EIMR2014-524

Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments

Steven Benjamins[1]
SAMS
Oban, Argyll, PA37 1QA

Violette Harnois
University of Exeter
Penryn, Cornwall TR10 9FE

Helen Smith
University of Exeter
Penryn, Cornwall TR10 9FE

Lars Johanning
University of Exeter
Penryn, Cornwall TR10 9FE

Lucy Greenhill
SAMS
Oban, Argyll, PA37 1QA

Caroline Carter
SNH
Oban, Argyll, PA34 4AE

Ben Wilson
SAMS
Oban, Argyll, PA37 1QA

SUMMARY

The development of marine renewable energy (MRE; offshore wind, tide and wave energy) in Scottish waters and elsewhere has given rise to concerns about the potential impacts of such technologies on the marine environment. One such potential impact of marine renewable energy development is the risk of whales, basking sharks and other large animals ("marine megafauna") becoming entangled in mooring systems and associated power cables. Similar entanglements in fishing gears have long been recognised as a significant global cause of injury and mortality for many species, and there are concerns that future expansion of the MRE industry may exacerbate the risk.

In the current absence of large numbers of MRE-associated moorings, there are few concrete data on which to base an assessment of entanglement risk. A comprehensive literature review confirmed that the vast majority of marine megafauna entanglement records worldwide involved fishing gear. There were, however, several reports of large whales interacting with (or becoming entangled in) anchor chains, aquaculture moorings and similar structures, sometimes leading to injury or mortality. This evidence suggests that moorings, such as those proposed for MRE devices, will likely pose a relatively modest risk in terms of entanglement for most marine megafauna, particularly when compared to entanglement rates in fisheries. Nevertheless, some circumstances were identified under which moorings associated with MRE devices could pose a risk to marine megafauna, particularly 1) in cases involving baleen whales and 2) if derelict fishing gears become attached to the mooring and continue to fish, thereby creating an entanglement risk for a wide range of species (including fish and diving seabirds).

To further assess potential entanglement risks across different mooring configurations, a qualitative risk assessment approach was developed. This approach assigned relative risks to different groups of marine megafauna and moorings on the basis of biological and physical risk parameters. Biological risk factors included: body size; animals' ability to detect moorings; animals' body flexibility; and general feeding modes. Physical risk factors included: mooring tension; swept volume; and mooring curvature. Physical risk factors were assessed by dynamically modelling the behaviour of six different commonly used mooring types (including several variations of catenary and taut designs) using OrcaFlex™ software. Biological and physical risk factors were then combined to populate a relative risk matrix for all combinations of megafauna groups and modelled moorings.

Results suggest that MRE device moorings are unlikely to pose a major threat to most megafauna at the population level, although some species (e.g. cetaceans, as European

[1] Corresponding author: Steven.Benjamins@sams.ac.uk

Protected Species) are afforded legal protection at the individual level. Baleen whales were considered to be at greatest relative risk overall, largely due to their size and foraging habits. Some mooring designs (e.g. various types of catenary moorings) presented a greater relative risk than others. Most moorings associated with MRE devices would likely be too strong for animals to easily break free if they became entangled. Entanglement risks among MRE arrays will likely vary substantially based on device spacing, mooring design and array layout.

Although the likely risk of megafauna entanglement in MRE moorings currently appears limited, there is a need to re-evaluate this tentative assessment as more devices are deployed. Indeed, entanglements in derelict fishing gears caught on moorings may well turn out to be more significant. To ensure that entanglement in moorings is properly assessed several modifications to current assessment and reporting procedures are suggested. The qualitative risk assessment approach developed in this study makes use of modelling results that form an integral part of the mooring design process. It therefore enables device developers and regulatory bodies to assess potential entanglement risks at an early stage of the development of a MRE proposal, allowing appropriate risk management and mitigation strategies to be developed if necessary. Details of moorings relevant to the risk of entanglement of marine megafauna should therefore be included alongside other potential impacts within Marine Licence applications and Environmental Statements. There is a need for the establishment of an official reporting mechanism by which developers can report the presence of marine megafauna entanglement in MRE device moorings to the regulator. A formal accident investigation procedure needs to be established to ensure that any such events can be properly acted upon and investigated. Further research is needed to clarify the distribution and abundance of derelict fishing gear in Scottish waters, and the extent to which gear caught on moorings presents an entanglement risk.