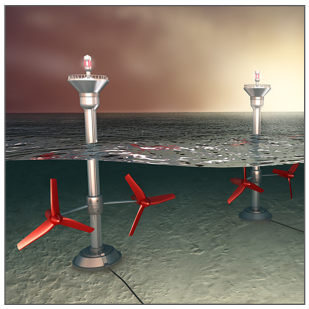
Collision Risk

POTENTIAL CONCERNS

The presence of marine renewable energy (MRE) devices—particularly the rotating blades of tidal turbines—in the ocean is thought to pose a risk to marine animals and diving birds. Animals might come into close contact with tidal turbine blades in the course of their natural movements; because they are attracted to the device for purposes of feeding, shelter, or out of curiosity; or because they are not strong enough to avoid tidal currents that might sweep them into the blades.



The concern is that collision with a tidal blade (or perhaps the stationary part of a device like the foundation) could cause irrecoverable injury or death. For animal populations that are under stress for other reasons, such as climate change or other human activities, loss of one or a few members due to collision might affect the survivability of the population. The greatest concerns are for marine mammals, especially those in declining populations; commercially and recreationally important fish species; and endangered seabirds.

STATUS OF KNOWLEDGE

No instances of marine mammals, fish, diving seabirds, or other marine animals colliding with an operational tidal turbine have been observed to date. Instrument packages capable of observing animal/turbine collisions are under development, but few have been adequately tested or deployed around an operational MRE device. Laboratory simulations have shown that fish may pass through turbines but very few are likely to be harmed. Modeling studies are being used to estimate the chance of animals encountering an underwater object such as a turbine. Many studies currently focus on understanding movements of marine animals in tidal areas, and tracking their reaction to installed tidal turbines. Most studies in Europe are focused on the interactions of marine mammals, particularly harbor seals, around tidal turbines, while North American studies are examining interactions and possible collisions of fish with tidal turbines. Studies have shown that a marine mammal colliding with a tidal turbine may be injured but not necessarily killed, and that animals are likely to recover from many of those injuries.

HOW WE UNDERSTAND THE PROBLEM

The lack of adequate observations of marine animals interacting with tidal turbines is exacerbated by two factors: 1) making observations with underwater cameras (which could operate on light [optical cameras] or sound [acoustic cameras]) in the very fast-moving tidal races is technically very difficult and results in very large sets of data that are costly to process; and 2) the chance of animals colliding with underwater structures is almost certain to be extremely rare. Modeling studies estimate the number of collisions and encounters from animal population data, but do not account for the animals' ability to change direction, to detect and avoid underwater structures, or to evade the structure at close range. For this reason, models of collisions and animal/turbine encounters tend to greatly overestimate likely collisions. Observations and modeling of marine animals and tidal turbines have been generally around single devices. As the industry moves towards large arrays, there is a need to understand how these interactions might scale.

FUTURE RECOMMENDATIONS

Technical methods need to be developed and scientific studies conducted that can accurately observe interactions of marine mammals and fish around turbines. Observations need to be made for single devices; how animals might react in close range to multiple devices in arrays is unknown. These studies will require improved instrument packages, as well as methods of data collection and analysis that can be deployed for long periods of time to ensure that a rare event such as a collision might be observed. In the absence of near-term evidence that collisions will not occur, studies of animal behavior around tidal turbines are needed to predict how marine mammals, diving seabirds, and large fish will avoid turbines, evade turbine blades, and otherwise interact with turbines. Collision risk and encounter risk models from other fields need to be further improved to accurately estimate the number of animals that are likely to come into close proximity with a tidal device.

FOR MORE INFORMATION

Annex IV State of the Science full report and executive summary available at: *http://tethys.pnnl.gov/publications/state-of-the-science-2016*

Contact:
Andrea Copping
Pacific Northwest National Laboratory
andrea.copping@pnnl.gov
+1 206.528.3049

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

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

iea Energy Technology Network

OES ANNEX IV

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965