Multi-platform studies of the MeyGen tidal energy site – using UAVs to measure animal distributions and hydrodynamic features

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Top predators are known to forage in tidal stream sites [1]. High flow speeds, upwelling or shear may enhance prey availability and foraging efficiency [2]. We need to measure the distribution of animals to understand potential animal interactions with tidal stream energy developments.

Our studies have focused on the MeyGen tidal energy site in the Pentland Firth, UK. The FLOWBEC seabed platform [3] was deployed in 2015 to collect baseline measurements on hydrodynamics *(ADCP & ADV)*, prey and turbulence *(EK60)* [4], and predator-prey interactions *(multibeam sonar)*.

Temporal persistence of the FLOWBEC platform was complemented with spatial coverage from vessel surveys using *MRV Scotia* in 2016 as a baseline before turbines were installed, and in 2018 with turbines installed. Vessel surveys used a similar sensor package to FLOWBEC, to measure hydrodynamics and turbine wake effects *(ADCP)*, prey and turbulence *(EK60)*, and surface detections of animals *(observers and cameras)*.

In 2016 and 2018, we also demonstrated the use of Unmanned Aerial Vehicles *(UAVs)* for environmental monitoring of tidal energy sites. UAV imagery allows concurrent measurement of animal distributions and fine-scale hydrodynamic surface characteristics to investigate the behavioural associations between top-predator foraging and hydrodynamic features. UAVs also overcome the cost and therefore infrequency of vessel or aeroplane surveys which limit understanding of seasonal trends, and overcome the limitations of vantage point surveys which suffer from reduced detectability with increasing distance from the observer.

UAV flights ahead of the vessel ground-truthed UAV observations of animals against observers, and ground-truthed UAV hydrodynamic measurements against hydroacoustics from the vessel. Surveys were against the tide to avoid double-counting and validated to ensure no effect of the UAV on animal behaviour.

Ongoing work is developing algorithms for automated detection of animals and hydrodynamic features from UAV datasets. We will present a preliminary overview of the multi-platform datasets investigating changes arising since installation of the turbines, and proof of concept results from using UAVs to survey tidal stream energy sites.

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