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Modelling seabird central place foraging under anthropogenic environmental change

Given the extensive planned expansion of offshore renewable energy sites, it is important to anticipate the effects that this may have on the surrounding marine environment. Important aspects include both direct and indirect effects on seabird demographics, and hence abundance. Advances in GPS tagging technology have allowed increased tracking of a wider range of seabird species, creating an opportunity for more biologically realistic modelling to support impact assessment.

My PhD project focuses on developing models of the movement paths of central-place foraging seabirds during the breeding season. We assume that the bird takes a directed trip away from its nest, and then alternates between foraging and resting out at sea, before returning to its nest. These assumptions are formulated as a set of biologically well-defined behavioural states that the model switches between, with movement within each state following a novel continuous-time step-and-turn model. We use a modelling framework in which both the switching rates between behavioural states and the characteristics of the steps and turns can be dependent on time and on spatial covariates.

Current work involves the simulation of tracks, and then assessing their biological plausibility and tailoring them to specific seabird species. We are then in the process of developing statistical methods to fit them to telemetry data. The simulations themselves can also be built into existing models of environmental impact, to enhance their defensibility. The ultimate objective of the project is to use these models and statistical methods to help better understand how a seabird's behaviour and movement patterns are likely to be affected by changes in the environment, including limitations on accessibility due to offshore developments such as wind turbines and changes in prey availability due to climate change.