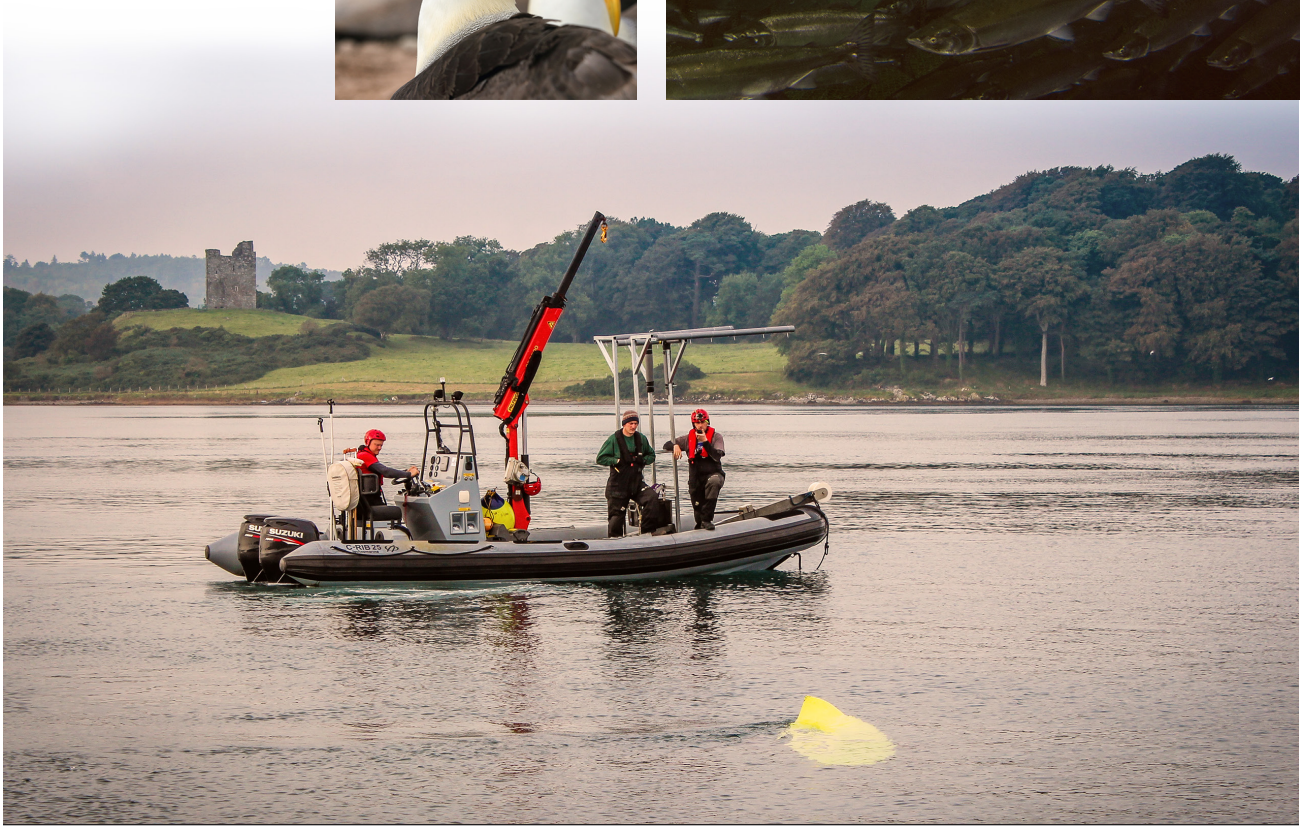
Environmental Monitoring for Detecting Interactions of Marine Animals with Turbines

RELEVANCE TO MARINE RENEWABLE ENERGY

The interaction of marine animals with tidal and river turbines remains the least understood aspect of potential MRE effects and has been hampered by the inability to observe these interactions. These challenges require the design of monitoring equipment that can survive in harsh marine environments, and the ability to manage power to operate instruments and onboard data acquisition systems.



STATUS OF KNOWLEDGE

The most commonly used instrumentation to examine animal interactions with turbines includes passive acoustic instruments, active acoustic instruments, and optical cameras:

- Passive acoustic monitoring uses hydrophones that measure underwater sound, including the ambient noise at a location, noise from construction/installation operations, operational noise from an MRE device, and marine mammal vocalizations.
- Active acoustic monitoring instruments generate a sound that bounces off the object of interest and is returned to the instrument to create a sound "picture" of the object. Active acoustics can observe marine animals, MRE devices, or the foundations and mooring lines holding them in place. Active acoustic instruments include sonars, echosounders, acoustic cameras, and others.
- Cameras that operate on light, including video and still cameras, are used to identify animals often to the species level, which cannot be done with active acoustics. However underwater cameras often require additional lighting in murky waters, which can change the behavior of the species of interest.

Researchers and engineers have combined instruments on platforms that can be fixed on the seabed or moved through the water. Five such platforms are currently functioning in the world:

- The Adaptable Monitoring Package (AMP, University of Washington, U.S.)
- The Fundy Advanced Sensor Technology (FAST-EMS, FORCE, Canada)
- The Flow, Water Column and Benthic Ecology 4-D (FLOWBEC-4D, EMEC, UK)
- The Sea Mammal Research Unit HiCUP Platform (SMRU, University of St Andrews, UK)
- The Integrated Monitoring Pod (IMP, Energy Technologies Institute, UK).

REMAINING UNCERTAINTIES

Many of the instruments developed to monitor the interactions of animals with turbines have been adapted from standard oceanographic equipment, but must be modified to achieve the necessary reliability and survivability in high-energy waters. Reliable detection of rare events, such as interactions between a marine mammal and a tidal turbine, requires continuous observation over long periods of time, resulting in large datasets. In addition, by integrating instruments on platforms, the challenge of avoiding electronic interference among instruments, as well as storing or processing large amounts of data, must be addressed. Biofouling, or biological growth on submerged surfaces, may degrade the performance of instruments or interfere with critical components of data collection. Operating instrument platforms requires significant power, which can be supplied by onboard battery banks or from shore via power cables. Battery power is limited and requires careful power management of the instruments, which is achieved through trade-offs such as taking fewer observations over long time periods to conserve power. Power cables are expensive and become technically and financially prohibitive when monitoring stations are in deep water, far from shore.

RECOMMENDATIONS

Reaching an agreement on a preferred suite of instruments and platforms could accelerate data collection and understanding of the risk to marine animals from turbine collision, thereby facilitating national and international consenting processes.

The large amounts of data collected by integrated instrument platforms can be simplified and monitoring results can be made rapidly available by developing automated data processing onboard the platform.

Cooperation among researchers, test centers, and MRE developers on integrated platforms has been significant to date. Encouraging and expanding these efforts can help move the industry toward larger arrays and commercial deployment.

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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