



Potential effects of large-scale offshore tidal energy extraction in the Pentland Firth on North Sea biogeochemistry

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Final results are presented of a model study to assess the potential wider area effects of large-scale tidal energy extraction in the Pentland Firth on the biogeochemistry. The coupled hydrodynamics-biogeochemistry model GETM-ERSEM-BFM was used in a shelf-wide application with a parameterisation of the effects of power extraction by tidal turbines on fluid momentum. Three scenario runs were carried out: a reference run without turbines, an 800 MW extraction run corresponding to current licenses, and an academic 8 GW extraction run. The changes simulated with the 800 MW extraction were negligible. The academic 8 GW extraction resulted in reductions in tidal elevations along the east coast of the UK that would be measurable (several cm.), and associated reductions in bed-shear stresses. These resulted in reductions in SPM concentrations, increased primary production, and increased biomass of zooplankton and benthic fauna. The effects were most pronounced in the shallow seas surrounding The Wash, with changes of up to 10%. These results indicate that, should tidal power generation substantially beyond the currently licensed amount be planned, either concentrated in one location or spread over multiple locations along the coast, further investigations are advisable.