venterra

Nature-Based Design & Hypothesis-Driven Monitoring

27 February 2025

Agenda

Nature-Based Design and Hypothesis-Driven Monitoring: Lessons Learned, Emerging Knowledge

There are Known Knows – lessons we have learned from our experiences in Europe and the U.S. Then there are Known Unknowns – areas in which knowledge is emerging to advance our industry.

Lessons Learned

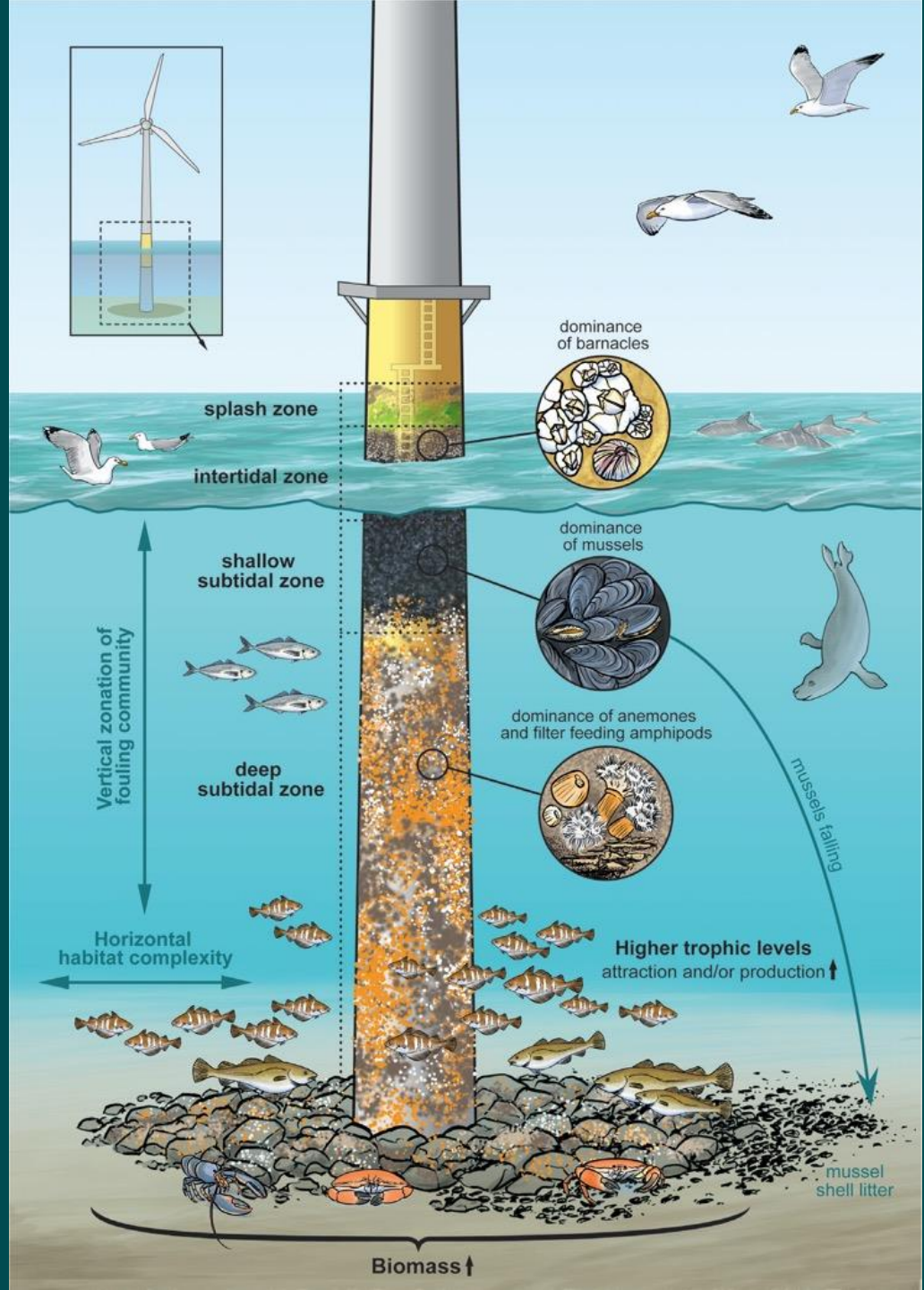
1. Structures as Habitat
2. Intentional Engineering to Promote Ecosystem Targets
3. Baseline Responses & Biodiversity

Emerging Knowledge

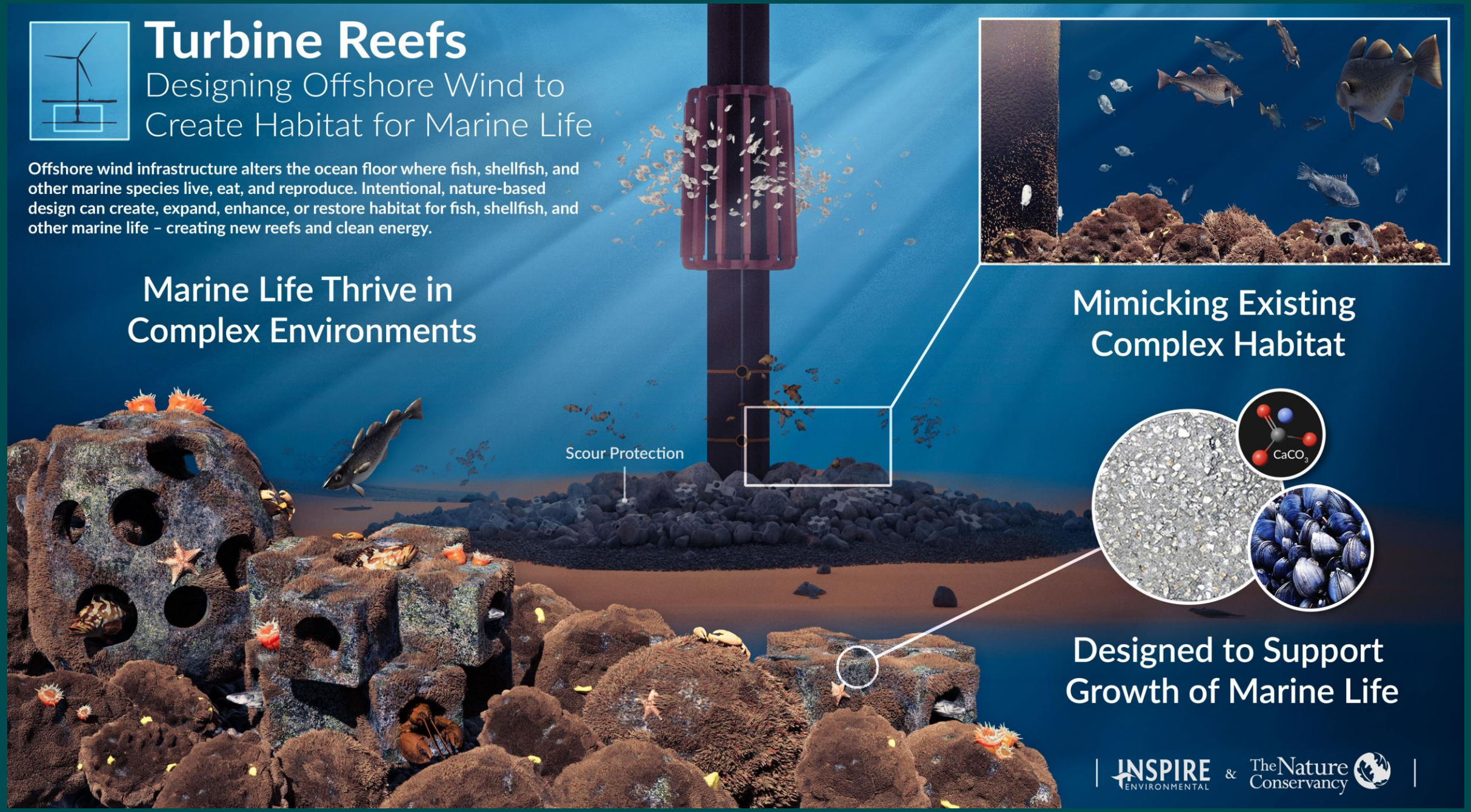
1. Beyond Biodiversity to Shifts in Ecosystem Function
2. 3D Models to Calculate Biomass
3. Hypothesis-Driven Monitoring

Offshore Wind Structures as Habitat

What and how structures are engineered and installed influence ecosystem responses



Degraer et al. 2020

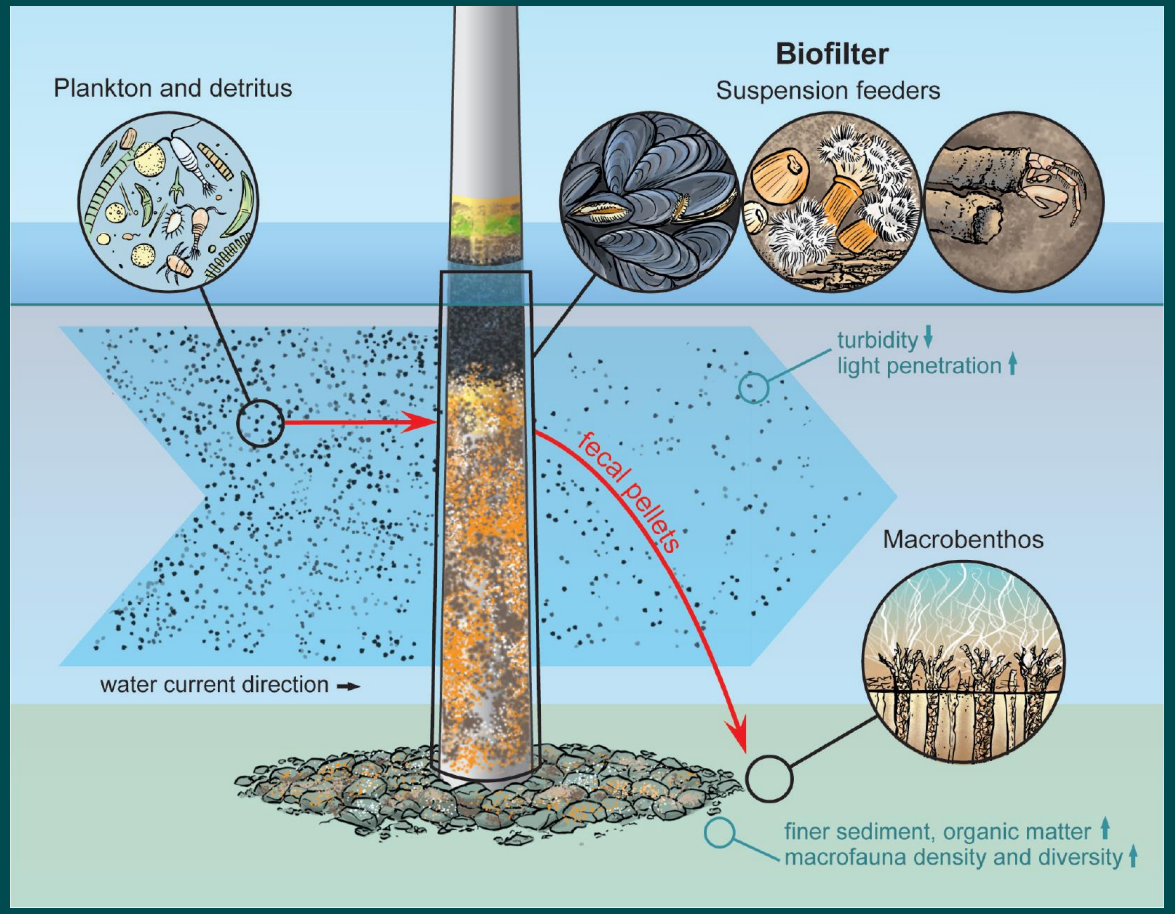


https://www.nature.org/en-us/newsroom/wind-turbines-marine-life/

Intentional Engineering

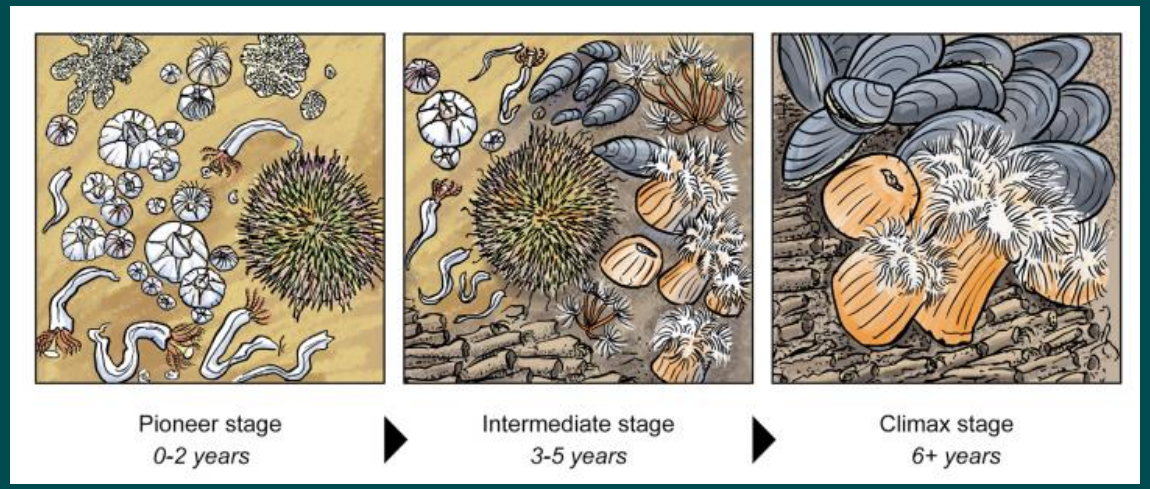
Possible Ecosystem Targets

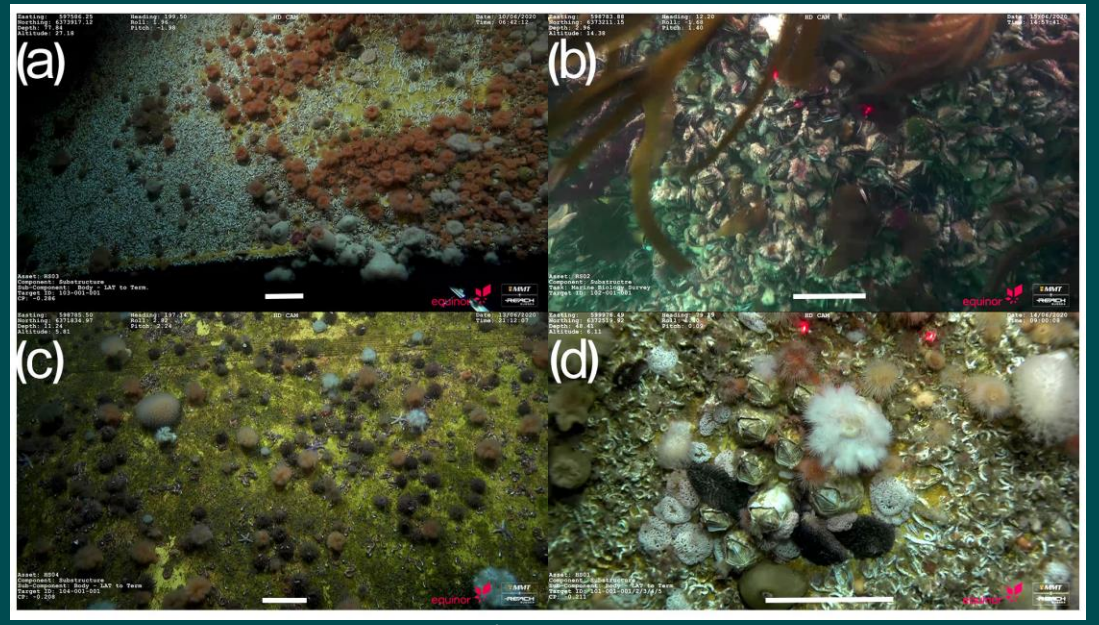
- Biodiversity
- Commercially valuable marine resources
- Resources for higher trophic levels
- Carbon sequestration



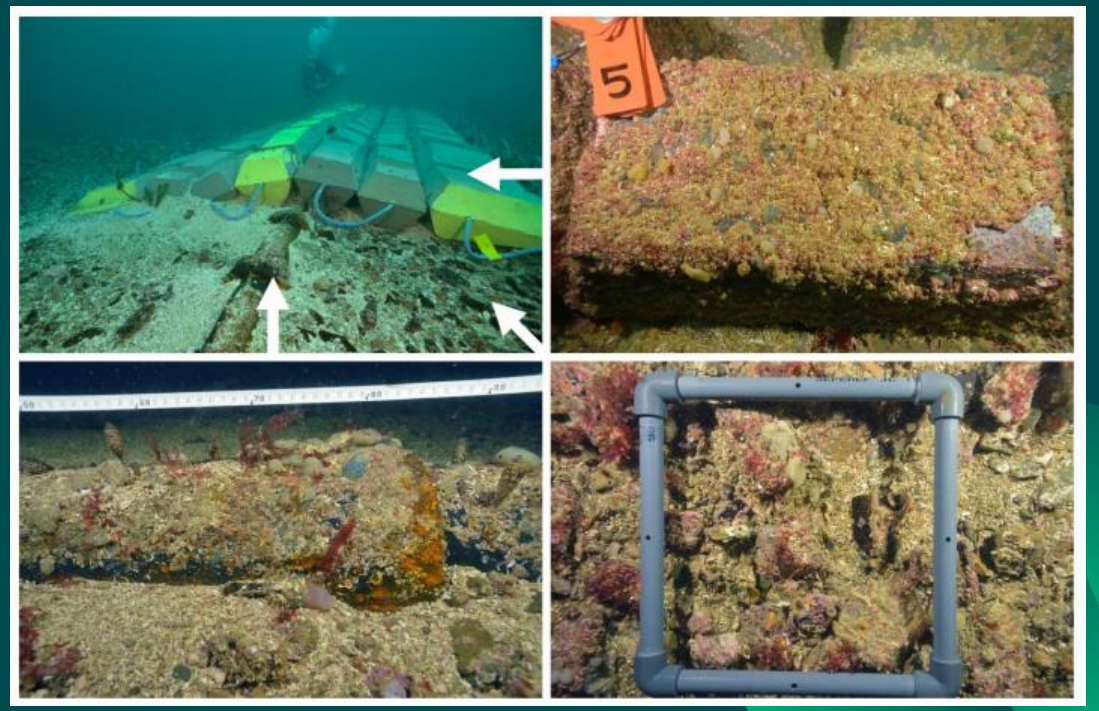
Existing Knowledge: Baseline Responses

- First step: Understand response to standard conventional structures
- Numerous studies from Europe
- Know a lot on shifts in biodiversity





Karlsson et al. 2022 [Hywind Scotland]



Bastien et al. 2020 [Brittany, France]

Emerging Knowledge

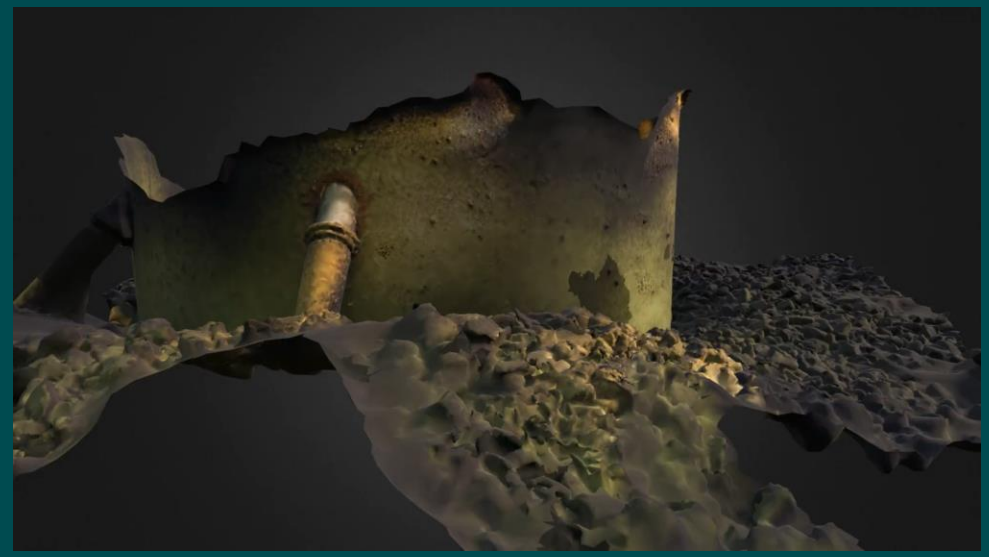
Beyond biodiversity to shifts in ecosystem function

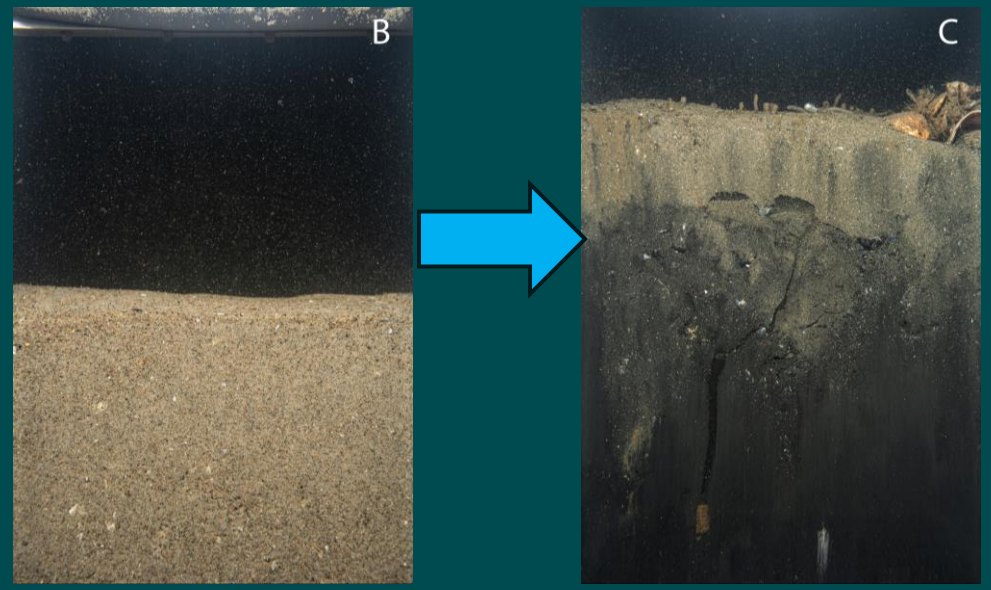
- Productivity, nutrient cycling, refuge, food-resource, benthic-pelagic coupling

3D models to estimate biomass

- Non-invasive tool to inform ecosystem models, decipher productivity, carbon cycling

Linking benthic with fisheries data to explore food web dynamics

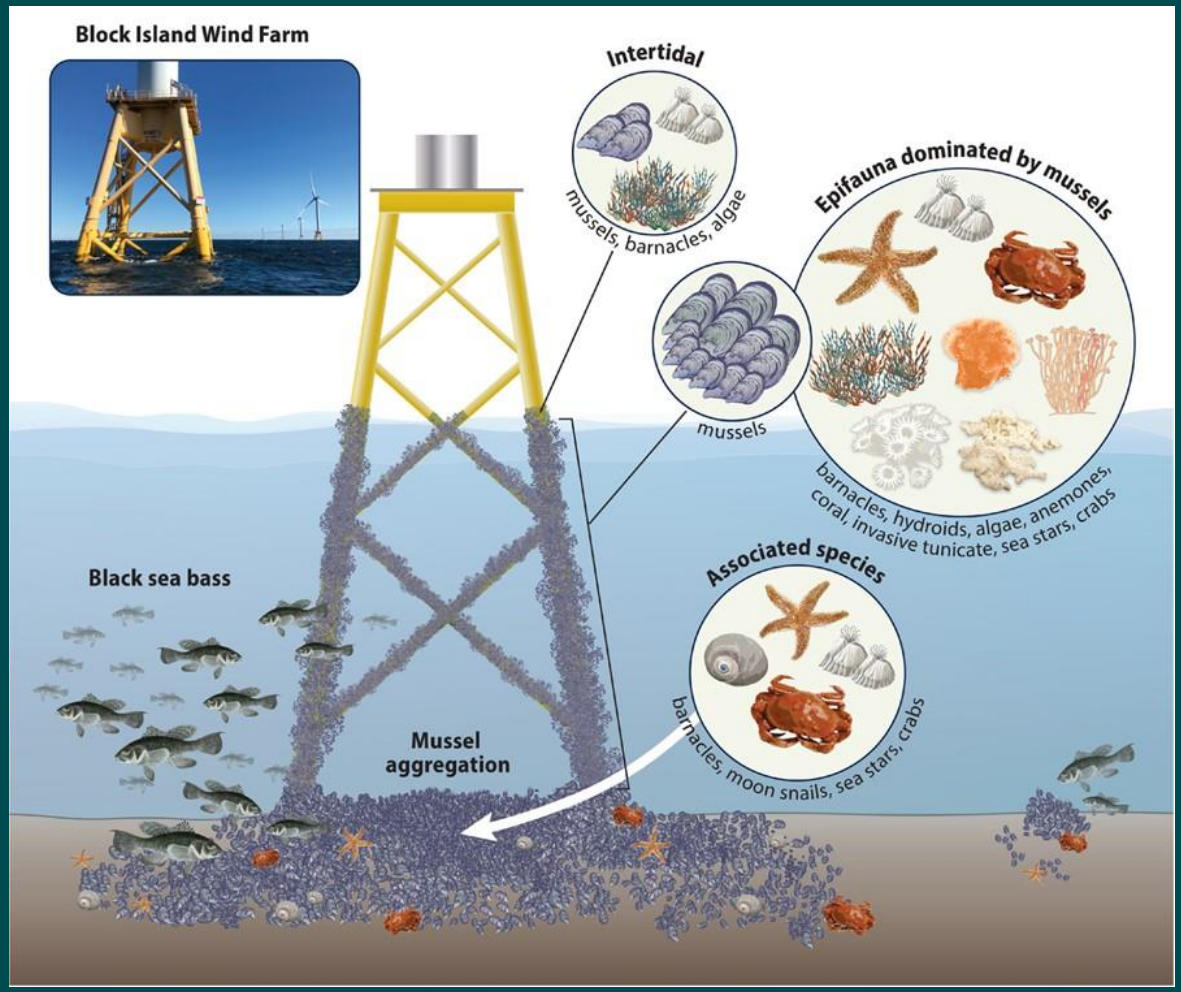




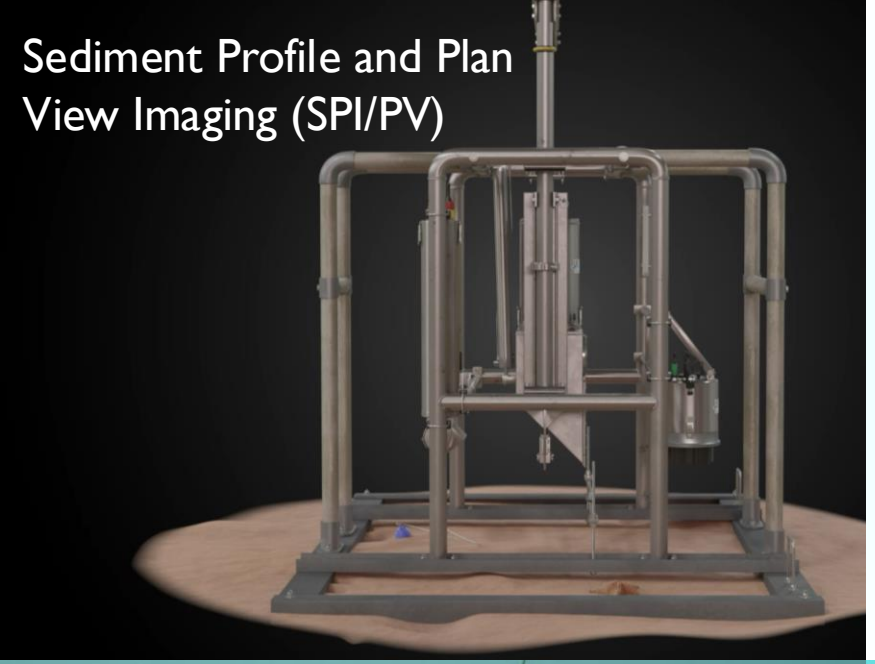
Hypothesis-Driven Resource Monitoring

Intentional engineering aimed at specific, measurable goals

Non-extractive monitoring tools to avoid impacting marine resources



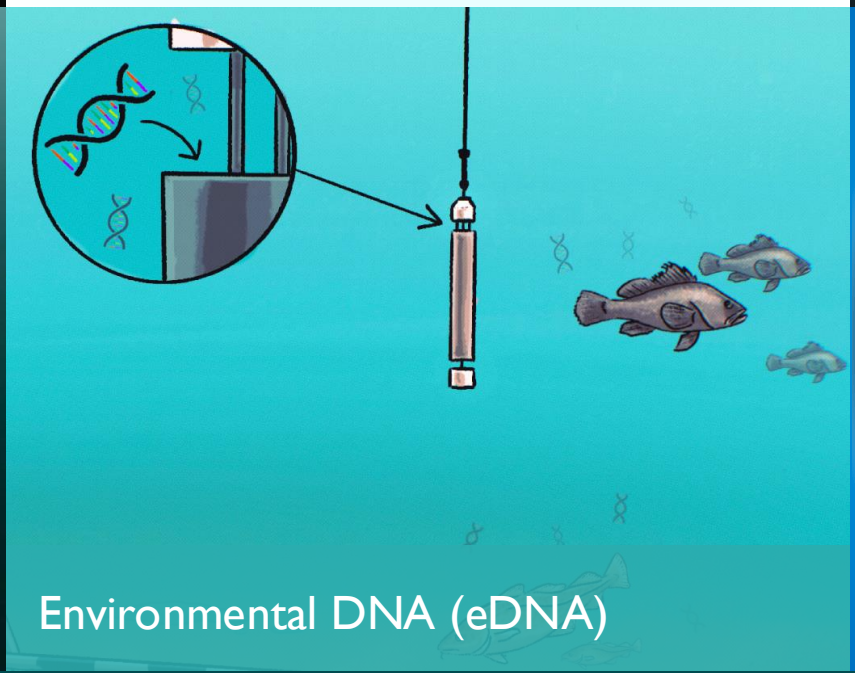
Sediment Profile and Plan View Imaging (SPI/PV)



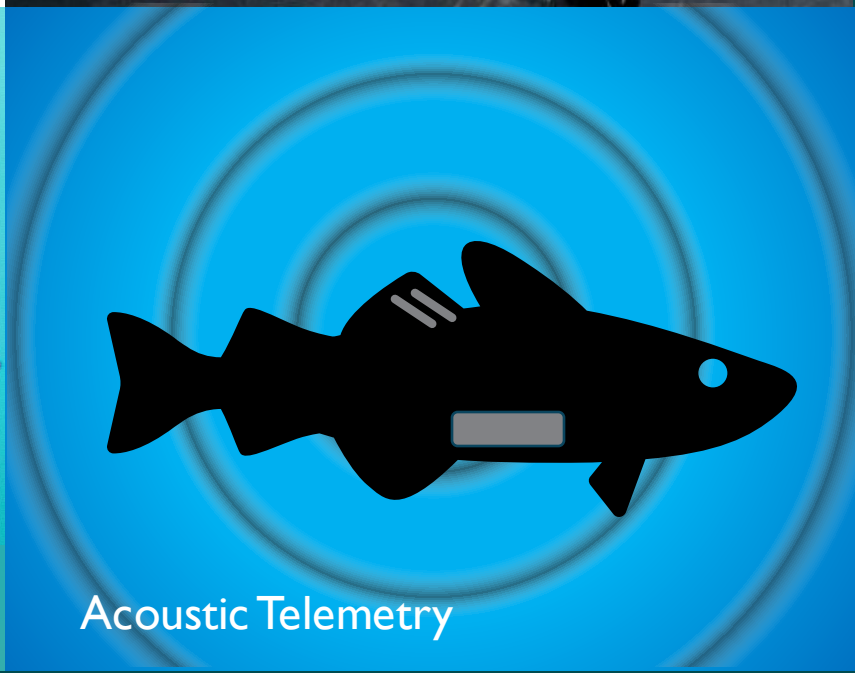
Video from Remotely Operated Vehicles (ROV-video)

Baited Remote Underwater Video (BRUV)

Small Underwater Drones



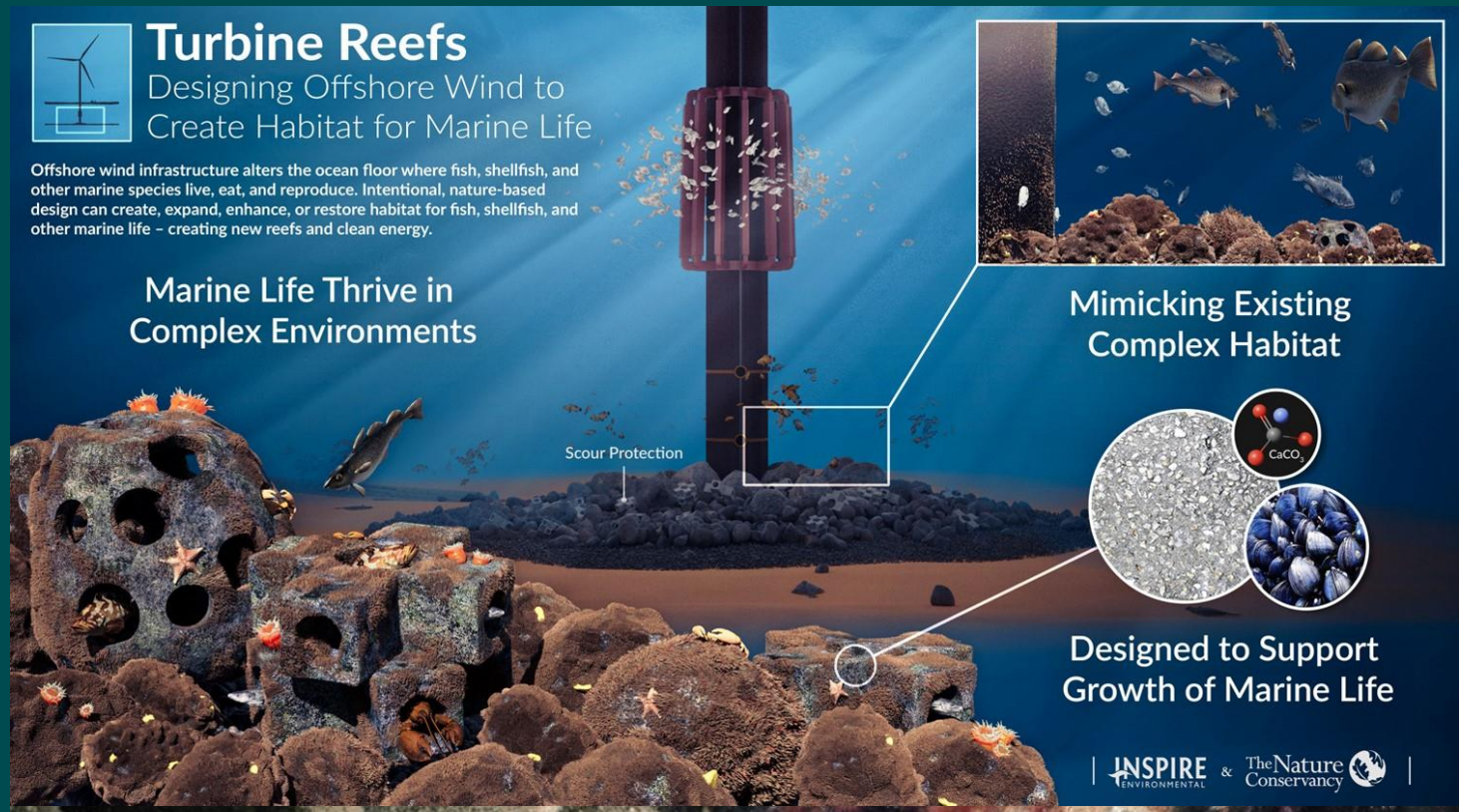
Environmental DNA (eDNA)



Acoustic Telemetry

Take Aways

- Early planning is needed to incorporate alternative engineering designs to promote ecological performance
- Need to define the precise, measurable ecological goal(s)
- Ecological goals can be related to the species inhabiting the new structures and/or the functions of the new community



Questions?

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