BOEM

Bureau of Ocean Energy Management

OFFICE OF ENVIRONMENT

Pacific Office • Camarillo, CA

Understanding the Potential Effects of Offshore Wind Development to Fishes, Essential Fish Habitat, and Fisheries

Donna M. Schroeder

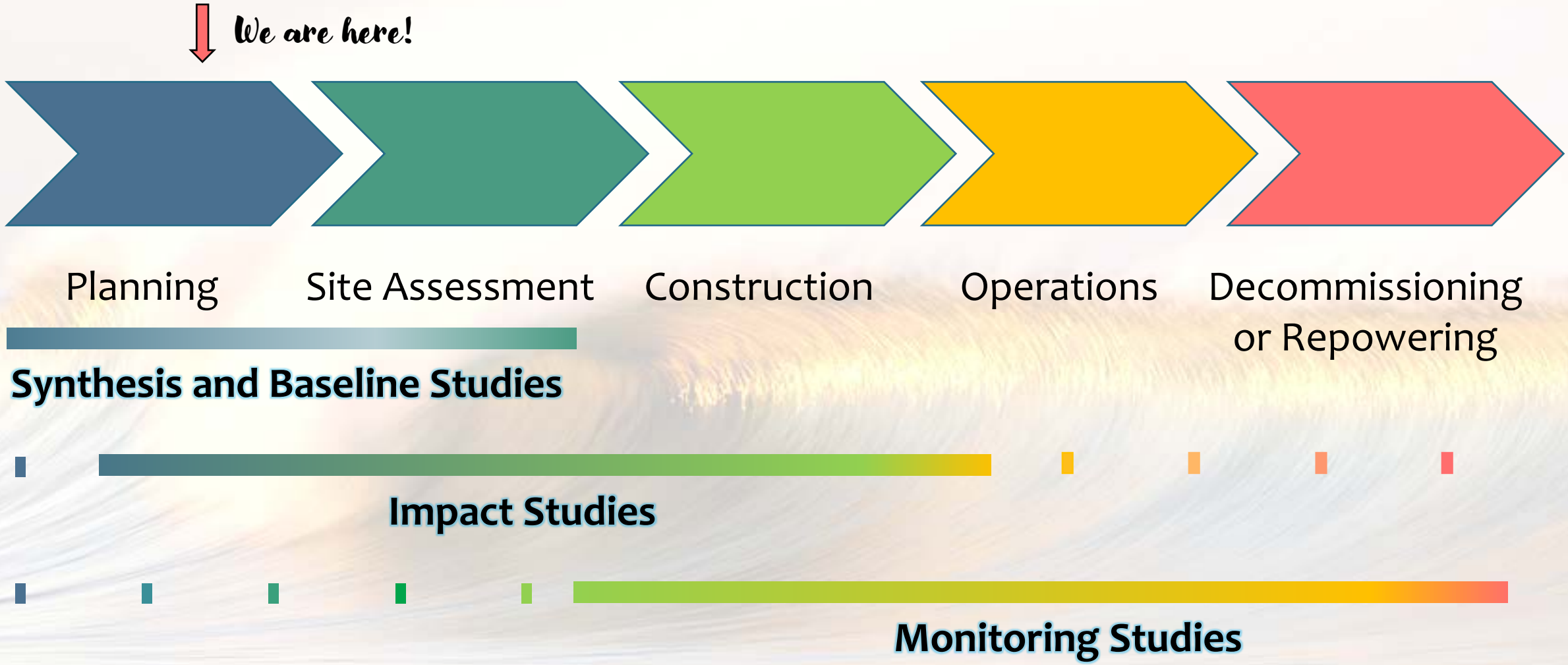
West Coast Renewable Energy Science Exchange, March 11, 2020

Essential Fish Habitat, Fishes, Fisheries

Outline:

- Overview of a Project Life Cycle and Approach to Studies
- Examples of Completed or Ongoing Studies of Different Types
- Where to Find Information

Type of Study in Relation to Project Life Cycle



Synthesis of Information

OCS STUDY
MMS 2007- 038

Worldwide Synthesis and Analysis of Existing Information Regarding Environmental Effects of Alternative Energy Uses on the Outer Continental Shelf

July 2007

MMS U.S. Department of the Interior
Minerals Management Service

https://espis.boem.gov/final%20reports/4325.pdf

OCS STUDY
BOEMRE 2010-014

UPDATED SUMMARY OF KNOWLEDGE: SELECTED AREAS OF THE PACIFIC COAST

Final Report

https://espis.boem.gov/final%20reports/4955.pdf

2012 Oregon Marine Renewable Environmental Science Conference

https://espis.boem.gov/final%20reports/5255.pdf

Baseline gaps (Fishes)

- Seafloor characterization
- Identification of ecological hotspots
- Distribution non-commercial species

Impact assessment gaps (Fishes)

- Electromagnetic fields (EMFs)
  Sharks and rays, salmon, sturgeon, crustaceans
- Artificial reef effects/Fish aggregating devices (FADs)

Important monitoring concepts (Fishes)

- Endangered species
- EMF and Acoustic environment
- Artificial reef effects/Fish attraction devices (FADs)

- Importance of partnerships and existing programs
- Data sharing and clearinghouse
- Shifting baselines

Baseline Gap - Seafloor Characterization

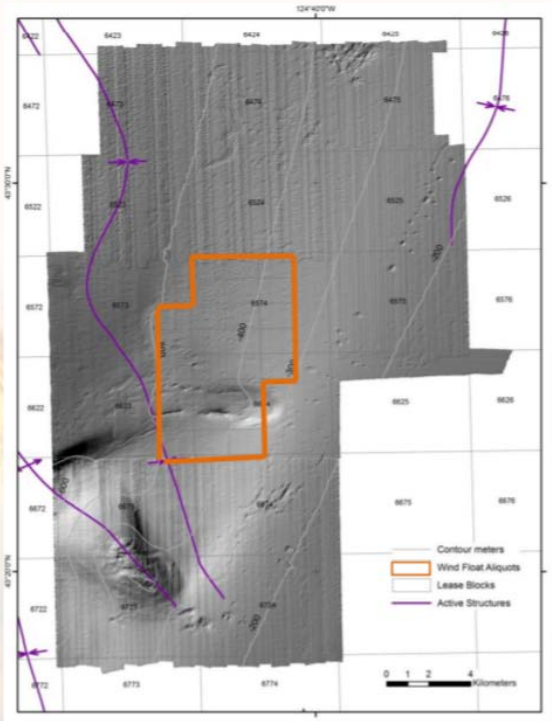
Baseline gaps

- Seafloor characterization
- Identification of ecological hotspots

Oregon OCS Seafloor Mapping: Selected Lease Blocks Relevant to Renewable Energy

Donna M. Schroeder, *Project Officer*
Bureau of Ocean Energy Management
Pacific Region

Guy R. Cochrane, *Principle Investigator*
U.S. Geological Survey
Pacific Coastal and Marine Science Center



https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/OR/2015-09-30_Schroeder_ORSciEx_seafloor_mapping.pdf

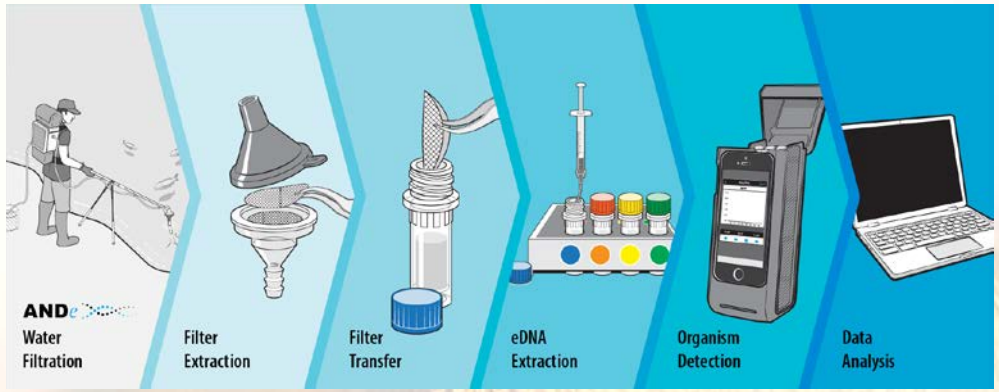
Coming soon!

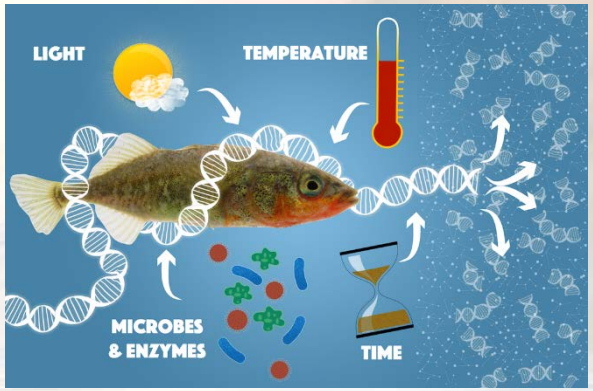
September 9, 2020 Science Exchange Seminar:
Overview of BOEM-funded Research about Benthic Habitats on the West Coast
Lisa Gilbane, Biologist, BOEM

Baseline Gap - Distribution Non-commercial Species

Baseline gaps • Distribution non-commercial species • Identification of ecological hotspots

Environmental DNA (eDNA)





Endangered Species Detections

Citizen Science

Difficult to Sample Habitats

Baseline Studies - Marine Biodiversity Observation Network

http://sbc.marinebon.org/

"Whales to Microbes"

Goals:

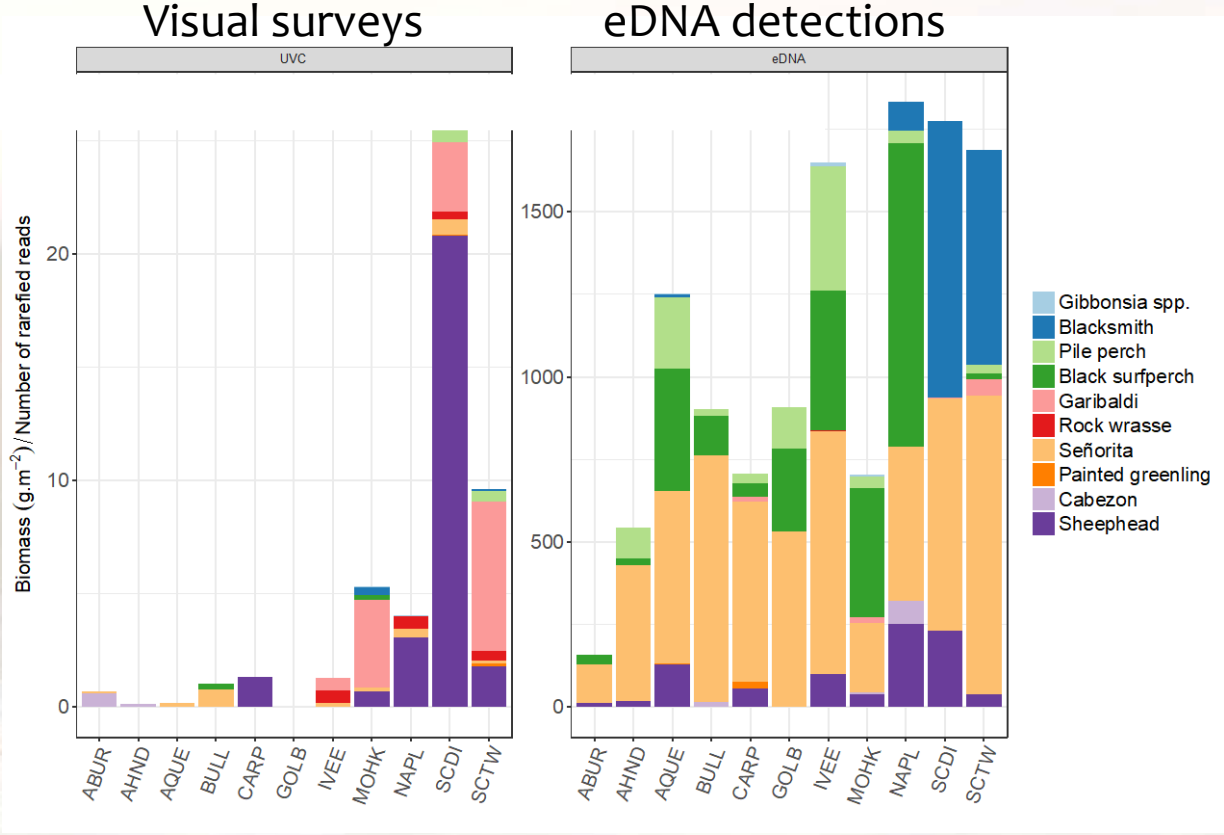
1. Integrate biodiversity data to enable inferences about regional biodiversity
2. Develop advanced methods using imagery and genomics for monitoring biodiversity
3. Implement a tradeoff framework that optimizes allocation of sampling effort

Baseline Studies - Marine Biodiversity Observation Network

MARINE BIODIVERSITY OBSERVATION NETWORK
SANTA BARBARA CHANNEL

MBARI

Comparing Visual Surveys and eDNA Detections in Temperate Rocky Reef Communities



BOEM Bureau of Ocean Energy Management

U.S. DEPARTMENT OF THE INTERIOR MARCH 3, 1849

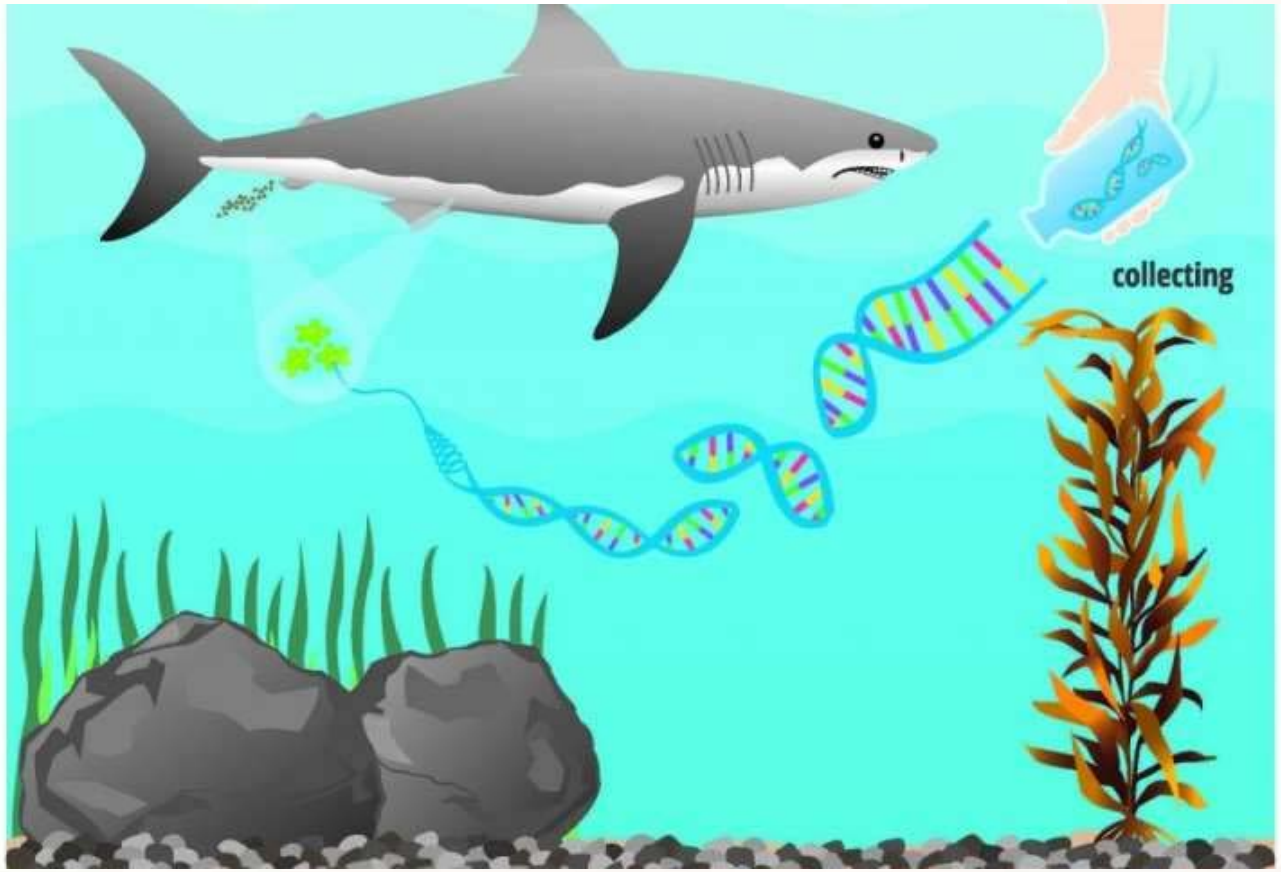
Baseline Studies - Marine Biodiversity Observation Network

MARINE BIODIVERSITY OBSERVATION NETWORK
SANTA BARBARA CHANNEL

eDNA

Detecting Southern California's White Sharks With Environmental DNA

Kevin D. Lafferty[1,2], Kasey C. Benesh[3], Andrew R. Mahon[3], Christopher L. Jerde[2] and Christopher G. Lowe[4]*



Impact Assessment

Effects versus Impacts

Effects – "something happened"
Impacts – describe changes with
- Intensity
- Spatial extent
- Duration (time)

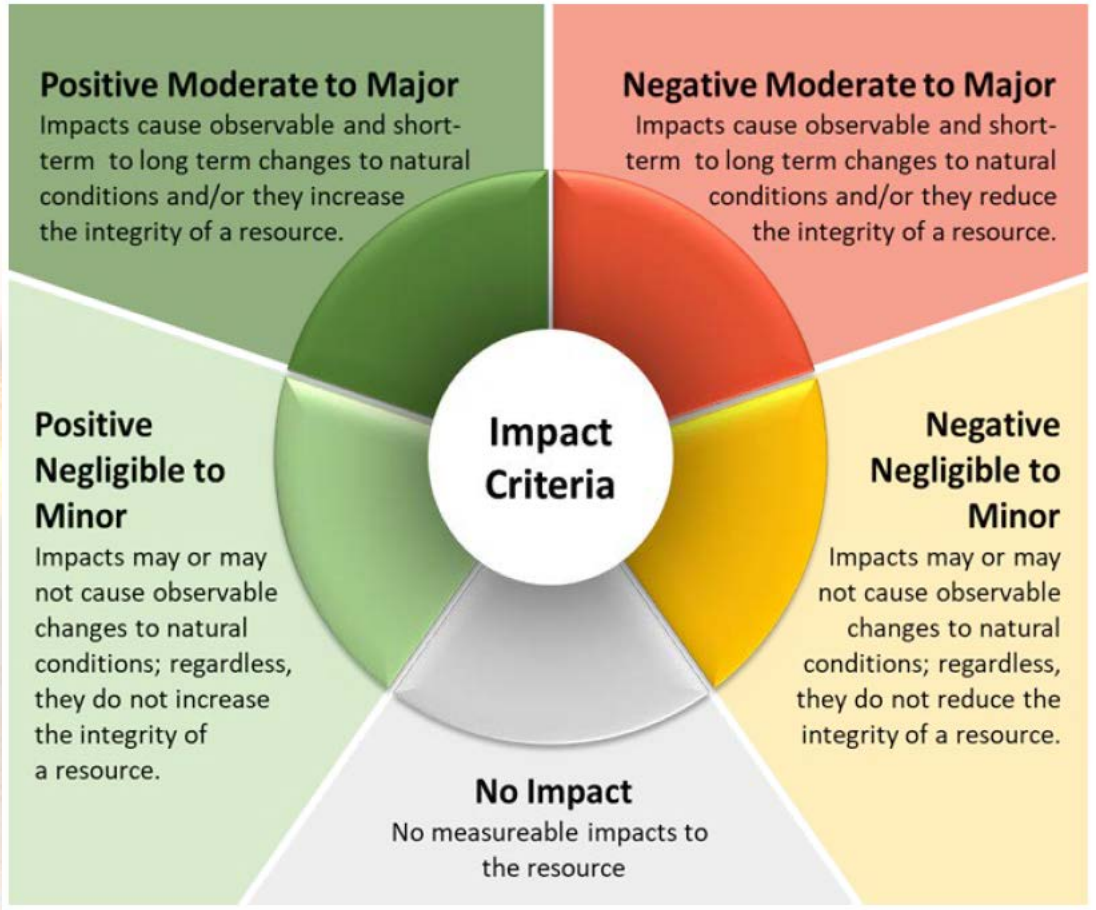
Potential descriptions:

e.g. Artificial Reef Effect from Wind Turbines

Minor/negligible positive impacts to Pacific groundfish at a regional scale for operational phase

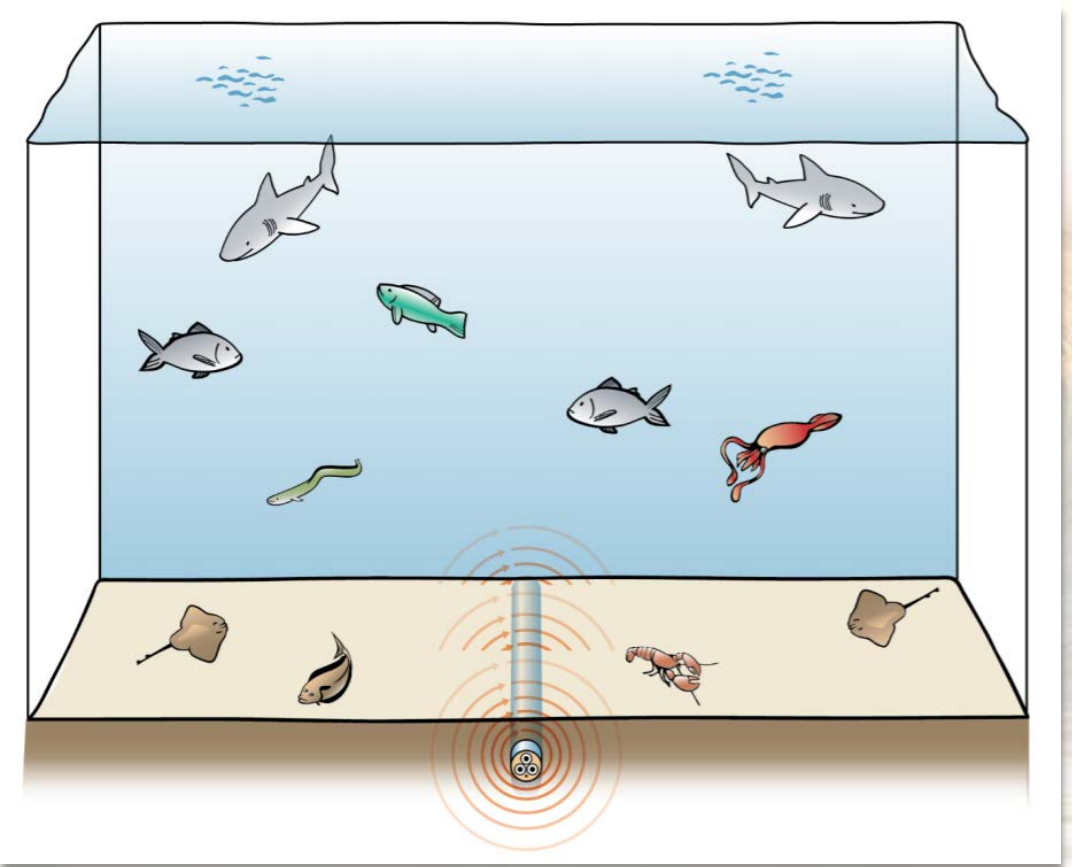
e.g. Space-Use Conflicts during Cable Installation

Moderate negative impact to Dungeness Crab fishery at the local scale for duration of cable installation phase

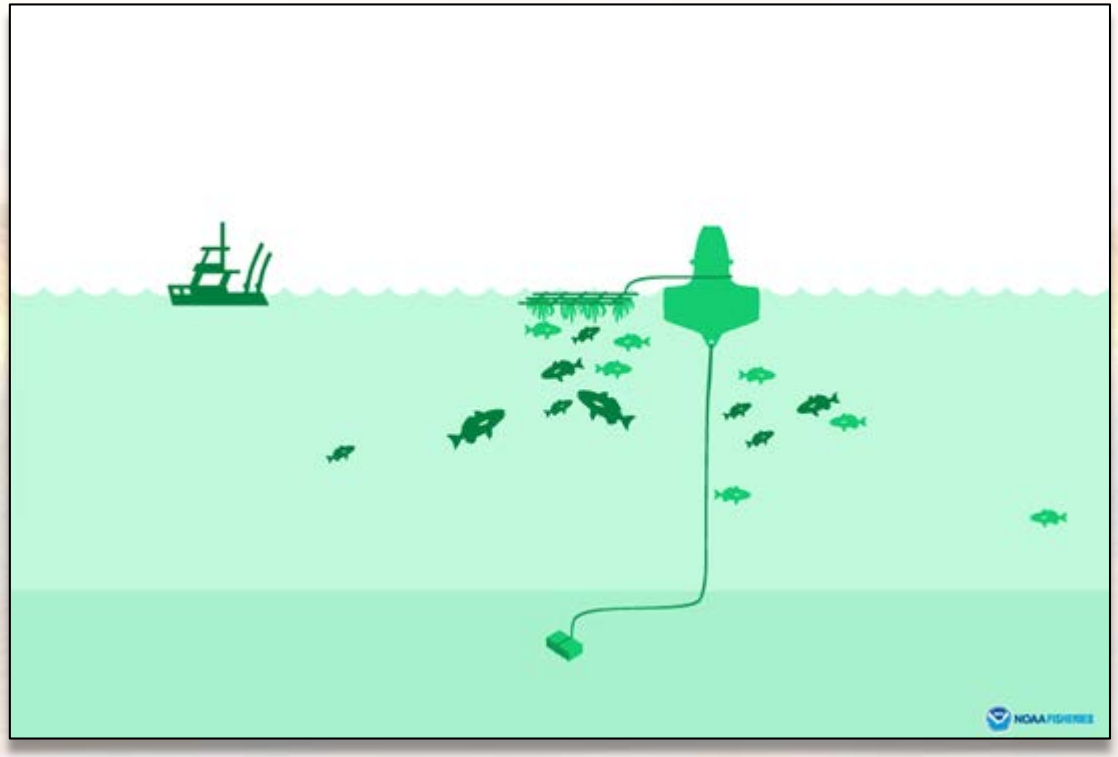


Impact Assessment Gaps

- Electromagnetic fields (EMFs)
  Sharks and rays, salmon, sturgeon, crustaceans



- Artificial reef effect/Fish Aggregating Device



Impact Assessment gap - EMF

Impact Assessment gaps

- Electromagnetic fields (EMF)

BOEM-funded Studies

Effects Of EMF From Undersea Power Cables On Elasmobranchs And Other Marine Species (2011)

Current Ability to Assess Impacts of Electromagnetic Fields Associated with Marine and Hydrokinetic Technologies on Marine Fishes in Hawaii (2015)

Renewable Energy in situ Power Cable Observation (2016)

Assessment of Potential Impact of Electromagnetic Fields from Undersea Cables on Migratory Fish Behavior (2016)

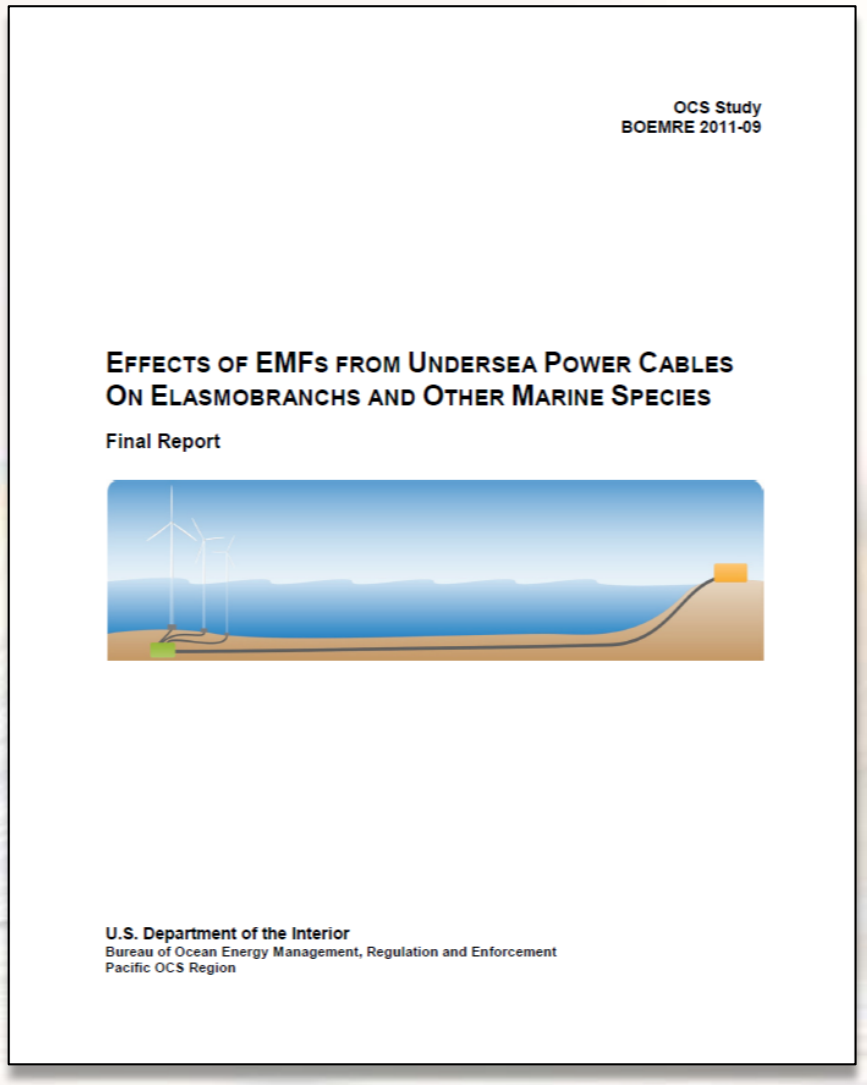
Electromagnetic Field (EMF) Impacts on Elasmobranch (shark, rays, and skates) and American Lobster Movement and Migration from Direct Current Cables (2018)

Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England (2019)

Potential Impacts of Submarine Power Cables on Crab Harvest (ongoing)

https://www.boem.gov/environment/environmental-studies/renewable-energy-research-completed-studies

Effects Of EMF From Undersea Power Cables On Elasmobranchs And Other Marine Species


OCS Study
BOEMRE 2011-09

EFFECTS OF EMFS FROM UNDERSEA POWER CABLES ON ELASMOBRANCHS AND OTHER MARINE SPECIES

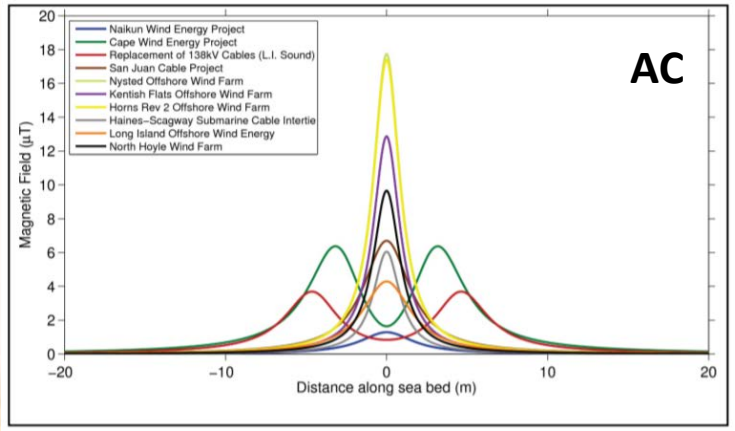
Final Report

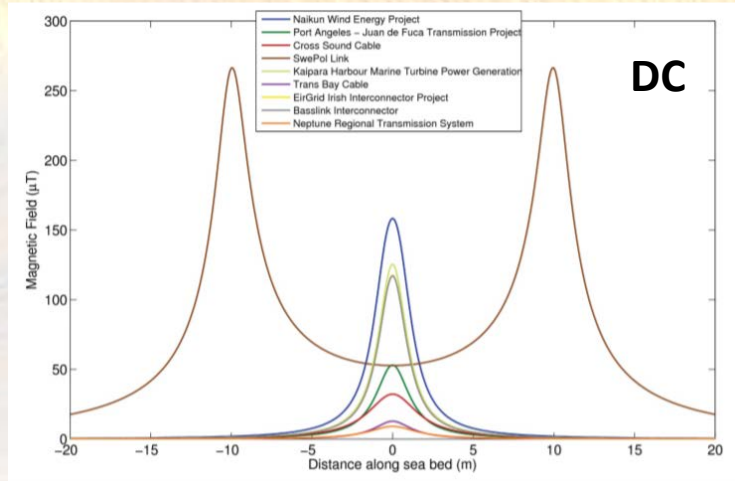
U.S. Department of the Interior
Bureau of Ocean Energy Management, Regulation and Enforcement
Pacific OCS Region

https://espis.boem.gov/final%20reports/5115.pdf

Objectives

- Alternating current (AC): intra-array cables
- Direct current (DC): transmission cable to shore (high-voltage)
- Review of evidence of species' sensitivity to electric and/or magnetic fields

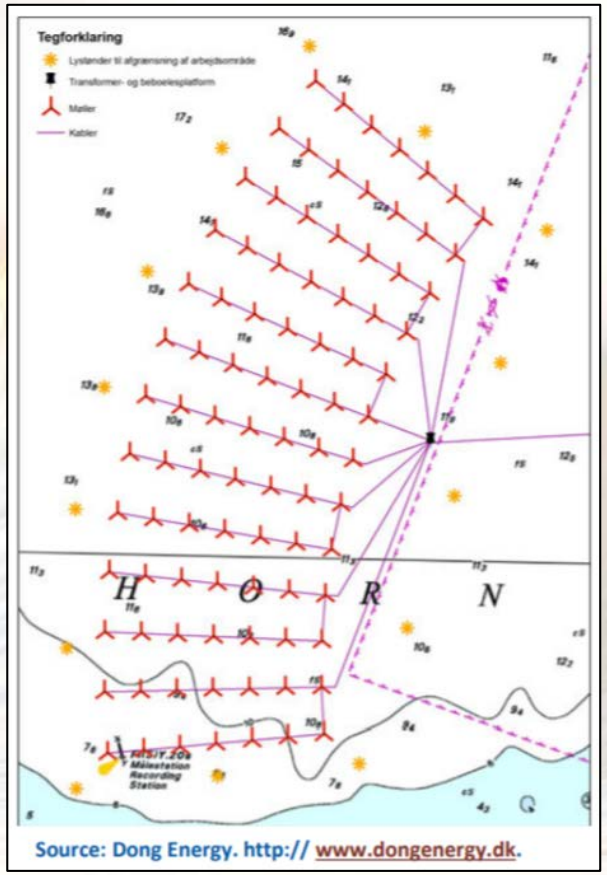




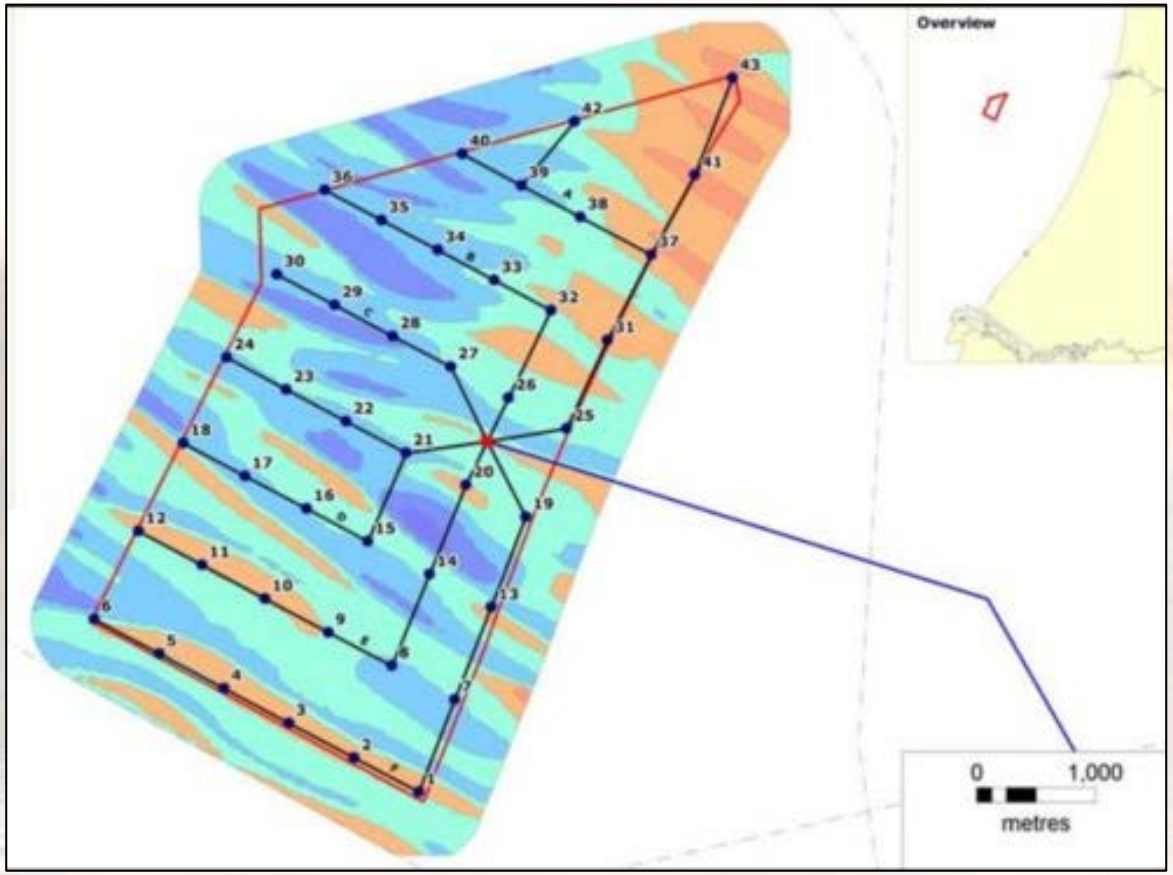
Effects Of EMF From Undersea Power Cables On Elasmobranchs And Other Marine Species

Examples of offshore wind farm cable layout

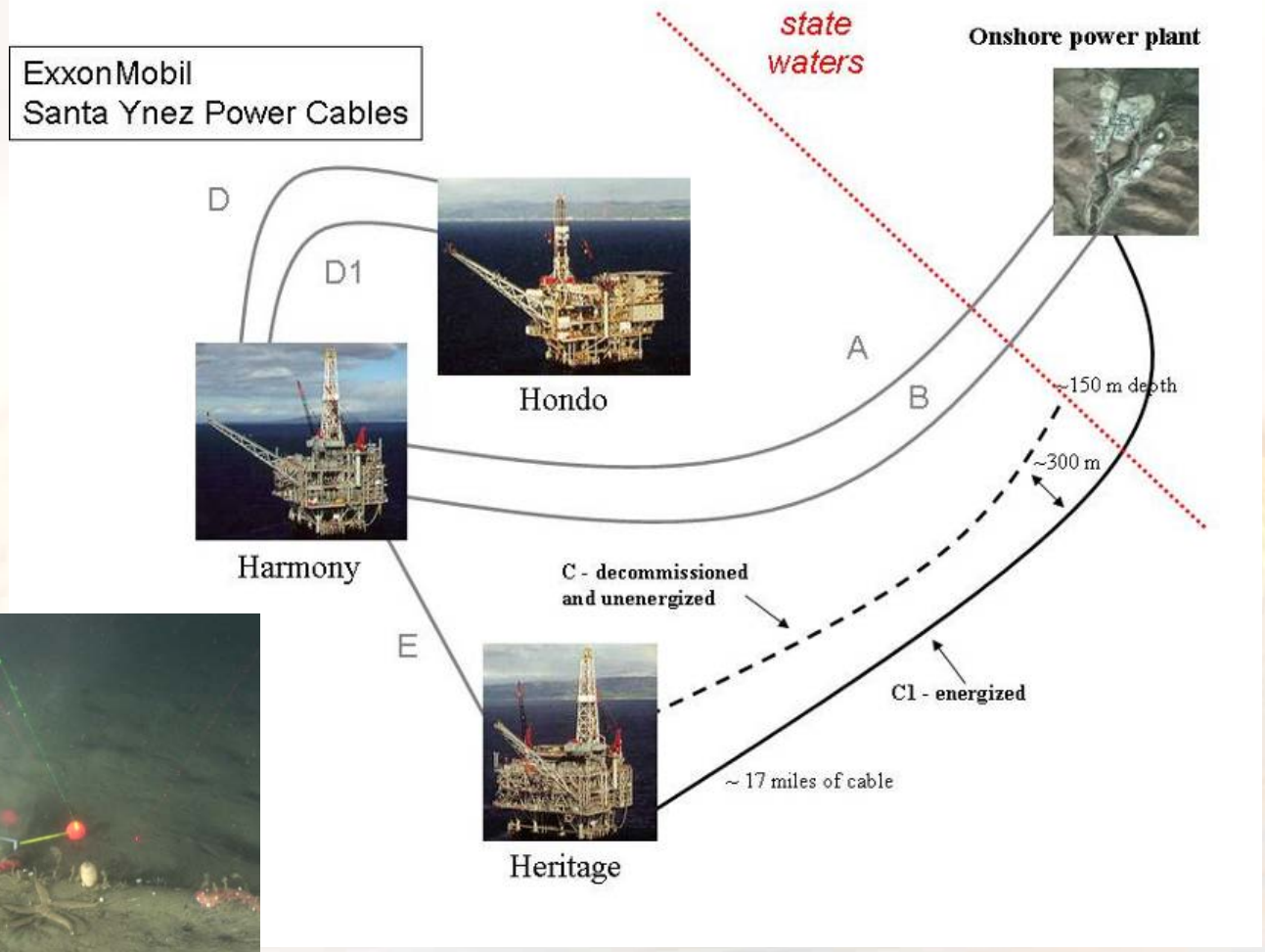
Horns Rev (Denmark)

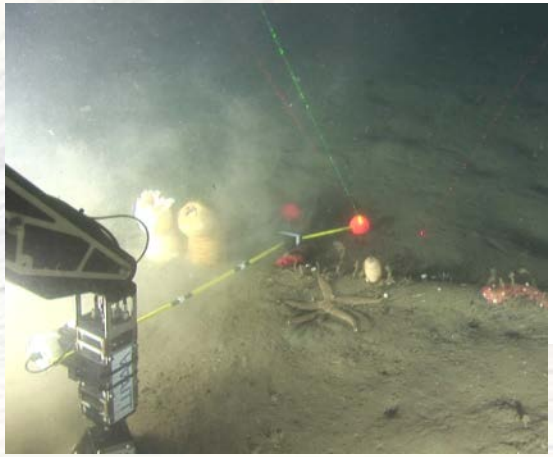


Luchterduinen (Netherlands)



Renewable Energy *in situ* Power Cable Observation





https://espis.boem.gov/final%20reports/5520.pdf

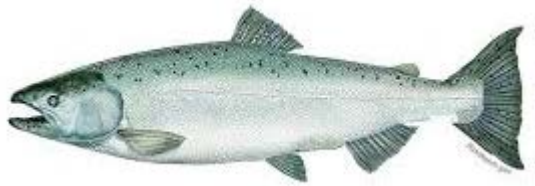
Objectives

- Measure the strength, spatial extent, and variability of EMFs along both energized and unenergized **35-kV AC cables**
- Determine attraction/repulsion of fish and macroinvertebrates to the EMF from the power cables

Some key findings

- EMF models consistent with field measurements
- No significant difference between cable types
- Negligible impact (local scale)

Assessment of Potential Impact of Electromagnetic Fields from Undersea Cables on Migratory Fish Behavior



https://www.boem.gov/2016-041/

Objectives

- Trans Bay **400-MW high voltage DC cable**
- Compare animal movements using biotelemetry before/after installation/energized Trans Bay cable
- Green Sturgeon, migrating adults (Southern DPS threatened species)
- Chinook Salmon, out-migrating juveniles

Some key findings

- Green sturgeon: negligible impacts
- Chinook Salmon: mixed minor/negligible impacts to behavior

Assessment of Potential Impact of Electromagnetic Fields from Undersea Cables on Migratory Fish Behavior

PLOS ONE

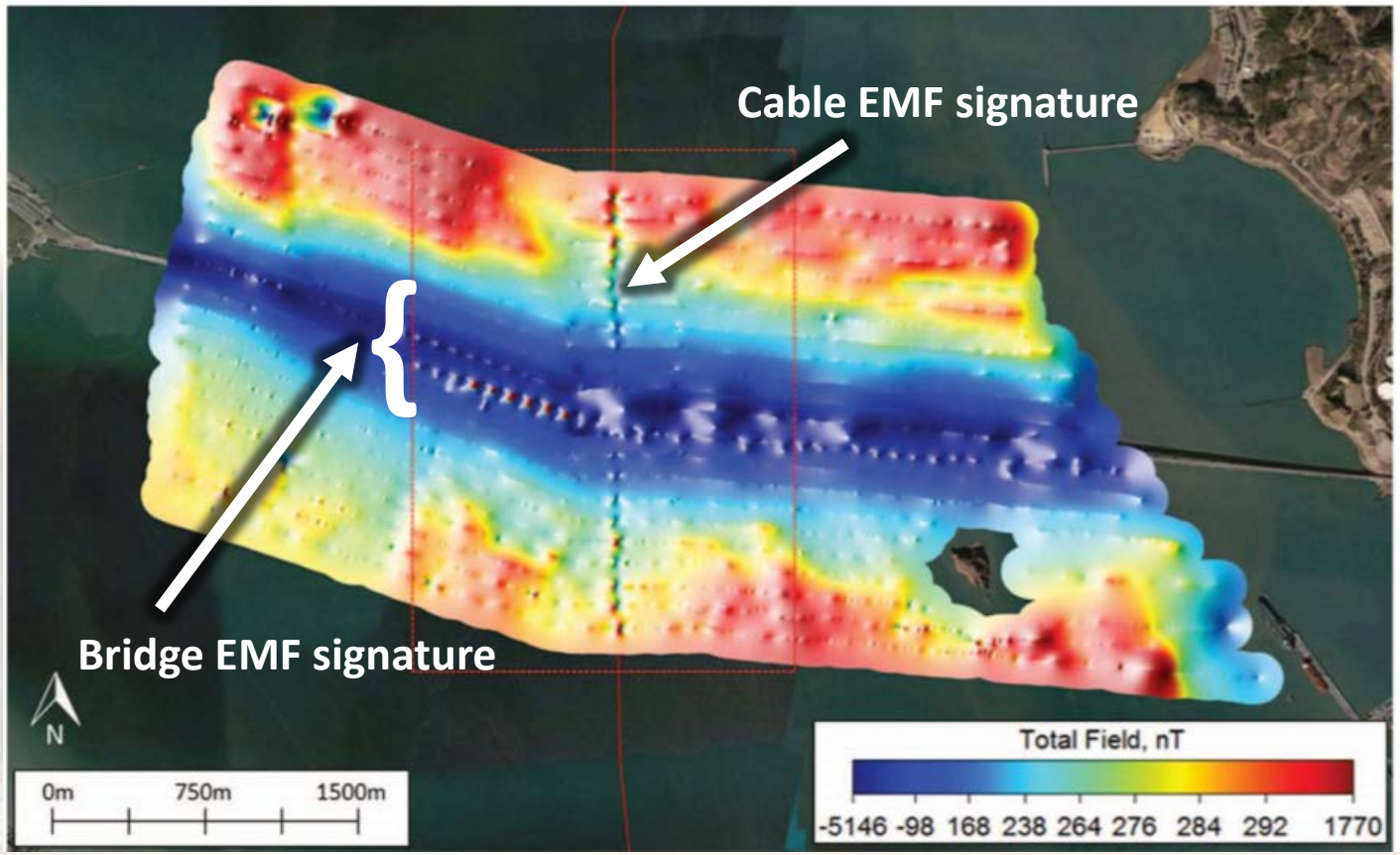
RESEARCH ARTICLE

Chinook salmon and green sturgeon migrate through San Francisco Estuary despite large distortions in the local magnetic field produced by bridges

A. Peter Klimley[1]*, Megan T. Wyman[1], Robert Kavet[2]

Bridge EMF signature at least an order of magnitude greater than EMF signature of Trans Bay 400-MV HVDC cable

EMF field changes do not prevent migratory behavior

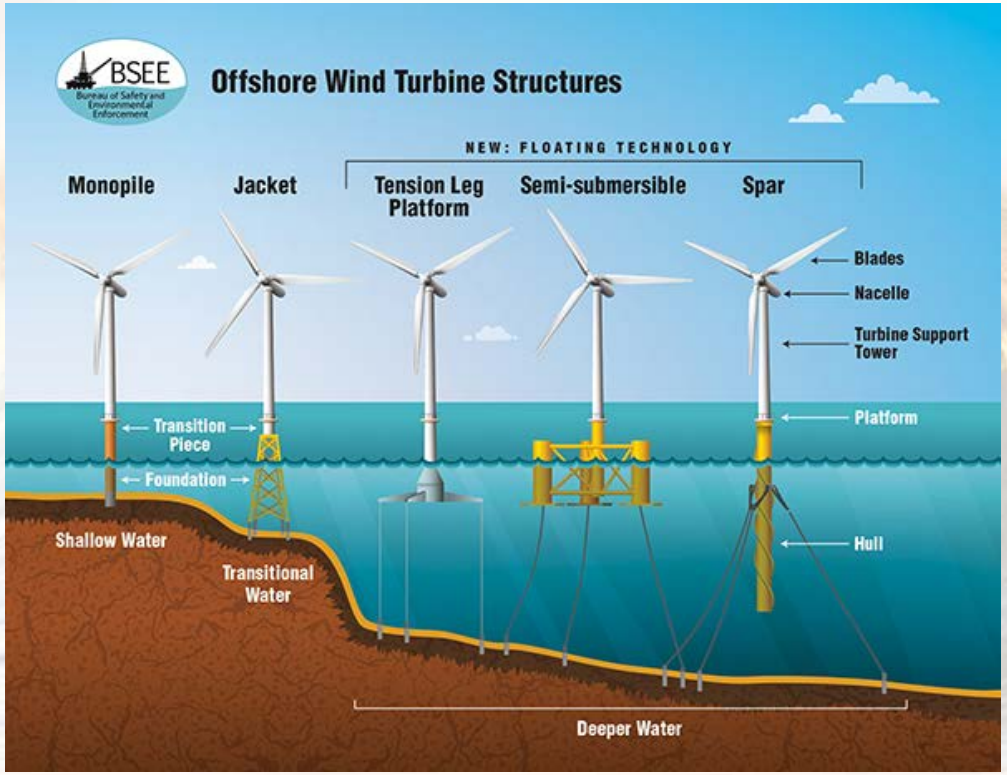


Impact Studies – Artificial Reef Effects/FADs

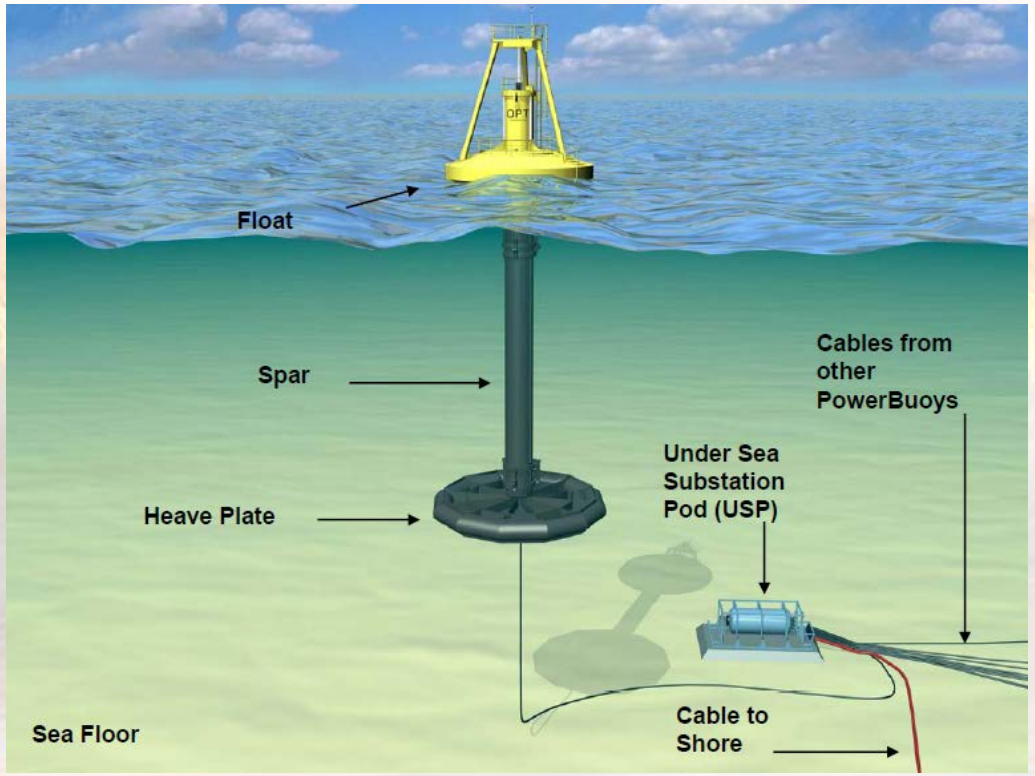
Impact Assessment gaps

- Artificial reef effects/Fish aggregating devices (FADs)

▷ large amount of infrastructure in the upper 30m + of water column ◁



Examples of Offshore Wind Turbines



Example of Wave Energy Conversion Device

Impact Studies – FADs

H. T. HARVEY & ASSOCIATES
Ecological Consultants

FINAL TECHNICAL REPORT

Evaluating the Potential for Marine and Hydrokinetic Devices to Act as Artificial Reefs or Fish Aggregating Devices

Based on Analysis of Surrogates in Tropical, Subtropical, and Temperate U.S. West Coast and Hawaiian Coastal Waters

Award No. DE-EE0006389
Project Period (04:14 – 03:15)

Support provided by:
U.S. Department of the Interior
Bureau of Ocean Energy Management
Environmental Studies Program Report
OCS Study BOEM 2015-021

Prepared for:
U.S. Department of Energy,
Energy Efficiency and Renewable Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401
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12 May 2015

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https://www.boem.gov/2015-021/

Evaluating the Potential for Marine and Hydrokinetic Devices to Act as Artificial Reefs or Fish Aggregating Devices

US West Coast

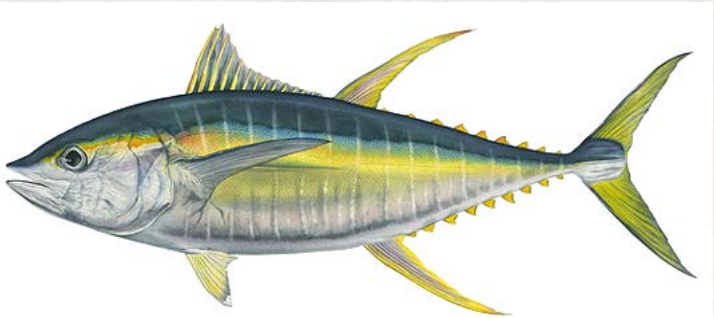
Albacore tuna: No evidence of potential FAD effect, but more information would be useful

NOAA

Hawai'i

Yellowfin tuna *et al.*: possible moderate local impact for project duration

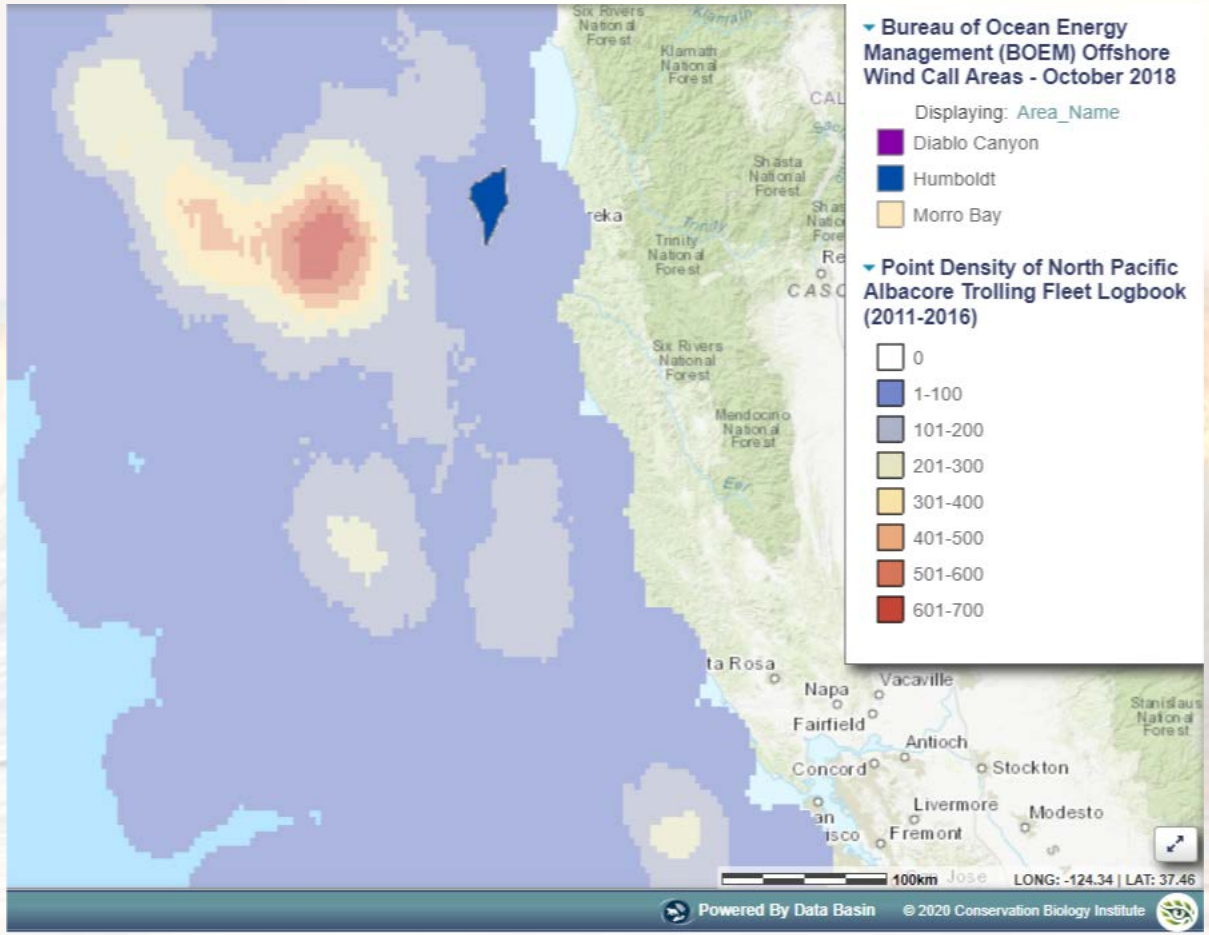
State of Hawai'i
Fish Aggregation Device Program
F A D s

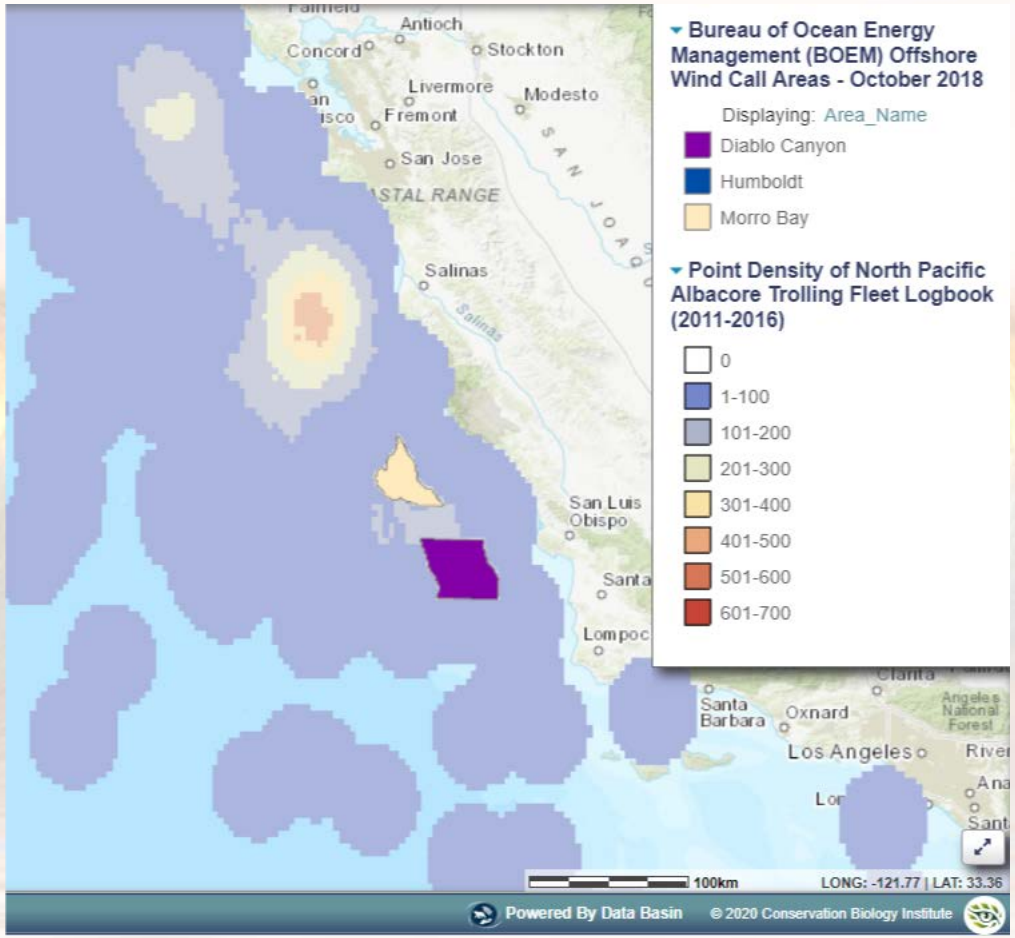


CA SEA GRANT

Fisheries – CDFW Logbook Data for Albacore Tuna

Point Density of North Pacific Albacore Trolling Fleet Logbook (2011-2016)

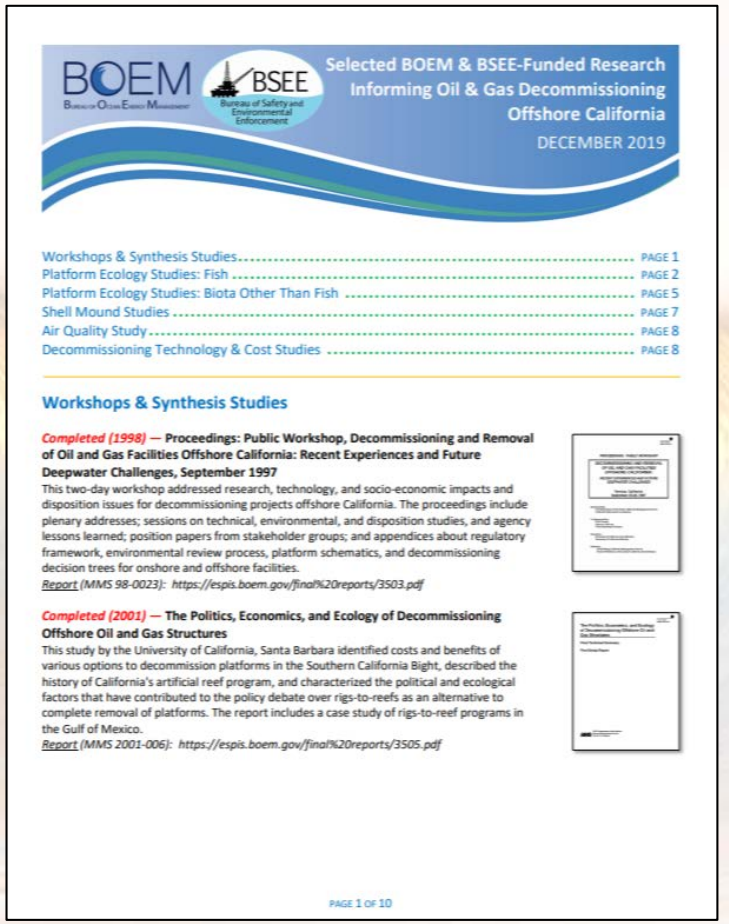




Impact Studies – Artificial Reef Effects

SCOTT GIETLER

Lessons Learned From Decommissioning Studies of Offshore Oil and Gas Platforms



BOEM BSEE

Selected BOEM & BSEE-Funded Research Informing Oil & Gas Decommissioning Offshore California

DECEMBER 2019

Workshops & Synthesis Studies

Completed (1998) — **Proceedings: Public Workshop, Decommissioning and Removal of Oil and Gas Facilities Offshore California: Recent Experiences and Future Deepwater Challenges, September 1997**

This two-day workshop addressed research, technology, and socio-economic impacts and disposition issues for decommissioning projects offshore California. The proceedings include plenary addresses; sessions on technical, environmental, and disposition studies, and agency lessons learned; position papers from stakeholder groups; and appendices about regulatory framework, environmental review process, platform schematics, and decommissioning decision trees for onshore and offshore facilities.

Report (MMS 98-0023): https://espis.boem.gov/final%20reports/3503.pdf

Completed (2001) — **The Politics, Economics, and Ecology of Decommissioning Offshore Oil and Gas Structures**

This study by the University of California, Santa Barbara identified costs and benefits of various options to decommission platforms in the Southern California Bight, described the history of California's artificial reef program, and characterized the political and ecological factors that have contributed to the policy debate over rigs-to-reefs as an alternative to complete removal of platforms. The report includes a case study of rigs-to-reef programs in the Gulf of Mexico.

Report (MMS 2001-006): https://espis.boem.gov/final%20reports/3505.pdf

PAGE 1 OF 10

https://www.boem.gov/Selected-BOEM-BSEE-Research-Decommissioning-CA/

Impact Studies – Artificial Reef Effects

PNAS

Oil platforms off California are among the most productive marine fish habitats globally

Jeremy T. Claisse[a,1], Daniel J. Pondella II[a], Milton Love[b], Laurel A. Zahn[a], Chelsea M. Williams[a], Jonathan P. Williams[a], and Ann S. Bull[c]

[a]Vantuna Research Group, Department of Biology, Occidental College, Los Angeles, CA 90041; [b]Marine Science Institute, University of California, Santa Barbara, CA 93106; and [c]Pacific Region, Environmental Sciences Section, Bureau of Ocean Energy Management, Camarillo, CA 93010

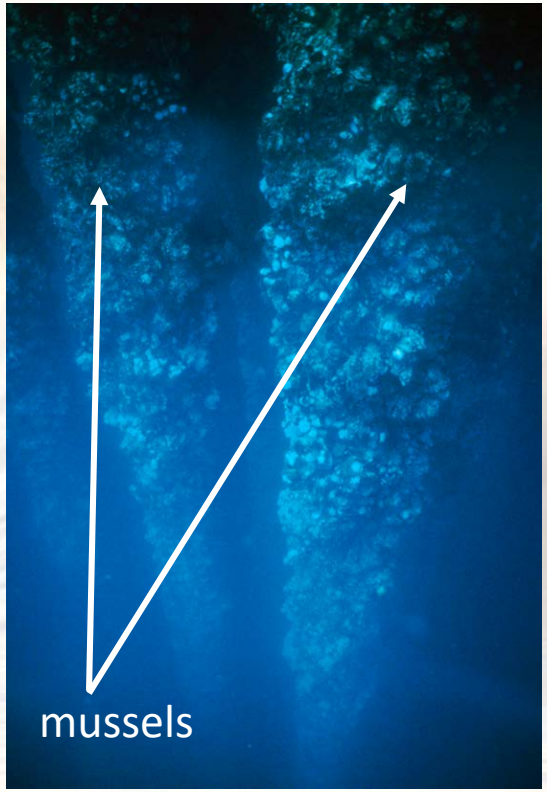
Edited by David W. Schindler, University of Alberta, Edmonton, Canada, and approved September 22, 2014 (received for review June 20, 2014)

"We found that oil and gas platforms off the coast of California have the highest secondary fish production per unit area of seafloor of any marine habitat that has been studied, about an order of magnitude higher than fish communities from other marine ecosystems."

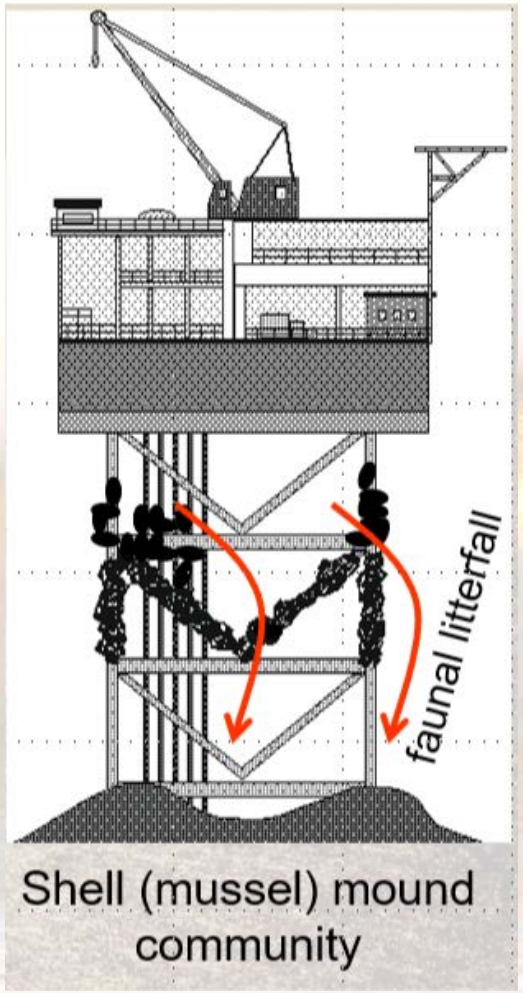
SCOTT GIETLER

Impact Studies – Artificial Reef Effects

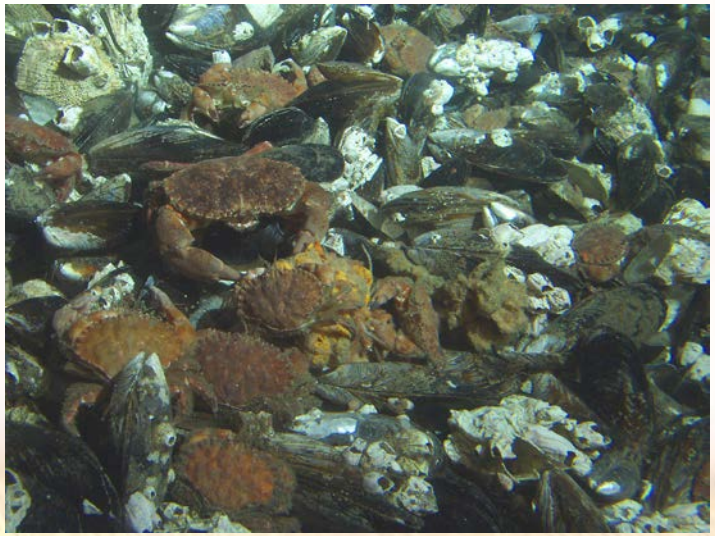
Key finding: A shell mound community forms on the seafloor



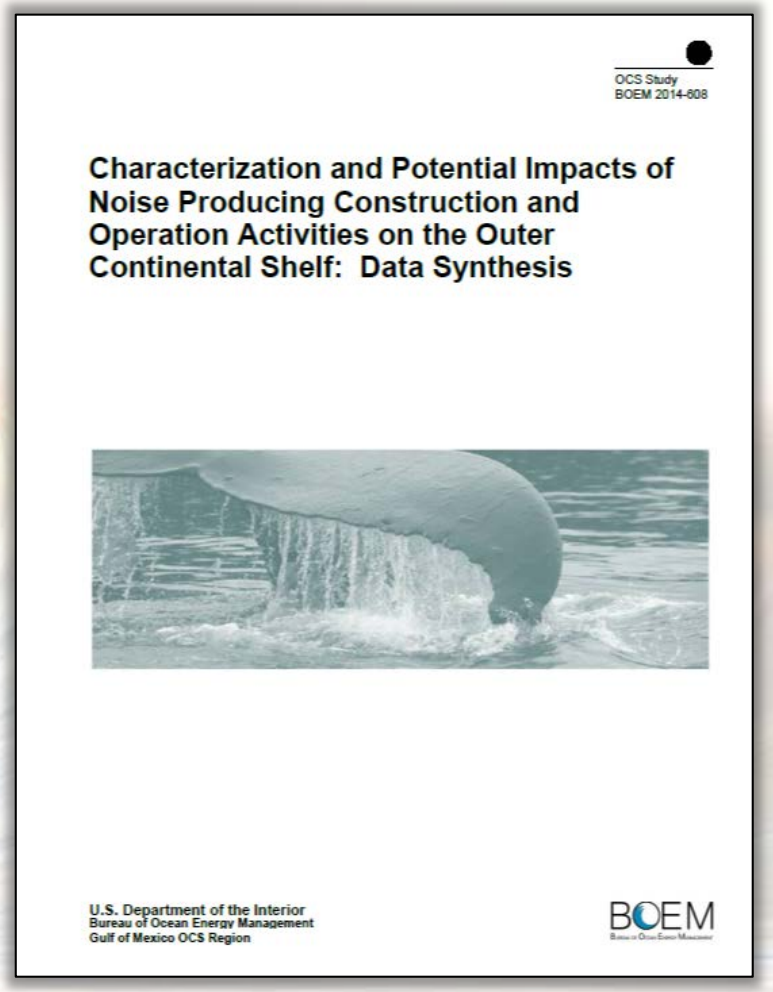
DAN DUGAN



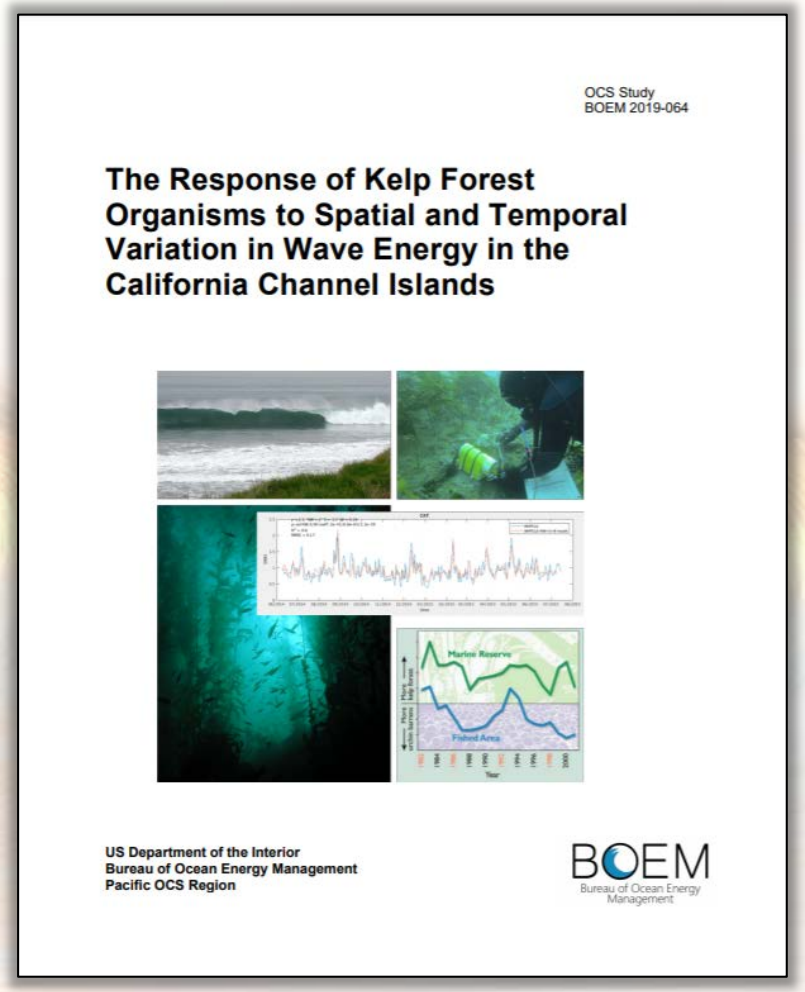
MARK PAGE MSI UCSB



Other Studies



https://espis.boem.gov/final%20reports/5413.pdf



https://espis.boem.gov/final%20reports/BOEM_2019-064.pdf

Impact Studies – Fishing

Baseline data

- Fishing grounds, other space use
- Socioeconomic information
- Port infrastructure

Potential Impacts

- Space-Use Conflicts, Offshore
- Space-Use Conflicts, Ports
- Safety issues/Nautical risks
- Effects to harvested species, including bycatch
- *Lessons learned from Conventional Energy*

Monitoring

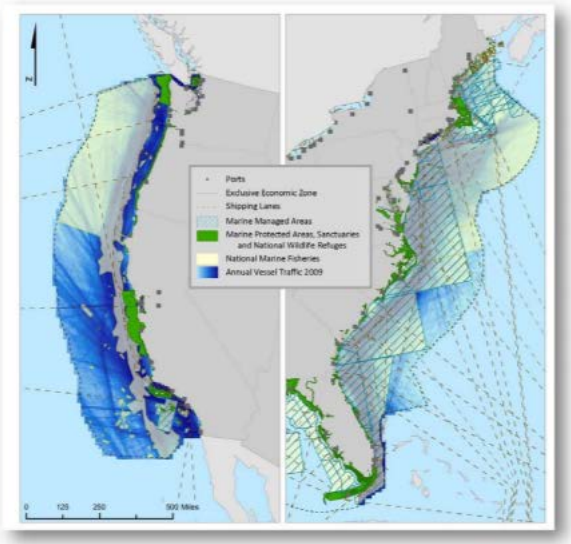
- Socioeconomic Indicators
- Space-use indicators
- *de facto* Marine Protected Area effect
- Gear entanglement and/or loss
- Safety concerns

- Importance of partnerships and existing programs
- Data sharing and clearinghouse
- Shifting baselines

Fisheries – Space-Use Conflicts

OCS Study
BOEM 2012-083

Identification of Outer Continental Shelf Renewable Energy Space-Use Conflicts and Analysis of Potential Mitigation Measures



U.S. Department of the Interior
Bureau of Ocean Energy Management

https://espis.boem.gov/final%20reports/5203.pdf

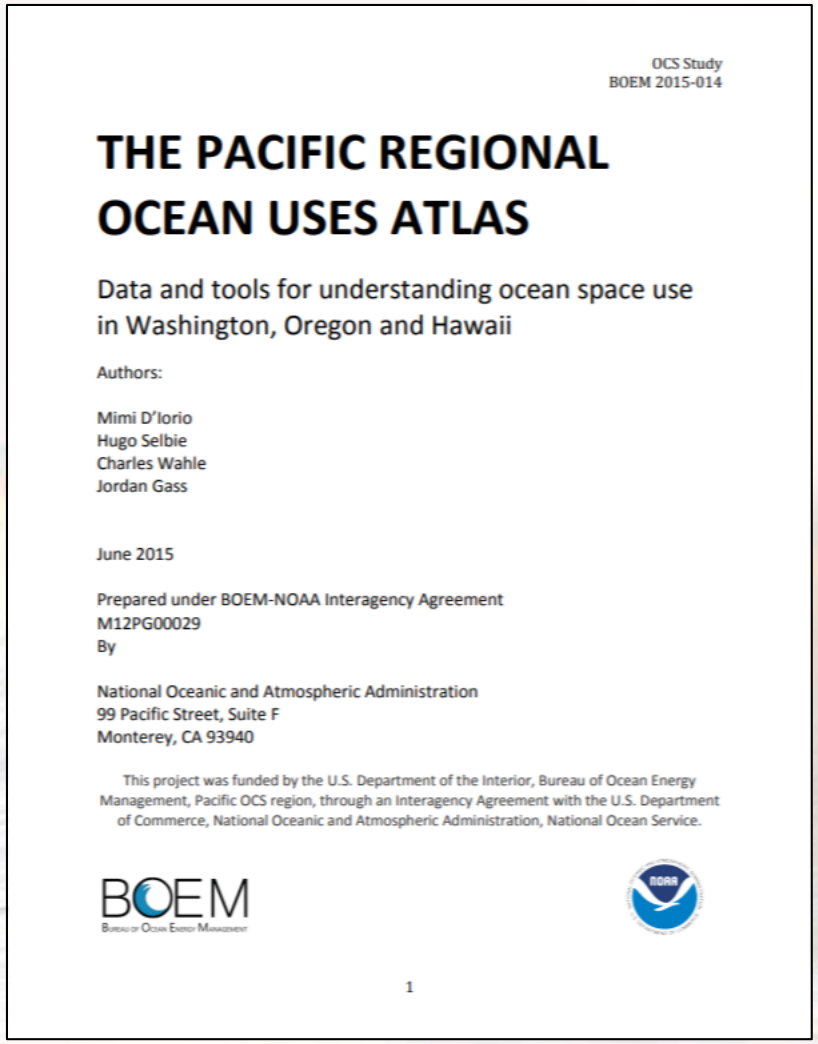
Pacific Northwest Commercial Fisheries, Gear Types, and Locations*

Fishery	Gear Type	Washington	Oregon	Charter
Tuna	Mobile (troll/pole, hook and line)	Generally near surface, 30-40 nm or more from shore	Generally near surface, 30 nm or more from shore at 50-100 up to 500-2,000 fathoms	Out to 20-50 nm (within a 70 – 80 mile radius of port)
Salmon	Mobile (troll, hook and line)	10-180 fathoms from Canada to Oregon border	Breakers to 200 fathoms; sometimes up to 650 fathoms	Breakers to 50 fathoms; 20+/- nm to high spots
Crab	Fixed (pot)	0-10 fathoms up to 90-100 fathoms; mostly sandy or mud bottom; **important tribal issues here - only southernmost 38 miles open to all**	Breakers to 130 fathoms and up to 700 in some years; around tops of canyons, high spots	Often inside of bays and estuaries; in the ocean out to 20-70 fathoms
Shrimp	Mobile (trawl)	30-150 fathoms; muddy, flat, soft bottom	30-150 fathoms; 90 percent in 60-140 fathoms; muddy, soft, flat bottom	n/a
Groundfish	Mobile (bottom and midwater trawl, hook and line)	Surf to 700 fathoms; midwater trawl generally at 1,000 fathoms, but nets are not this deep	Breakers to 400 -700 fathoms; 1,200f for midwater, but nets are not this deep.	Bottom fishing very important; within 5 nm or 40 fathoms (within 30 mile radius of port); look for reefs and high spots
Black Cod	Mobile (trawl); Fixed (pots, long line)	100-500 fathoms; depends on time of year	100-500/650 fathoms	See above for black cod as well
Halibut	Fixed (long line)	90-100 fathoms	22 nm at 100-125 fathoms	Very valuable fishery; within 40 – 100 fathoms; focus on sand or gravel habitat
Spot Prawns	Fixed (pot)	85-120/130 fathoms, Washington to California; primarily hard bottom at around 100 fathoms		n/a

Source: Guided conversations with stakeholders conducted for this study nm = nautical miles

* Bottom trawling is not currently allowed outside of 700 fathoms in the entire West Coast Exclusive Economic Zone. This relatively new regulation is intended to protect essential fish habitat.

Fisheries – NOAA Pacific Regional Ocean Uses Atlas



OCS Study
BOEM 2015-014

THE PACIFIC REGIONAL OCEAN USES ATLAS

Data and tools for understanding ocean space use in Washington, Oregon and Hawaii

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June 2015

Prepared under BOEM-NOAA Interagency Agreement
M12PG00029
By

National Oceanic and Atmospheric Administration
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Monterey, CA 93940

This project was funded by the U.S. Department of the Interior, Bureau of Ocean Energy Management, Pacific OCS region, through an Interagency Agreement with the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service.

BOEM
Bureau of Ocean Energy Management

1

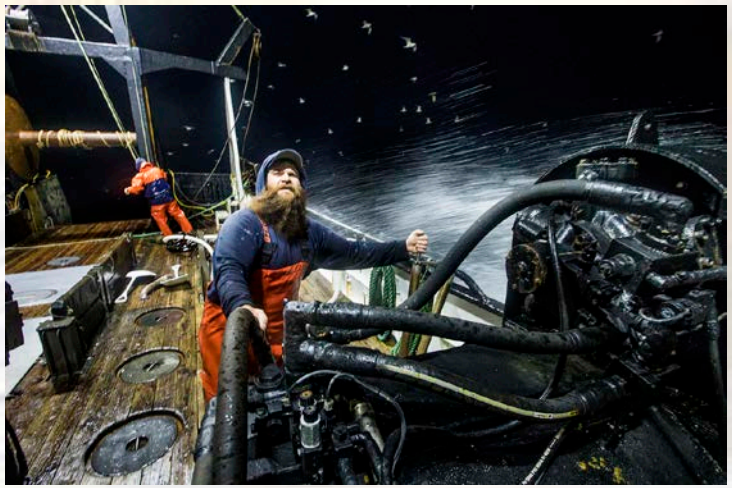
https://www.boem.gov/2015-014/

Participatory Mapping

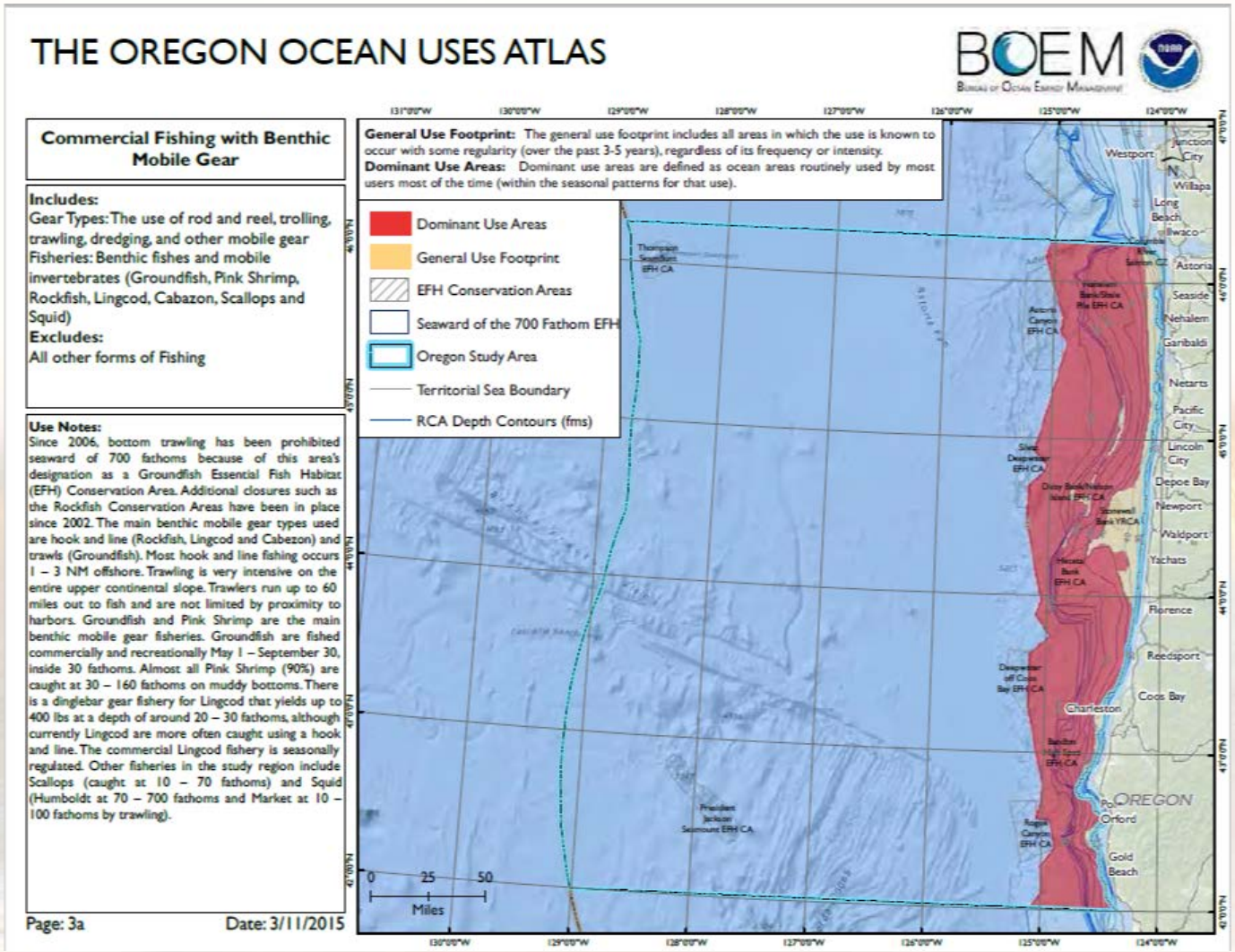
Industry/Military Sector	Extractive Sector	Non-Extractive Sector
• Commercial Shipping • Ocean Dumping • Mariculture • Military Operations • Mining and Mineral Extraction • Renewable Energy • Underwater Pipelines • Underwater Transmission Cables	• Commercial Fishing with Benthic Fixed Gear • Commercial Fishing with Benthic Mobile Gear • Commercial Pelagic Fishing • Commercial Seaweed Harvest • Recreational Fishing from Boats for Benthic Species • Recreational Fishing from Boats for Pelagic Species • Subsistence Fishing and Harvest	• Cruise Ships • Cultural Use Areas • Motorized Boating • Permanent Research Areas • Sailing • Wildlife Viewing at Sea

Fisheries – NOAA Pacific Regional Ocean Uses Atlas

Commercial Fishing with Benthic <u>Mobile</u> Gear



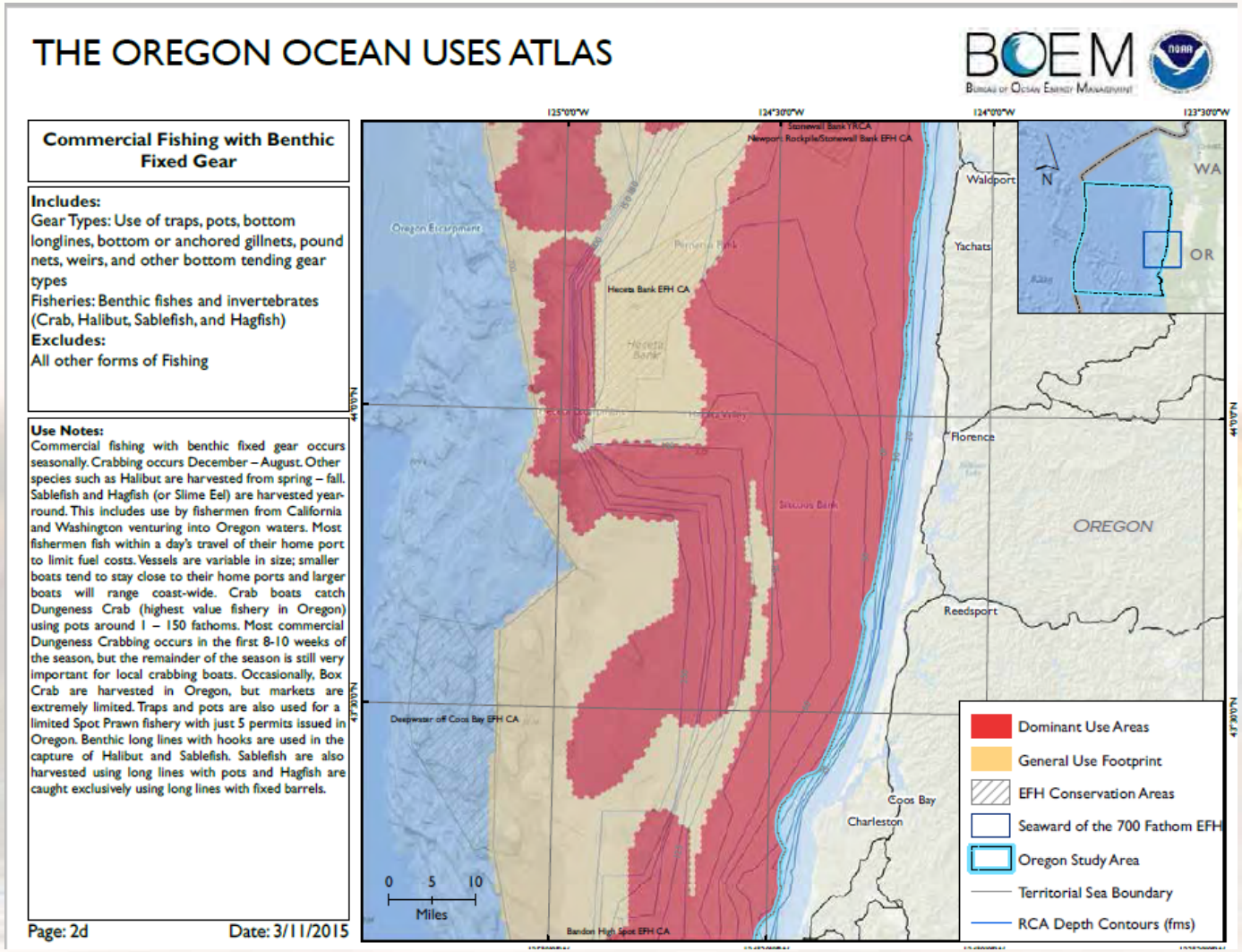
JOHN RAE



Fisheries – NOAA Pacific Regional Ocean Uses Atlas

Commercial Fishing with Benthic Fixed Gear

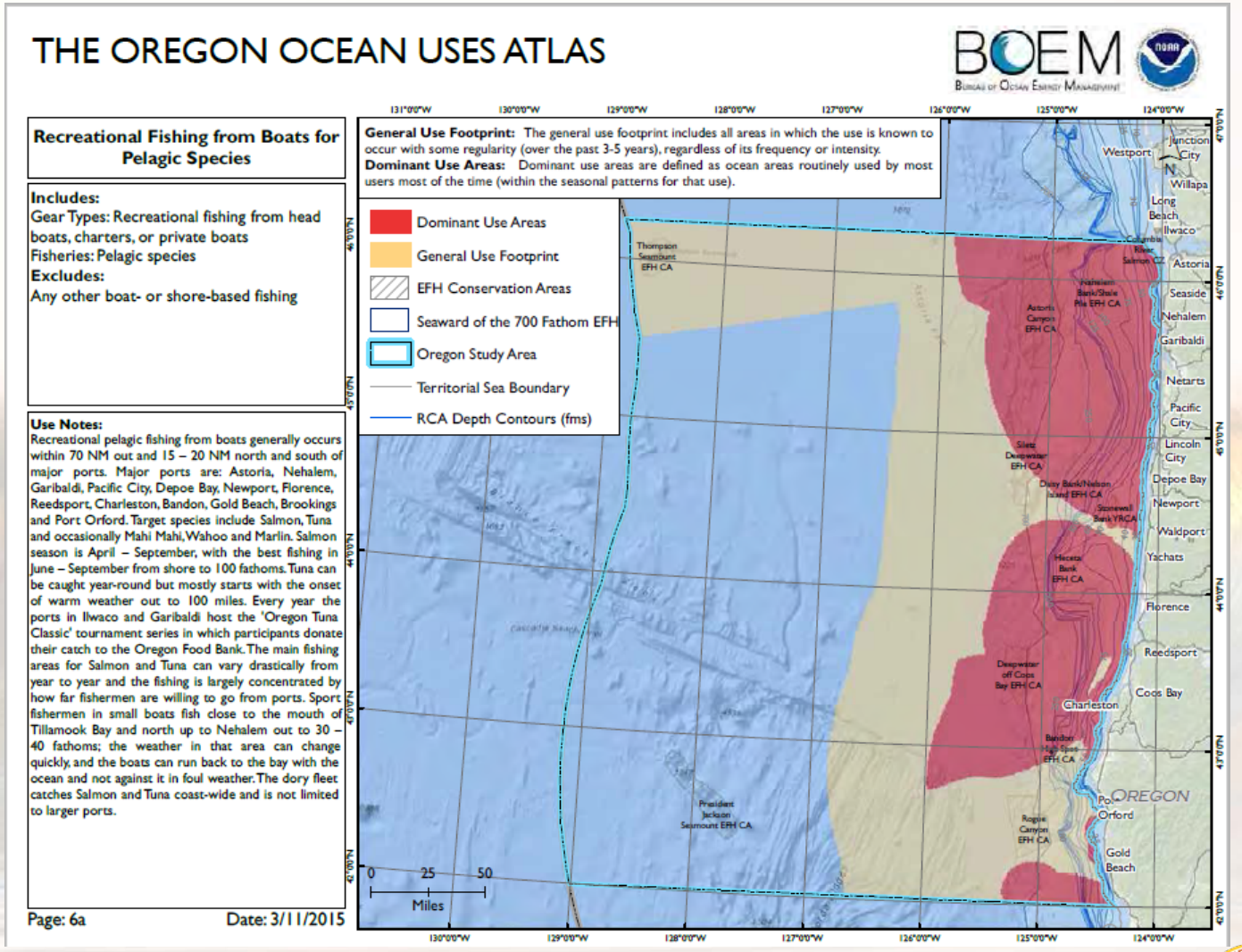
CDFW



Fisheries – NOAA Pacific Regional Ocean Uses Atlas

Recreational Fishing from Boats for Pelagic Species

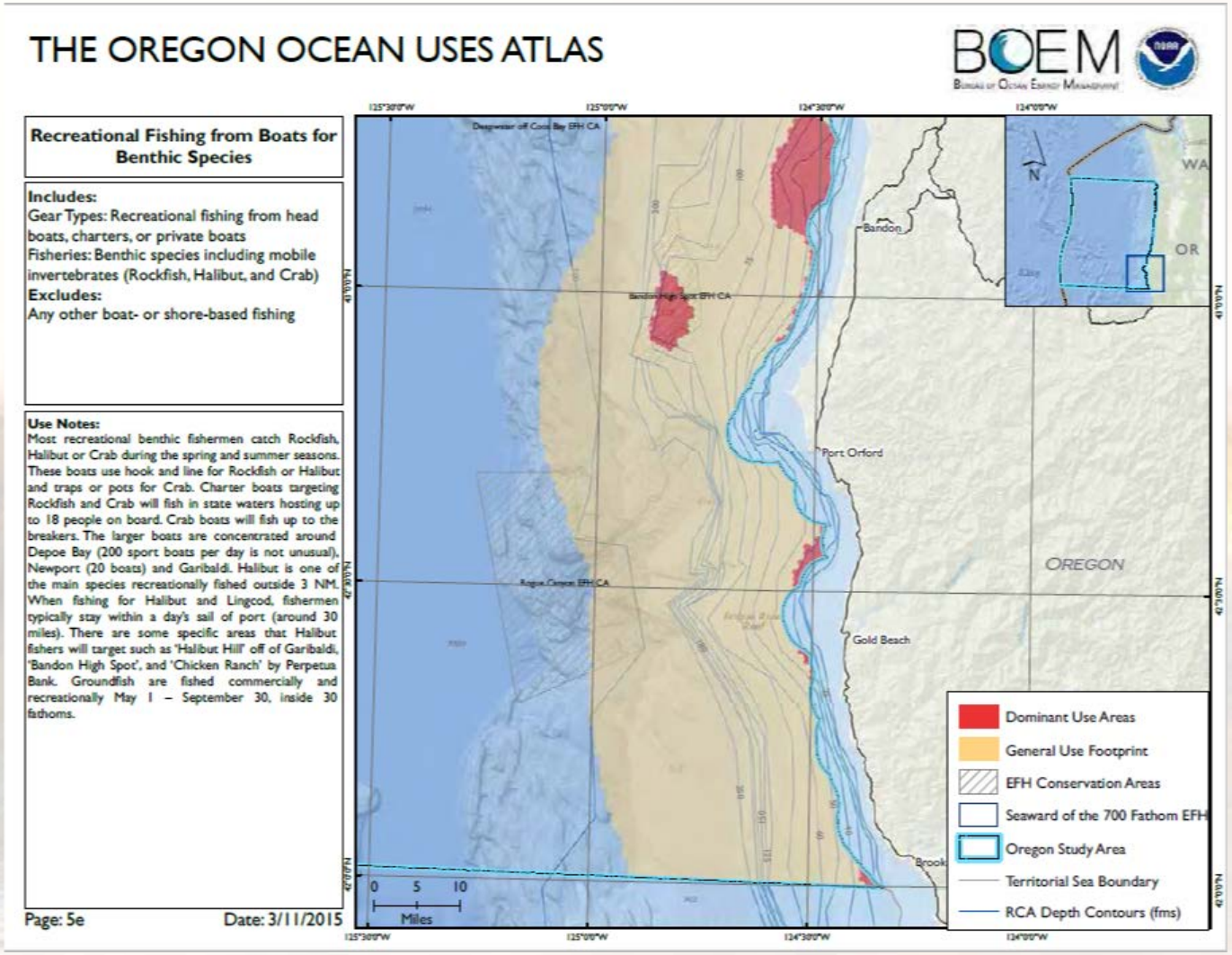
ODFW



Fisheries – NOAA Pacific Regional Ocean Uses Atlas

Recreational Fishing from Boats for Benthic Species

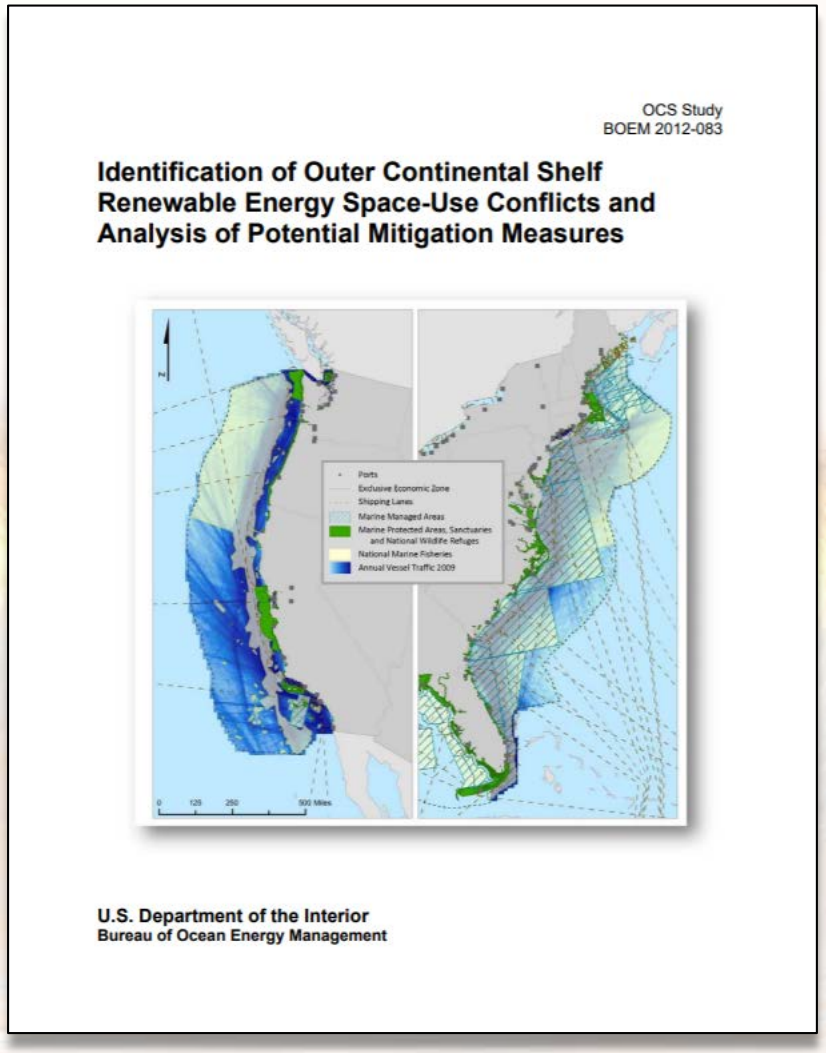
CNETRALCOASTKAYAKING.COM



Impacts - Fisheries

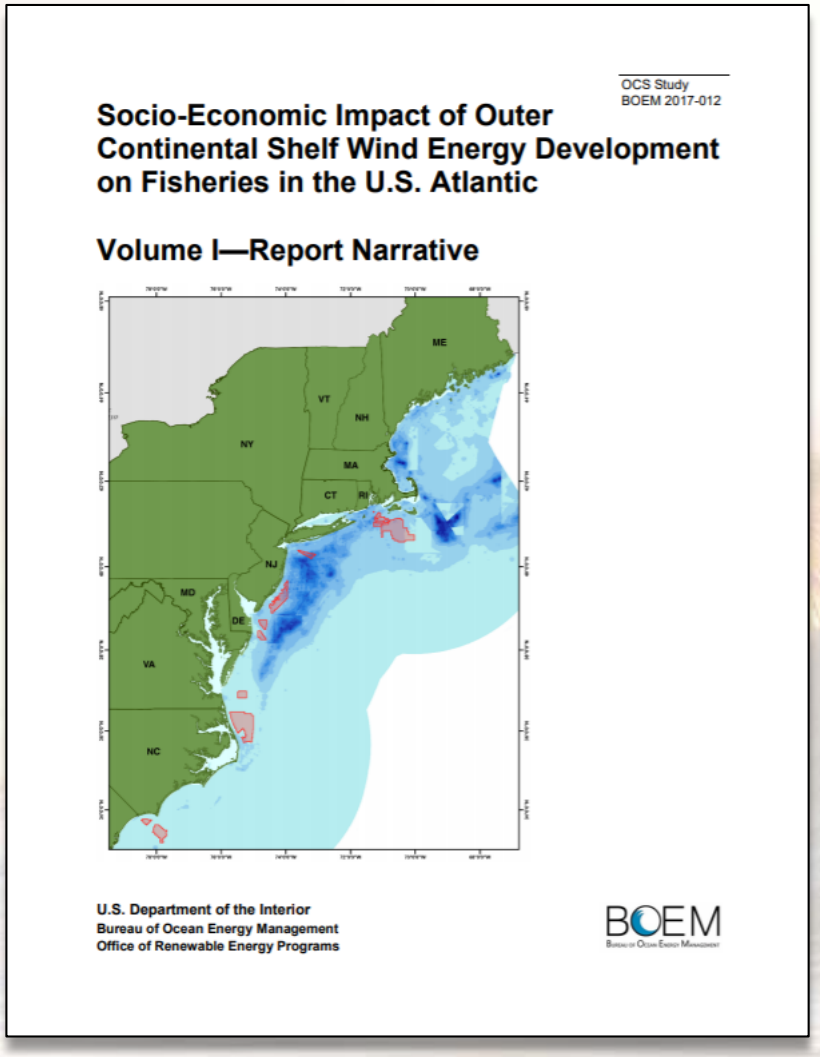
Potential Mitigation Measures

- Siting
  - Large scale – Wind Energy Areas
  - Small scale
    - Turbine arrangement
    - Existing cable corridors
    - Marine vessel traffic corridors
- Cable burial
- Fisheries Liaison
- Compensation
- Other comments on aspects of design
- **Port infrastructure enhancement**
- Consider consequences to marine populations



https://espis.boem.gov/final%20reports/5203.pdf

Fisheries – Socioeconomic Impacts (East Coast)



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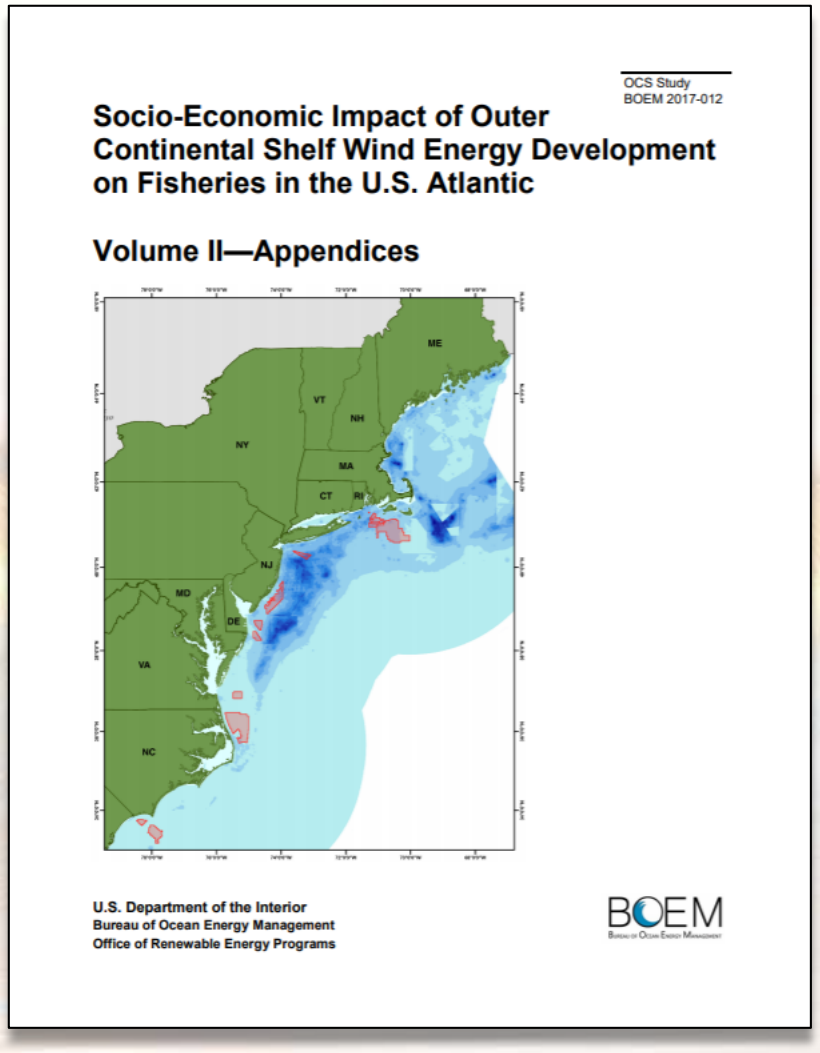
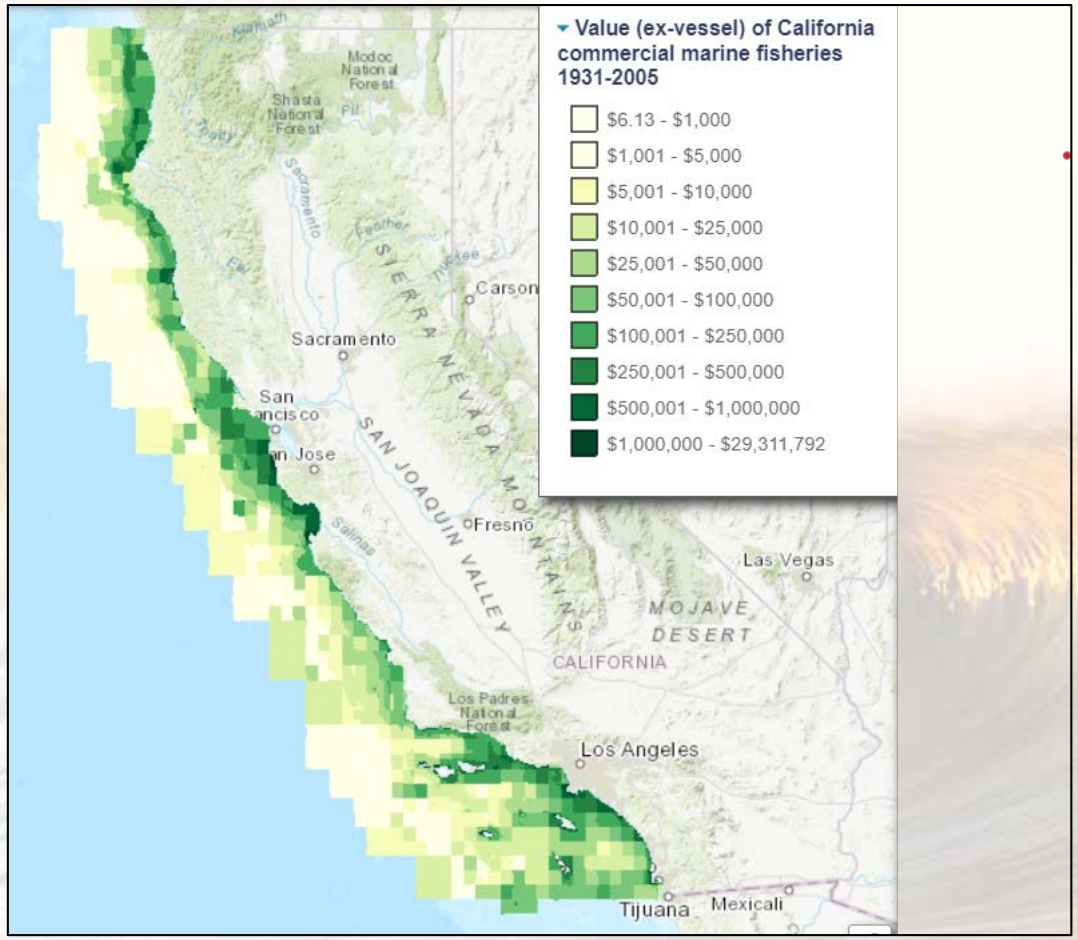


https://espis.boem.gov/final%20reports/5581.pdf

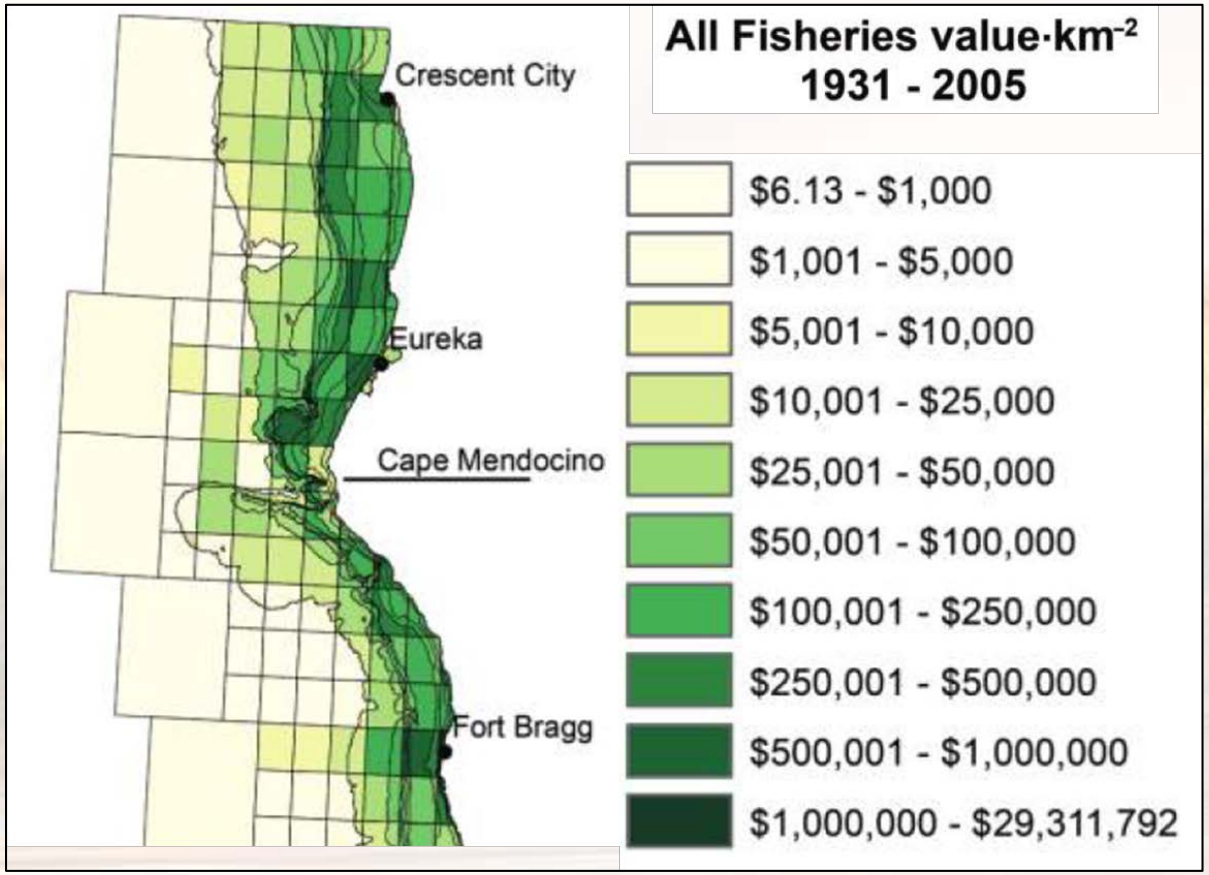
External Information and Studies

- **NOAA Fisheries**
  - Federal Fishery Management Plans
  - Essential Fish Habitat
  - Endangered Species Act
- Department of Energy & Labs
- DOI – Bureau of Safety and Env Enforcement
- DOI – US Geological Survey
- DOI – US Fish & Wildlife Service
- DOI – National Park Service
- NOAA – National Centers for Coastal Ocean Science
- NOAA – Ocean Exploration
- NOAA – National Marine Sanctuary Program
- National Space and Atmospheric Administration
- Tribes/Government-to-Government Consultations
- NOAA Sea Grant
  - California (2)
  - Oregon
  - Washington
- **California Dept of Fish and Wildlife (CDFW)**
  - **Landing and Logbook Data**
  - State Fishery Plans and Summaries
- California Energy Commission
- California Ocean Protection Council
- **Oregon Dept of Fish and Wildlife (ODFW)**
  - **Landing data**
  - State Fishery Plans and Summaries
- Local Governments
- Industry
  - Energy Industry
  - Recreational Fishers and Associations
  - Commercial Fishers and Associations
  - Environmental Consulting Businesses
  - Other Maritime Industries
- Academia
- Non-Governmental Organizations
- Public
- *Others*

Fisheries – Socioeconomics



Gridded overlay of total monetary value of commercial fisheries landings, 1931-2005, summarized from the California Department of Fish and Wildlife catch blocks. Adapted from Miller et al. 2017, Can. J. Fish. Aquat. Sci. 74:1732-48.



Fisheries – Summary of Landing Data 1

Ex-vessel value (2019$) of landings for some California commercial fisheries

	Average Annual Ex-vessel Landings Value (2019$) 2009-2018*	Statewide Value %	Regional EPC Value %	Local Harbor Value %	Depth (m) or Offshore Range (km) of Potential Fishing Grounds†	Call Area Overlaps with Potential Fishing Grounds?
California Statewide	**$ 216,128,424**	**100%**				
Eureka Port Complex (EPC)	**$ 38,907,766**	**18%**	**100%**			
Eureka Harbor	**$ 14,762,368**	**7%**	**38%**	**100%**		
Dungeness crab	$ 8,451,701	4%	22%	57%	less than 230 m	No
Sablefish	$ 1,870,730	< 1%	**5%**	**13%**	**57 to 1524 m**	**Yes**
Dover Sole	$ 1,289,162	< 1%	**3%**	**9%**	**27 to 914 m**	**Yes**
Ocean (pink) shrimp	$ 661,688	< 1%	2%	4%	73 to 229 m	No
Petrale sole	$ 547,548	< 1%	1%	4%	18 to 460 m	No
Thornyheads	$ 494,852	< 1%	**1%**	**3%**	**26 to 1524+ m**	**Yes**
Albacore tuna	$ 391,040	< 1%	1%	3%	greater than 55 km offshore	No
Chinook salmon	$ 306,987	< 1%	< 1%	**2%**	**0 to 46 km offshore**	**Yes**
Night/Surf smelt	$ 201,904	< 1%	< 1%	1%	surf zone	No
All other species	$ 546,756	< 1%	1%	4%		
Trinidad Harbor	**$ 2,547,544**	**1%**	**7%**	**100%**		
Dungeness crab	$ 2,514,008	1%	6%	99%	less than 230 m	No
All other species	$ 33,536	< 1%	< 1%	1%		

* Landing data downloaded from https://www.wildlife.ca.gov/Fishing/Commercial/Landings and adjusted to June, 2019 values using the Consumer Price Index Inflation Calculator https://data.bls.gov/cgi-bin/cpicalc.pl.

† Depth data obtained from (1) Status of the Fisheries reports at https://www.wildlife.ca.gov/Conservation/Marine/Status for Dungeness crab, ocean (pink) shrimp, petrale sole, coonstripe shrimp, Pacific hagfish, and black rockfish, and (2) Miller and Lea 1976. Guide to the Coastal Marine Fishes of California, Calif. Dept. Fish and Game, Fish Bull. No. 157, for sablefish, Dover sole, petrale sole, longspine and shortspine thornyheads, surf smelt, night smelt, and black hagfish. Albacore and Chinook offshore range obtained from Industrial Economics, Inc. 2012. BOEM OCS Study 2012-083. Original data converted to metric units when necessary.

Fisheries – Summary of Landing Data 2

Ex-vessel value (2019$) of landings for some California commercial fisheries

	Average Annual Ex-vessel Landings Value (2019$) 2009-2018*	Statewide Value %	Regional EPC Value %	Local Harbor Value %	Depth (m) or Offshore Range (km) of Potential Fishing Grounds†	Call Area Overlaps with Potential Fishing Grounds?
California Statewide	**$ 216,128,424**	**100%**				
Eureka Port Complex (EPC)	**$ 38,907,766**	**18%**	**100%**			
Crescent City Harbor	**$ 19,511,137**	**9%**	**50%**	**100%**		
Dungeness crab	$ 15,144,538	7%	39%	78%	less than 230 m	No
Ocean (pink) shrimp	$ 2,716,064	1%	7%	14%	73 to 229 m	No
Sablefish	$ 410,664	< 1%	**1%**	**2%**	**57 to 1524 m**	**Yes**
Coonstripe shrimp	$ 343,493	< 1%	< 1%	2%	less than 185 m	No
Black rockfish	$ 216,766	< 1%	< 1%	1%	less than 366 m	No
All other species	$ 679,612	< 1%	2%	3%		
All other locations	**$ 1,483,021**	< 1%	**4%**	**100%**		
Dungeness crab	$ 992,994	< 1%	3%	67%	less than 183 m	No
Hagfishes	$ 348,353	< 1%	< 1%	**23%**	**9 to 732 m, generally less than 549 m**	**Yes**
Chinook salmon	$ 102,334	< 1%	< 1%	**7%**	**0 to 46 km offshore**	**Yes**
All other species	$ 39,340	< 1%	< 1%	3%		

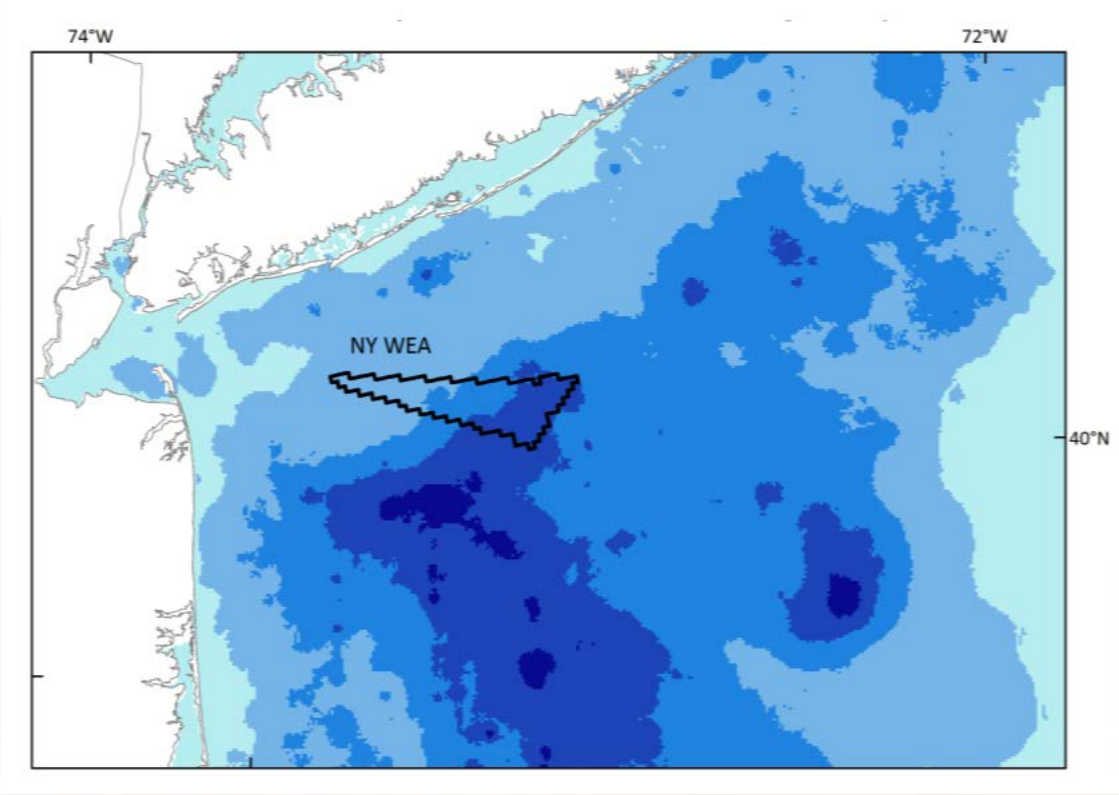
Summary

- Eureka Port Complex is an important fishing community
- Dungeness Crab is the most important species harvested
- **Pacific Groundfish Fishery** (Sablefish, Dover Sole, Thornyheads, Hagfishes) has the most overlap with Call Area
- **Eureka Harbor** fishers may experience the highest reduction in fishing grounds
- Further investigation (a) to determine **ability to troll** inside windfarm, and (b) understand potential FAD effect for Albacore tuna

Future - Vessel Monitoring System and Landing Data

Vessel Monitoring Systems (VMS)
Is a general term to describe systems that are used in commercial fishing to allow regulatory agencies to track and monitor the activities of fishing vessels to prevent illegal activities and thus protect the resource which enhances the livelihoods of fishers.

Example from a similar project offshore New York



Cumulative Impacts

What about the cumulative effects of spatial closures to fishers?

West Coast Recreational Fishing Closures, 2015

Uploaded by Eli Harland

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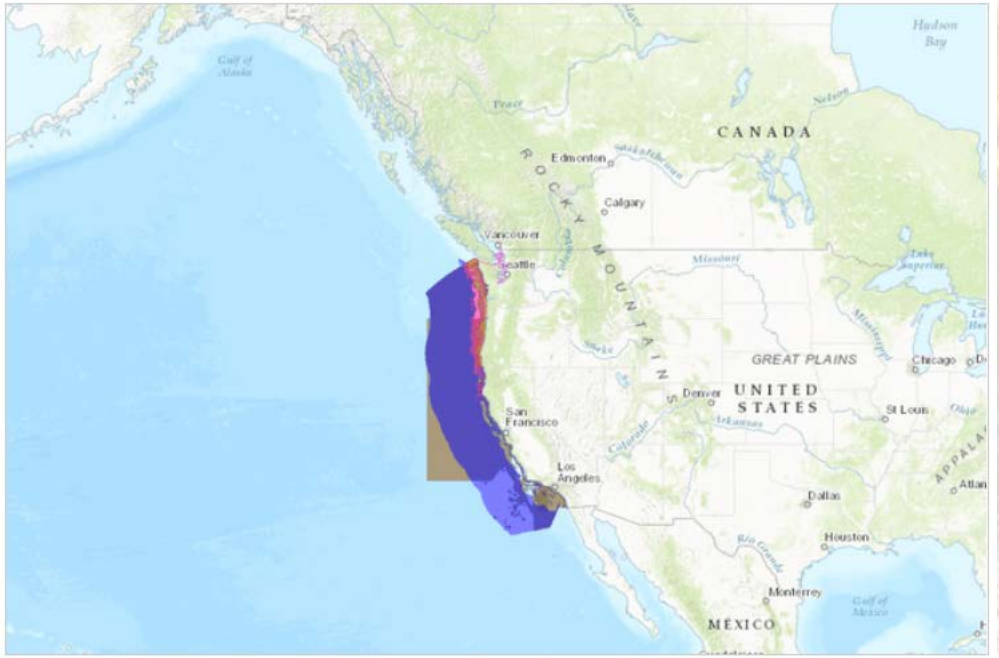

West Coast Commercial Fishing Closures, 2015

Uploaded by Eli Harland

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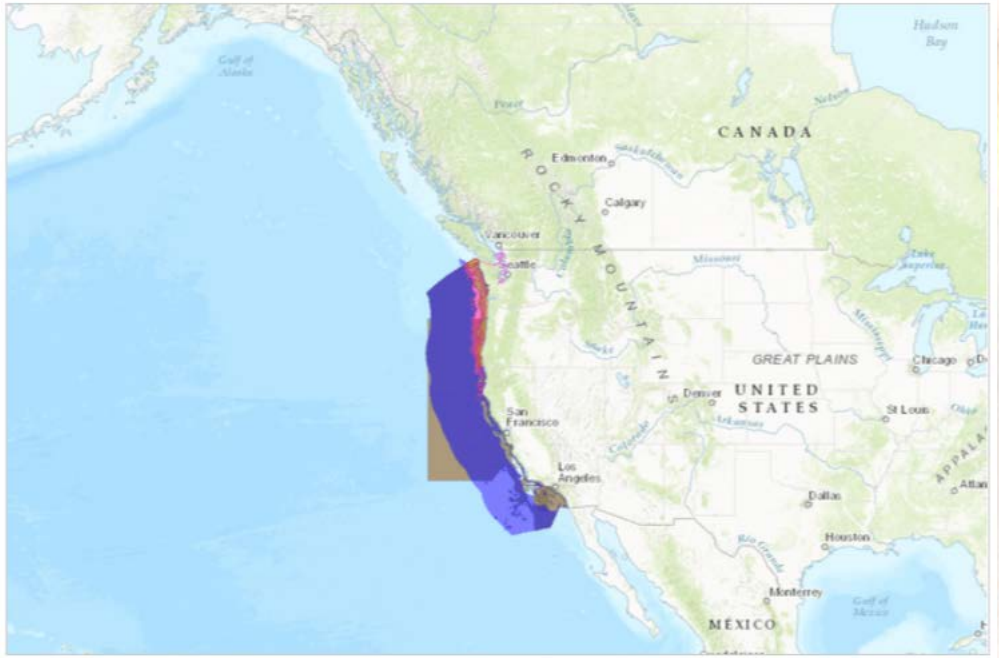
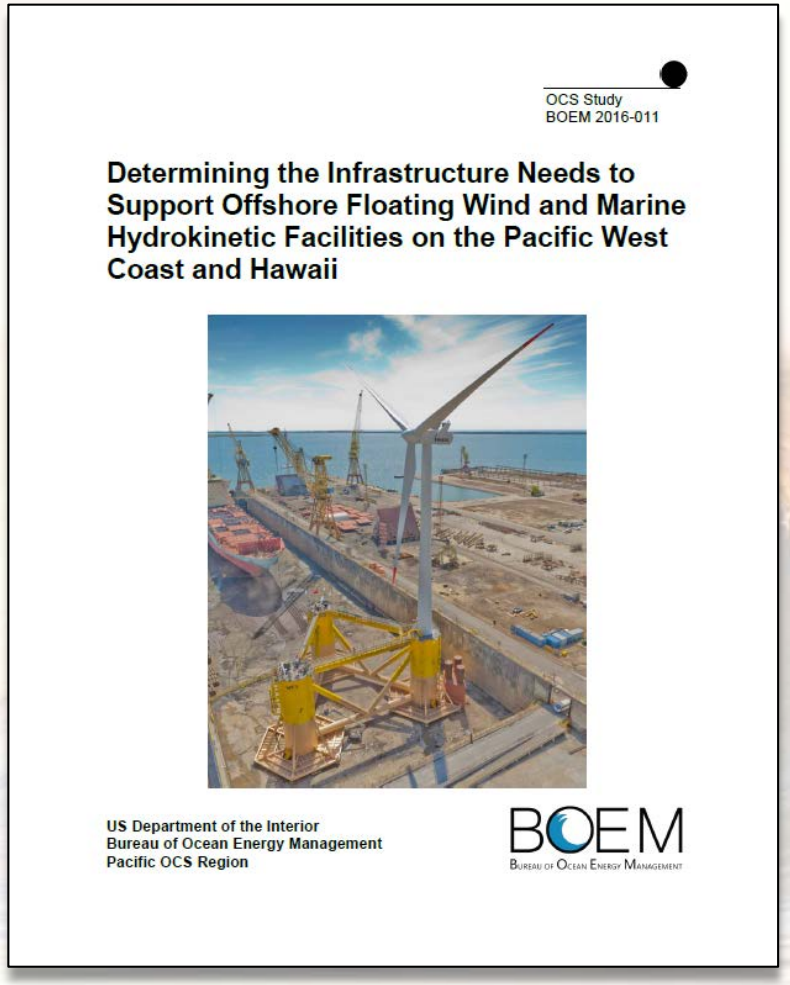


Fisheries – Port Infrastructure



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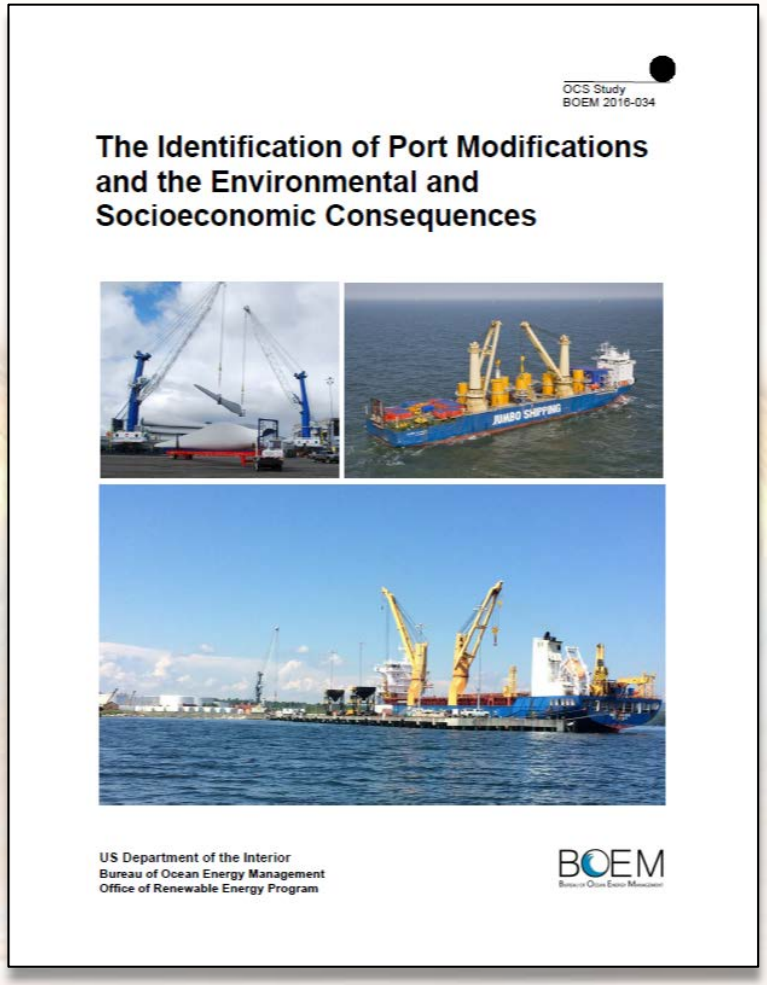
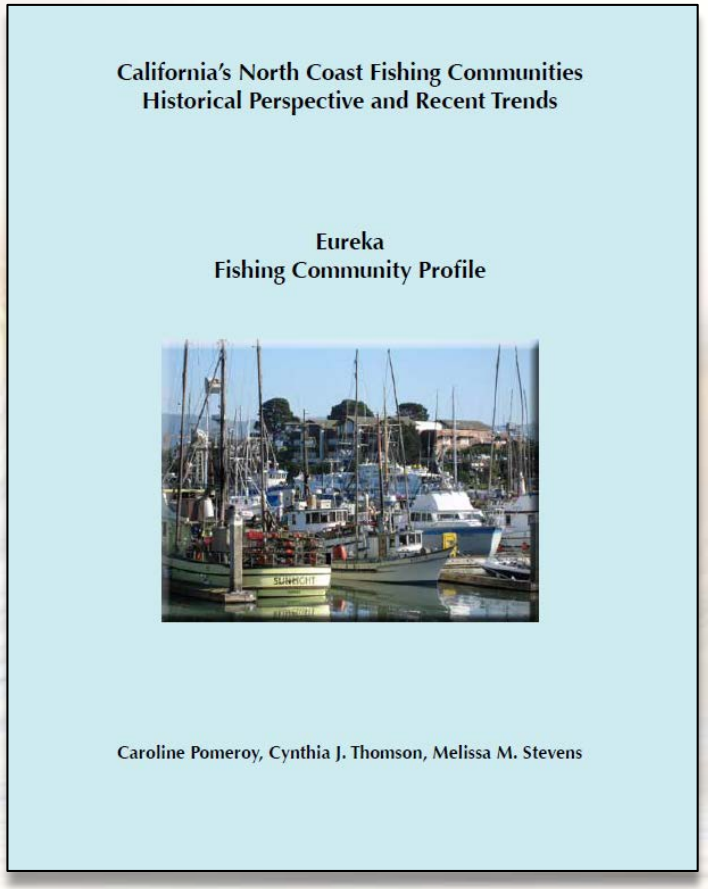
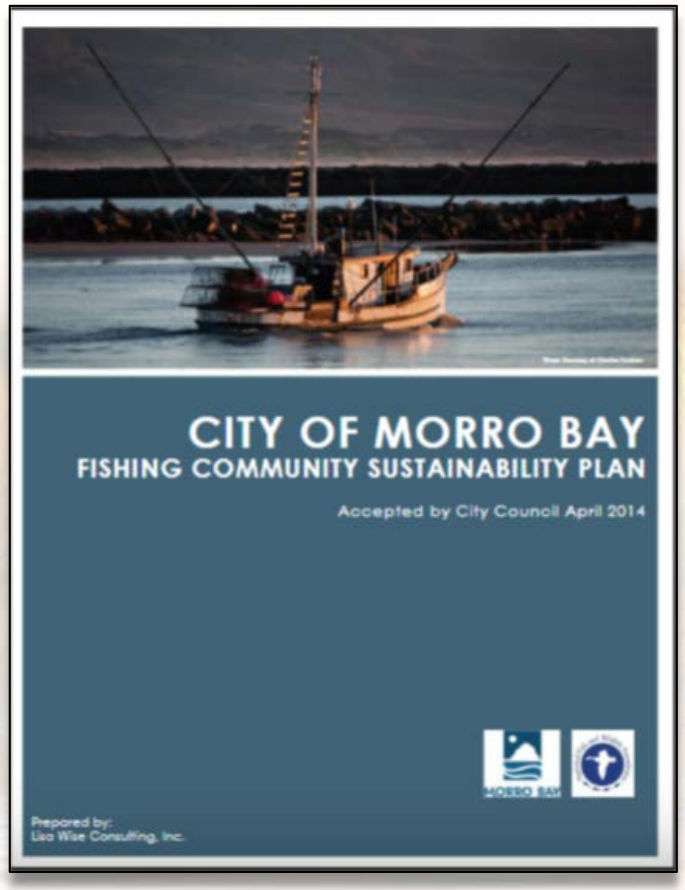


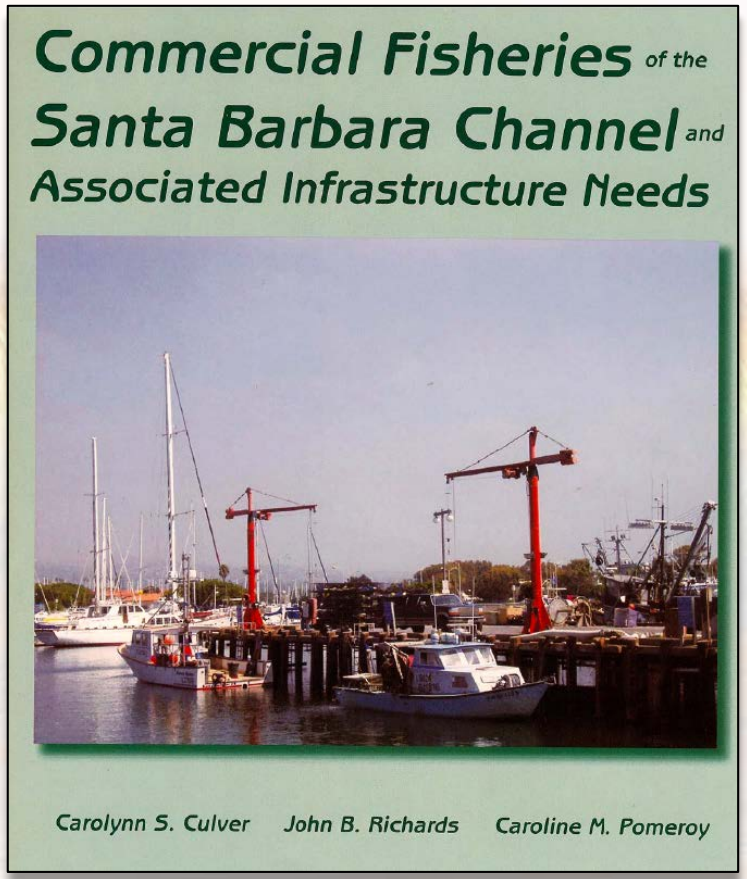
https://espis.boem.gov/final%20reports/5508.pdf

Fisheries – Port Infrastructure

Future work: Build upon existing information on fishing communities and port infrastructure

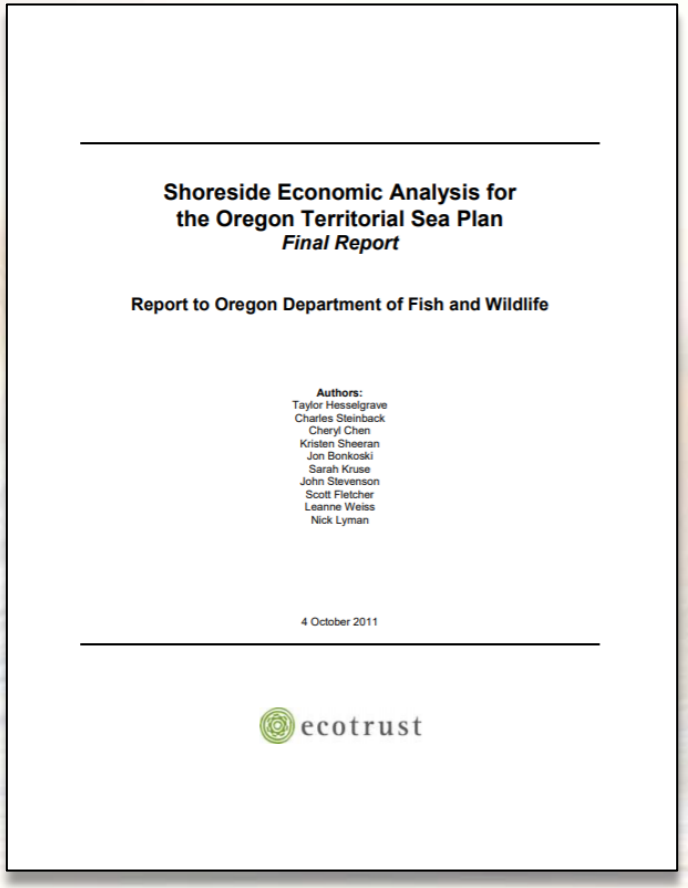


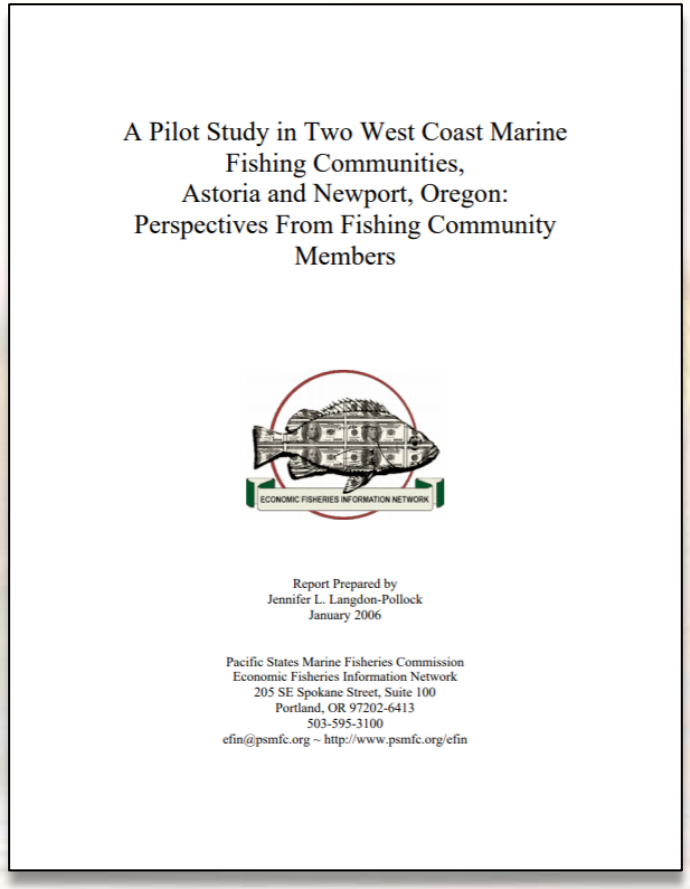


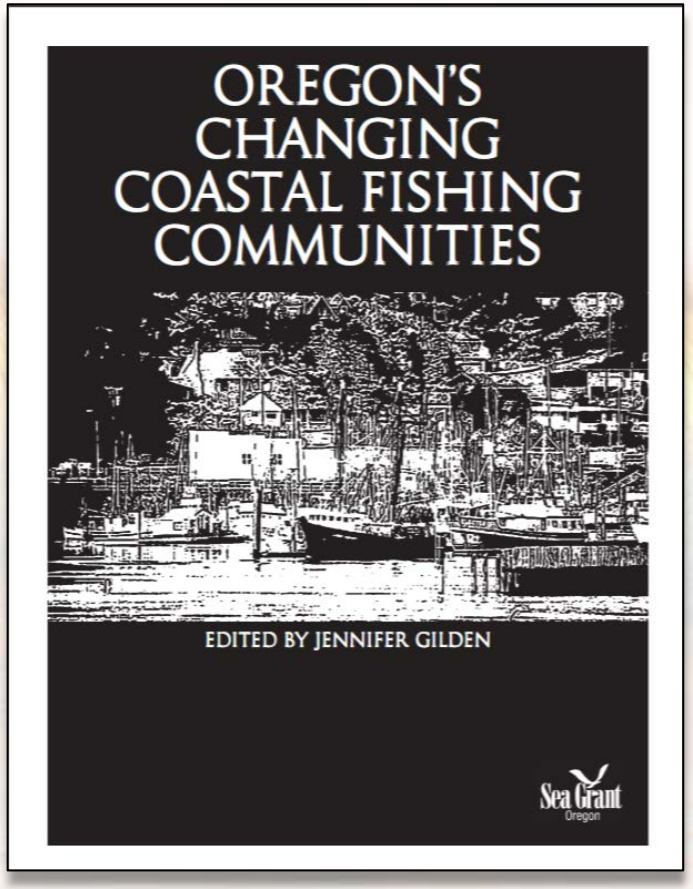


Fisheries – Port Infrastructure

Future work: Build upon existing information on fishing communities and port infrastructure







Monitoring Studies

Real-time Opportunity for Development Environmental Observations (RODEO) (AT-14-01) *Ongoing*

https://www.boem.gov/sites/default/files/documents/environment/environmental-studies/RODEO.pdf

Block Island Wind Farm
(Rhode Island State waters)

Dennis Schroeder / NREL

Where to Find Data and Maps?

- **California**

  DataBasin

  https://caoffshorewind.databasin.org

- **Oregon**

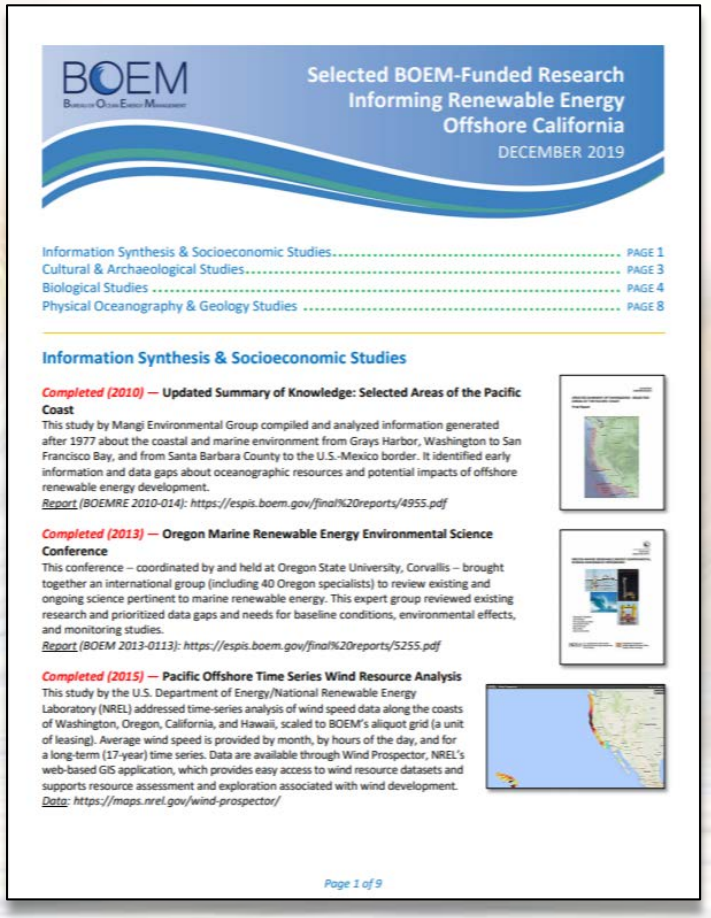
  West Coast Data Portal *in development*

  https://portal.westcoastoceans.org

- **www.MarineCadastre.gov**

Where to Find BOEM Reports?

Selected BOEM-Funded Research Informing Renewable Energy Offshore California



BOEM
Selected BOEM-Funded Research Informing Renewable Energy Offshore California
DECEMBER 2019

Information Synthesis & Socioeconomic Studies

Completed (2010) — **Updated Summary of Knowledge: Selected Areas of the Pacific Coast**
This study by Mangi Environmental Group compiled and analyzed information generated after 1977 about the coastal and marine environment from Grays Harbor, Washington to San Francisco Bay, and from Santa Barbara County to the U.S.-Mexico border. It identified early information and data gaps about oceanographic resources and potential impacts of offshore renewable energy development.
Report (BOEMRE 2010-014): https://espis.boem.gov/final%20reports/4955.pdf

Completed (2013) — **Oregon Marine Renewable Energy Environmental Science Conference**
This conference – coordinated by and held at Oregon State University, Corvallis – brought together an international group (including 40 Oregon specialists) to review existing and ongoing science pertinent to marine renewable energy. This expert group reviewed existing research and prioritized data gaps and needs for baseline conditions, environmental effects, and monitoring studies.
Report (BOEM 2013-0113): https://espis.boem.gov/final%20reports/5255.pdf

Completed (2015) — **Pacific Offshore Time Series Wind Resource Analysis**
This study by the U.S. Department of Energy/National Renewable Energy Laboratory (NREL) addressed time-series analysis of wind speed data along the coasts of Washington, Oregon, California, and Hawaii, scaled to BOEM's aliquot grid (a unit of leasing). Average wind speed is provided by month, by hours of the day, and for a long-term (17-year) time series. Data are available through Wind Prospector, NREL's web-based GIS application, which provides easy access to wind resource datasets and supports resource assessment and exploration associated with wind development.
Data: https://maps.nrel.gov/wind-prospector/

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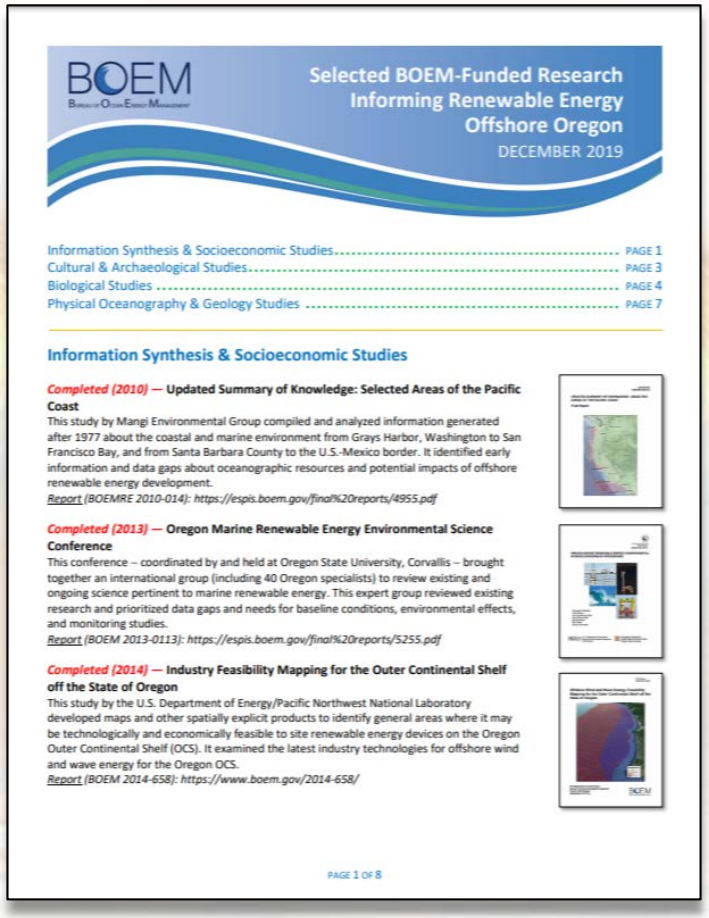
https://www.boem.gov/Selected-BOEM-Research-Renewable-CA/

Selected BOEM-Funded Research Informing Renewable Energy Offshore Oregon



BOEM
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DECEMBER 2019

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Report (BOEM 2013-0113): https://espis.boem.gov/final%20reports/5255.pdf

Completed (2014) — **Industry Feasibility Mapping for the Outer Continental Shelf off the State of Oregon**
This study by the U.S. Department of Energy/Pacific Northwest National Laboratory developed maps and other spatially explicit products to identify general areas where it may be technologically and economically feasible to site renewable energy devices on the Oregon Outer Continental Shelf (OCS). It examined the latest industry technologies for offshore wind and wave energy for the Oregon OCS.
Report (BOEM 2014-658): https://www.boem.gov/2014-658/

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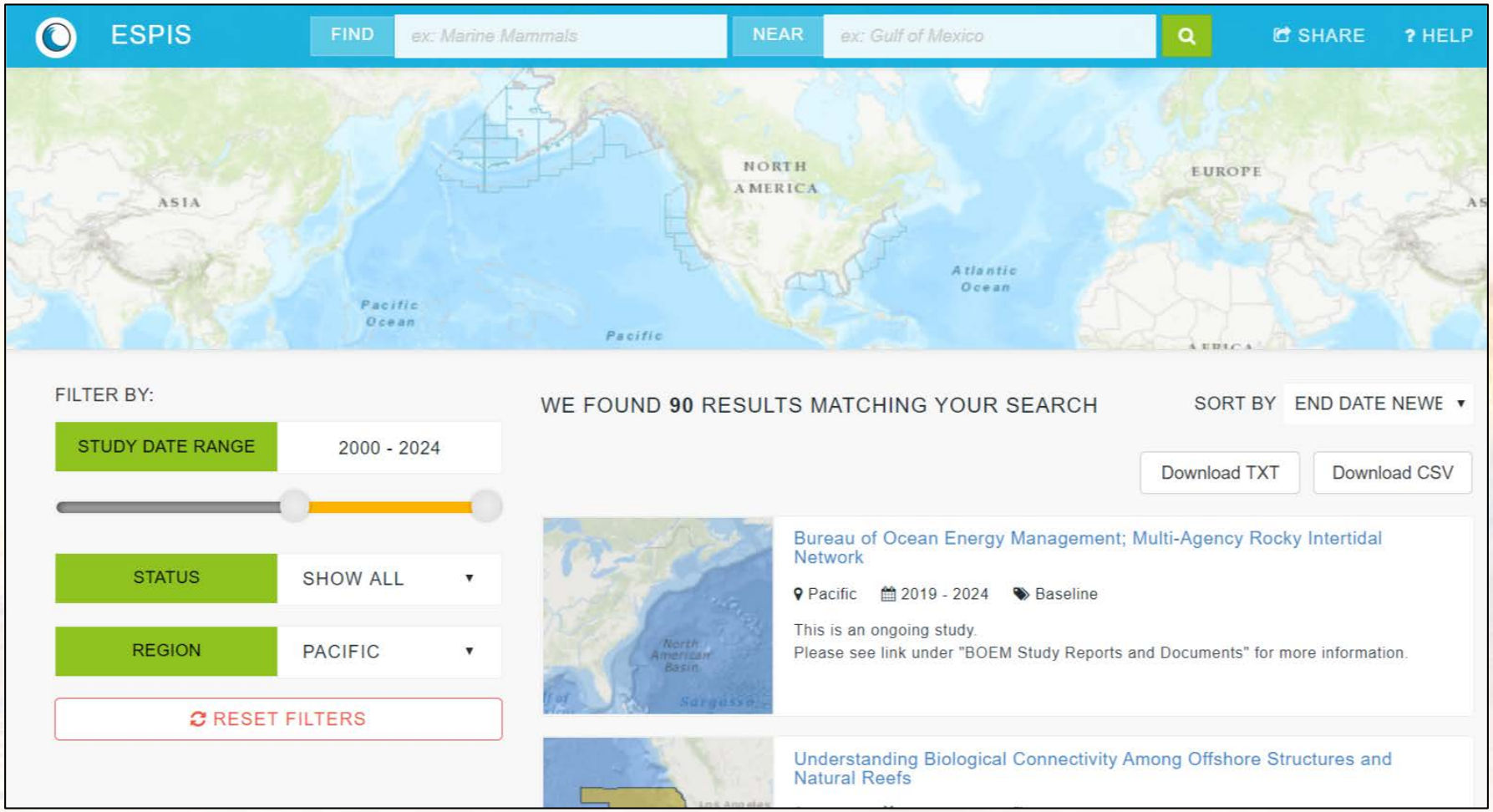
https://www.boem.gov/Selected-BOEM-Research-Renewable-OR/

Where to Find BOEM Reports?

Environmental Studies Program Information System (ESPIS)

https://marinecadastre.gov/espis/#/




Thank You

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