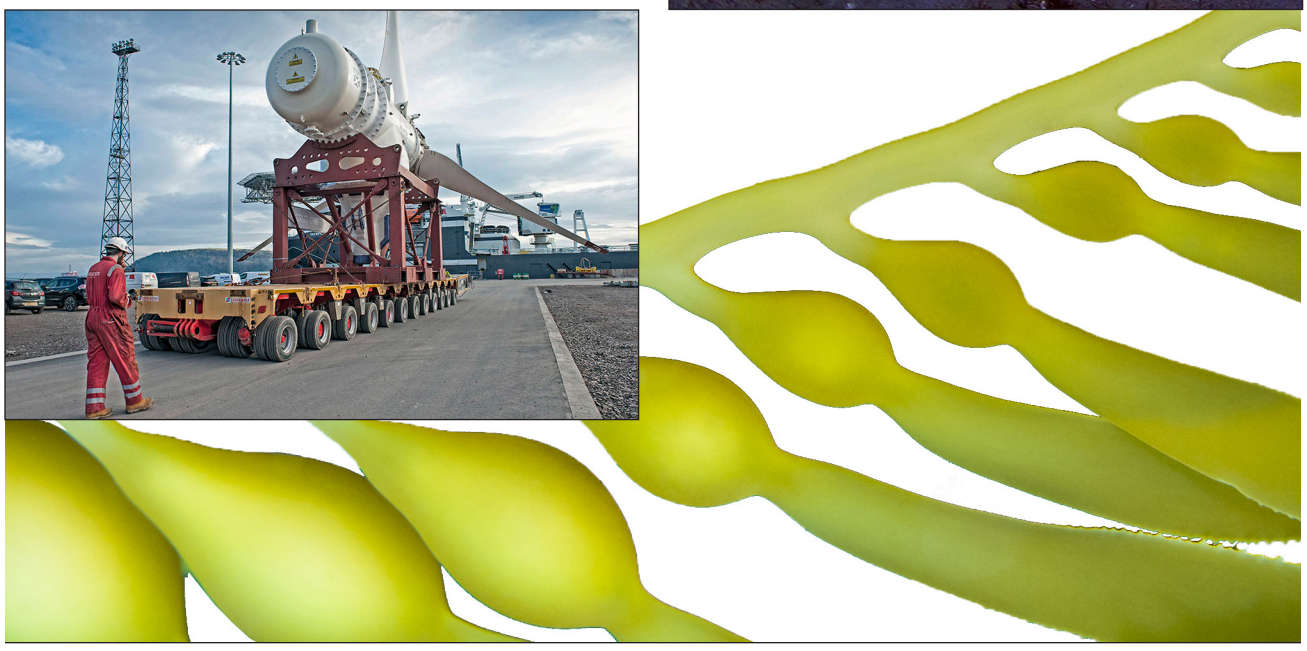
# Changes in Benthic and Pelagic Habitats

## RELEVANCE TO MARINE RENEWABLE ENERGY

Most marine renewable energy (MRE) devices must be attached to the seafloor in some way, either by gravity foundations, pilings, or anchors, and many will also have transmission cables on the seabed, and mooring lines, as well as the devices themselves in the water column. Physical changes in benthic and pelagic habitats have the potential to alter where species live and how common they are at a site, and they may lead to habitat loss, provide opportunities for non-native species to become established, alter ecological patterns, modify ecosystem functions and services, and affect the behavior of many marine organisms.



## STATUS OF KNOWLEDGE

The loss of benthic habitat caused by the footprint of anchors and foundations is limited and can be avoided or mitigated when fragile habitats have been identified during the siting process. Sediment scouring by local turbulence in the immediate vicinity of an MRE device can create further loss of benthic habitat during operation. This concern has been assessed and measured around tidal turbines. While a negative effect on benthic organisms was noticed in the immediate vicinity of a turbine, the effect quickly dissipated with distance from the structure. This scouring effect on benthic communities is likely to be limited to the seafloor area directly adjacent to the device. MRE devices are linked to a substation or the grid by cables, and the cable-laying process may also lead to direct disturbance or alteration of large areas of benthic habitats. Studies of cables in different environments have shown that the benthic communities and habitats recovered at about the same rate as they would grow naturally.

MRE devices also provide new habitats for numerous organisms. Devices left in the water long enough will be colonized by biofouling communities (i.e., the accumulation of biological matter and organisms on the surfaces of submerged objects). Biofouling species groups will vary between deployment sites, as well as specific MRE devices and other parts of the system, because of natural ocean variability, the seasonal availability of planktonic larvae, and the survival rates of newly settled larvae. MRE devices may also act as artificial reefs or fish-aggregating devices by attracting mobile organisms like crabs and lobsters, demersal and pelagic fish, and top predators. Some of the biofouling and aggregating species may be non-native organisms, already known to occur in nearby natural or artificial habitats. As has been shown for offshore wind farms and by models predicting marine activity near MRE projects, areas with MRE devices may act as marine reserves because their presence excludes fishing activities. The nature and importance of these effects will vary according to the size and location of the deployment, the existing ecosystem, and natural habitats.

## REMAINING UNCERTAINTIES

Several knowledge gaps need to be addressed to advance our understanding of the risks associated with changes in benthic and pelagic habitats. There is still little understanding of the appropriate spatial and temporal scales for environmental impact assessment and monitoring in relation to MRE and natural variability. There is also a need for suitable thresholds of undesirable consequences. Other gaps concern the composition of biofouling and aggregating species, their geographic distribution, and how widely planktonic larvae are spread. Filling these gaps would allow the identification of non-native invasive species in order to assess risks and develop measures to prevent their spread. While surveys using underwater images are accepted as a powerful means of assessing habitat changes over time, they are challenging because very large areas must be covered, and extremely large data sets are needed to determine changes of ecological significance. Finally, it is unclear whether the effects of decommissioning (removing) of MRE devices will have a positive or negative effect on benthic communities.

## RECOMMENDATIONS

Guidelines needed for data collection should include specific spatial and temporal scales to help reduce uncertainties about changes in benthic and pelagic habitats associated with MRE devices. More information is needed about species groups and their distributions to characterize biofouling communities, identify non-native biofouling and artificial reef species, and identify levels of change that are not deemed acceptable. Modeling can help define the best habitats and connections among MRE sites and natural habitats, and can identify the cumulative effects of MRE devices and other anthropogenic activities, as well as climate change.

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REPORT AND MORE INFORMATION

*OES-Environmental 2020 State of the Science* full report and executive summary available at:
*https://tethys.pnnl.gov/publications/state-of-the-science-2020*

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Go to *https://tethys.pnnl.gov* for a robust collection of papers, reports, archived presentations, and other media about environmental effects of MRE development.

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