

## Investigating the influence of tidal-topographic fronts on marine megafauna off southwest UK

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### Keywords

Oceanic fronts, marine megafauna, seabirds, cetaceans

### Rationale

The distribution, persistence and intensity of oceanic fronts exert a strong bottom-up control on marine ecosystems, by influencing spatio-temporal distribution of phytoplankton blooms, zooplankton aggregations, fish shoals and associated commercial fishing activities. Resulting prey aggregations lead to concentrations of megafauna (e.g. cetaceans, seabirds and basking sharks) at a variety of spatio-temporal scales. Understanding these relationships is vital for effective conservation action.

Ongoing research is investigating the influence of tidal-topographic and tidal-mixing fronts off southwest Cornwall, utilising a multi-disciplinary approach that combines 1) high-resolution seafloor bathymetry, 2) satellite oceanography, 3) *in situ* zooplankton sampling, 4) acoustic monitoring of cetaceans, and 5) intensive effort-based visual monitoring of all marine megafauna. The aim of this study is to broaden this approach to a wider range of tidal-topographic fronts off southwest UK, utilising new high-resolution multibeam bathymetry data. Target locations include rocky reefs aligned perpendicular to tidal flow, nearshore islets and deeps, and prominent headlands.

### Methodology

The project will utilise a fully multi-disciplinary approach, combining elements of seafloor mapping, satellite oceanography and field-based data collection. The first stage will be to analyse newly available multibeam bathymetry data from southwest UK in order to identify prospective tidal-topographic fronts. Satellite-based front maps will provide additional information on the proximity of larger-scale tidal-mixing fronts. Land- and boat-based fieldwork will include effort-based monitoring of all target megafauna at selected sites to constrain spatio-temporal distributions. *In situ* zooplankton sampling and passive acoustic monitoring of cetaceans may also be conducted at some locations.

Environmental data will be compiled in a GIS, while biological data will be entered into an appropriate database and analysed using various statistical techniques. It is anticipated that cross-correlation of environmental and biological data will highlight relationships that can be tested across a series of sites over the three years of the PhD. Complementary tagging and tracking studies of

certain species, e.g. Balearic Shearwater, may also be incorporated into the project.

### Training

The student will join a highly active, multi-disciplinary research group and will gain experience of a wide range of techniques. These include handling and visualisation of geophysical data, e.g. high-resolution bathymetry and satellite oceanography images, and relevant GIS skills. Field-based training will include identification of a wide range of seabird and cetacean species, and use of appropriate survey methods, e.g. theodolites, photo identification. Engagement with various data users and policymakers will provide the student with excellent communication skills and a wide range of contacts in the environmental sector. The NOCS Graduate School provides training in key skills, e.g. report writing, presentation skills, H&S, and a stimulating programme of internal seminars.

### Wider implications

This study will provide vital information on the short-term (diurnal to inter-annual) spatio-temporal distribution of marine species at a variety of 'biodiversity hotspots'. The results will allow better prediction of impacts of long-term climate change on the marine environment. The PhD will also contribute to the SeaWatch SW project, which provides information and advice to a variety of data users. In the last year, SeaWatch SW data have contributed to marine spatial planning off southwest UK (MCZ network, offshore energy), and protection of endangered species (SAC for Balearic Shearwater, BAP for Basking Shark). Project partners include RSPB, BTO and Marinelife. Project results will also contribute to NERC's Marine Environmental Mapping Programme.

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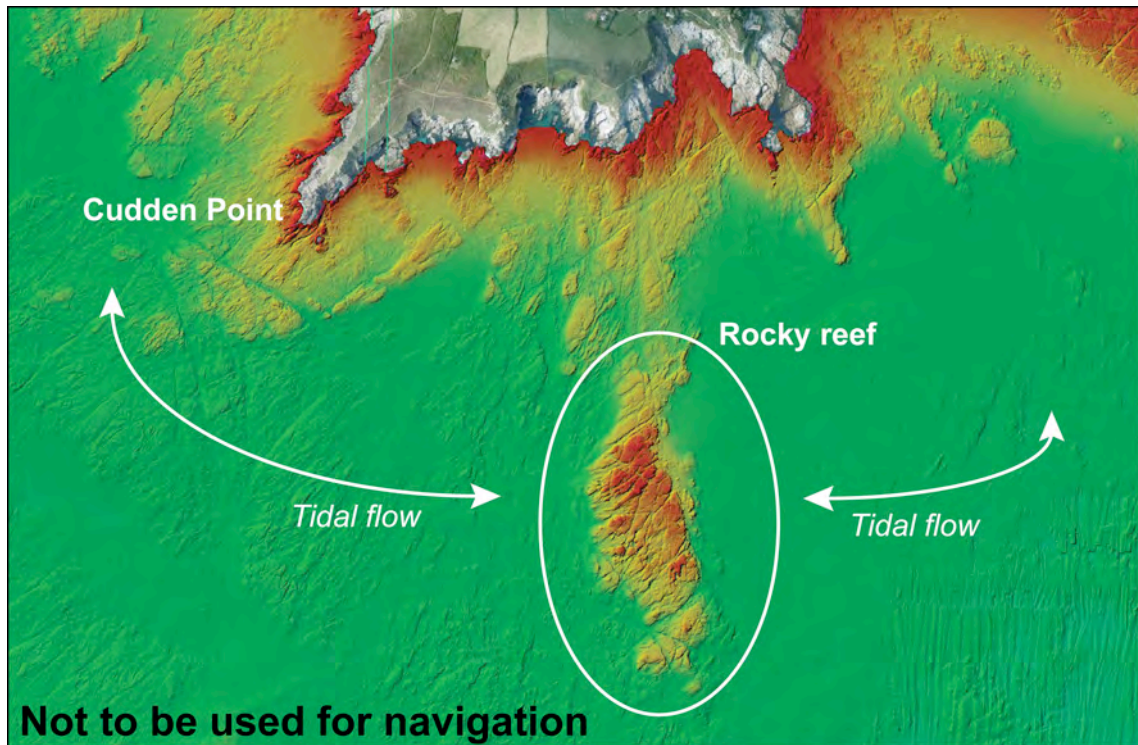


Image showing high-resolution multibeam bathymetry data off Cudden Point, southwest Cornwall, highlighting likely location of tidal-topographic front associated with a linear rocky reef. Such features are likely to be 'biodiversity hotspots' that host elevated numbers of pelagic species, e.g. foraging cetaceans.