



Nature-Based Design & Hypothesis-Driven Monitoring

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
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What and how structures are engineered and installed influence ecosystem responses





Turbine Reefs

Designing Offshore Wind to
Create Habitat for Marine Life

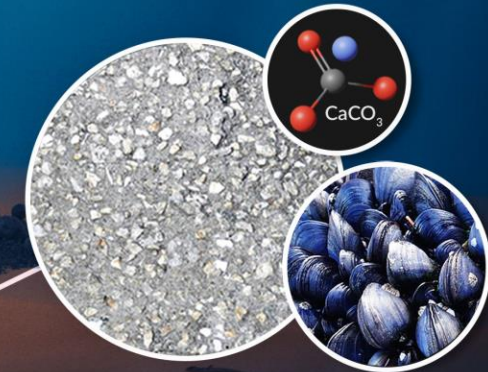
Offshore wind infrastructure alters the ocean floor where fish, shellfish, and other marine species live, eat, and reproduce. Intentional, nature-based design can create, expand, enhance, or restore habitat for fish, shellfish, and other marine life – creating new reefs and clean energy.

Marine Life Thrive in
Complex Environments

Scour Protection



Mimicking Existing
Complex Habitat

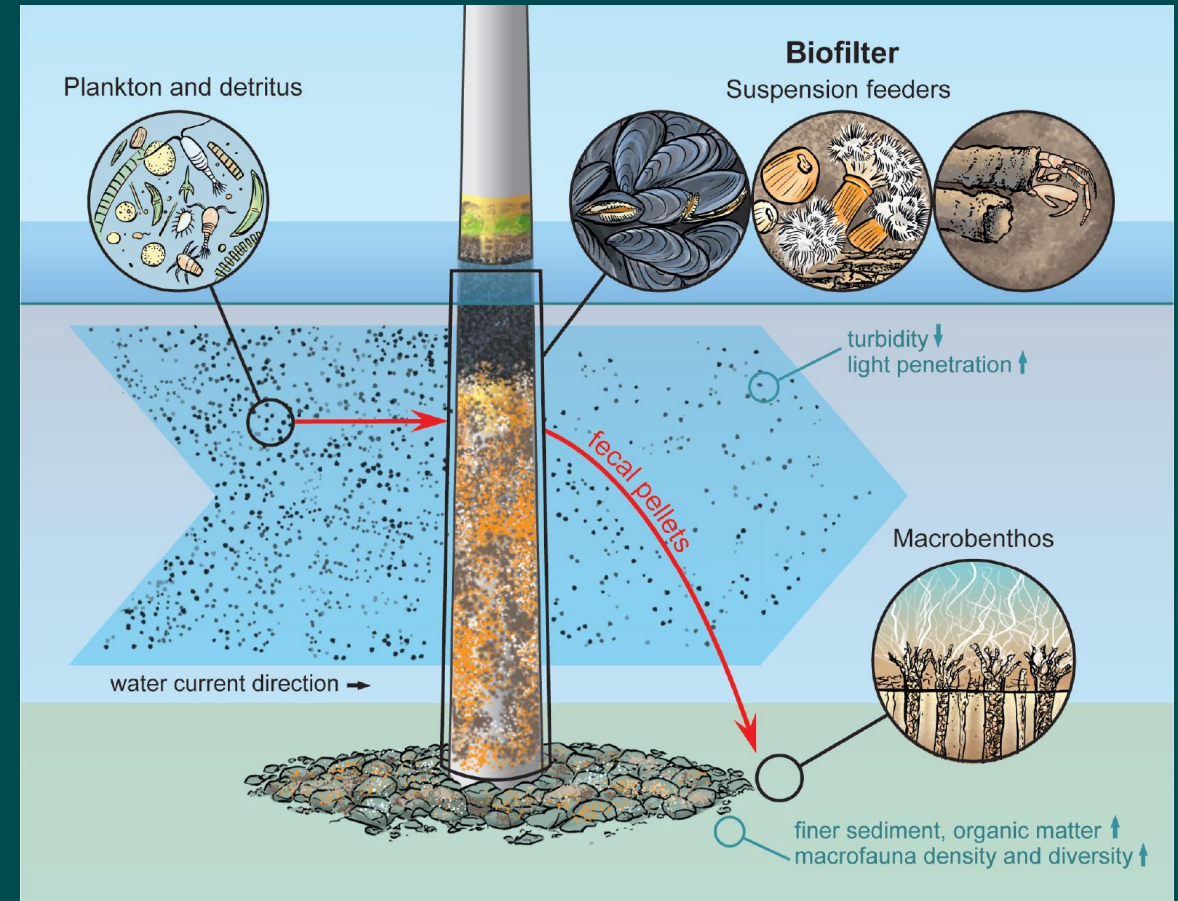


Designed to Support
Growth of Marine Life

Intentional Engineering in Early Stages

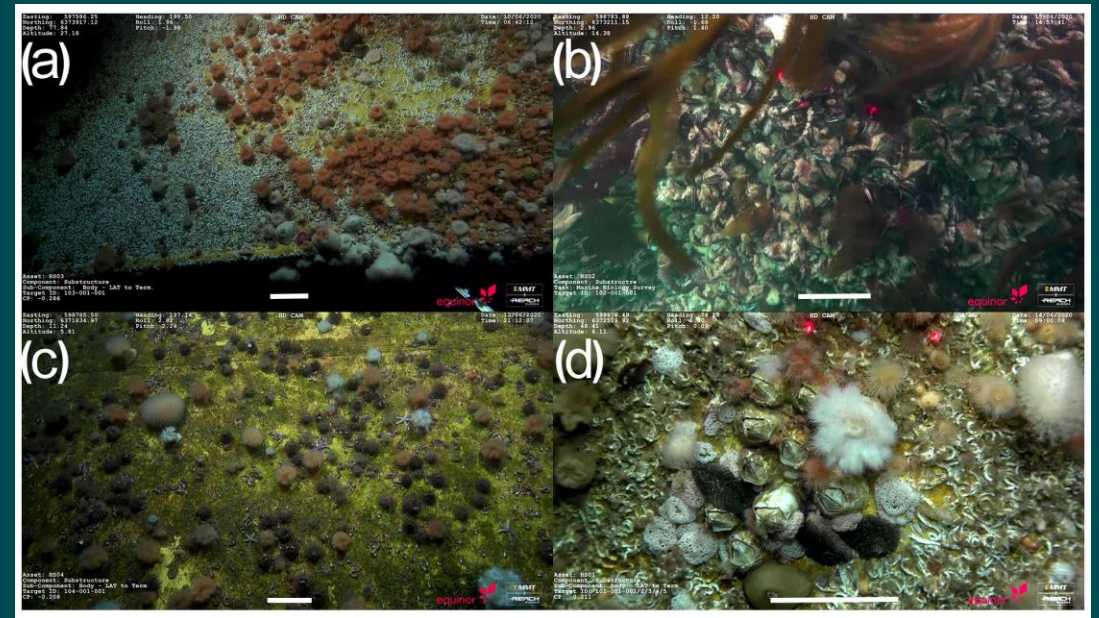
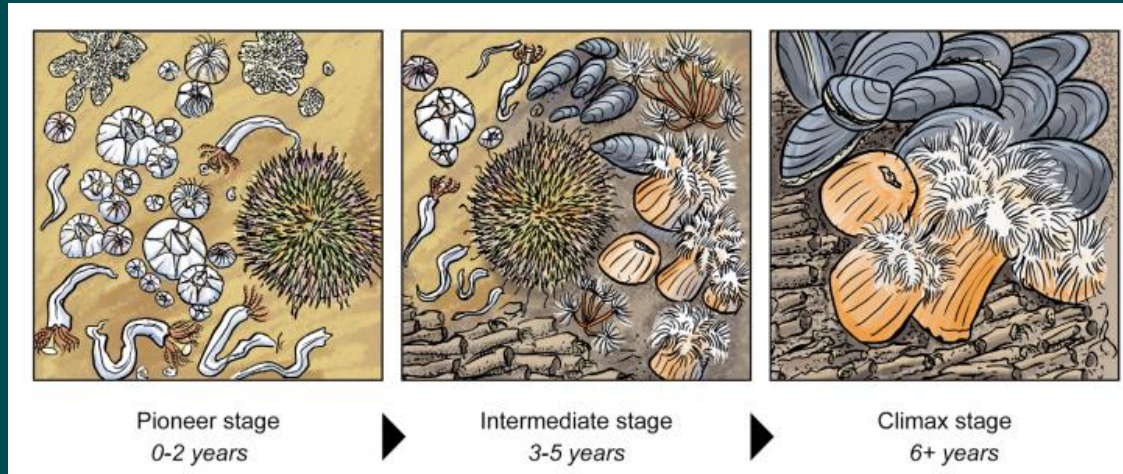
Possible Ecosystem Targets

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

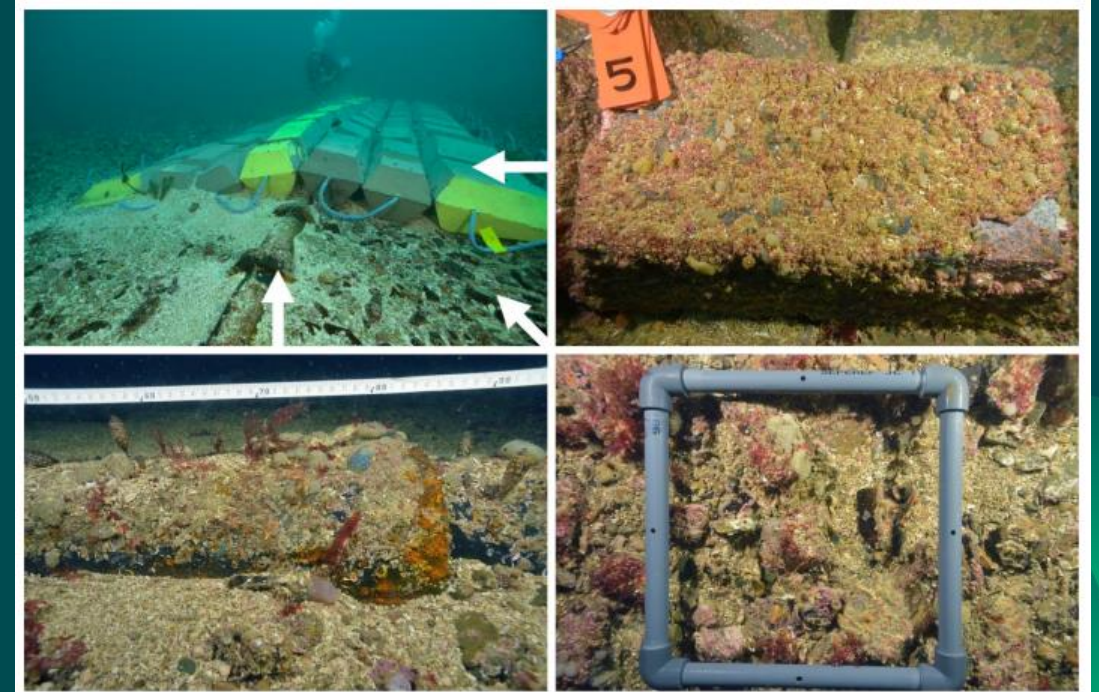


Existing Knowledge: Baseline Responses

- 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

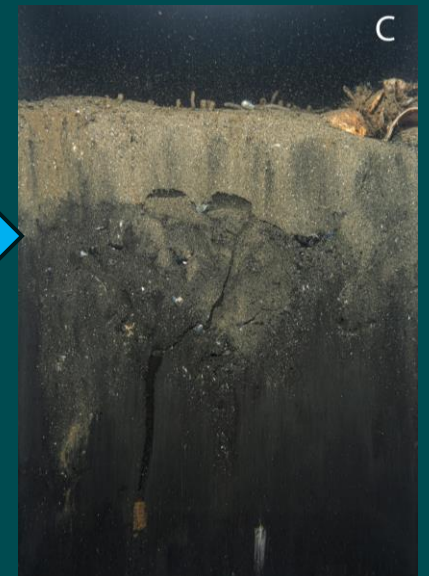
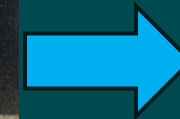
Beyond biodiversity to shifts in ecosystem function

- 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

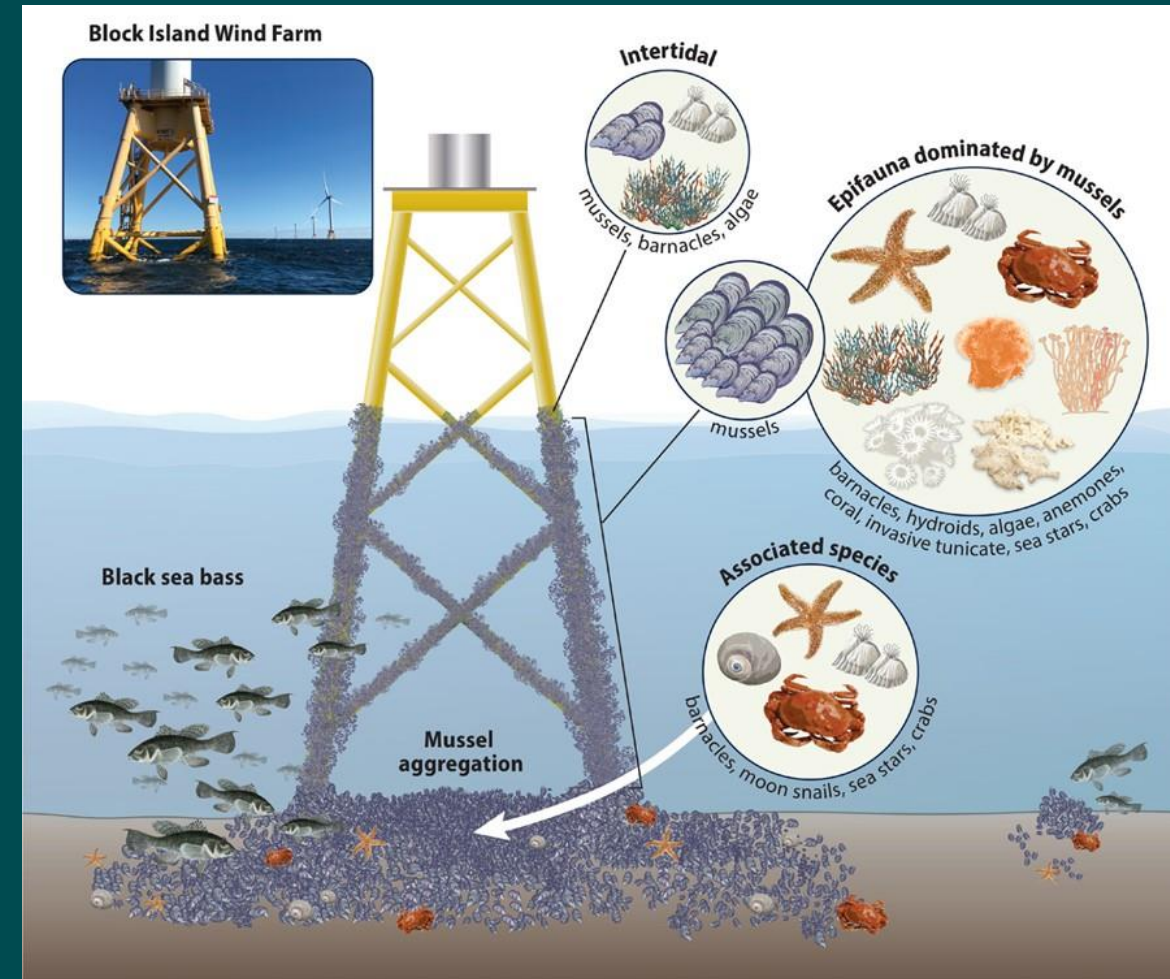
Linking benthic with fisheries data to explore food web dynamics



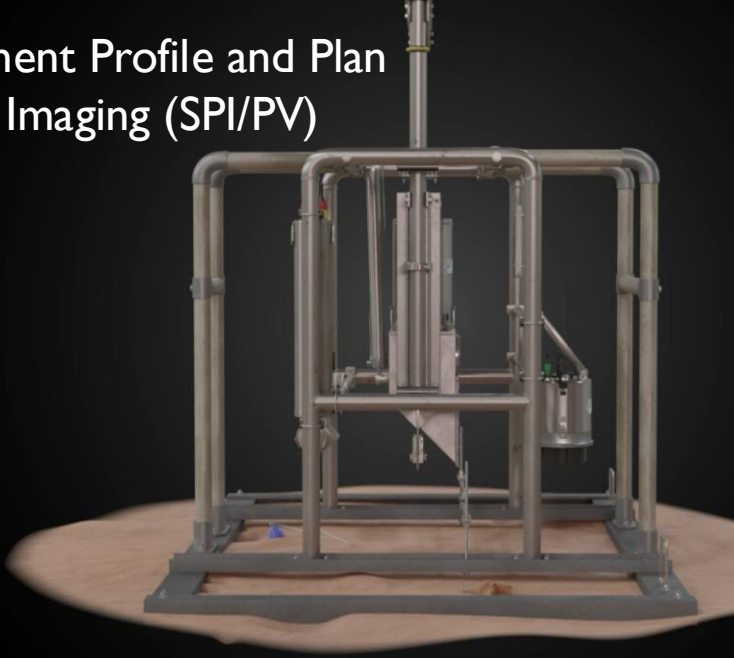
Hypothesis-Driven Resource Monitoring

Intentional engineering aimed at specific, measurable goals

Non-extractive monitoring tools to avoid impacting marine resources



Sediment Profile and Plan
View Imaging (SPI/PV)



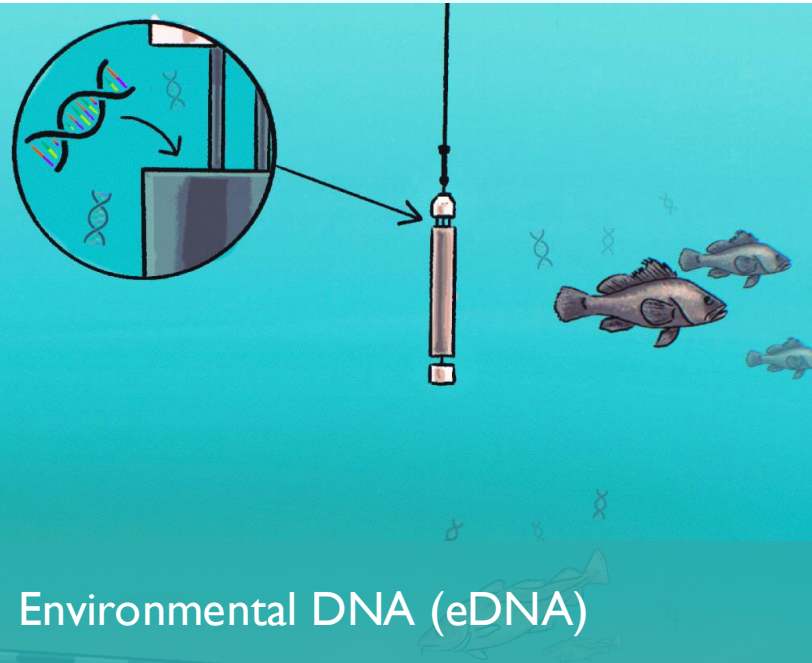
Video from Remotely Operated Vehicles
(ROV-video)



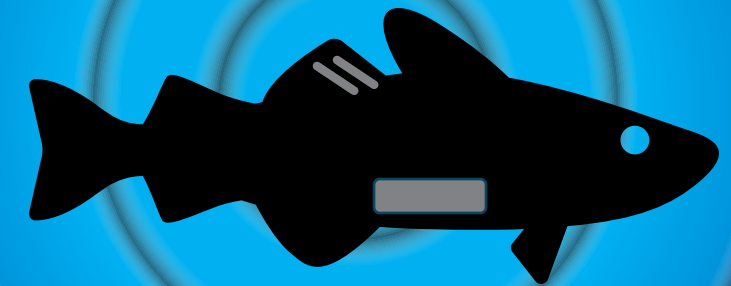
Baited Remote Underwater Video (BRUV)



Small Underwater Drones



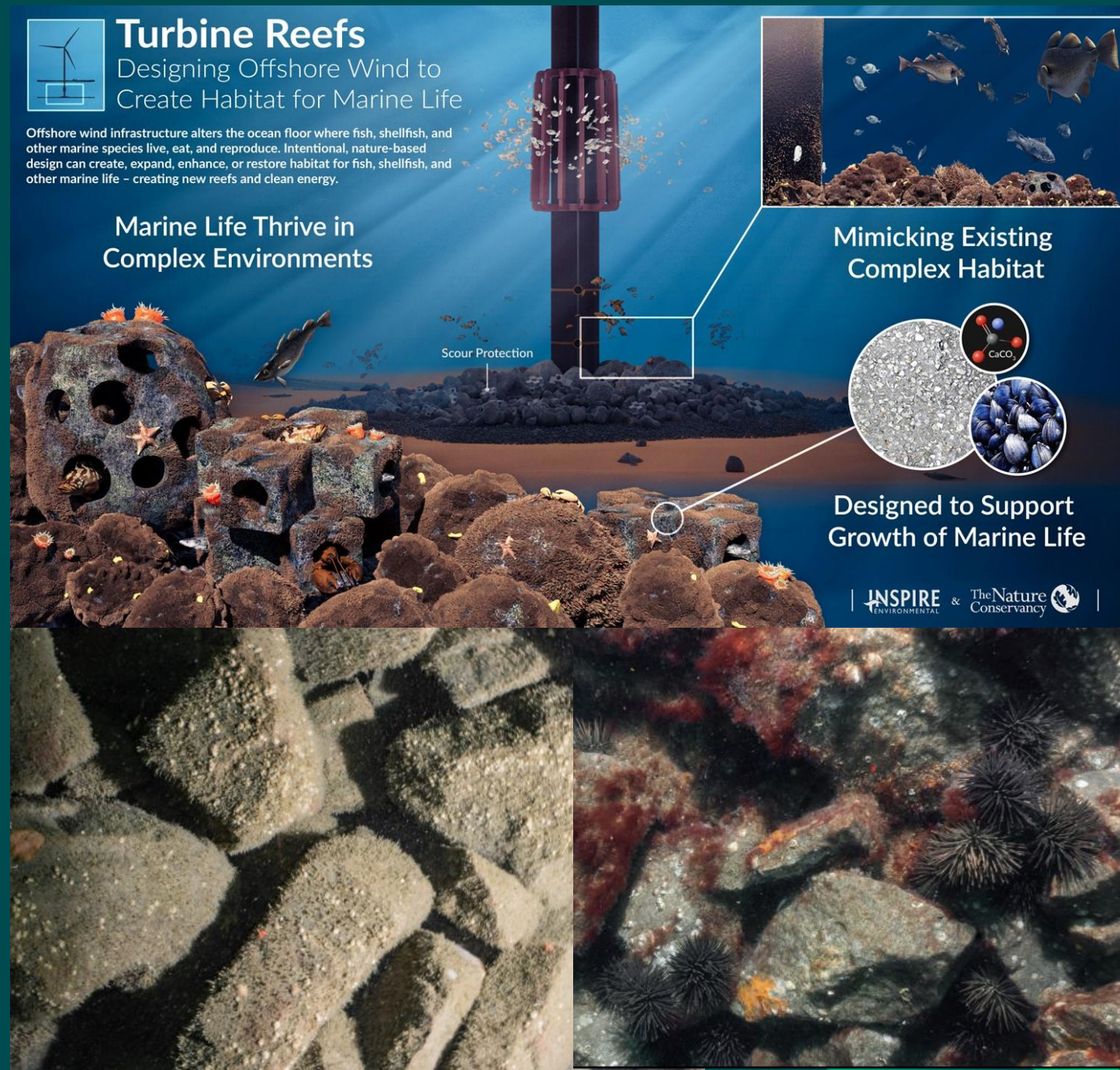
Environmental DNA (eDNA)



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



Get in Touch

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