Multi-use platforms at sea (MUPS): an innovative way to manage offshore space and reduce coastal anthropic pressure

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The Irish Sea is host to numerous industrial activities (i.e. renewable energy, tourism, aquaculture and maritime transport) resulting in an increase of offshore human infrastructures and pressure on marine sea space for the wildlife. One option, to ease the demand of space, is the development of multi-use platforms at sea, where co-location of industries (e.g. Aquaculture and offshore renewable energy such as a wind farm) will benefit from each other.

Offshore renewable energy (ORE) in the Irish Sea will occupy approximately 14% (6,564 km^2) of the space in near future to address the UK government ambition to power all homes with wind (Fig. 1). The highest concentration of ORE is located in the eastern Irish Sea, which is also home to shellfish aquaculture (Fig. 1). The mussel industry in North Wales represents one third of the UK production (valued at ~ £15M). Therefore the shellfisheries aquaculture industry is economically significant to the area, and there is concern that it could be impacted by the development of other industries.

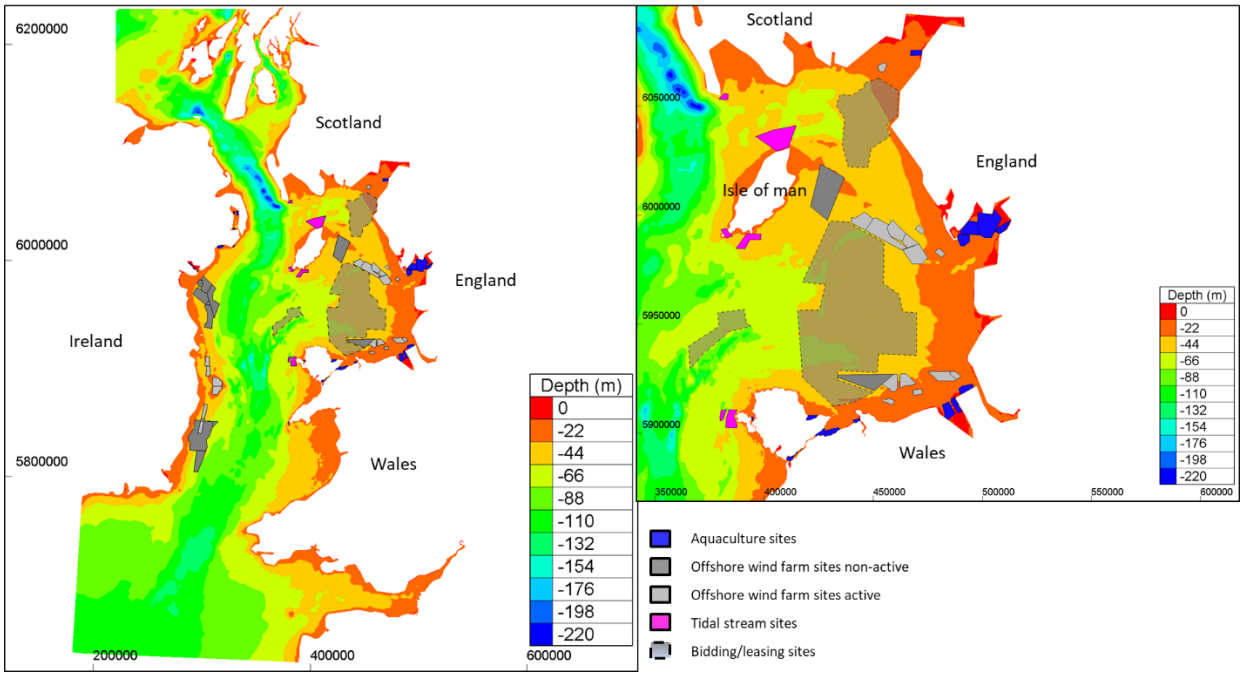

Fig. 1. Domain of study showing the Irish Sea hydrodynamic model domain (WGS84 coordinates in m) and bathymetry (m rel. to MSL), the larval release and sink sites (1-6 in blue), plus additional sink sites only (black dotted area 7-16).

To study the feasibility of MUPS in the Irish Sea we use a numerical approach, which couples a hydrodynamic model (i.e. model representing the oceanographic parameters such as tide, current velocity and direction) and particle tracking model (i.e. PTM simulating the motion of particles in the water column). However, a PTM needs to be validated against field data to represent accurately the dispersal of particles. Several validation methods exist such as genetics and microchemistry; however these method give information of the origin and connection between populations but not on the transport of larvae in the water column.

The SUPERGEN ECR funding has helped us to acquire lagrangian drifters (Figure 2, left panel). They were released the 18th of July 2021 during a multi-disciplinary research cruise on the Prince Madog (Figure 2, right panel) organised by SEEC project (http://seec.bangor.ac.uk/). The drifters were released in the eastern Irish Sea near Llandudno (North Wales, U.K.), which was chosen due to proximity of active offshore wind farm (OWF) sites. The data collected from drifters trajectory will help to: 1) improve accuracy of hydrodynamic models for future ORE projects (e.g. tidal lagoon); 2) improve accuracy of PTM to study larvae pathways and impact of ORE on larval recruitment.

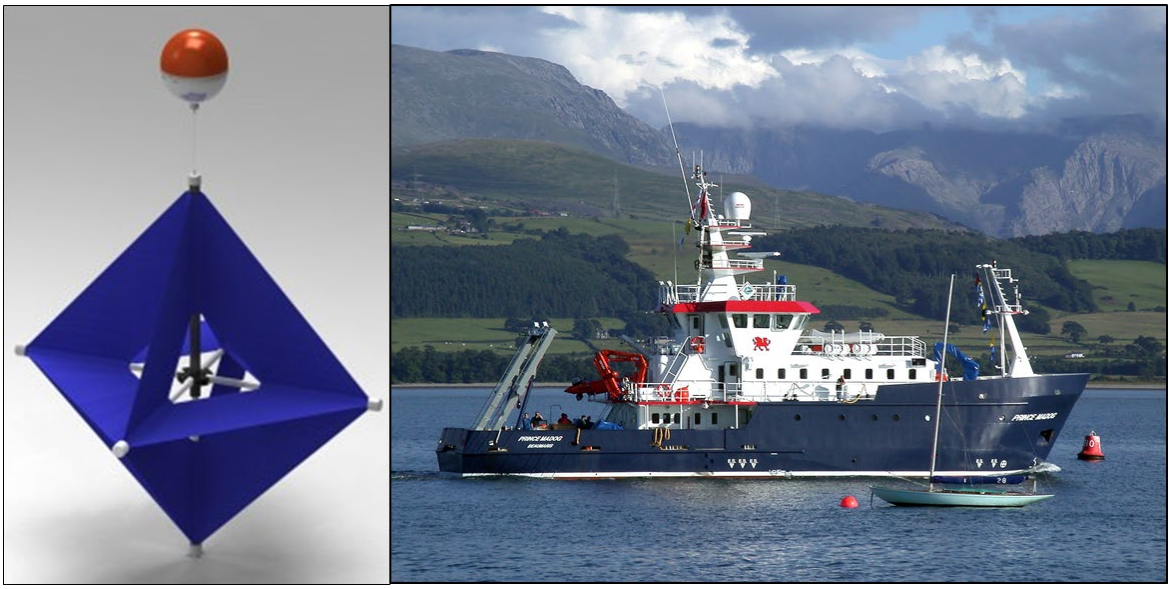

Fig. 2. Microstar drifter (left panel) and Prince Madog research vessel (right panel).

The drifters remain approximately 25 days in the water column until they reach the Cumbria coast (Drifter 1; light blue trajectory) and Morecambe Bay (Drifters 2 and 3; magenta and dark blue trajectories; Figure 3). Drifters trajectory results show that they crossed several OWF sites, which if they were larvae (e.g. mussels and oysters) could have potentially settle on the infrastructure and/or been catch for aquaculture.

The next step will consist of studying the combined effect of tide, wind and waves on drifter dispersal which will allow us to improve the accuracy of our PTM but also understand better the impact of wind on sea surface currents. An accurate PTM could be use in a near future for different purposes like: 1) define best sites for MUPS; 2) ecological studies on invasive species spread; and 3) dispersal of plastics and pollutant.

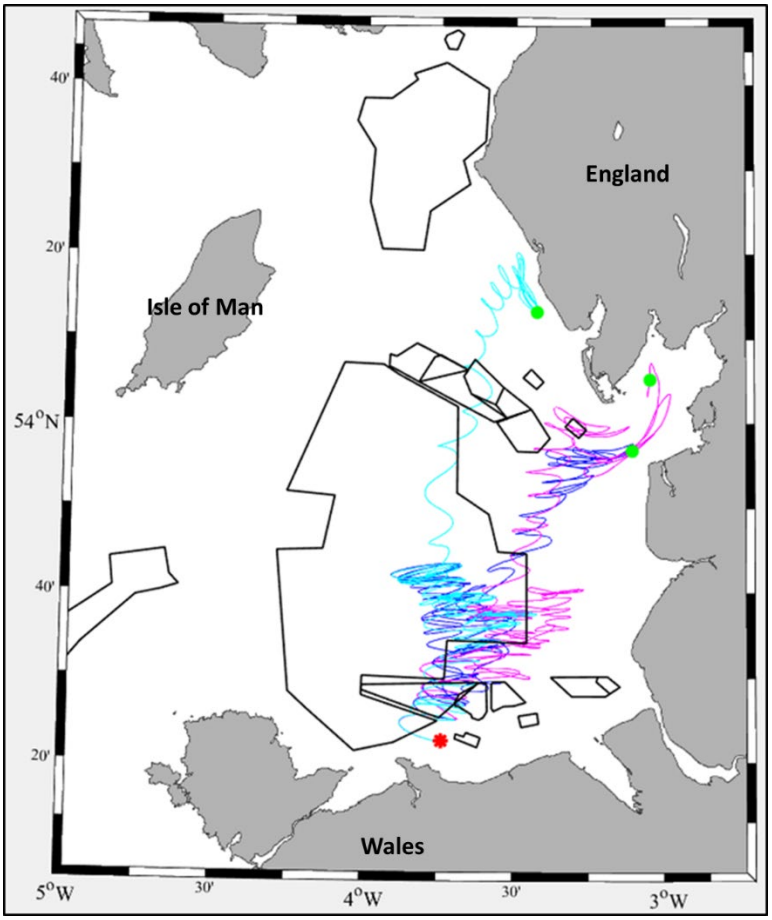

Fig. 3. Drifter trajectories (light blue, dark blue and magenta). The release drifter position is represented by a red dot and the end positions are represented by green dots. Offshore renewable energy sites are delimited by black line.