Potential environmental impacts of offshore renewable energy deployment: knowledge gaps and the importance of proxies, models, and monitoring

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Environmental impacts of OSW

- Include: marine mammals, birds, benthic/bottom habitats, fish/fisheries, physical factors (winds/upwelling, EMF, etc.), plus other socioeconomic effects
- Lots of OSW in Europe, mostly shallow (<60m), fixed bottom
- CA will be well offshore in deeper water (up to 1300m)
- Challenge: few data exist this far offshore

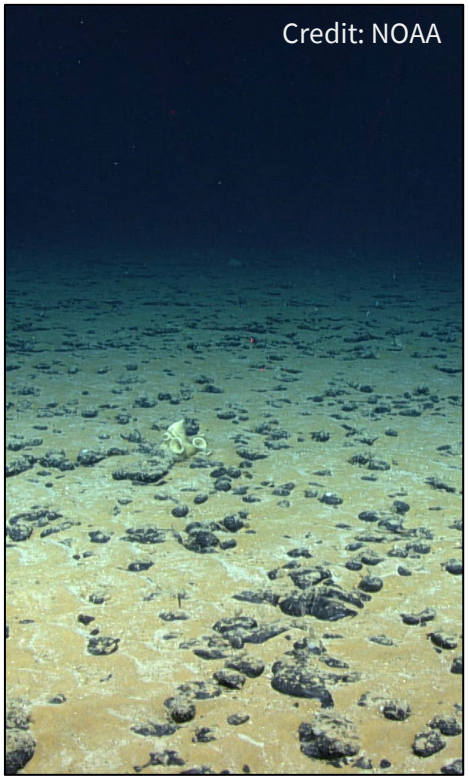
Environmental impacts of OSW

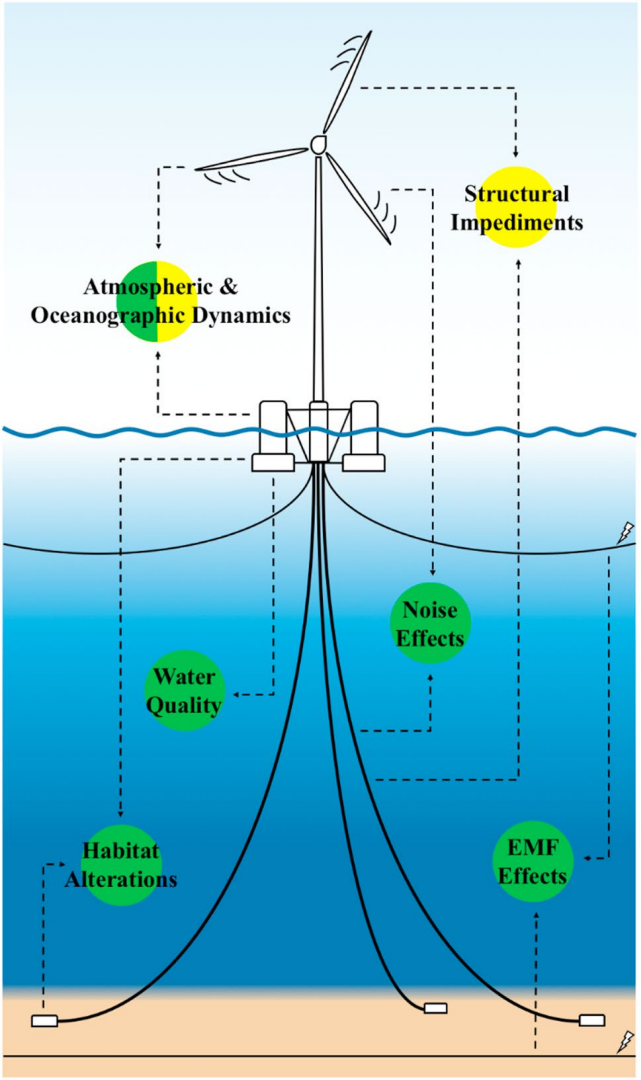
- Understanding impacts will require new data and new approaches to analyze/interpret
- Currently 3 floating wind farms (all in Europe), but little environmental monitoring; a lost opportunity?

So what do we need and how do we do it?

Approaches:
Proxies, Modeling, and Monitoring

- Proxies: similar information in other places or other equipment
- Good first step when little is known





Magnitude of Effect

Negligible **Moderate**

Minimal **Major**

- **Minimal:**

Electromagnetic (EMF) Effects; Habitat; Noise; Water Quality; Atmos. & Ocean. Dynamics

- Possible reduction of downstream windspeed
- May impact local circulation & regional upwelling (biological effects unknown)

- **Moderate**

Structural Impediments

Farr et al. 2021

Proxies for Fishes and Fisheries

- Recent work in wind farms suggest minor/zero impacts & some positive artificial reef/fish aggregation effects
  (e.g., Langhamer et al. 2018, Gimpel et al. 2023, Buyse et al. 2023)
- Extensive research that (de facto) closed areas benefit fish pops
- Little information on sound/EMF on fish; effects may be minimal?
  (Popper et al. 2022)

Modeling

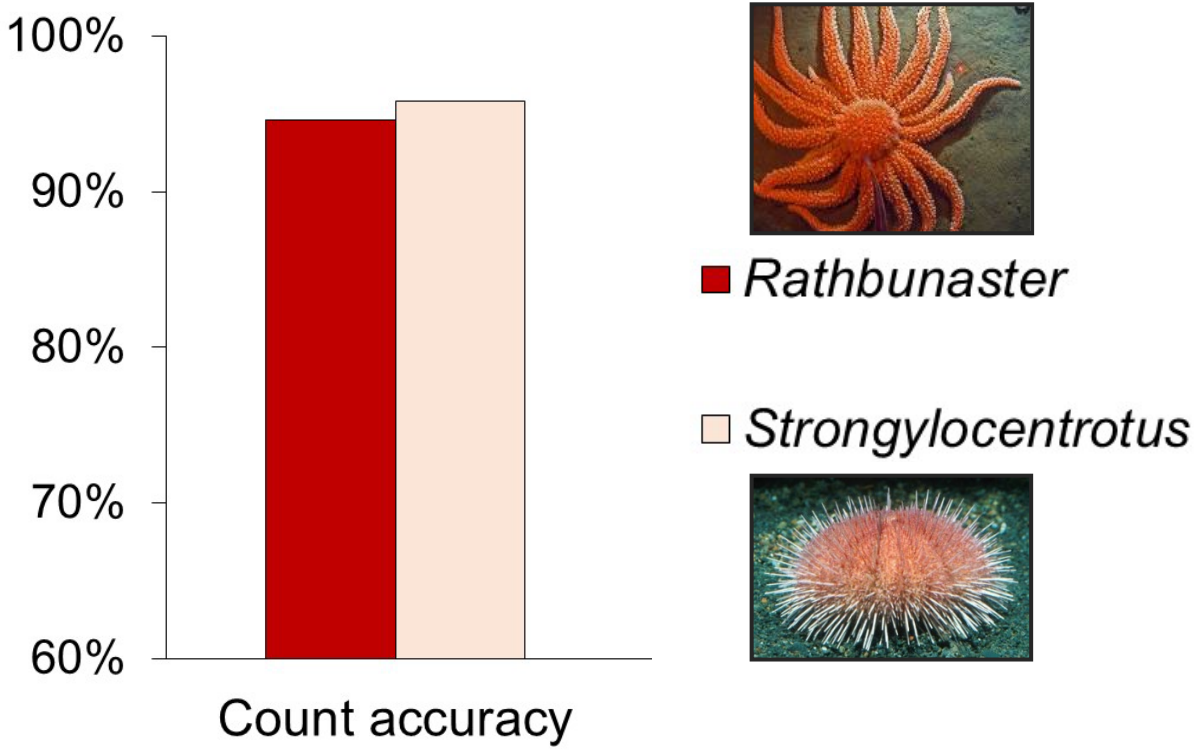
- Uses available data to understand a system (e.g., where species are/may be, how species may interact with equipment, etc.)
- Can generate or test hypotheses
- Can provide information about key factors or features for empirical study
- Work at Cal Poly:
  - Examined complementarity of OSW and other renewables (esp. solar)
  - Spatial distribution of fishing effort along US west coast and landings in CA

Link to Cal Poly OSW Research

Monitoring

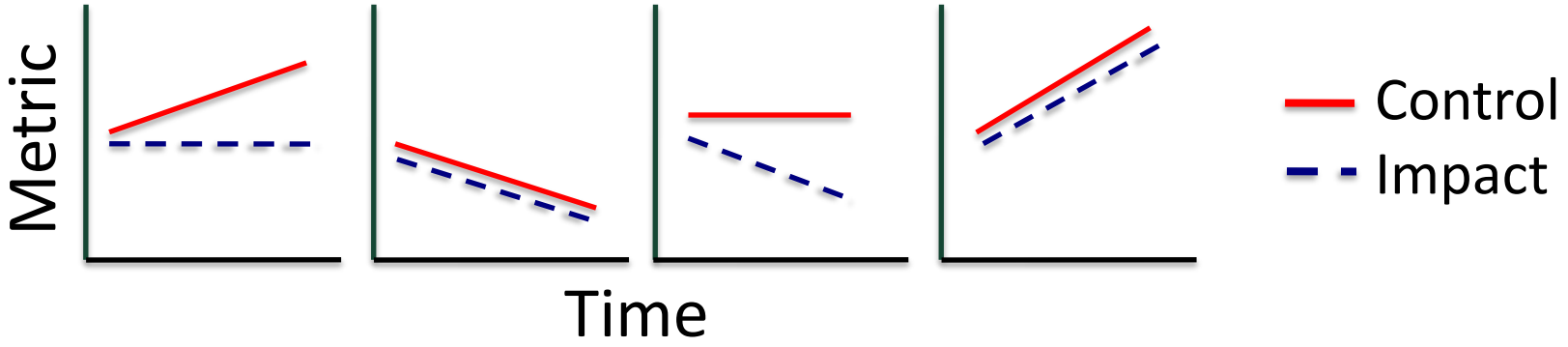
- Collection of field data from places that might be impacted
- Will need LOTS of new technology
- Example: Cal Poly Deep Sea AI (CEC funded)
  - Developed Web application for creating training data; users can generate and quality check training data efficiently
  - During pilot, created 8,000 annotations for several species

AI Model Performance



Monitoring

- Need info beyond just the areas that will be impacted
- ‘Gold standard’ in impact assessment is Before-After Control-Impact (BACI)
- Will need large monitoring framework beyond just the WEAs (for some groups, scale will be VERY large)

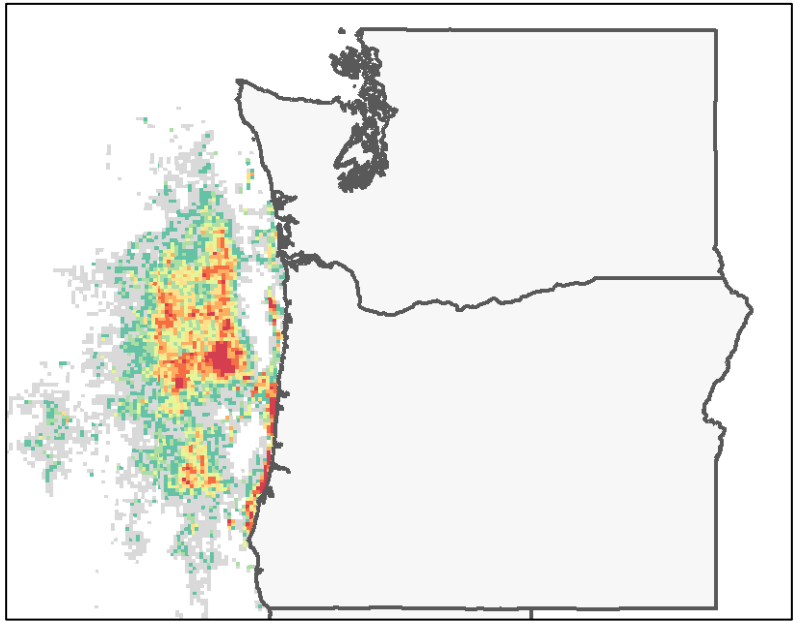


Also…the oceans are changing

So, we'll need:

- Long-term monitoring: some impacts/changes happen slowly; long-term (10+ yr) datasets needed to detect effects
- Ongoing modeling to help understand where things are now and where they will be in the future
- Feedback among all approaches improves knowledge

OR-WA Highly Migratory Species Fishery Effort



Funding this work

All of these approaches will cost money

- AB 80: A good start; could create new OSW entity within OPC to prioritize research, manage funding, and summarize information
- Developers should pay for much of this work, but important to avoid real ***and*** perceived conflicts of interest
- One option? Developers pay into fund managed by AB 80 entity; ensures rigorous science, provides stakeholders with confidence in the findings
- Still—developers need to be involved as collaborators

We can do this!

- We have or can develop technology and approaches to understand effects of offshore renewables
- Rigorous science is essential to understand effects ***and*** potential mitigation
- Will require sustained commitment and strong cooperation among developers, state and federal governments, academics, other stakeholders

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