A framework to predict, validate and review the acoustic footprints of operating tidal turbines.

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The rapid growth and diversification of the tidal-stream energy sector has led to many sites and device concepts being considered for imminent development. Though the UK has been the focus for many companies, other countries notably France, Canada, China and the US have begun to scope, lease and develop sites. With tidal-stream energy being renewable, installations are likely to represent long-term changes to what are usually discrete and biologically important habitats. This brings significant environmental responsibility in terms of determining and mitigating short and long-term effects on marine life. A potentially key impact that will feature in most environmental assessments is the acoustic emissions of operating devices. Initial drivers were the determination of whether devices might produce sounds loud enough to produce auditory damage in sensitive species but the potential for barrier effects in narrow channels is another obvious concern. Less obvious but perhaps more important is whether the sounds emitted by turbines will be loud enough to be heard by approaching animals like marine mammals with sufficient distance/time that they can avoid harmful collisions with the moving blades.

Currently the information to make these assessments is lacking. In particular, little is known about turbine sound emissions because of the small number of devices that have been built and recorded and the constantly evolving designs that are being proposed. Likewise, little is known about the levels of ambient noise in the coastal high-flow speed waters where such installations will be sited.

In this presentation we will outline a method that uses a combination of predictive modelling, propagation and empirical at-sea measurement to better inform assessments of the audibility of tidal turbines for marine mammals. For this, precise information on the physical configuration of the turbines, (blades, gearboxes, substructure and so on) are used to determine the characteristics of sound production of the component moving parts and their modes of sound transmission into the surrounding water. Site specific propagation modelling is then used to determine how the sound will emanate into the environment and this is compared with on-site ambient sound measurements taken using drifting recorders at a range of tidal states and water flow speeds. When put together these provide a predictive footprint for single devices or arrays and most importantly (when decision making) for devices of different specifications or design envelopes.

In addition to EIA stage decisions, the proposed methods may also inform other predictive studies of animal behaviour. Particularly those considering what information and options acoustically sensitive animals have when manoeuvring within turbine arrays and therefore collision risk and the need or otherwise for acoustic mitigation.