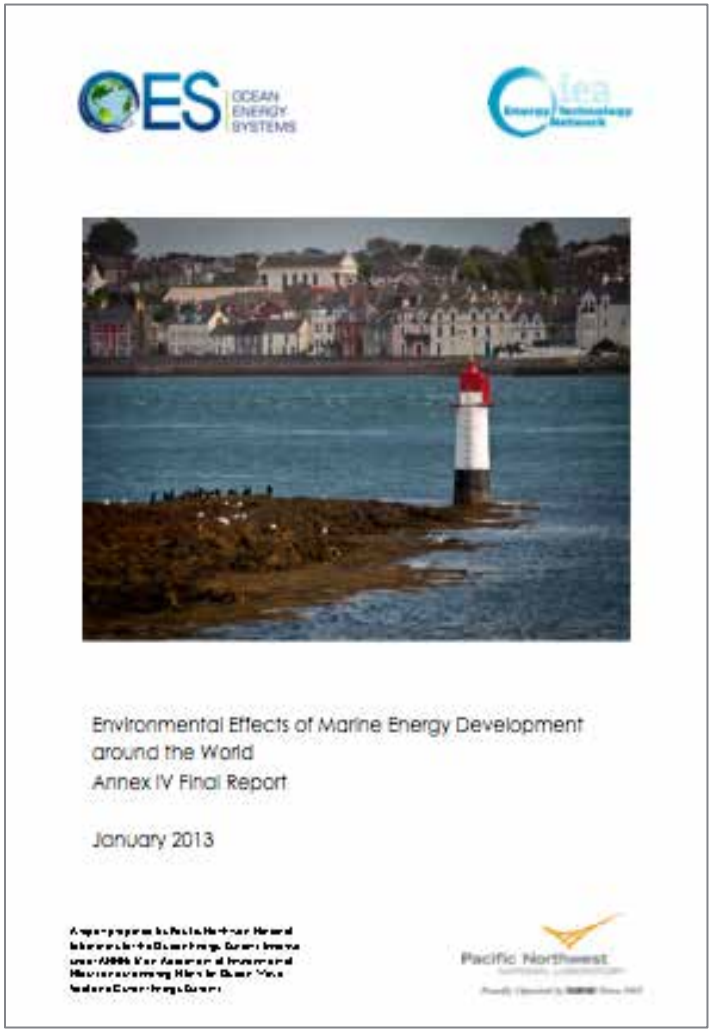
TETHYS

Environmental Effects of Renewable Energy from the Sea

tethys.pnnl.gov

- Online knowledge base that assembles literature and information dealing with environmental effects of offshore renewable energy
  - Search with key words, or by stressors and receptors
- Also has offshore wind literature which can be pertinent
- Provide recordings of webinars and expert forums on environmental issues and concerns

Annex IV Phase 1 Final Report



Available on Tethys…

- Three Case Studies:
  - Interaction of Marine Animals with Turbine Blades
  - Effects of Acoustic Output from Tidal and Wave Devices on Marine Animals
  - Effects on Physical Systems
- Collect and synthesize all available information on these three issues of international regulatory concern.

Recent Research at PNNL (lab, field, models)

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- Marine Mammal Strike (Tidal)
- Marine Mammal Entanglement (Wave)
- Acoustics (Tidal)
- EMF
- Navigation Risks (OSW)
- Birds and bats (OSW)
- Coastal and Marine Spatial Planning

Marine Mammal Tidal Turbine Strike Analysis

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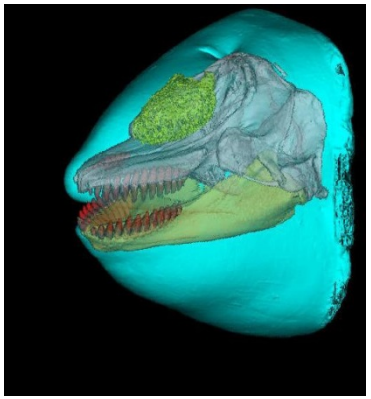
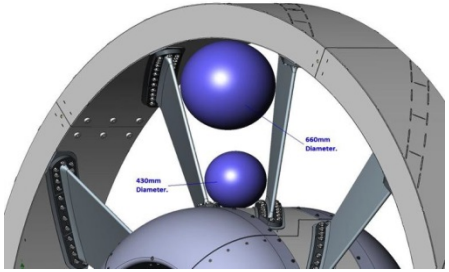
Origin:

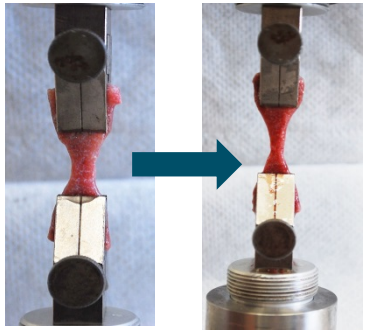
- Regulatory concern for outcome of tidal turbine blade strike on SRKW in Puget Sound





Methods and Results:

- Determine dimensions and biomechanical properties of 3 marine mammal species
- Determine strike forces from 3 tidal turbine designs
- Model interaction of strike from turbine on marine mammals
- Outcome of SRKW and OpenHydro = little damage, akin to bruising



Outcomes:

- First version of SRKW modeling used by FERC, NOAA to continue licensing process for SnoPUD project in PS
- Other marine mammal results to be used in simplifying permitting processes

Marine Mammal and Wave Power Entanglement Risks

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Origin:

- Anecdotal concerns about potential for marine mammals to become entangled in WEC mooring lines

Methods and Results:

- Drawing from existing literature, information on entanglement of marine mammals were summarized.
- Assess whale behavior in the presence of analogs to WEC mooring lines, including fishing gear, aquaculture facilities, and other buoys.
- Assess likely west coast WEC mooring configurations.
- Conclusions drawn through case study approach.

Outcome:

- Literature review and case study offers a departure point for discussion of this issue..
- high tension mooring lines on WEC devices are unlikely to entangle marine mammals due to the buoyancy of the device and the inability of the line to be pulled down and wrap around the whale.

EMF Experimental Setup

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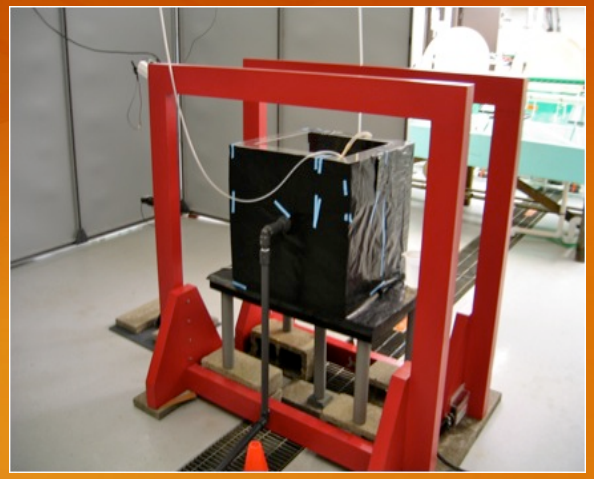
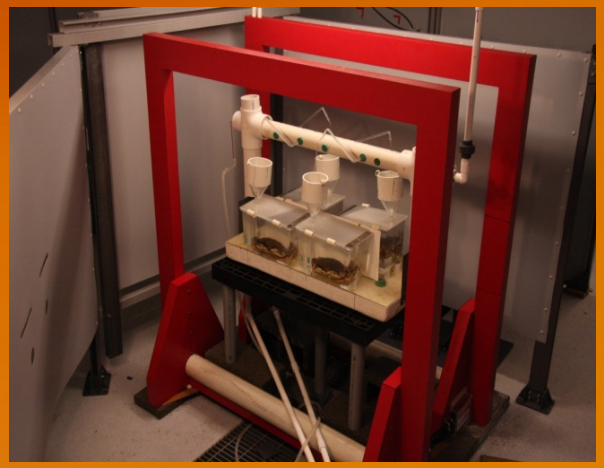
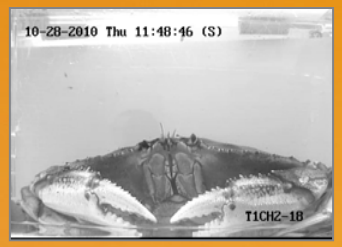




Helmholz setup for constant EMF exposure experiments for: salmon, Atlantic halibut, Dungeness crab

Recording system and visual blinds Around Helmholtz coil

Control and exposure for decaying EMF field, for avoidance/attraction experiments



Experimental Outcomes – Screening Level

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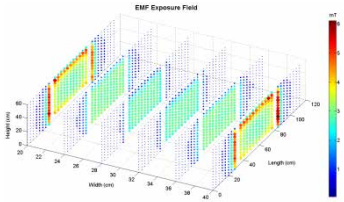
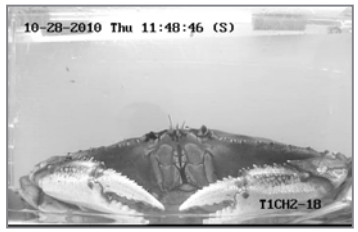
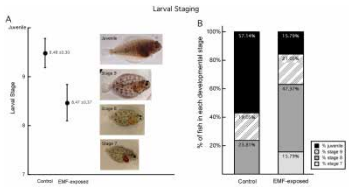
Species Tested	Testing Endpoint	Result
Juvenile Coho salmon	Decreased swimming as alarm- response behavior	Inconclusive @ 3mT
Juvenile Coho salmon	Melatonin/cortisol production as indication of stress	Decreased melatonin levels at 3 and 0.13mT but NSS
Rainbow trout eggs	Survival and development	SS delayed development @ 3mT for one exposure group; other exposure group NSS
Atlantic halibut embryos	Growth and development	Decreased growth and development @ 3mT but NSS
California halibut embryos	Growth and development	No difference between test and control exposures
Adult Dungeness crab	EMF detection as change in antennular flicking rate	No difference between test and control exposures
Adult Dungeness crab	Interference in food detection ability	Decreased flicking rate @ 3mT but NSS
Adult Dungeness crab	Avoidance or attraction to EMF	No difference between test and control exposures







NSS: Not statistically significant at p = 0.05. SS: Statistically significant at p = 0.05

Acoustics Experimental Setup—Tidal Power

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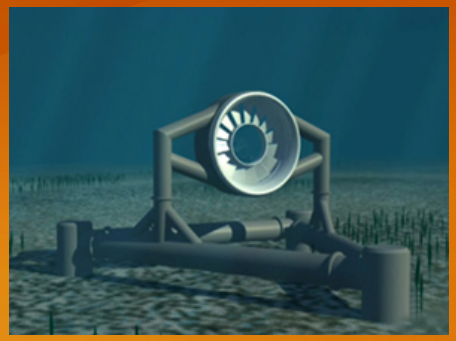
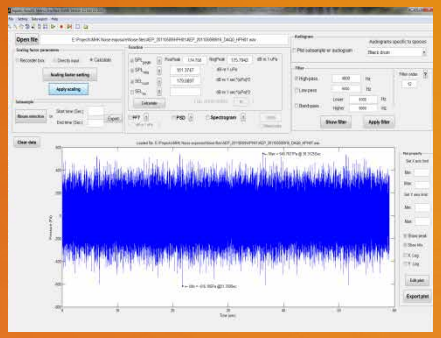
Deck-top underwater sound recorder

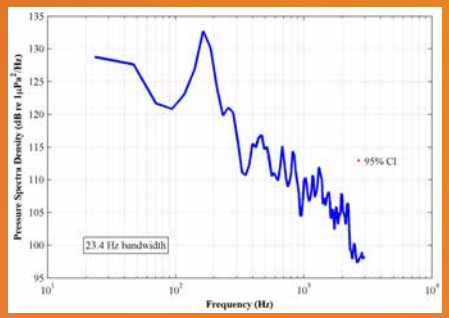


Turbine noise simulated from Open Hydro turbine at EMEC

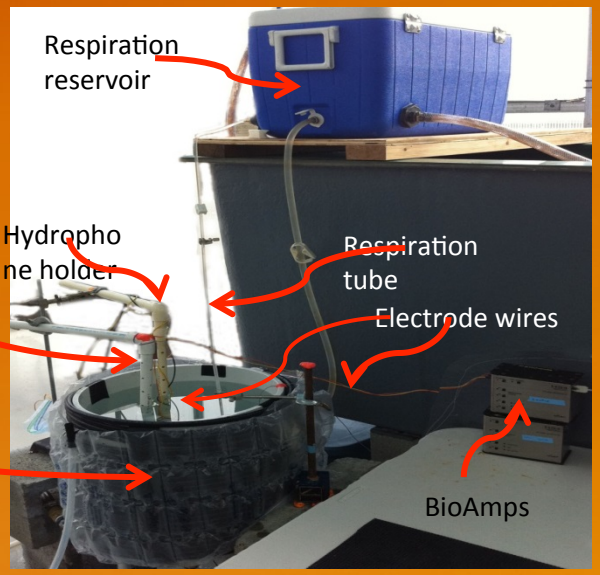


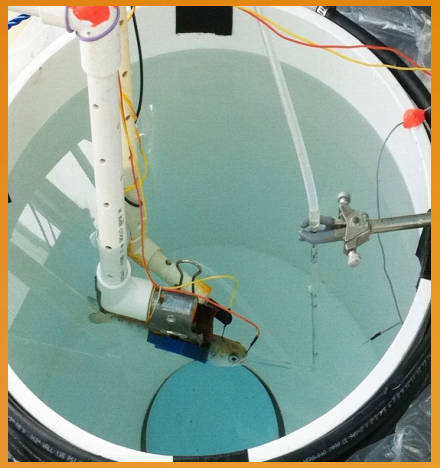
Sound file in PNNL GUI, written in Matlab

Cultured juvenile Chinook salmon



Recorded sound spectra for 6m OpenHydro tidal turbine





Experimental setup for Auditory Evoked Potential (AEP)

Acoustic Experimental Outcome – Juvenile Chinook Salmon

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Species Tested	Testing Endpoint	Result
Juvenile Chinook salmon	Tissue damage	SS low levels of tissue damage observed @ 155-163dB. Low physiological cost to fish.
Juvenile Chinook salmon	Hearing loss	NSS difference between test and control exposures @ 155-163dB

NSS: Not statistically significant at p = 0.05. SS: Statistically significant at p = 0.05

Detecting Birds and Bats—Offshore Wind Technical Approach

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Origin

- Remote monitoring and automated processing of birds and bats in offshore environments reduces need for human observers at sea.

Technical Approach

- Algorithms for processing thermal infrared (IR) video to automatically detect and characterize species of concern
- Developed methods for post-processing track statistics to quantify the number of birds and bats, and to classify the species.

Outcome:

- Algorithms developed and implemented, and software has been demonstrated, made available to collaborators. 93% detection rate.

Risk Assessment for Marine Vessel Traffic and Wind Energy Development in the Atlantic

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Origin:

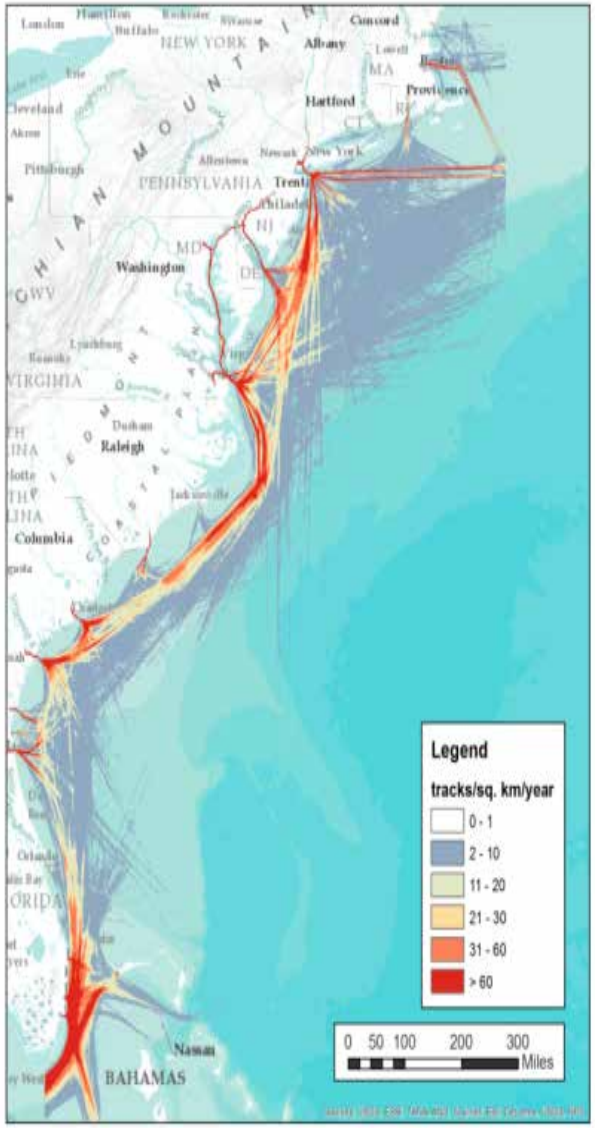
- Coast Guard objections to Wind Energy Areas (WEAs) due to potential impact for vessel traffic

Approach:

- Develop predictive capabilities to determine the interaction of shipping with the presence of OSW
- Methodology: data-driven modeling process using AIS data extraction and filtering

Outcomes:

- Visual displays of existing shipping routes and operational areas
- Creation of navigational risk scenarios, using decision tree and expert panel input
- Estimation of Risk
  - Counted vessel interactions during a 2-week model run
  - Compared base case versus wind farm case
  - **<1% increase in collisions, 44% decrease in groundings**



Geospatial Analysis of Technical and Economic Suitability for Ocean Energy Development

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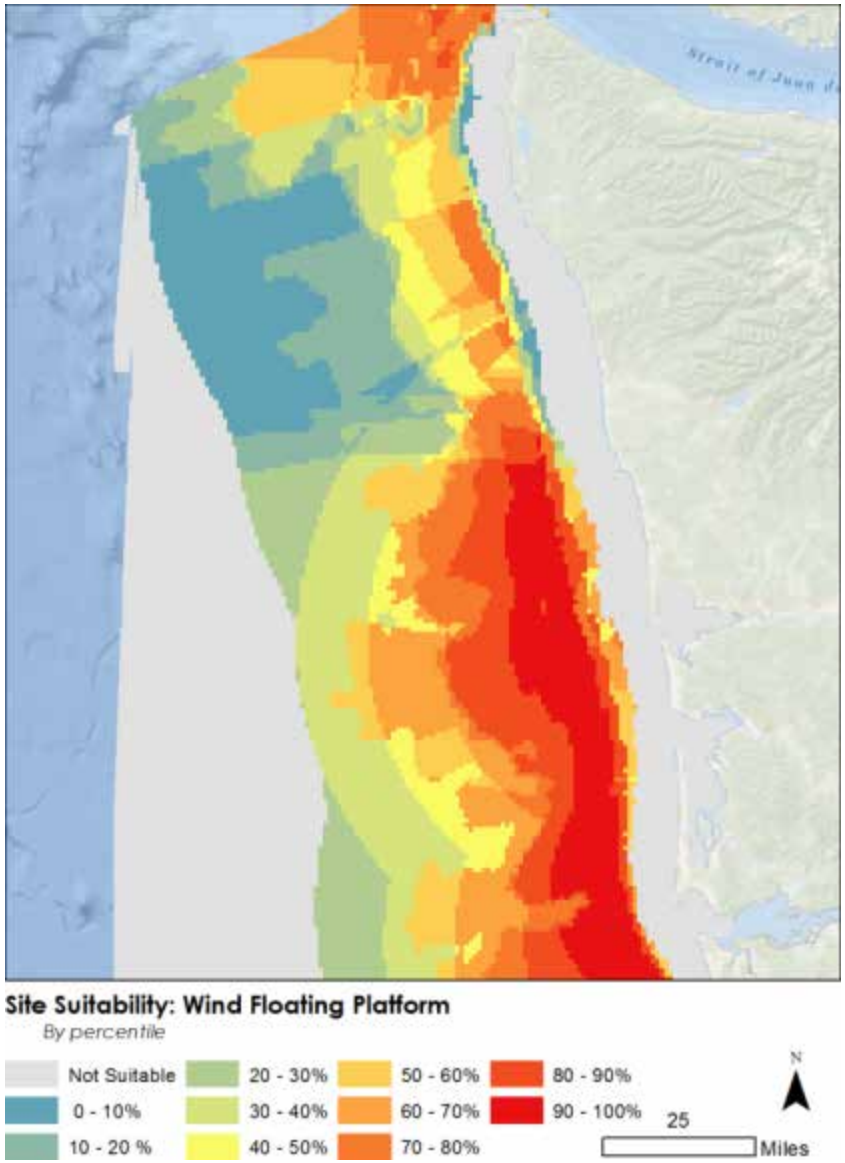

- **Challenge:** Focusing planning discussions on areas appropriate for energy development
- **Approach:** expert interviews + spatially explicit multi-criteria decision analysis
  - Analysis of suitability via attributes of site quality, grid connection, and shore-side support
  - Spatial coverage, technology and clients
    - WA outer coast, ocean energy = WA DNR
    - OR Outer Continental Shelf (OCS), wave and offshore wind = DOI BOEM
    - N CA coast and OCS, offshore wind = DOE EERE Wind Power
- **Outcome:** Development of maps depicting locations with high potential for renewable energy production with minimal potential for conflicts with other existing uses or sensitive environments.

Learning by Doing—Demonstration Projects: Principle Power and the WindFloat Pacific

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- Principle Power's WindFloat Pacific Project
  - Located off of Coos Bay, OR
- Chosen as on of the US Department of Energy's Offshore Wind Advanced Technology Demonstration Projects
  - Originally chosen as one of 7 in country
  - Only project on west coast
  - Only floating technology
- PNNL is responsible for overseeing the environmental permitting and monitoring

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Site: Key Location Features

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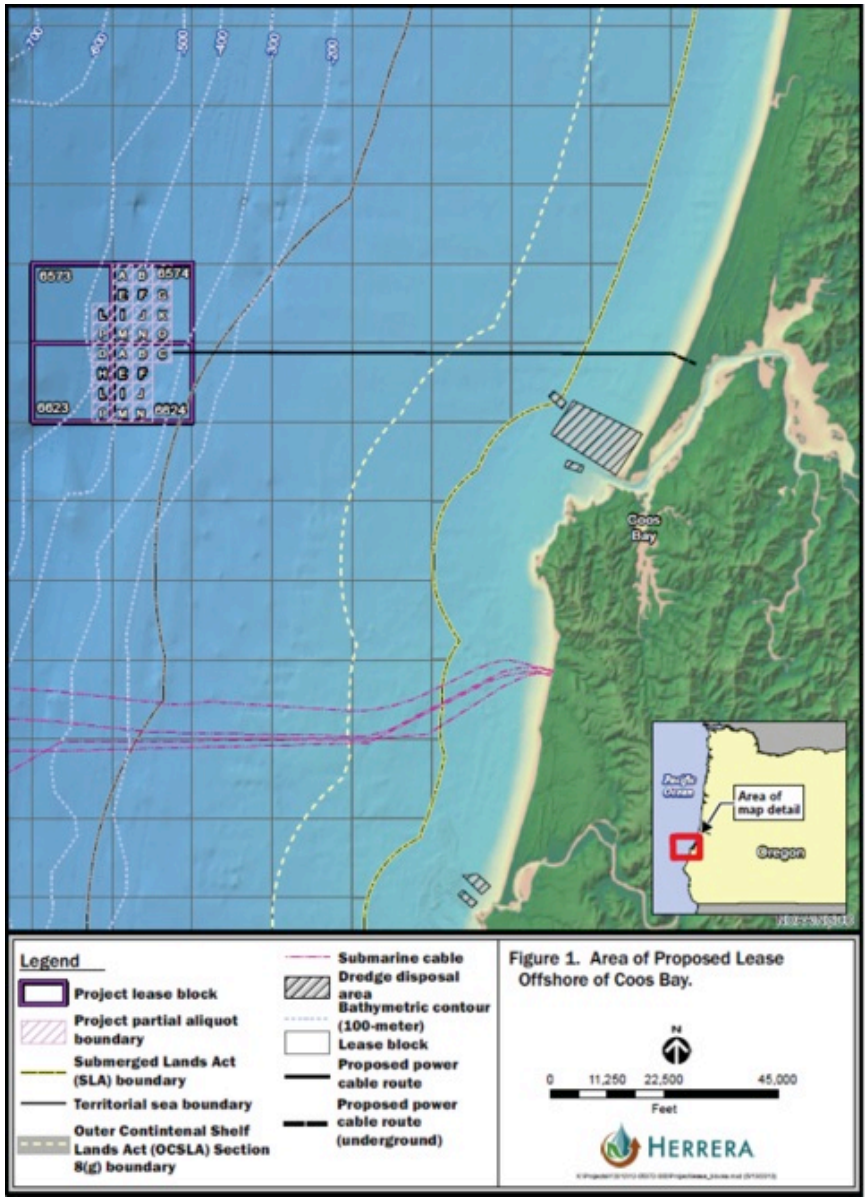
- Lease application filed with BOEM May 14th 2013
- Application area for OCS lease blocks (and aliquots) to BOEM
- 15 – 18 miles offshore
- Up to five floating wind platforms, one turbine per platform
- Up to 30 MW total (6 MW turbines)
- Project will be in about 350+ meters (~1200 feet) of water
- Generally sandy/silty bottoms



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Site Characterization Completed and Data Collected to Date

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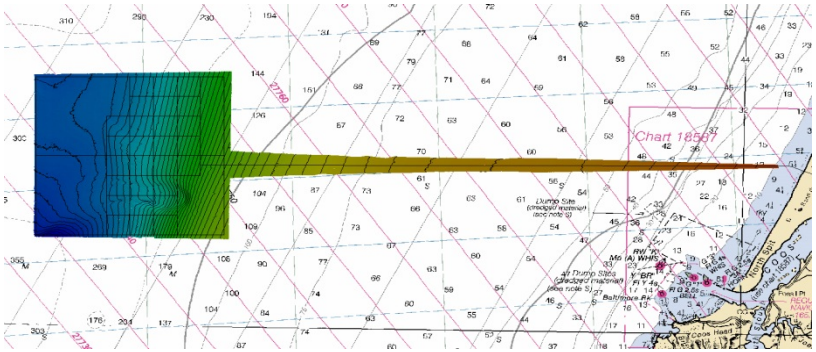
2013 surveys and analyses as defined by BOEM/NEPA:

1. Measuring water movement
2. Acoustic monitoring for marine mammals
3. Surface sediment sampling
4. Seabird surveys
5. Bathymetric survey
6. Analysis of visual effects of WFP



2014 surveys:

1. Measuring water movement
2. Acoustic monitoring for ambient marine mammals
3. Side scan sonar
4. Magnetometer
5. Sub-bottom profiling
6. Seabird and marine mammal surveys
7. Additional analyses of visual effects

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Pre-Install and Post-Install Monitoring

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Planning in cooperation with BOEM, NOAA Fisheries, USFWS, OR state agencies:

- Seabirds
  - Continuous line surveys
  - Radar and infrared video
- Marine Mammals
  - Passive acoustic detection system
  - Aerial surveys
- Sea Turtles
  - Continuous line surveys
- Bats
  - Anabat Deployment (PMEC or WindFloat)
- Fish
  - ROV
  - Fish Tag Receivers on WindFloat
- Benthic Habitat
  - ROV surveys w/ inspections

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Partners, Collaborators, and Resources (just a partial list…)

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- NW National Marine Renewable Energy Center
  - UW and OSU (and now including University of Alaska Fairbanks)
  - OSU Wave Energy Testing Sites
  - UW Tidal Power Testing Sites with Navy
  - Field Experiments and Deployments
  - Tremendous Technical Resource for the Region
- DOE and National Laboratories
  - DOE funds much of our research—NREL, SNL, and ORNL as well
  - DOE investing in demonstrations, instrumentation development, data processing, monitoring platforms, data and information access
- Bureau of Ocean Energy Management
  - BOEM Pacific funding environmental studies, as well as leasing for PP and OSU projects
- Oregon Wave Energy Trust
  - Excellent resource on wave energy issues—OR focused, national impact
- State Energy Offices—WA (Commerce), OR (ODOE)
  - Fund research, technical assistance, policy

Thank you!!

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