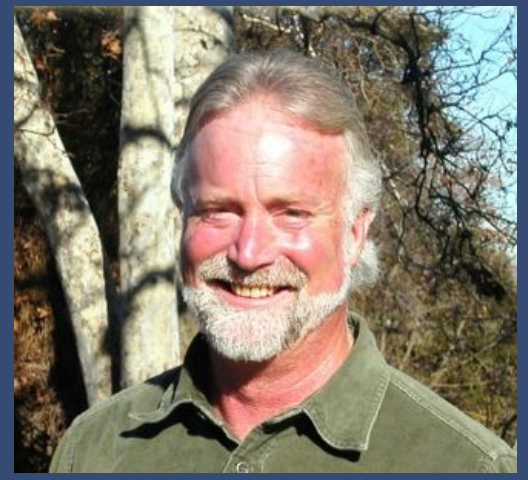
North Coast Offshore Wind Feasibility: *Environmental Conditions and Potential Concerns*

Dr. Sharon Kramer, Principal
Senior Marine Biologist



Dr. Scott Terrill, Principal
Senior Avian Ecologist

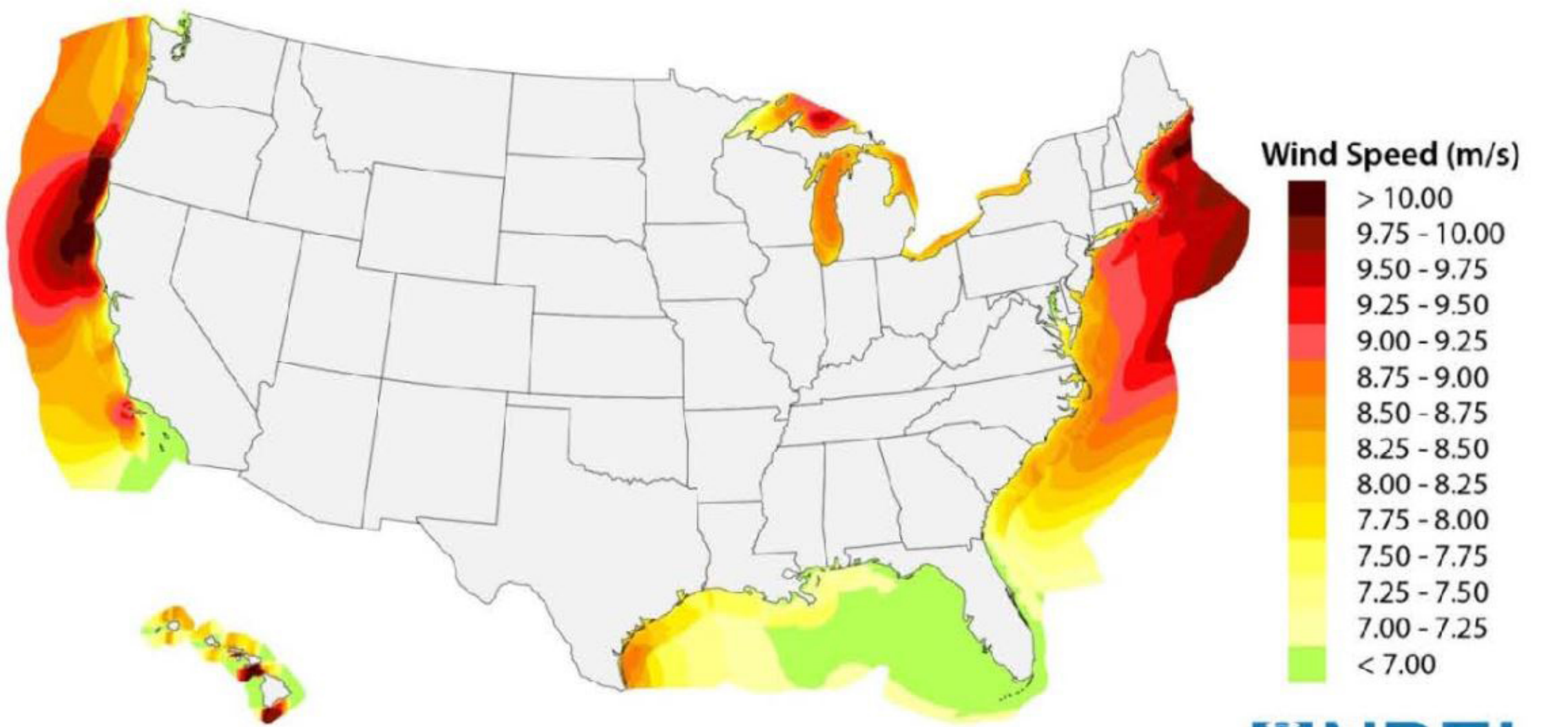
Schatz Energy Research Center Webinar Workshop Series
Exploring the Feasibility of Offshore Wind Energy
for the California North Coast
September 21, 2020

H. T. HARVEY & ASSOCIATES
Ecological Consultants
50 years of field notes, exploration, and excellence

Topics Covered

- **Overview of north coast offshore wind scenarios**
- **Environmental considerations onshore**
  - Transmission line improvements
- **Environmental considerations offshore**
  - Regulatory setting
  - Project components
  - Environmental stressor-receptor interactions
  - Construction and O&M
  - Seabirds
- **Key takeaways**

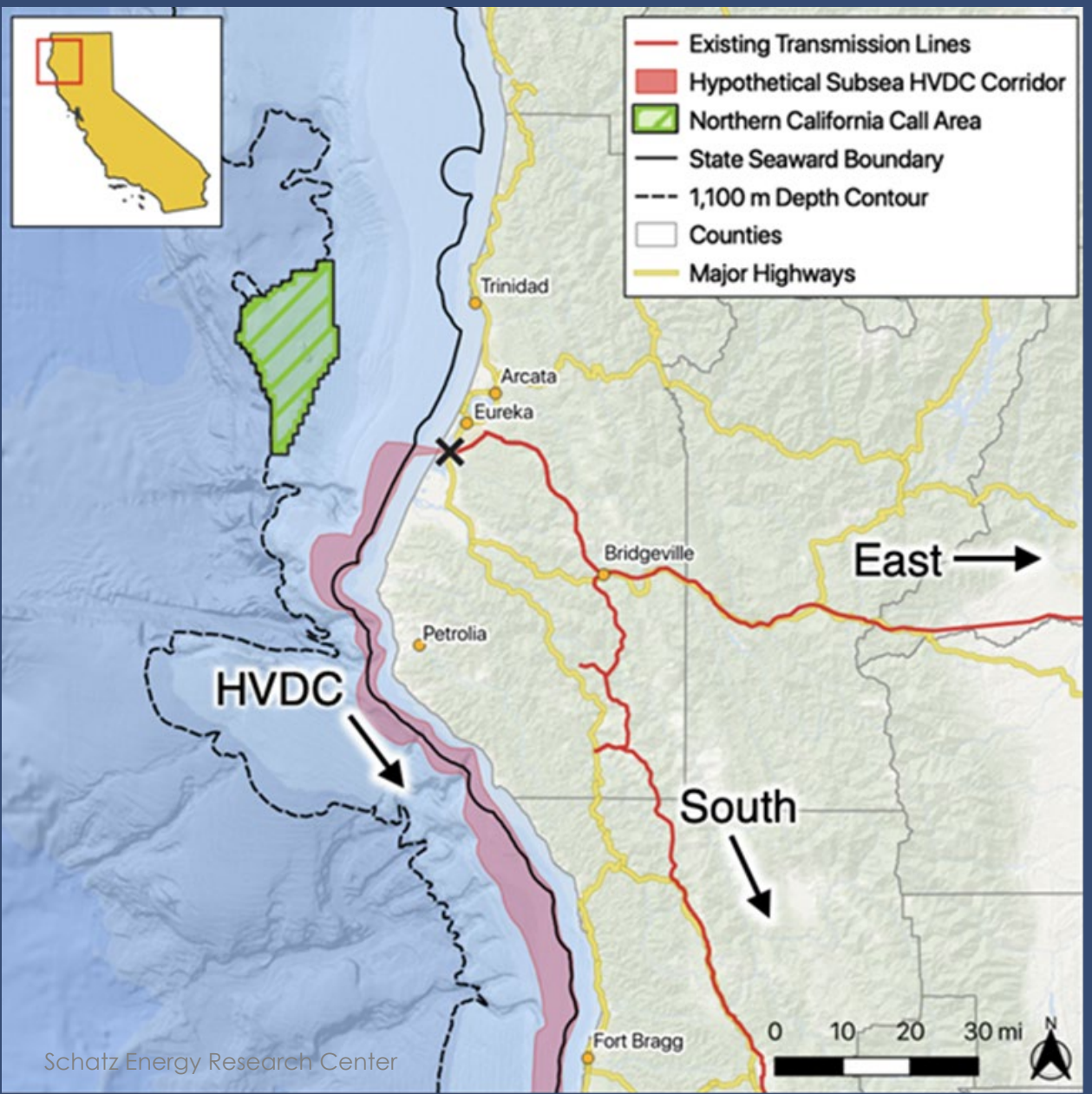
Offshore Wind Energy Resource Map



Data Source: AWS Truepower 0-50nm; NREL WIND Toolkit beyond 50nm.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

North Coast Offshore Wind Project



Offshore call area

- Location
  - 21 miles off Eureka
  - ~206 square miles

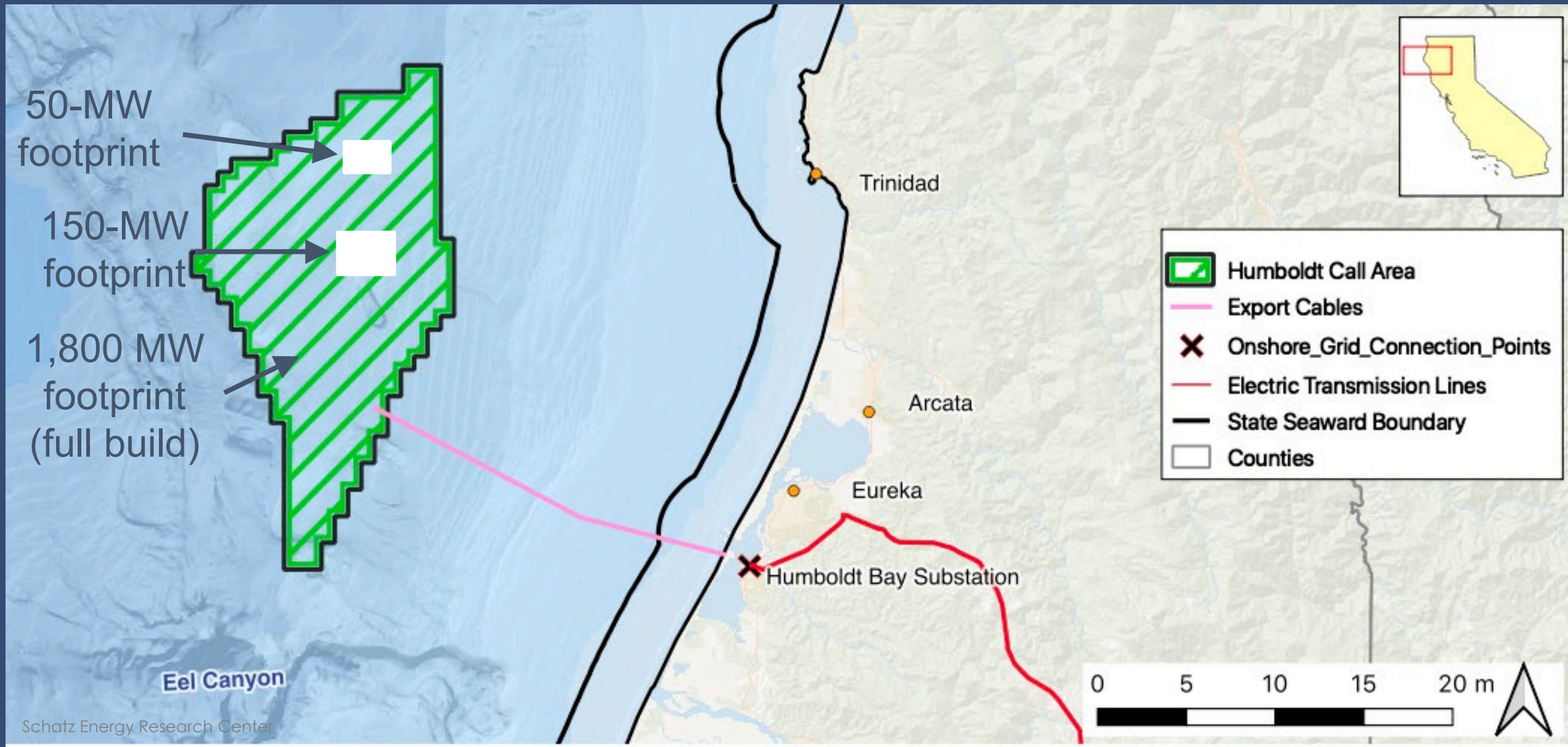
Transmission to shore

- Export cable
- Cable landfall
- Subsea transmission cable

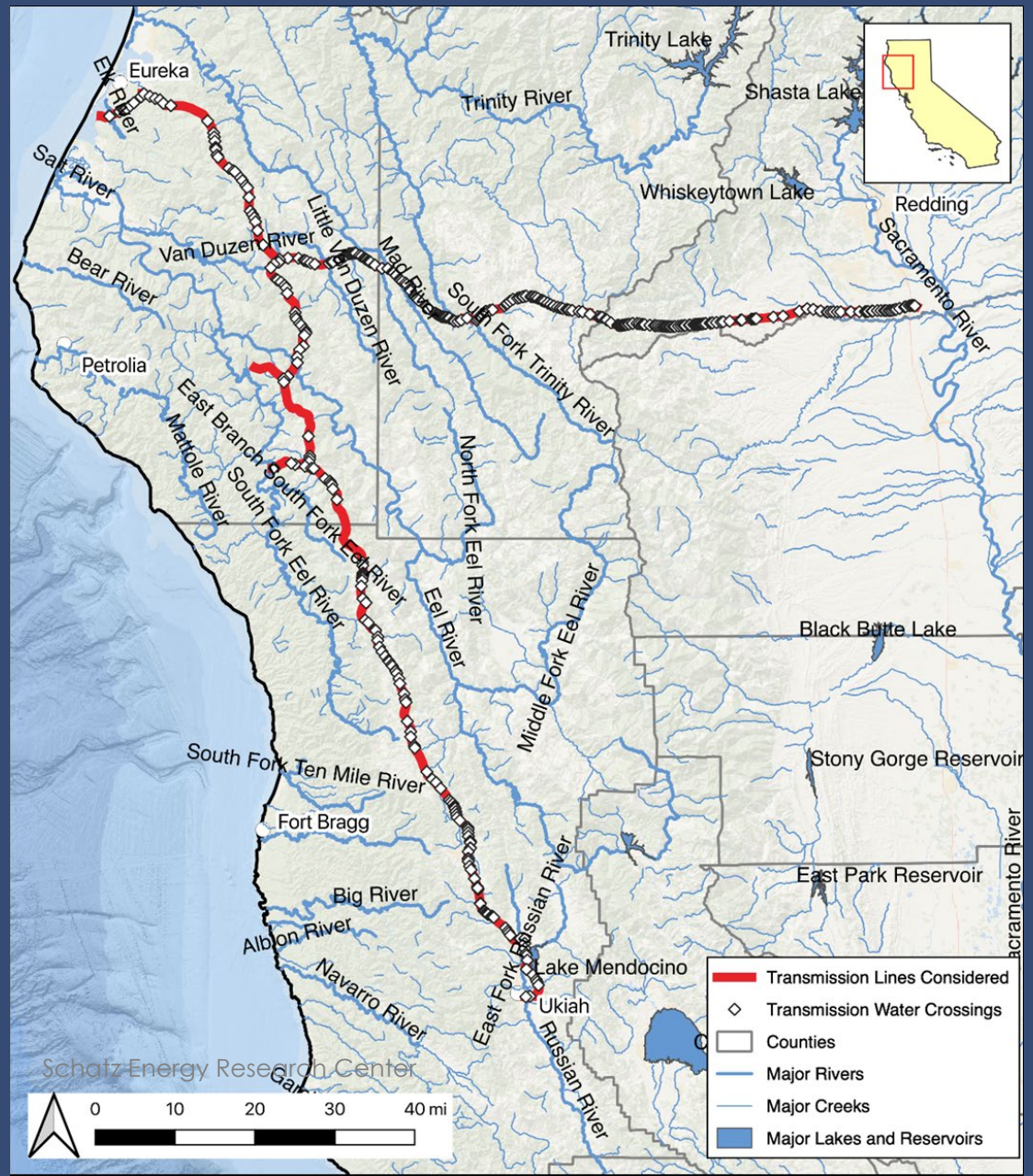
Terrestrial interconnect and transmission

Humboldt Bay port improvements

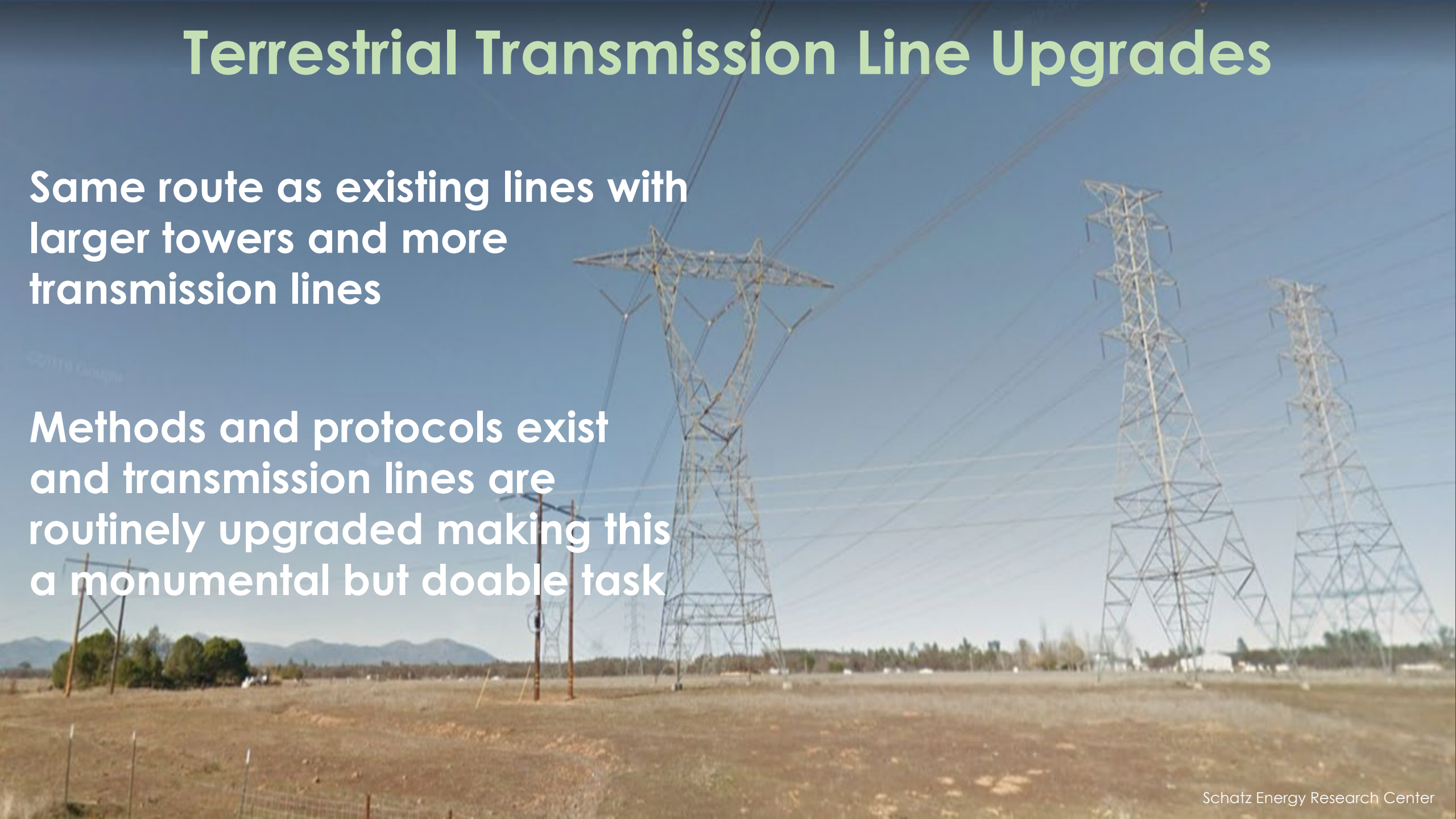
Our Team's Study Scenarios



Physical Setting: Onshore



Terrestrial Transmission Line Upgrades



Same route as existing lines with larger towers and more transmission lines

Methods and protocols exist and transmission lines are routinely upgraded making this a monumental but doable task

Onshore Construction and O&M Effects

Wildlife

- Habitat loss due to vegetation removal
- Noise disturbance from horizontal directional drilling and transmission line improvement activities
- Increased long-term risk of bird collision with transmission lines

Plants, Wetlands, and Watercourses

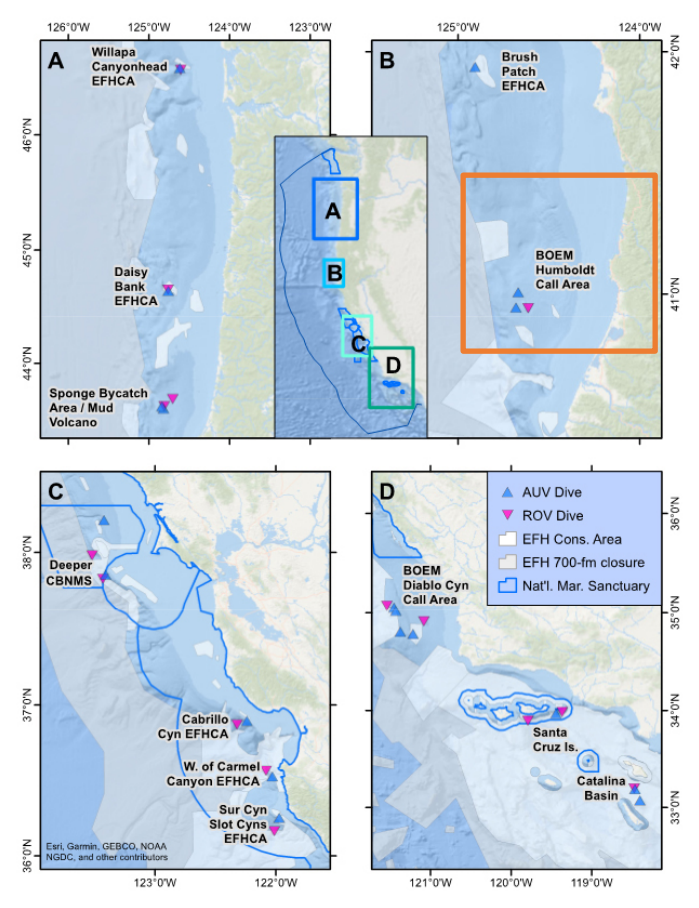
- Impacts on threatened or endangered plant species or sensitive natural communities from ground-disturbing activities
- Ground disturbance causing hydrological interruption or placement of fill in jurisdictional waters
- Introduction and spread of terrestrial invasive plant species

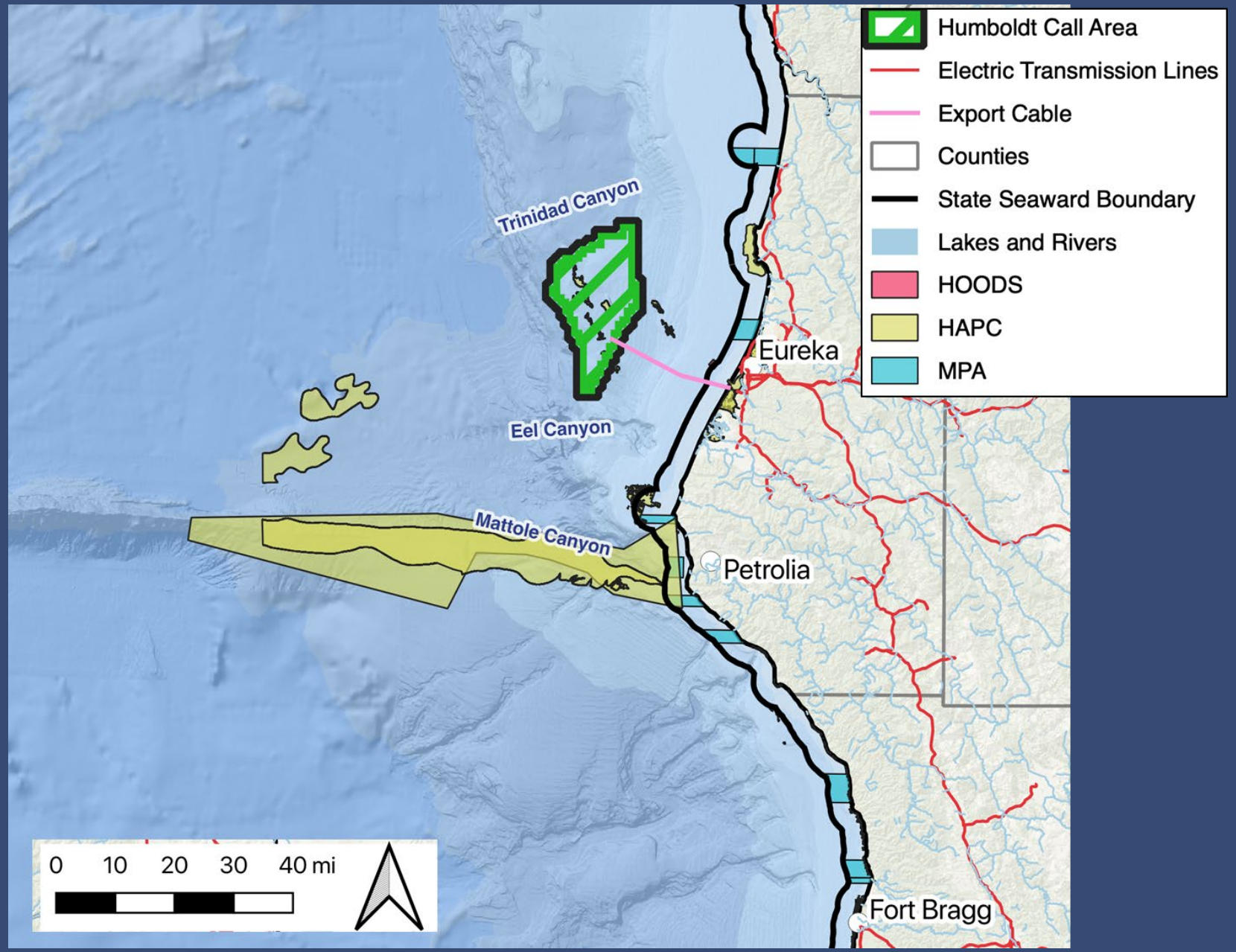
Regulatory Framework for Offshore Wind: Bureau of Ocean Energy Management (BOEM)

https://www.boem.gov/renewable-energy/regulatory-framework-and-guidelines

Environmental Review Requirement	Approving/Lead Agency
Energy Policy Act of 2005	BOEM
National Environmental Policy Act	BOEM
Section 401 of the Clean Water Act	U.S. Environmental Protection Agency; North Coast Regional Water Quality Control Board; Central Valley Regional Water Quality Control Board
Section 404 of the Clean Water Act; Section 10 of the Rivers and Harbors Appropriation Act of 1899	U.S. Army Corps of Engineers, San Francisco and Sacramento Districts
Section 7 of the federal Endangered Species Act	U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS)
Magnuson-Stevens Fisheries Conservation and Management Act	NMFS
Marine Mammal Protection Act	NMFS
Migratory Bird Treaty Act	USFWS
Bald and Golden Eagle Protection Act	USFWS
California Environmental Quality Act	California State Lands Commission (CSLC); California Public Utilities Commission; Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD)
California Endangered Species Act	California Department of Fish and Wildlife (CDFW)
California Fish and Game Code Section 1600 et seq.	CDFW
California Coastal Act	California Coastal Commission, Humboldt County
Section 307 of the Coastal Zone Management Act	California Coastal Commission
Section 106 of National Historic Preservation Act	California Office of Historic Preservation
National Forest Management Act of 1976	U.S. Forest Service
Approval for Navigation Aids	U.S. Coast Guard
Obstruction Evaluation/Airport Airspace Analysis	Federal Aviation Administration
Federal Land Policy and Management Act of 1976	Bureau of Land Management
California Submerged Lands Act	CSLC
California Clean Air Act	California Air Resources Board
Development Permit	HBHRCD

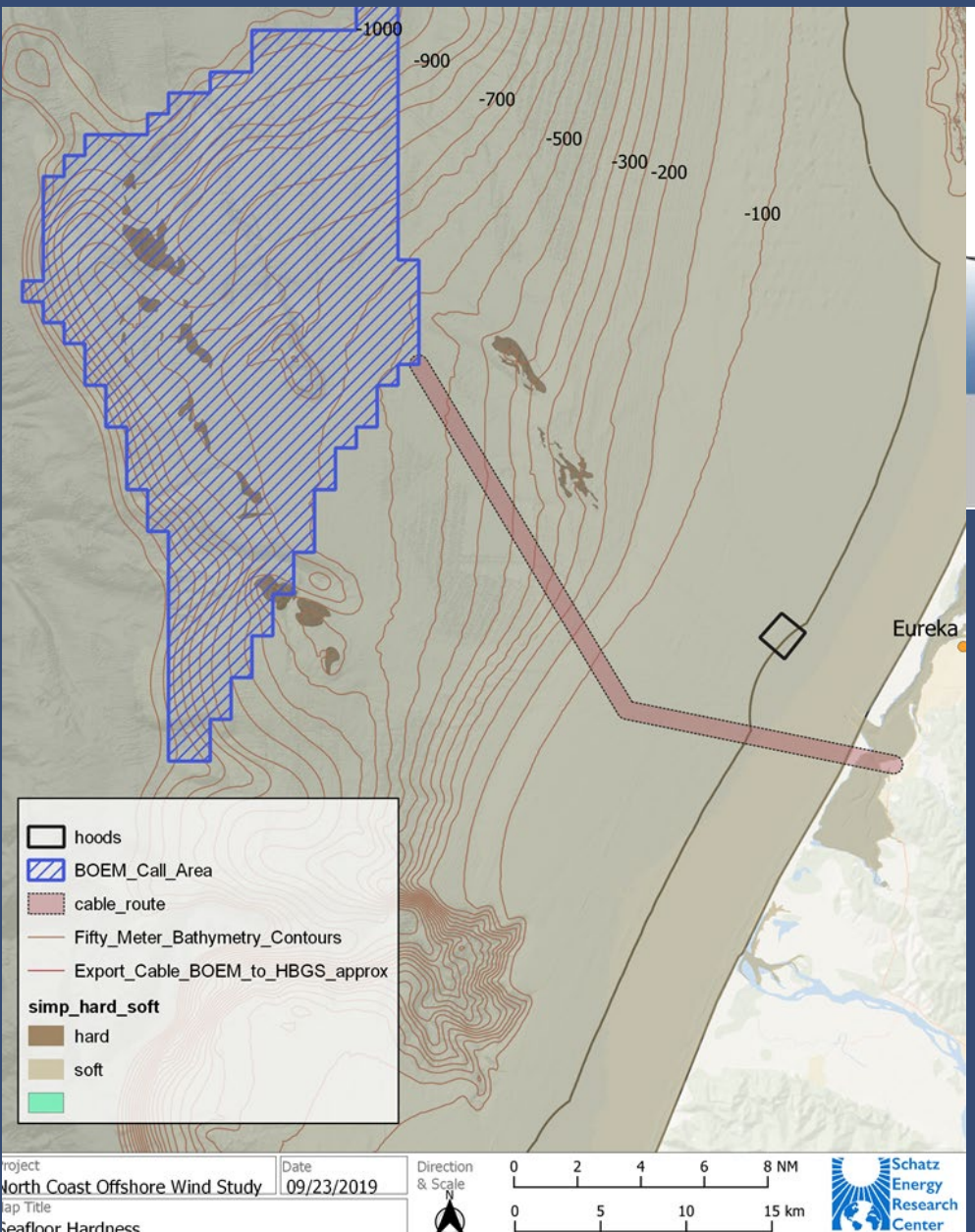
Physical Setting: Offshore

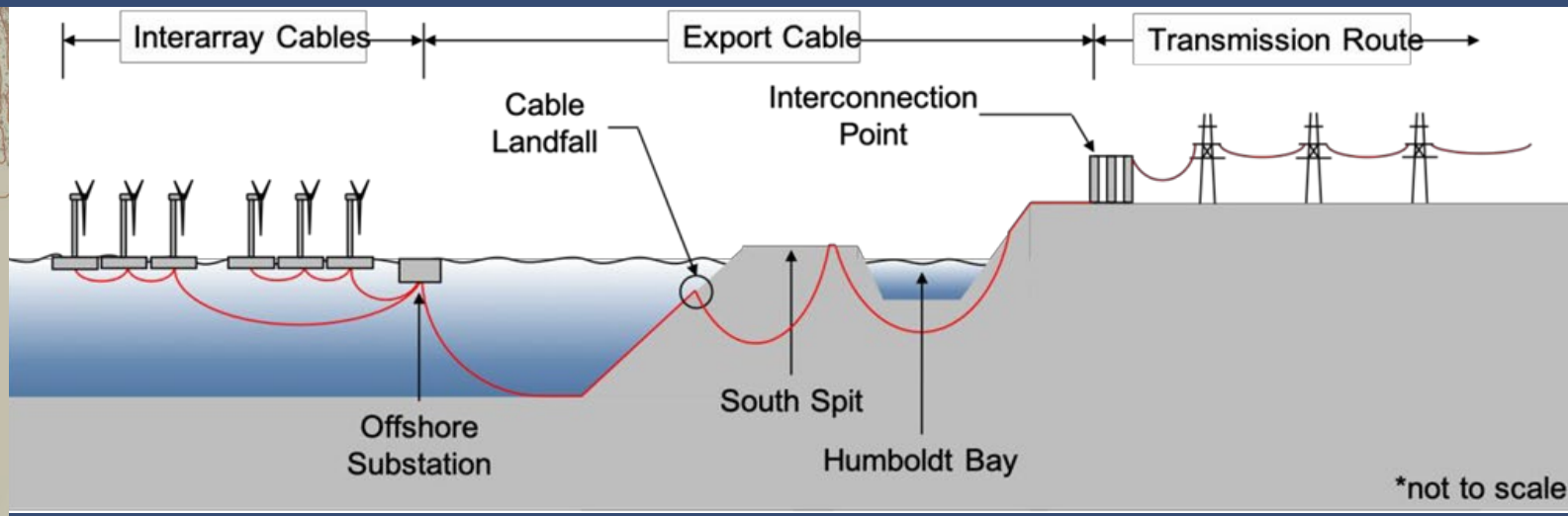




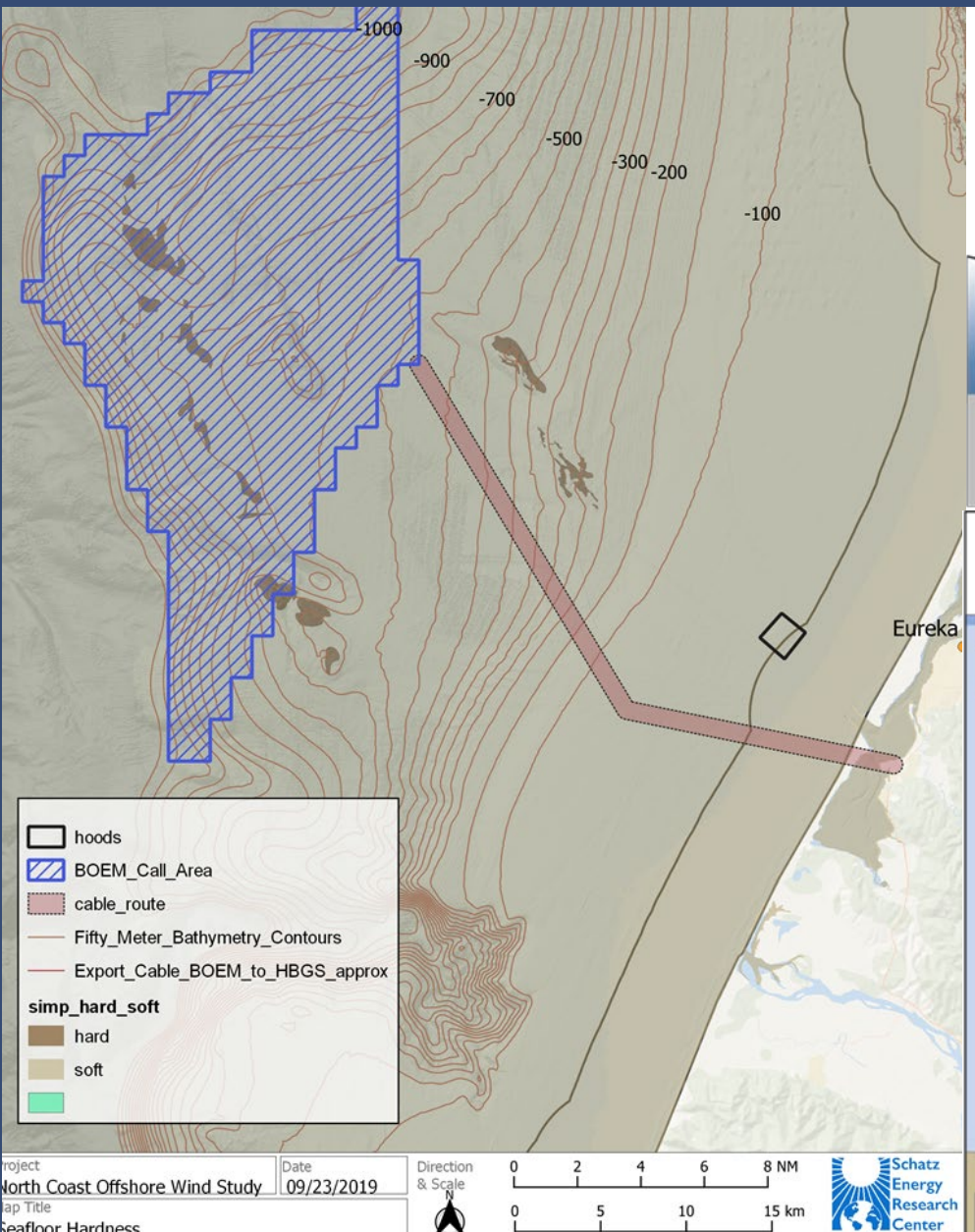
NOAA Ocean Exploration and Research

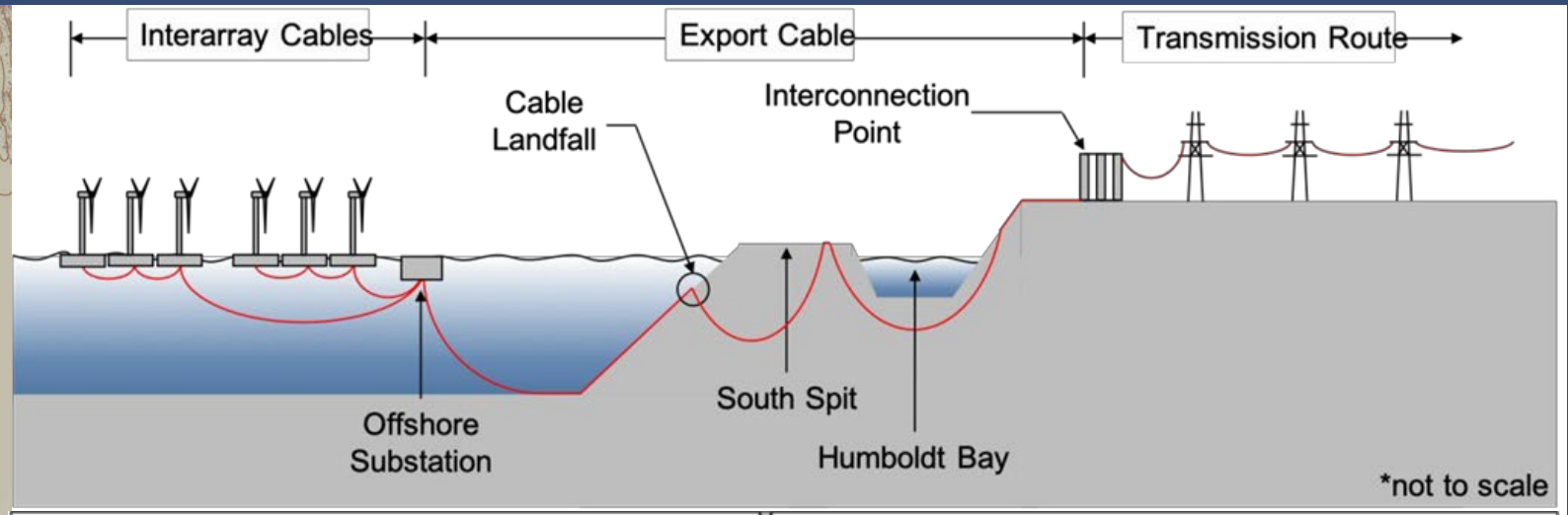
Project Components

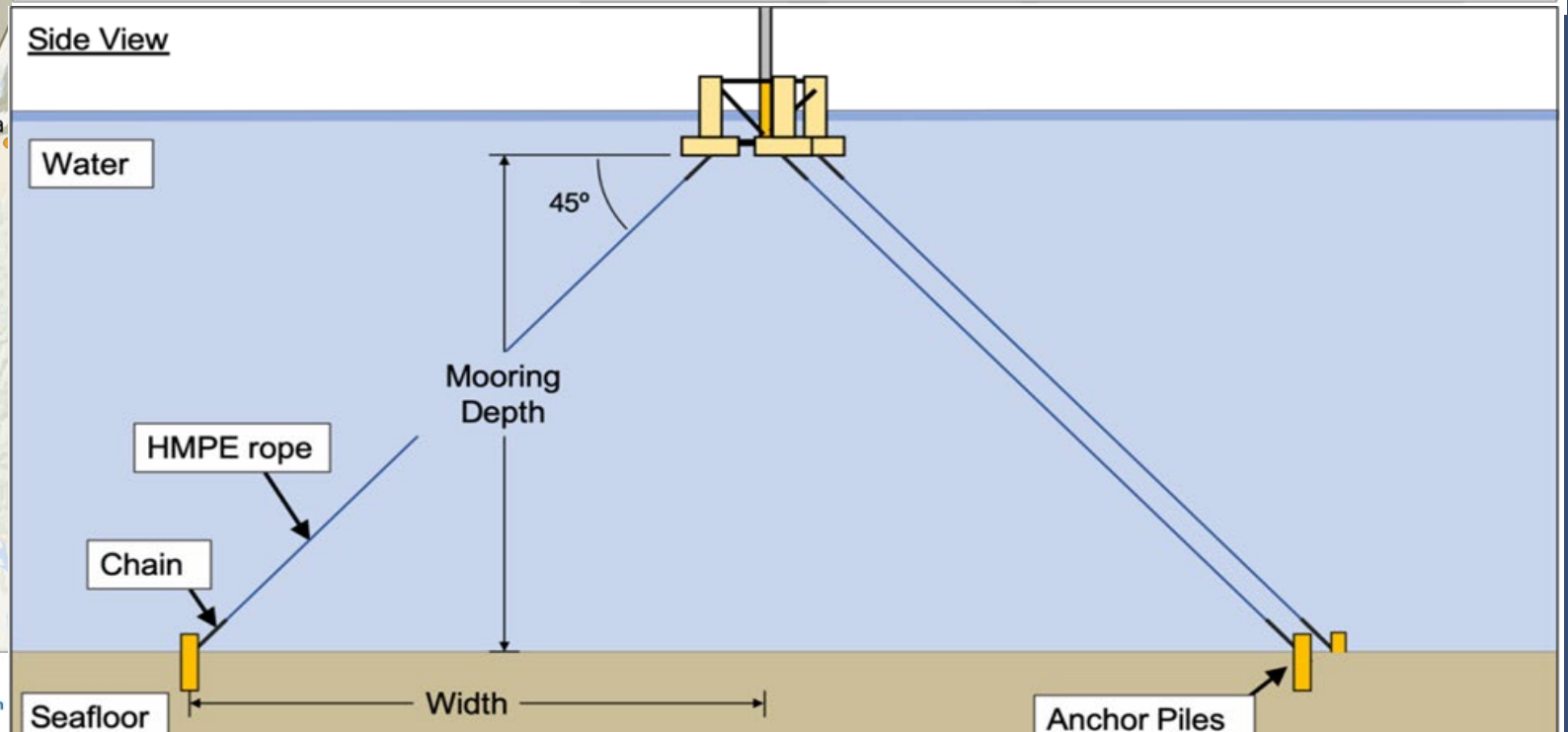




Project Components





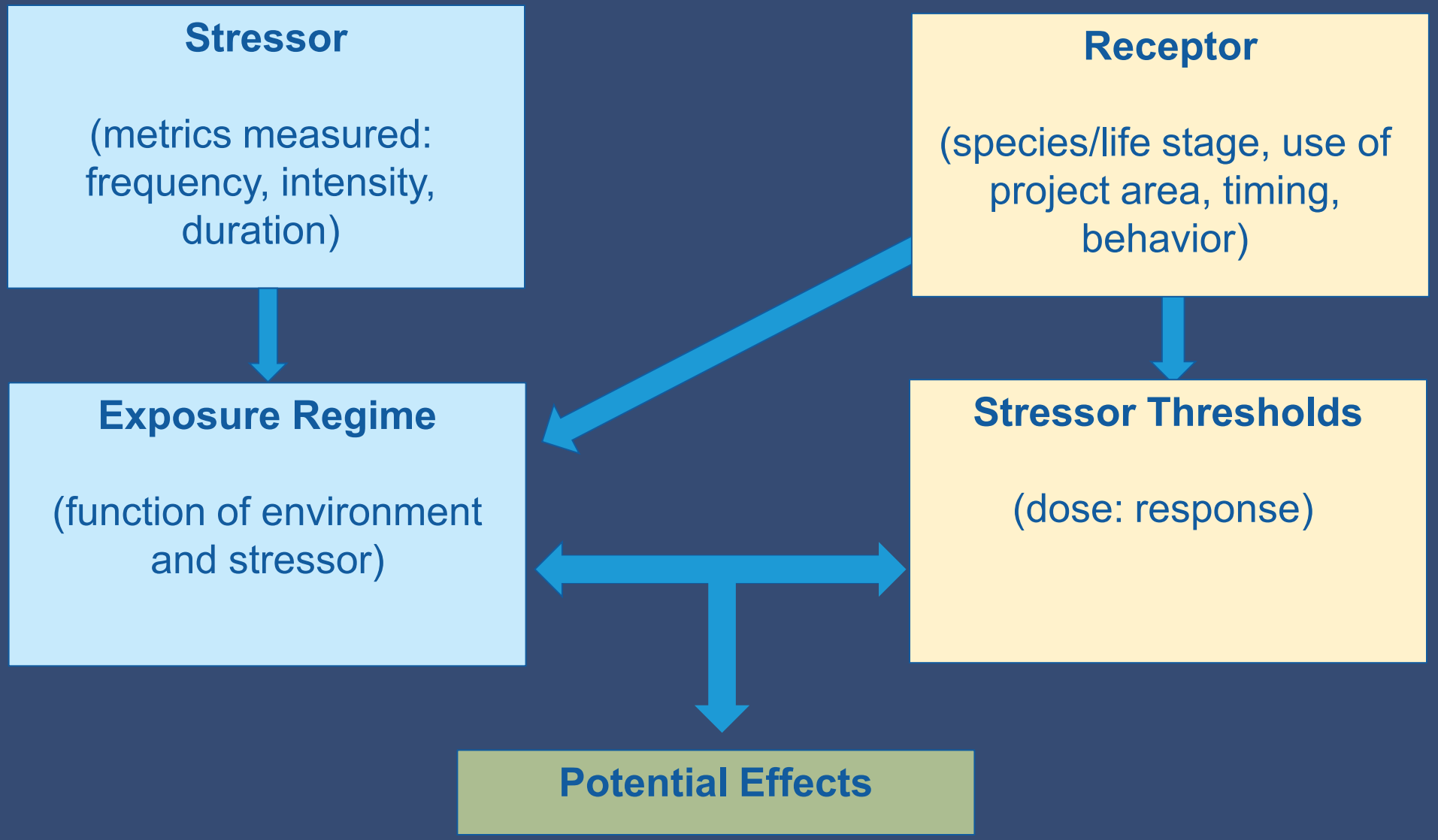


In-Water Project Phases

Phase 1	Phase 2	Phase 3	Phase 4
Site Assessment and characterization	**Construction**	**Operations and maintenance (O&M)**	**Decommissioning**
Collecting information needed to design and permit a project [weeks]	Cable laying, anchoring, mooring, and device deployment [months-years]	Monitoring and maintenance activities [years]	Project removal [months – years]

*[https://tethys.pnnl.gov/sites/default/files/publications/EMEC_2005.pdf]

Stressor ➡ Interaction ⬅ Receptor



Interactions: Offshore Construction

Construction disturbance

- Disturbance of benthic habitat during cable lay and anchor placement
- Changes in water quality from sedimentation or contaminants

Increase in underwater acoustic levels

- Vessels
- Cable lay

Increase in the risk for vessel collisions with wildlife

Artificial lighting disturbance to wildlife (e.g., on decks or underwater)

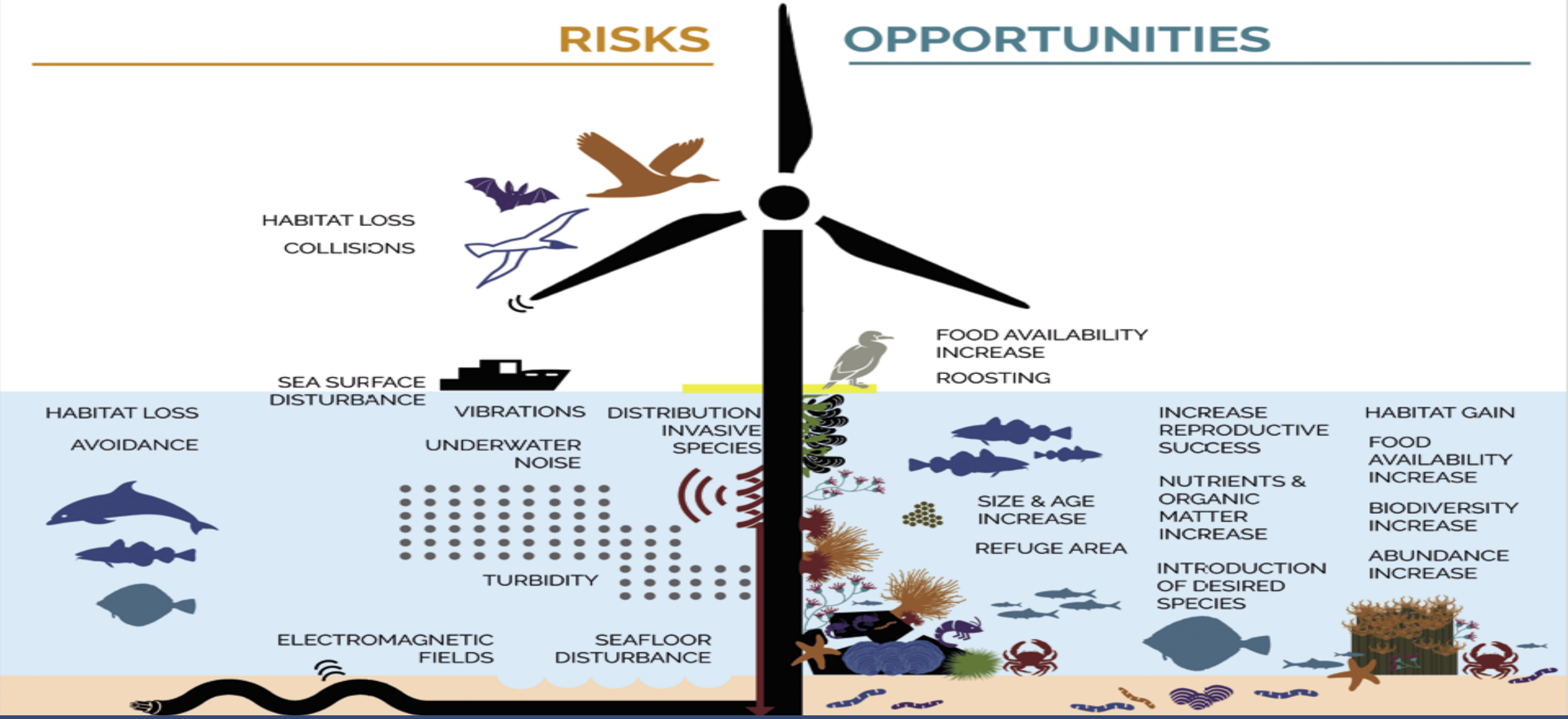
Cable Lay

https://www.vanoord.com/activities/cable-laying-vessel

Taormina et al. 2018. A review of potential impacts of submarine power cables on the marine environment: knowledge gaps, recommendations, and future directions. Renewable and Sustainable Energy Reviews 96:380-391.

Fig. 1. Wheel cutter (left); Plough (centre) and Towed Jetting Vehicle (right) (courtesy: www.ldtravocean.com).

Interactions: Offshore O&M



https://www.noordzee.nl/north-sea-wind-farms-ecological-risks-and-opportunities/

Interactions: Offshore O&M

Habitat changes

- Hard structure on seafloor and in the water column
- Noise produced by turbines and maintenance vessels
- Artificial light
- Electromagnetic fields produced by cables and substation
- Resting and foraging opportunities for birds and mammals

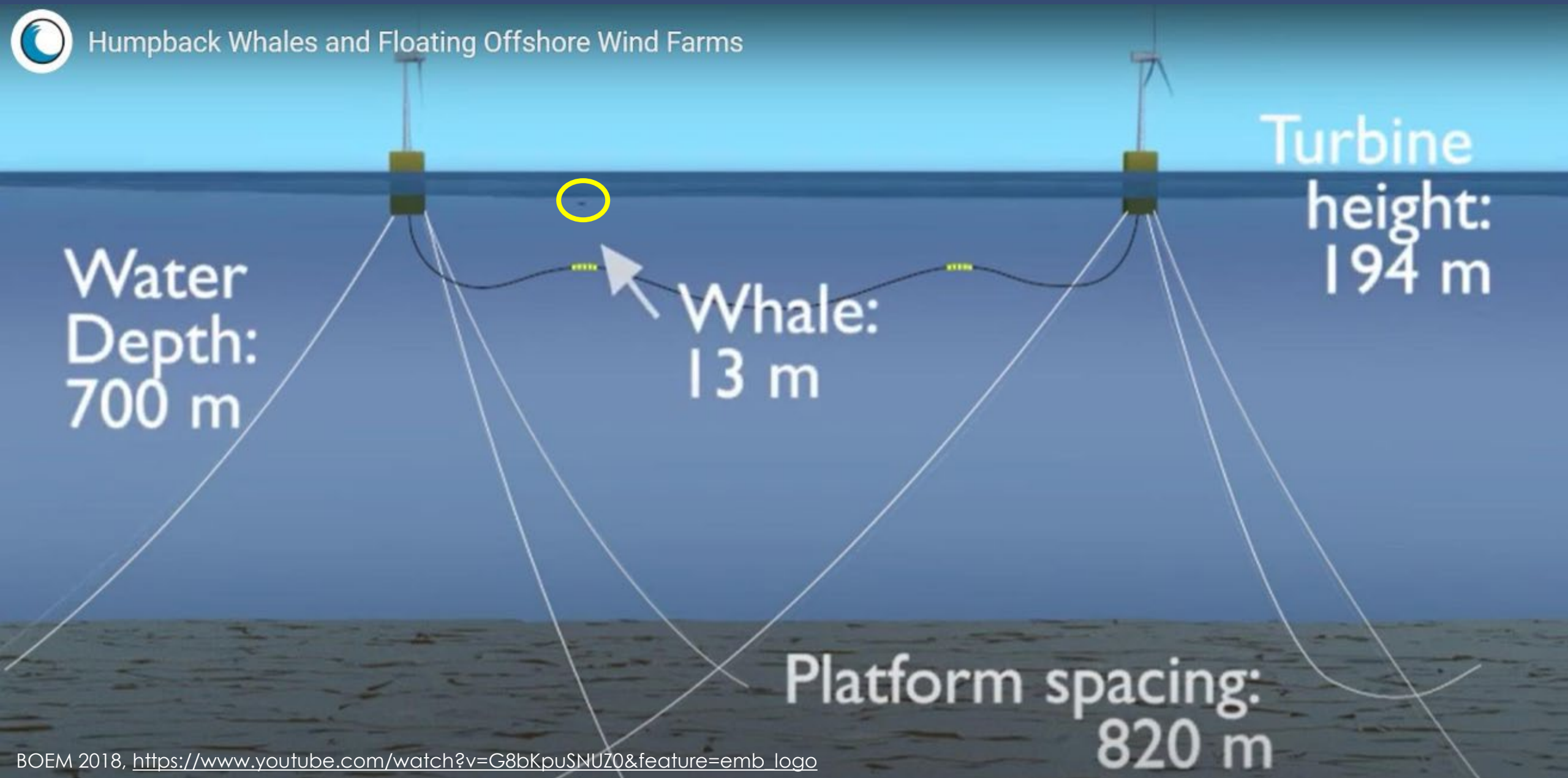
Entanglement

- Lost fishing gear on interarray cables and mooring lines

Collision

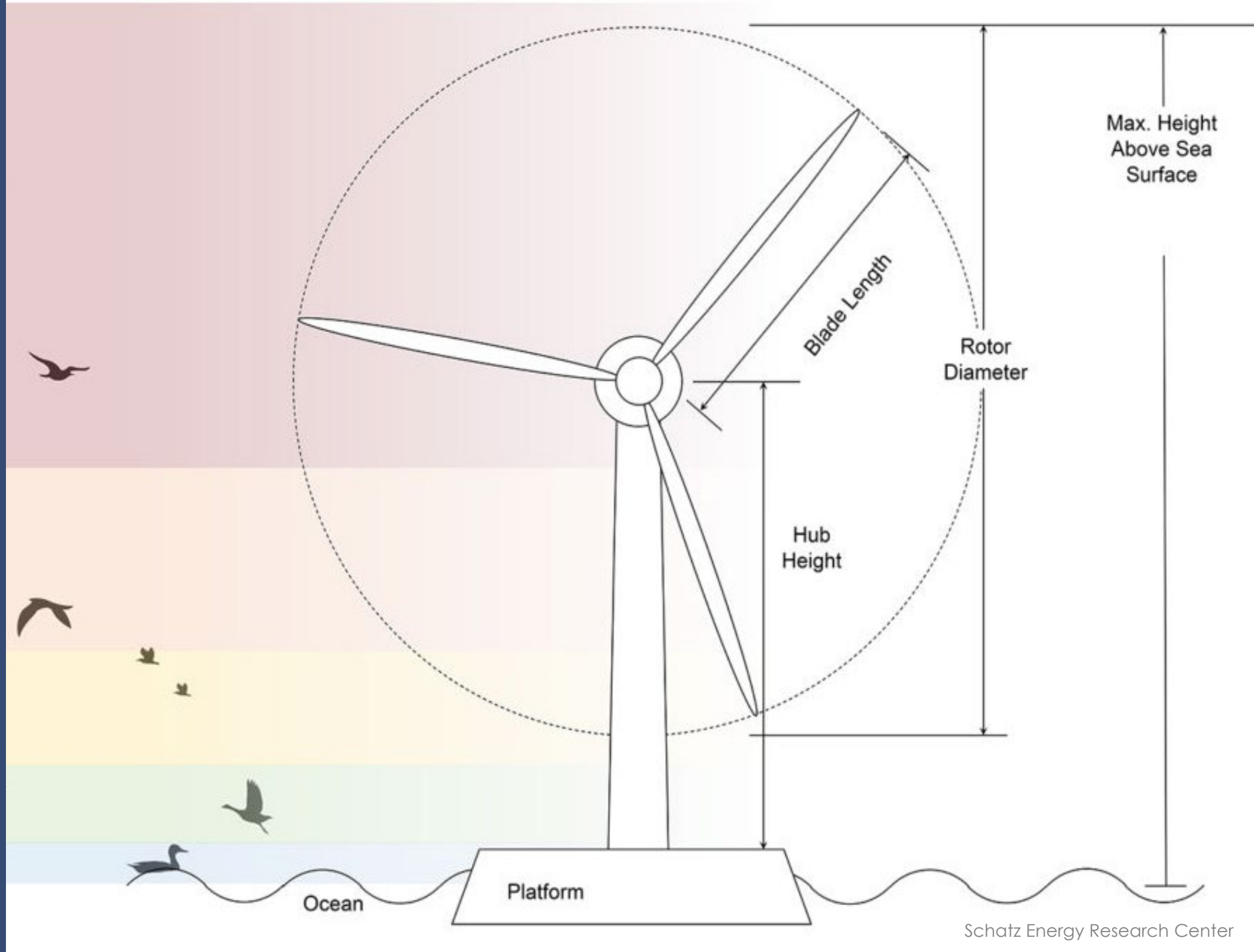
- Underwater structures and large cetaceans
- Rotor swept areas and seabirds (potentially bats too)

Example: Marine Mammal Interactions



BOEM 2018, https://www.youtube.com/watch?v=G8bKpuSNUZ0&feature=emb_logo

Example: Seabird Interactions



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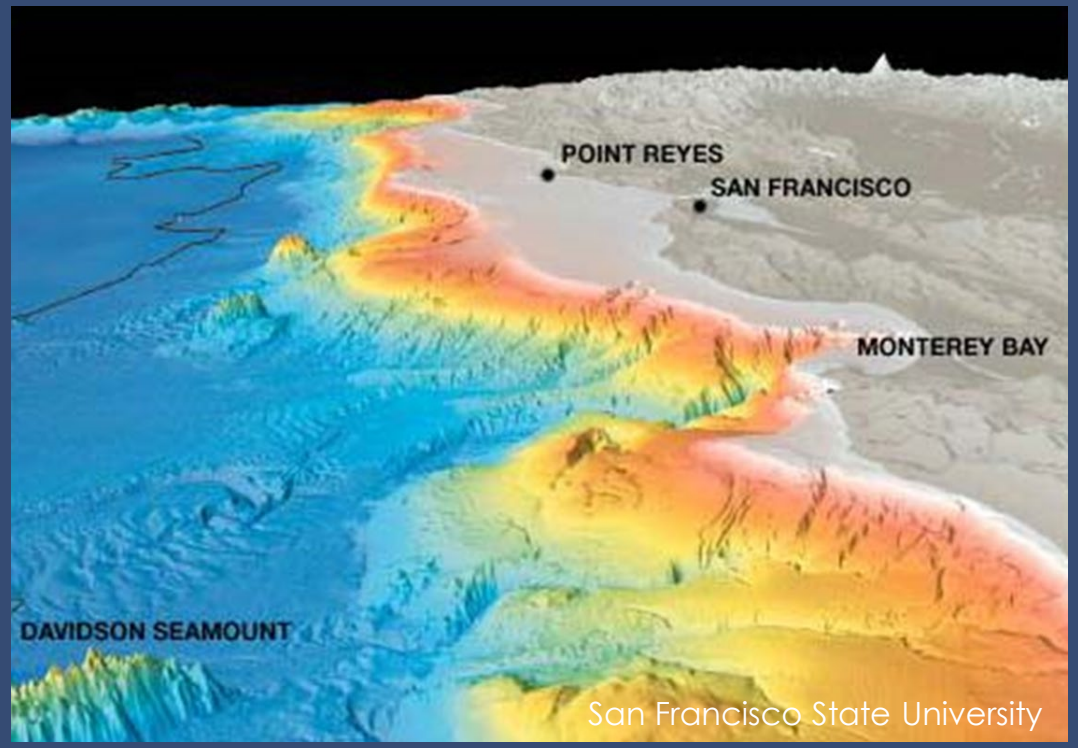
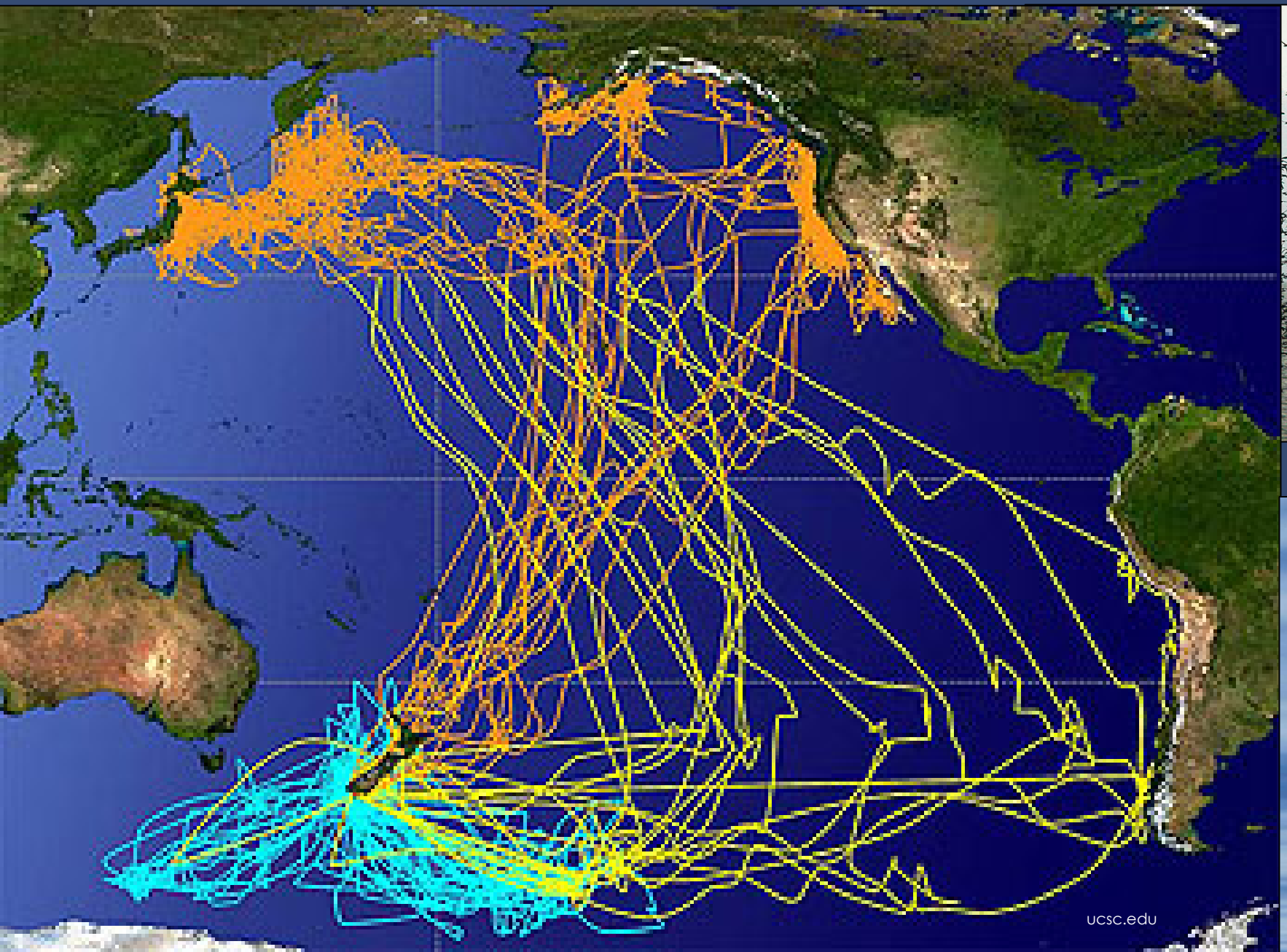
California Current Differs from East Coast and Europe

- **Eastern boundary current**
  strong upwelling = high production
- **Oceanographically and topographically diverse**
- **Greater abundance of seabirds**
- **More complex and diverse species composition**
- **Narrow continental shelf means oceanic species are closer to coast**



Many species migrate to the California Current

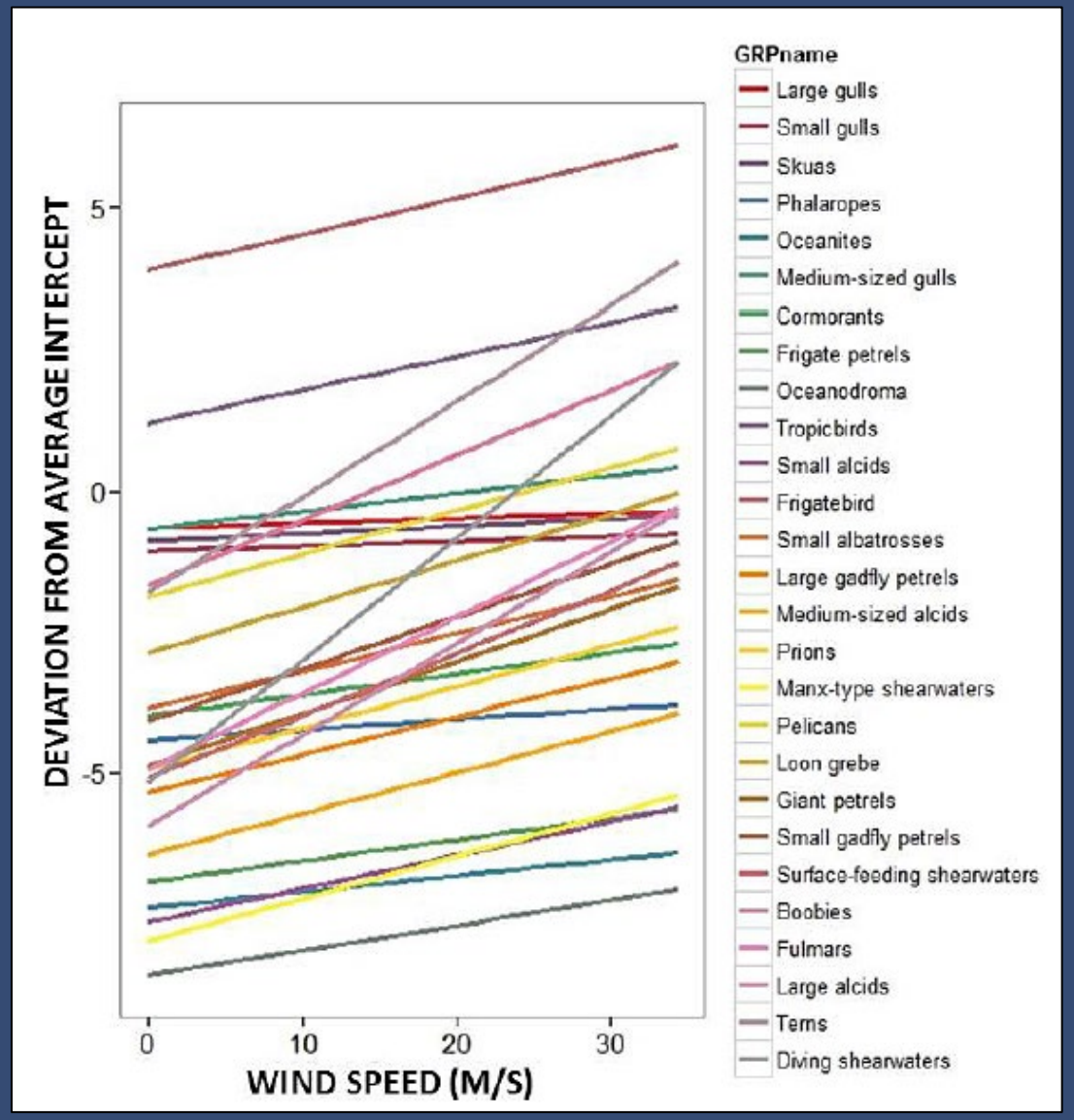


Many Studies and Monitoring Efforts in the Atlantic

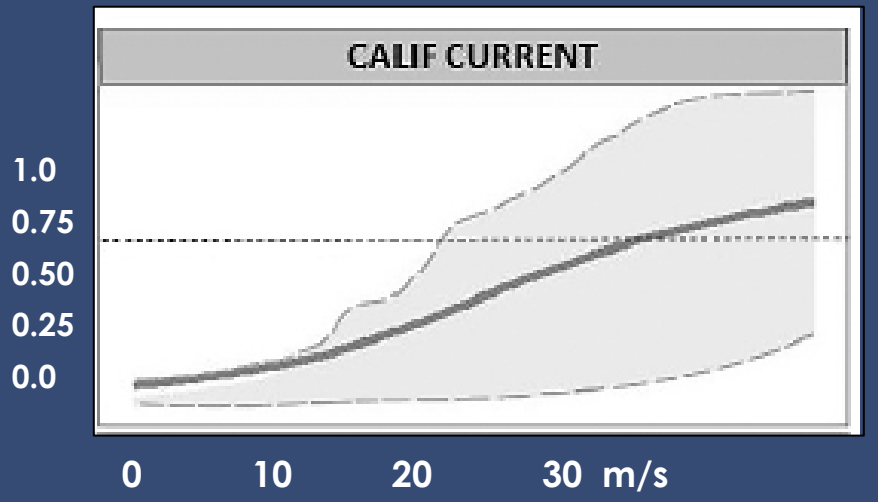
Some of the results with similar species groups in both oceans, especially in the nearshore environment, may be transferred to the Pacific, especially nearshore, but not applicable for many species in the California Current

Significant differences regarding species in the Pacific, especially pronounced off the outer continental shelf

Responses to Increased Wind Speed



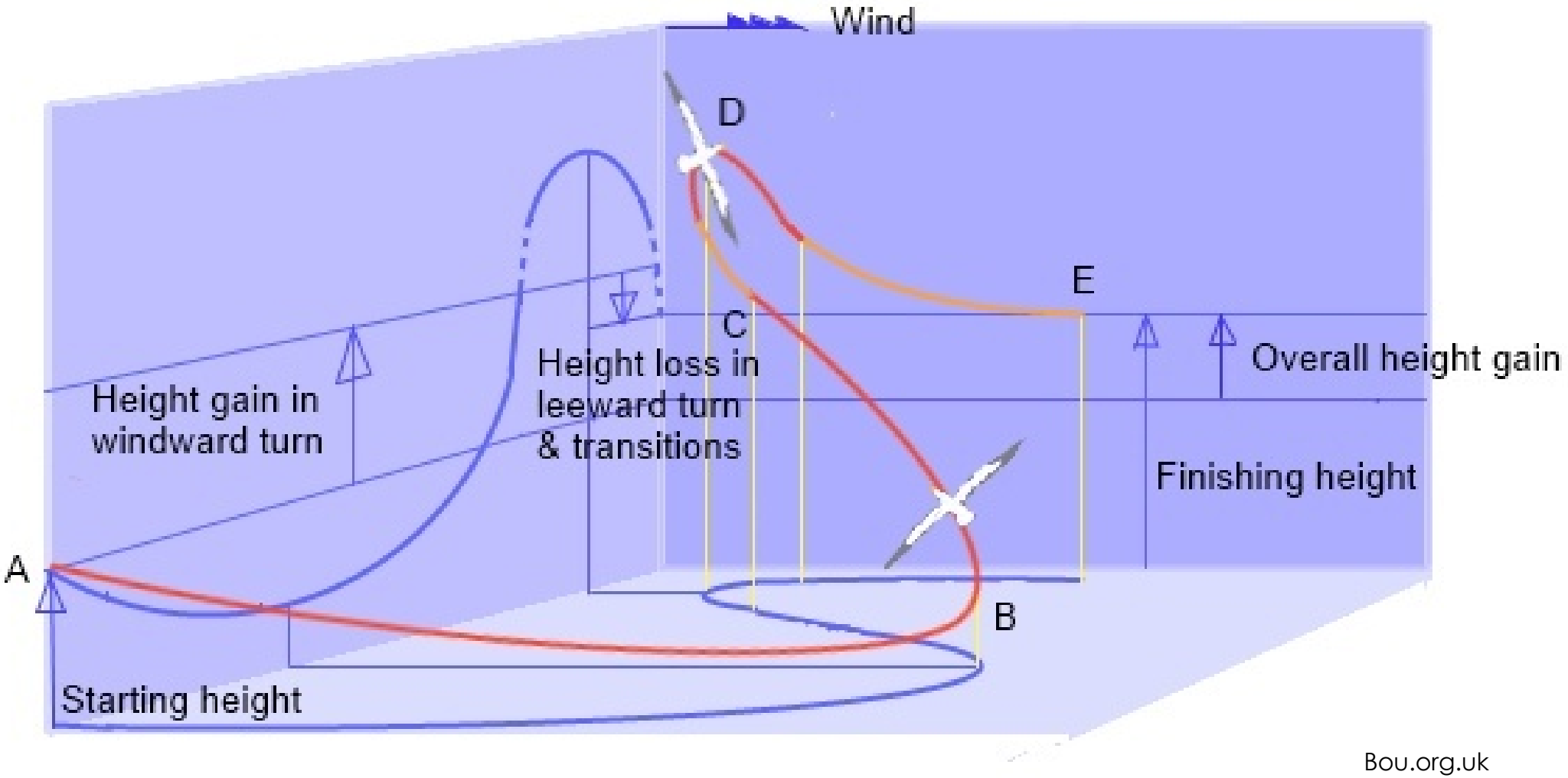
Some flight style groups change flight height more readily as wind speed increases (albatrosses, petrels, and shearwaters)



Probability of flying higher than 10 m as function of wind speed

Source of graphs: Ainley et al. 2005. Marine Ornithology 43:25-36

Figure 1
The Dynamic Soaring Manoeuvre



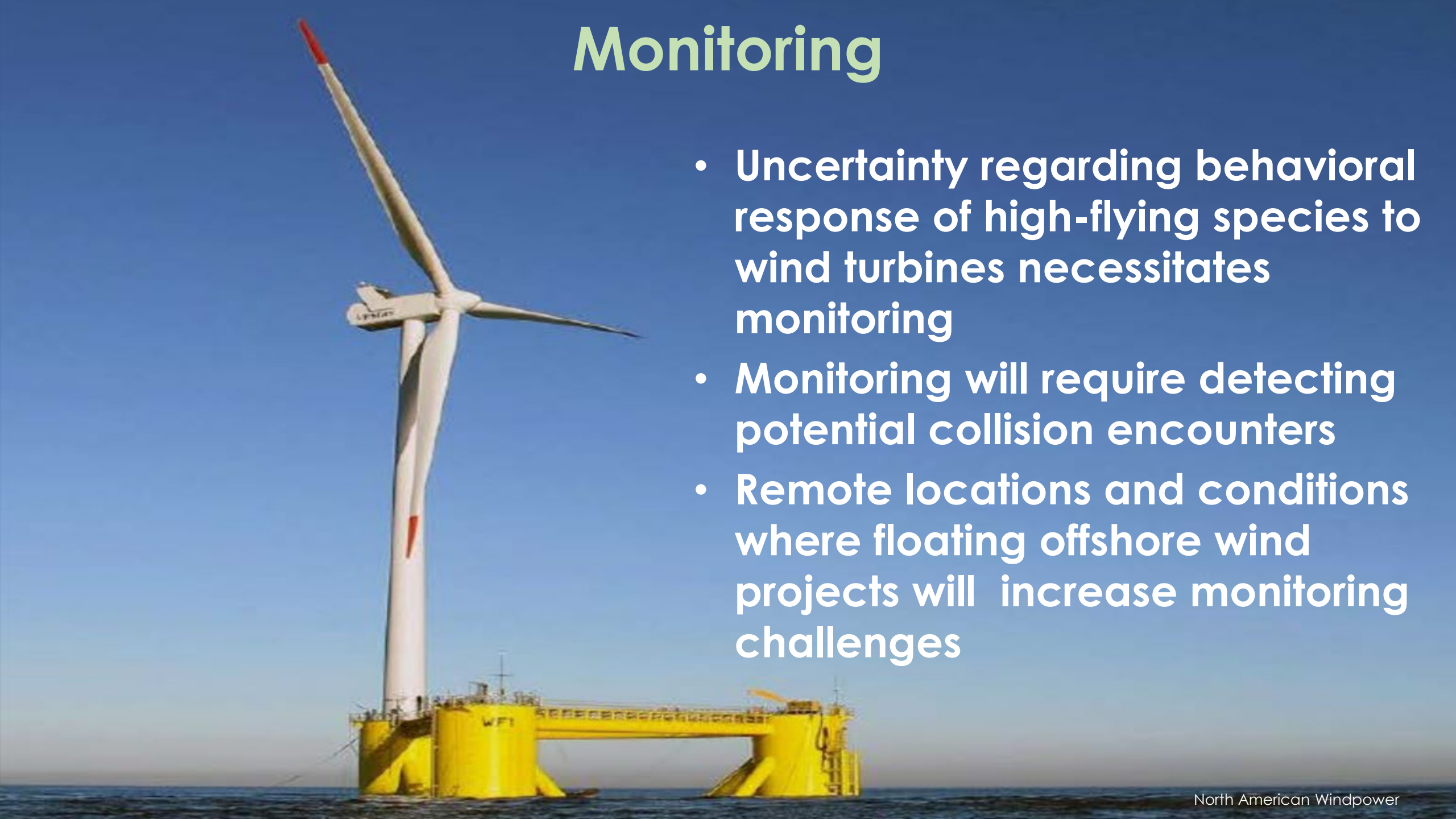
Bou.org.uk

Seabird Behavioral Response to Presence of Wind Turbines

- **Risk models are a necessary first step**
- **Several data-driven probability risk models are currently under development**
- **But, we have no a priori information on how pelagic birds that fly high under high winds will respond to the presence of turbines**
  - ? May avoid them entirely
  - ? May be indifferent
  - ? May collide

Monitoring

- Uncertainty regarding behavioral response of high-flying species to wind turbines necessitates monitoring
- Monitoring will require detecting potential collision encounters
- Remote locations and conditions where floating offshore wind projects will increase monitoring challenges



North American Windpower

Avian Monitoring Offshore Is a Challenge

Unique relative to terrestrial facilities: unable to directly monitor for avian fatalities via search

Direct observational surveys are difficult and very expensive far offshore

- boat-based surveys
- aerial surveys

Remote monitoring technologies are being developed to address these difficulties

Monitoring Technologies

Technologies under development that show promise include

- Radar (horizontal and vertical)
- Optical (visual, thermal imagery)
- Acoustic
- Accelerometers (vibration sensors)

Considerations

- Need for platform stability
- Scale
- Data streams
- Level of detection required (e.g., species identification)

Monitoring Technologies

Thermal Tracker: remote sensing for offshore wind

- Animal temperature contrasts with background temperature
- Records bird and bat activity
  - day and night
  - low visibility conditions
- Automated processing of key metrics
- Passage rates, flight speed and pathway, species ID

Shari Matzner et al. Pacific Northwest National Laboratory

Humboldt Call Area Thermal Tracker Monitoring

DOE's AXYS WindSentinel buoy poised for deployment September 2020. Thermal Tracker deployment in 2021

Example seabird flight track captured with Thermal Tracker software.

Key Takeaways

Construction impacts on- and off-shore

- Shorter-term, localized

Operations and maintenance impacts

- Long-term
- Uncertainty for seabirds and marine mammals
- Monitoring challenges

Improvements to overland transmission lines

- Long-term, localized to stretches of existing transmission lines
- Impacts to terrestrial and freshwater biota and habitats

Avoid, minimize and mitigate impacts; monitoring and adaptive management

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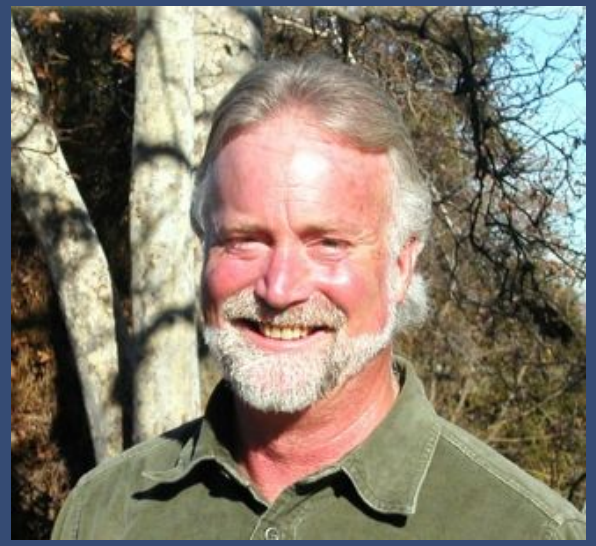

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