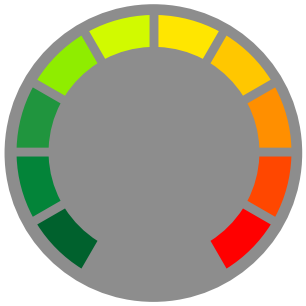
Path Forward

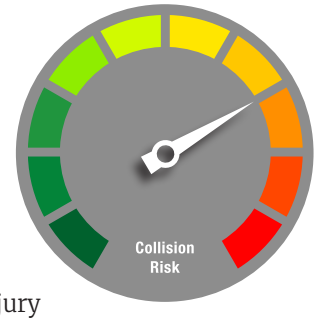
The path forward for the consenting/permitting (hereafter consenting) of marine renewable energy (MRE) devices requires a common understanding among regulators, developers, and other stakeholders of the risk associated with each interaction of MRE devices and systems (stressors) with marine animals, habitats, and ecosystem functions (receptors). Through the integration and assessment of all the information gathered through the 2020 OES process, a series of graphical representations of risk, at this point in time, have been developed.

ILLUSTRATING RISK



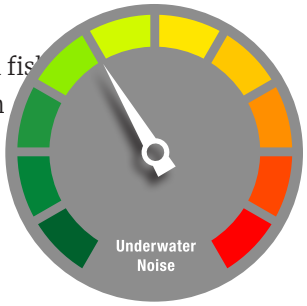
The status of knowledge for each stressor-receptor interaction can be used to provide a path forward for decreasing the potential risk to the marine environment. This will allow for recurring assessments of risk when new information becomes available. Each of the following dashboards demonstrates the broadly understood level of risk for specific stressors, with recommendations to further understand and lower the perceived risk of the stressor, as of 2020. The level of risk represented by the dials ranges from lower risks in deeper green to higher risks in red. The path forward to lowering risk for each interaction includes: 1) increased sharing of existing information; 2) improved modeling of interaction; 3) monitoring data needed to verify findings; and 4) new research needed.

COLLISION RISK FOR ANIMALS AROUND TURBINES



The risk of marine mammals, fish, diving seabirds, or sea turtles colliding with a moving blade of a tidal or river turbine, resulting in injury or death is considered to be high. This perceived risk is high because of the level of uncertainty about whether the animals are likely to collide with MRE devices, and how serious the consequences might be if a collision were to occur.

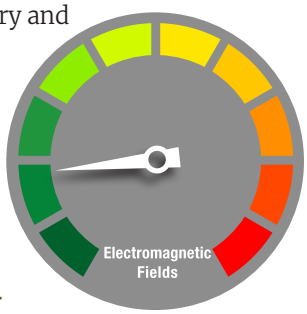
UNDERWATER NOISE



Risk to marine mammals and fish due to operational noise from turbines and wave energy converters (WECs) can be determined by following an international standard and comparing the noise to regulatory thresholds and guidance developed in the United States. To date, these measurements show that MRE operational noise falls below thresholds of concern, although measurements of more turbine and WEC types are needed. The findings suggest underwater noise is a moderate risk.

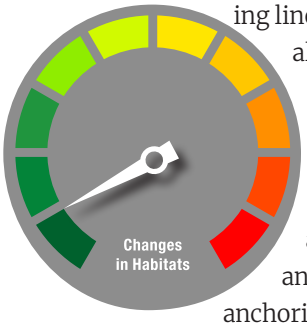
ELECTROMAGNETIC FIELDS (EMFs)

EMFs from power export cables could affect the behavior and reproductive success of certain sensitive marine animals. The EMF emissions from MRE cables are comparable to or smaller than those from offshore wind turbines as well as telecom and other electric cables currently operating. Laboratory and field studies indicate that the levels of EMF from MRE projects are too low to adversely affect sensitive marine organisms, making this a relatively low risk.



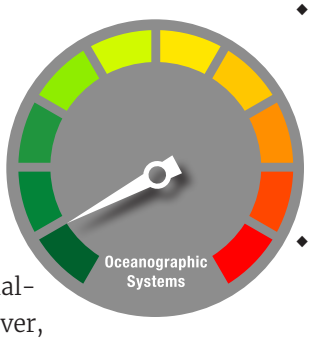
CHANGES IN HABITAT

Placing MRE devices on the seafloor and running mooring lines through the water column alters and removes some habitat, in a manner similar to the small changes made by many other industries such as developing offshore oil and gas, mooring navigation and observation buoys, and anchoring ships. Learning from these applications, the effects of MRE development on marine habitat are likely to be very limited; hence, the risk is considered low.



CHANGES IN OCEANOGRAPHIC SYSTEMS

Operating tidal turbines and WECs can change water flow, wave heights, and consequently sediment transport and water quality surrounding MRE sites. However, the effects, as demonstrated by computer models, are much too small to measure for limited numbers of MRE devices, but should be reexamined for large arrays. Hence, the risk is considered to be low.



MOORING LINES AND SUBSEA CABLES

Mooring lines are needed to anchor floating WECs and tidal turbines, and cables will be draped in the water column to carry power between devices in an array, before sending electricity to shore. Concerns have been raised that large marine animals such as whales could become entangled in, injured by, or drowned by the lines and cables, much as they are by abandoned fishing gear. MRE lines and cables have no loose ends and are too taut to create an entangling loop, so this risk is considered to be low.

CHARTING A PATH FORWARD FOR MRE CONSENTING

If the concept of risk can support a path forward for consenting processes for MRE world-wide, there are strategies that can be helpful, including marine spatial planning, adaptive management, and risk retirement. In addition, consenting processes could benefit from four primary perspectives:

- ensuring that requirements for data collection and analysis are proportional to the risk to marine animals and habitats of concern;
- establishing a full understanding of the risks and implications of MRE development so that sufficient evidence is gathered at each project to improve our scientific understanding of MRE effects, while ensuring that the MRE industry can meet the goal of sustainable energy production;
- considering the transferability of information and evidence from consented projects, research studies, and analogous industries, before new data collection is initiated; and
- working toward retirement of risks that have been shown to be low, so that resources and data collection efforts can be focused on more important risks.

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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