Scallop larval dispersal, Northern Ireland.

With scallop stocks declining around the Northern Irish coast, the Northern Ireland Scallop Fisherman's Association (NISFA) have become proactive in working with Seafish, the Department of Agriculture, Environment and Rural Affairs (DAERA) and the Agri-Food and Biosciences Institute (AFBI) to improve the long-term sustainability of stocks.

In 2017, four sites were highlighted as having potential for any future scallop enhancement. In 2020, a desktop study was prepared by AFBI to assess the options available for scallop enhancement. In 2022, legislation was introduced which prohibits the use of mobile gear and the taking of any scallops, from these sites. At the time of site selection there was no model available to determine the potential location of settlement of the larvae produced from the scallops within the enhancement sites. With scallop larvae drifting in the water column for 3-4 weeks before becoming actively able to swim, larvae can potentially move great distances from the location where they were spawned. The aim of this current project was to develop a larval dispersal model for scallops which could be used to determine potential larval dispersal routes from the four enhancement sites.

MerMADE is a coupled biophysical, eco-evolutionary modelling software for predicting population dynamics, movement, and dispersal evolution in aquatic environments. Following developments to the model functionality to account for the life history of scallops, the model was initially run for the entire species distribution to get a visual representation of general movement patterns in the study area.

Following this proof-of-concept run, the model was applied to the four scallop enhancement sites using dates chosen to cover both the spring and autumn spawning periods. Of the four enhancement sites, larvae spawned from Whitehead had the highest incidence of settlement within Northern Ireland waters (Figure 1). Larvae from the other three enhancement sites was shown to have lesser or no settlement within Northern Ireland waters.

Based on these model outputs, the NISFA requested other sites be examined as potential enhancement sites that would show settlement within NI waters. It was decided that current Marine Protected Areas (MPA's), which are already closed to scallop fishing, be examined. The suggested sites were:

1. Skerries and Causeway MPA
2. Rathlin Island MPA
3. The Maidens MPA
4. Outer Belfast Lough MPA

The additional sites, which were modelled only for the spring dispersal, showed a higher success in terms of scallop larval settlement within NI waters. The Maidens showed settlement aggregations throughout NI waters on each of the dates modelled (Figure 2). The area of Muck Island/Moyle Interconnector, close to the Maidens MPA, was investigated during the 2017 site selection scoping exercise. This area was shown to be suitable for scallop settlement and survival scoring favourably across all site characteristics. However, discussions with the industry led to the current four sites being selected above this area at that time. Based on these model outputs, it is recommended that the Maidens MPA is the most suitable site, of

those investigated during this study, for survival of scallops (juvenile and adult) and with dispersal of the scallop larvae from this site showing successful settlement within NI waters.

While the other three additional sites showed success in terms of larvae from these areas settling in NI waters, the characteristics of these sites was not analysed in the 2017 site selection report and therefore the suitability is unknown. However, since adult scallops are found in each of these areas, this would indicate that they are suitable sites for juvenile and adult scallop survival.
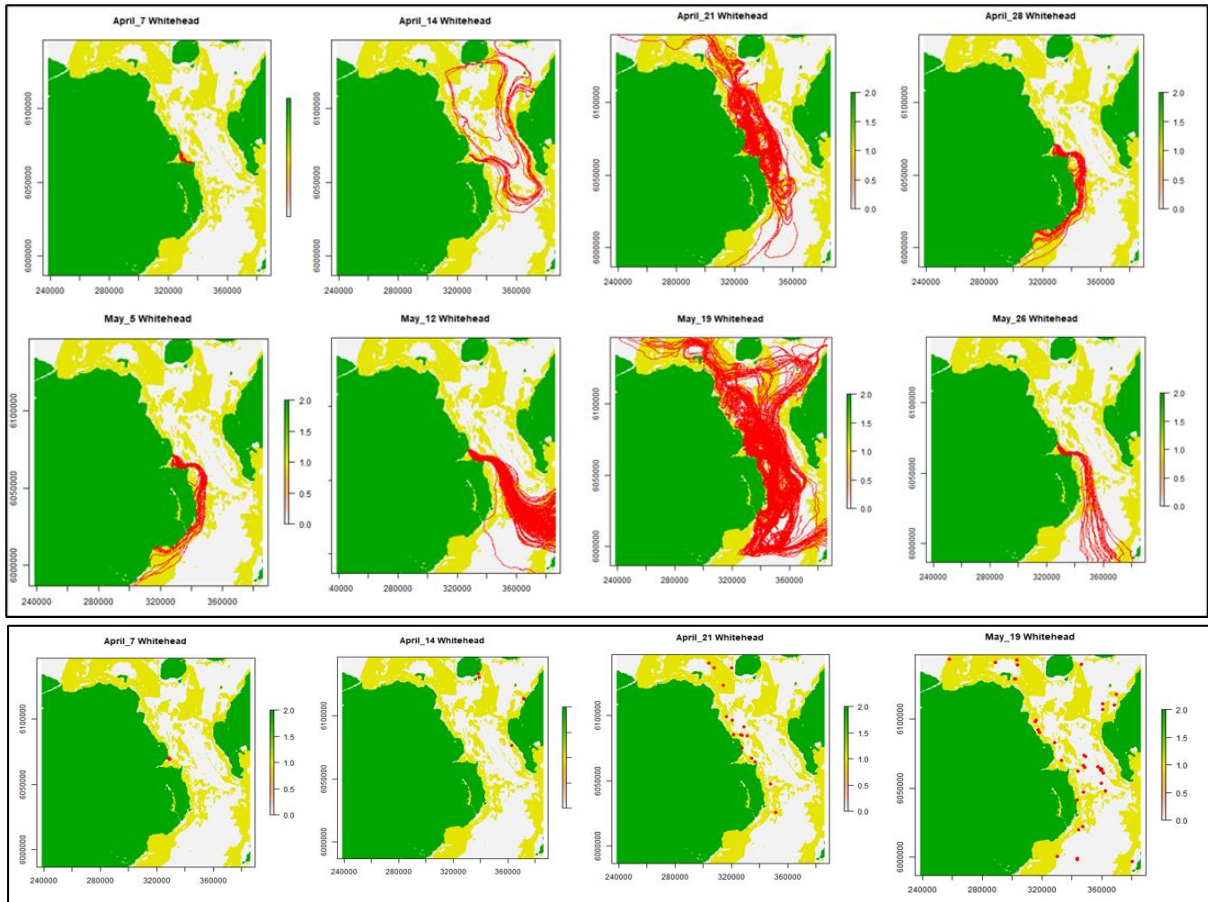
Figure 1: Modelled movement of larvae released from Whitehead between 7th April and 26 May 2022 and predicted sites of successful settlement (red dots) occurring within the model study area.
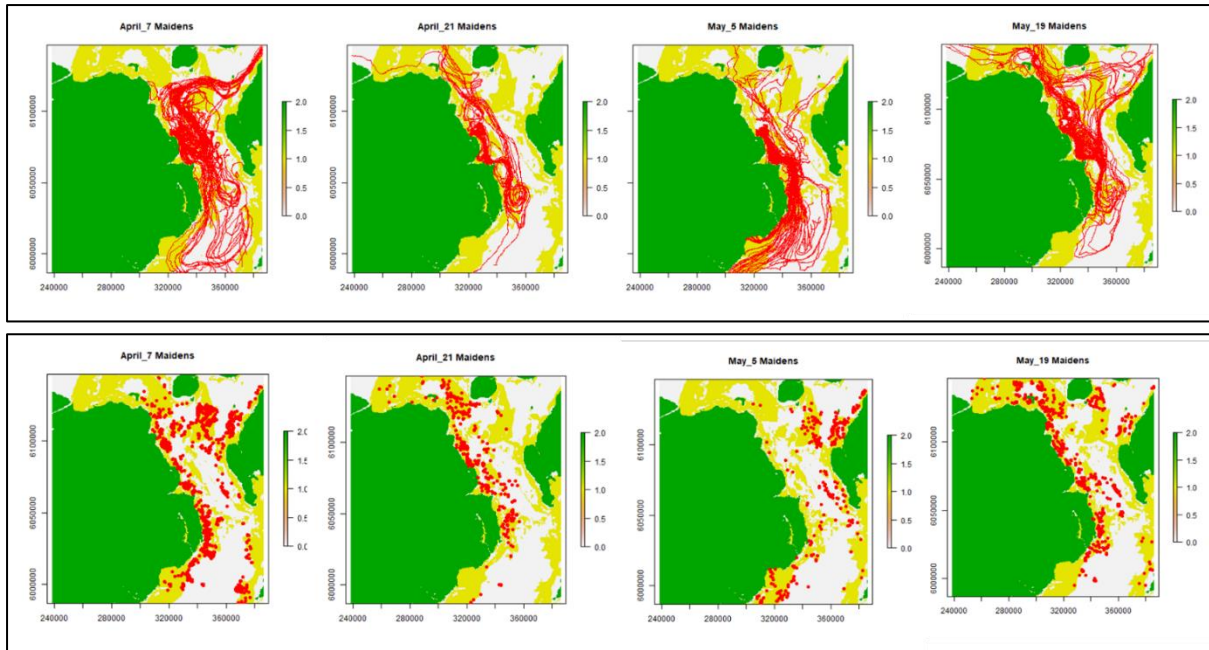
Figure 2: Modelled movement of larvae released from Maidens MPA between 7th April and 19th May and predicted sites of successful settlement (red dots) occurring within the model study area.