

Energy from Wind, Waves, and Currents – the Environmental Synergies

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Devices &
Systems

Environment

Turbine

WEC

Flow disruption
Noise

Substrate

Habitat

Foundation/Substructure

EMF

Collision

Marine mammals

Fish

Substation

Anchors

Displacement
Interference

Birds

Other fauna

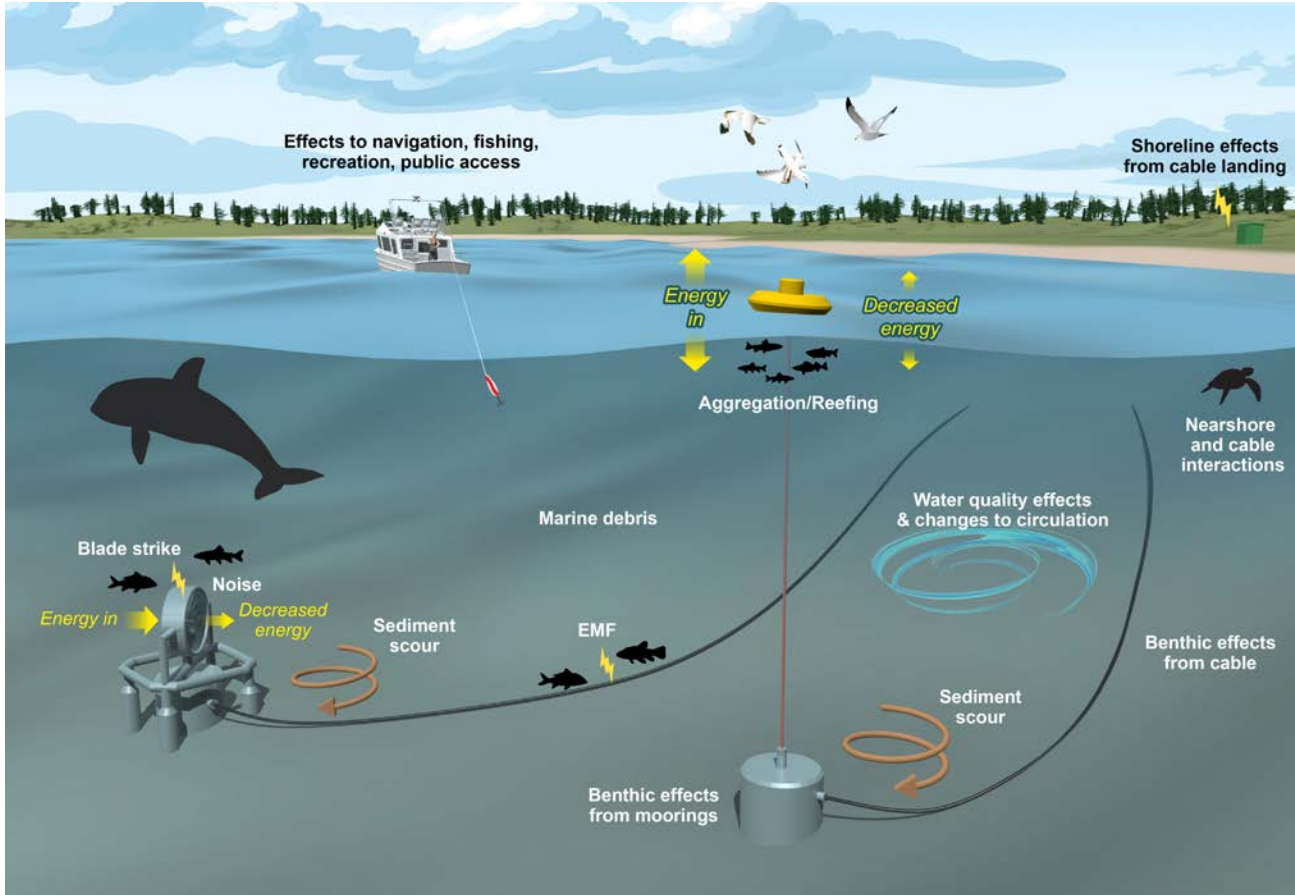
Cables

Mooring
lines

Spills

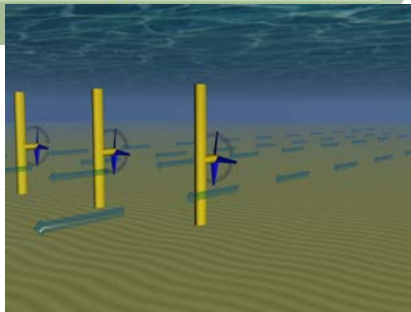
Existing
infrastructure

Cultural
artifacts

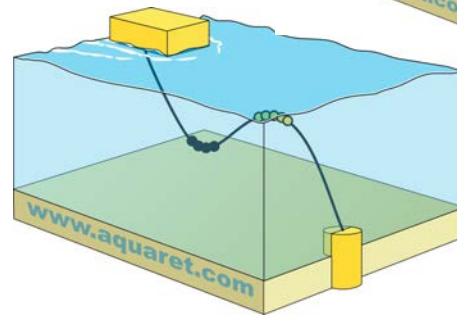
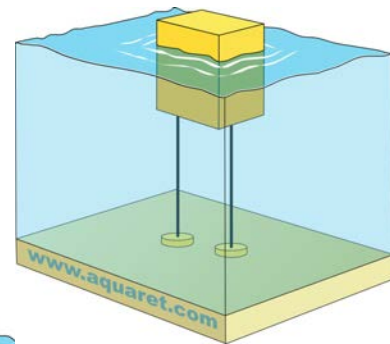




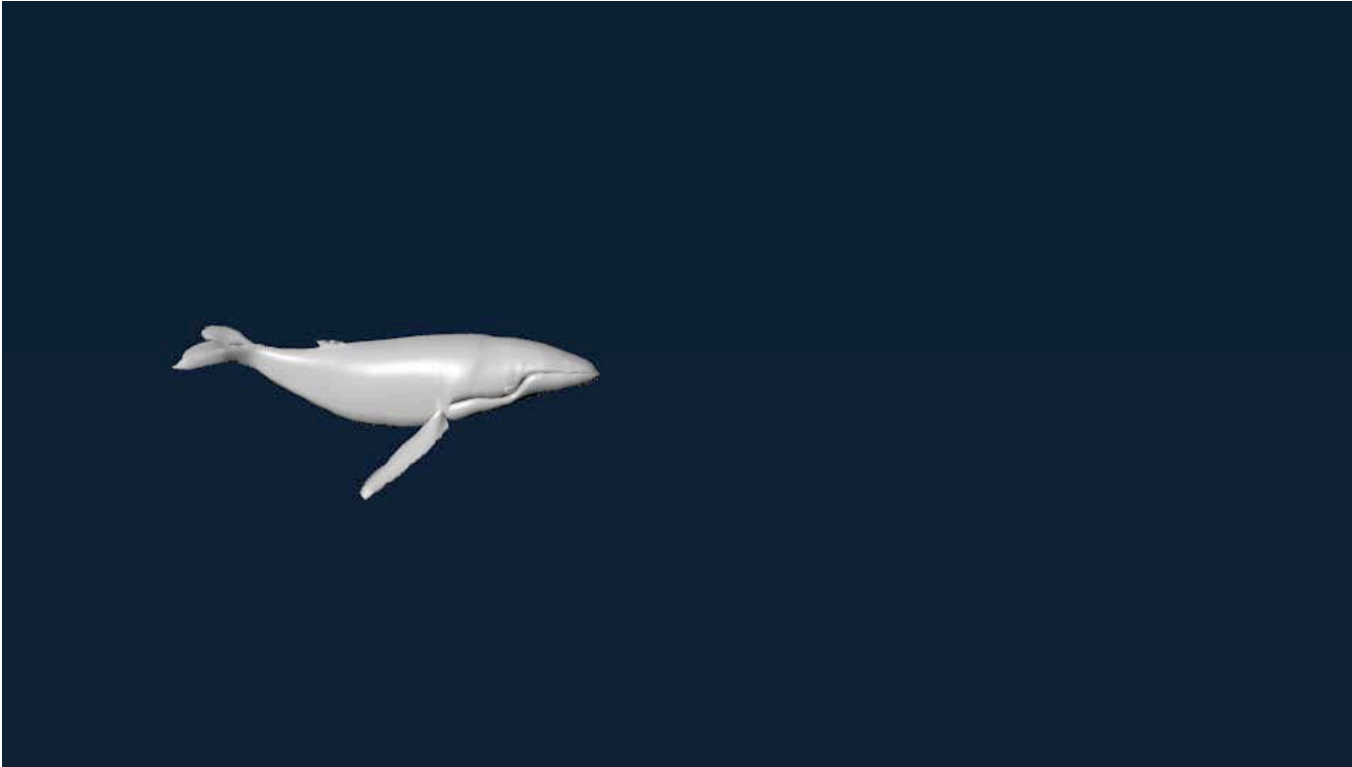
[Source: Aqua-RET]



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Scale matters:



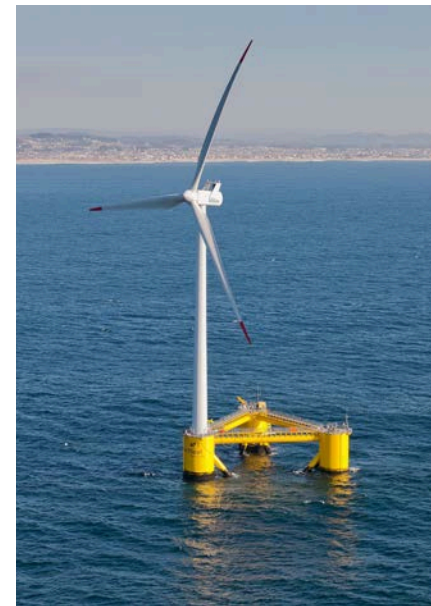


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Key Environmental Concerns

- ▶ Collision risk for animals around turbines: in water/in air
- ▶ Risk to animals from underwater sound
- ▶ Effects of EMF on marine animals from cables and devices
- ▶ Changes to habitats: benthic habitats and reefing patterns
- ▶ Changes in physical systems: energy removal and change in flow/hydrodynamics
- ▶ Displacement of animals: in water/in air
- ▶ Disturbance or contamination from increased vessel traffic
- ▶ Marine spatial planning

Apply to both offshore wind and wave/current



[Source: WindFloat 2012]

Site surveys –



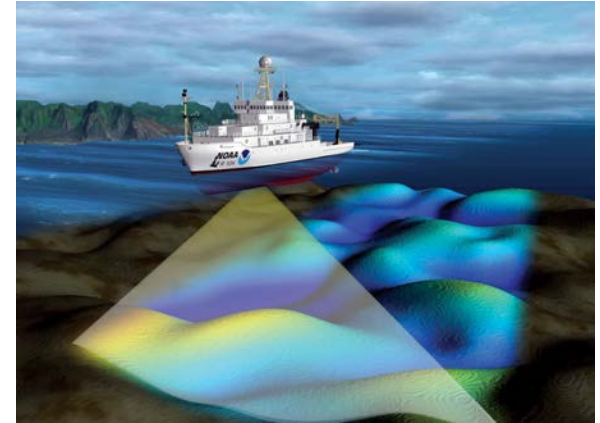
Ecological surveys -

Socioeconomic studies –

Metocean
Geophysical
Geotechnical

Habitat
Fish
Marine Mammals
Birds

Commercial fishing
Cultural resources
Landscape/seascape



Permitting MRE and Offshore Wind: Environment

- Great similarities:
 - State waters (to 3 nm), federal on OCS
 - NEPA, ESA, MMPA, MBTA
- Some differences:
 - MRE = FERC all the time; OSW = only for grid connection
 - Emphases may differ:
 - Birds (and bats) rule for OSW
 - Marine mammals, fish, sea turtles for MRE (also true for OSW)



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*THE PESSIMIST COMPLAINS ABOUT
THE WIND; THE OPTIMIST EXPECTS IT
TO CHANGE; THE REALIST ADJUSTS
THE SAILS.*

William Arthur Ward

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U.S. DEPARTMENT OF
ENERGY
Energy Efficiency &
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ANNEXIV