

Interaction of Marine Mammals with tidal turbines

Thomas Lake, Dr I Masters, Dr T.N. Croft

Introduction

This project aims to simulate the movements of Harbour Porpoise in Ramsey sound in order to investigate the potential impacts of tidal turbine installation on the usage of the area by the porpoise population.

Individual Based Models

- An IBM simulates a number of virtual creatures (boids)
- Each boid examines the environment around itself before making decisions about its movement and behaviour.
- Both the decision making process and the amount of environmental information available to each boid can be defined



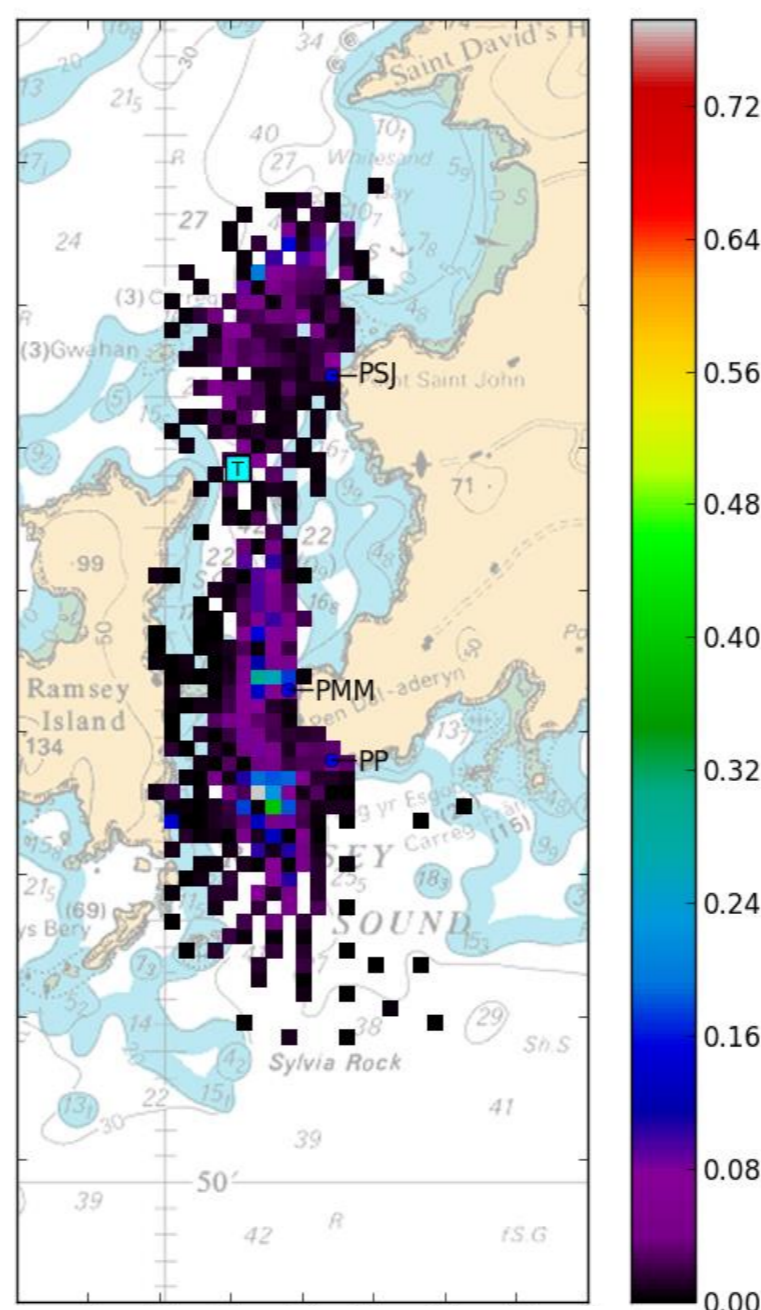
These models have successfully been used to mimic the behaviour of various species in the past, including larvae, different species of birds and larger mammals.

Outline of an IBM

A simple individual based model is an iterative process:

1. For each boid in the population:
 - a) Get list of nearby boids
 - b) Make decision about movement
 - c) Update velocity/orientation/position
2. Record positions
3. Advance simulation clock
4. Repeat from 1 for next time step

Typically, the movement decision of each boid is based on the position of its neighbours, current position and velocity and information about the environment around it.



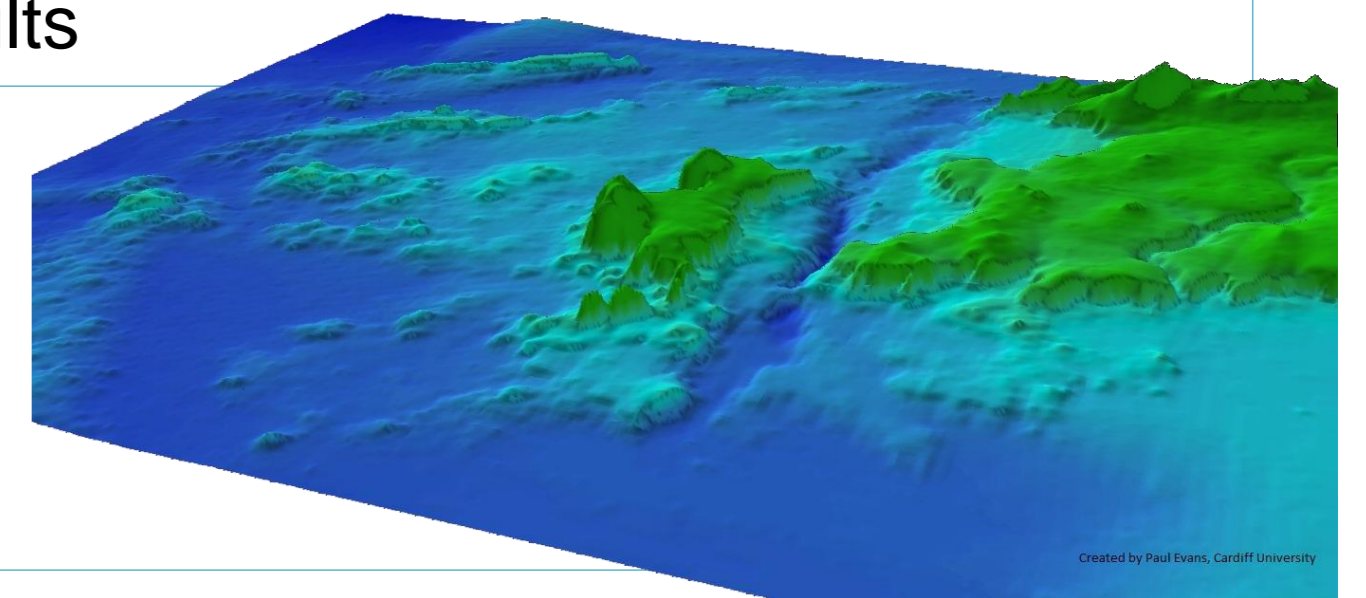
Above: Sightings/hour effort on a 100m grid of Ramsey Sound

Right: Bathymetry of Ramsey Sound
Image created by Paul Evans, Cardiff University

Working with observational data

Observations of Harbour Porpoise in Ramsey sound are made from three points with overlapping fields of view. The plot to the left shows the number of sightings per hour of survey effort after accounting for the overlap between the different observation points.

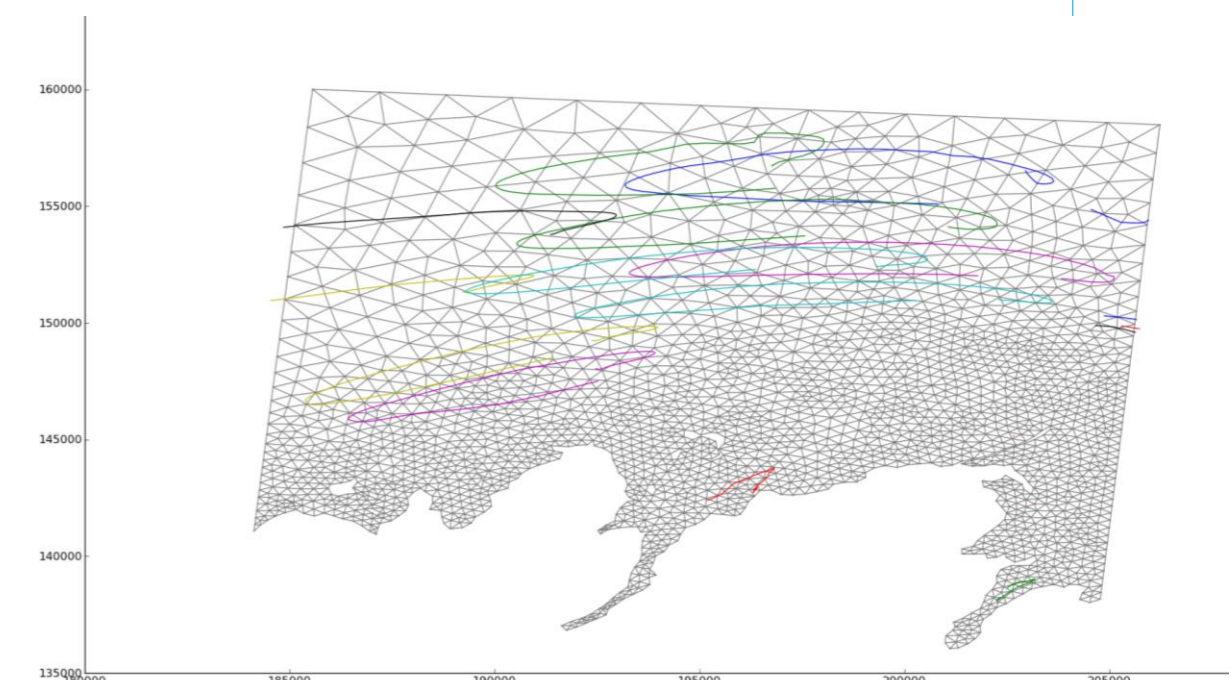
This data can be compared to the model results



What can this be used for?

Marine energy projects are required to assess the impact of the project on local marine life, including potential risks to protected species such as porpoise.

If this model can successfully mimic animal movements in a simulated version of Ramsey Sound, it may be possible to test the effects of a marine energy device by including it in the simulated environment and investigate the changes in modelled behaviour.



Point particles being tracked through a simulated 2D tidal environment

Progress and Future Work

Currently 2D particle tracking has been implemented, taking TELEMAC results as an input to define both the area to be simulated and the hydrodynamic conditions of that area. This code is currently being extended to handle 3D data, after which work will begin to determine and implement behaviour for the virtual porpoise