The following supplement accompanies the article

Connectivity modelling and network analysis of sea lice infection in Loch Fyne, west coast of Scotland

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Supplement 1. Hydrodynamic model meshes and detailed mesh results

For the hydrodynamic modelling component of this project, 2 finite element meshes were developed. The coarser of the 2 meshes used 943 nodes (Fig. S1). This included all main features and included increased resolution for particular areas such as river outflows and 1 island in the upper section of the loch. The second mesh that was developed used 2958 nodes (Fig. S2). This was more detailed, allowing enhanced resolution of certain areas of the loch, including several small islands that were unresolved in the coarser mesh. However, the increased resolution means greatly increased computational cost, resulting in longer run times.

It is unclear whether the results generated using the more detailed hydrodynamic model mesh represent an improvement over those generated using the coarse mesh. The original coarse model comparison is shown in Fig. 2 in the main text. Particular items of concern here were (1) a general lack of low current speed records in the model output, relative to the data (Fig. 2b) and (2) residual flow in an incorrect direction for some sites (notably Sites 2, 7 and 9; Fig. 2d).

This situation does not appear to be improved in the more detailed model (Fig. S3). In this case, there also appear to be sites in the model where low currents are predicted that are not seen in the data (a case that was never seen in the coarse model). There are also still sites

where low currents are observed in reality, but rarely in the model (Fig. S3b). The issue with residual flow direction is also not resolved by the more detailed model (Fig. S3d). Site 2 is matched slightly better than in the coarse model, but Site 3 is much worse.

Several factors likely contribute to these mismatches. Firstly, the observed currents are the result of wind forcing of unknown intensity and direction, while the model currents in both cases here are those in the absence of any wind forcing. In particular, the observed residual flows that are not matched may result from the interaction of particular winds with features local to the sites of interest. It is also possible that improved bathymetry, improved representation of certain coastal features (large flat tidal areas, for example) and/or more advanced open boundary forcing are required to improve the model fits – both meshes are based on the same underlying bathymetry and high water boundary information.

It was not clear that the more detailed mesh provided a more accurate representation of the hydrodynamics of Loch Fyne, and therefore all results presented in the main text were generated using the coarser mesh.

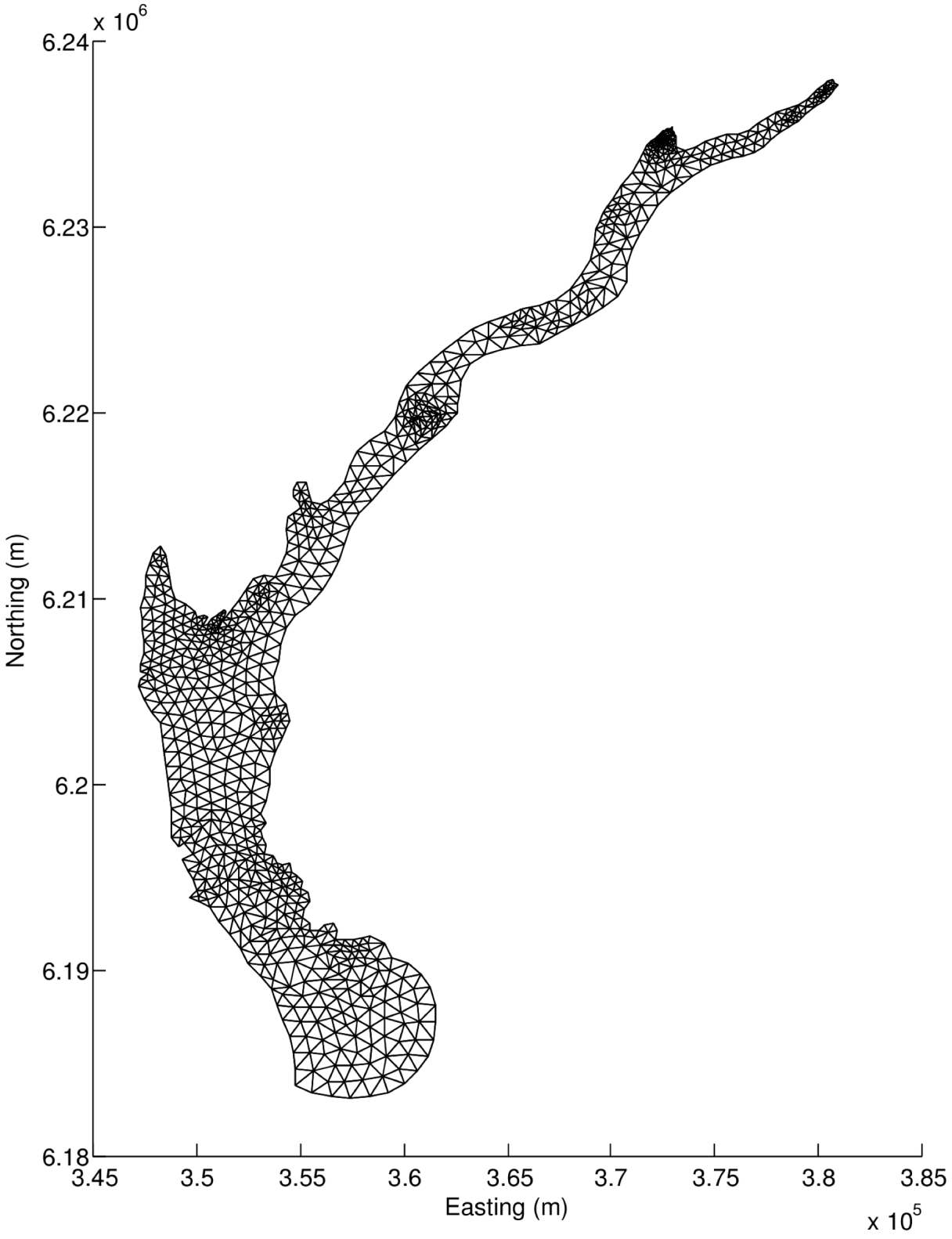

Fig. S1. Coarse 943-node mesh used for hydrodynamic model of Loch Fyne. All results in the main text were generated using this mesh

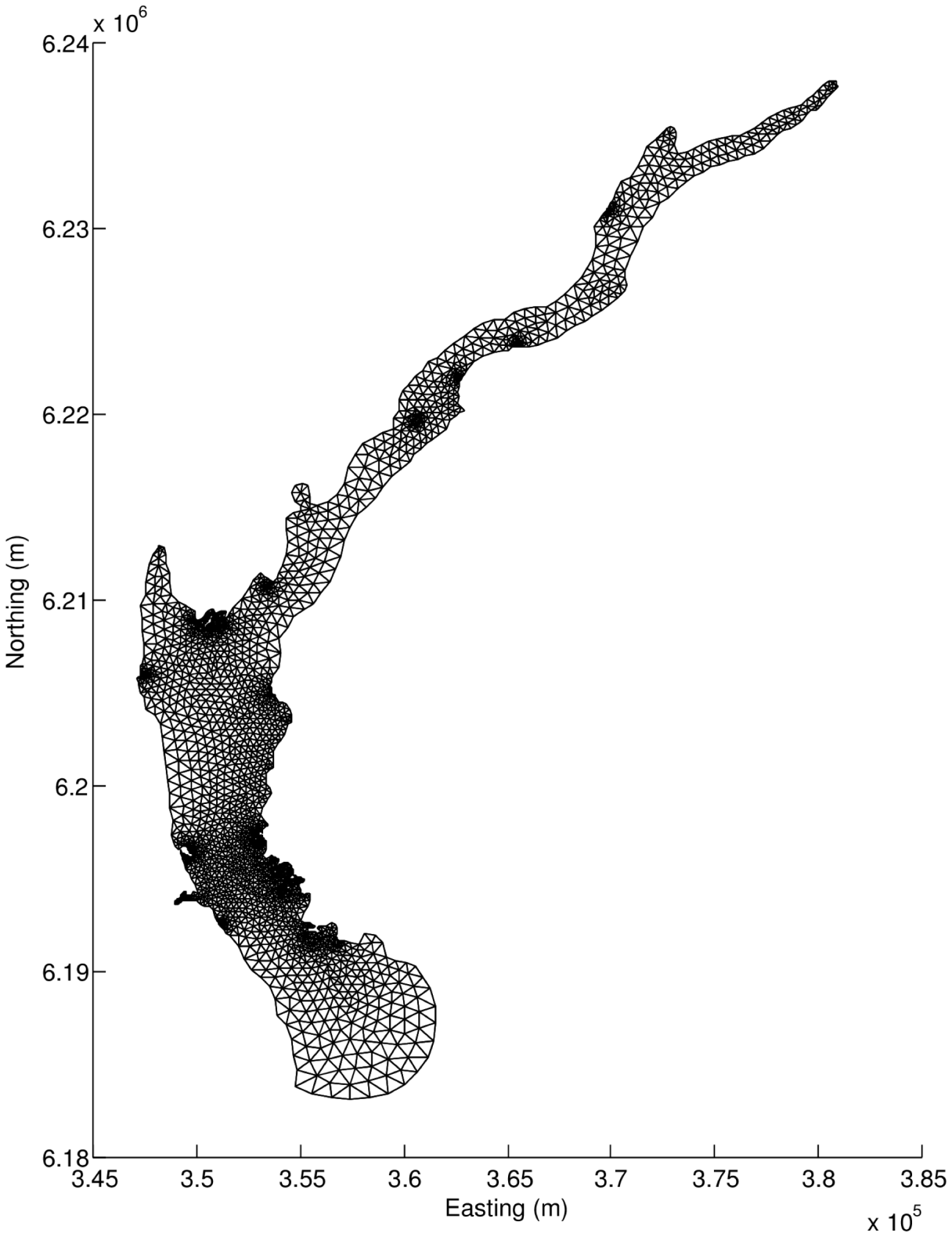

Fig. S2. Detailed 2958-node mesh. Results from this mesh are not presented in the main text

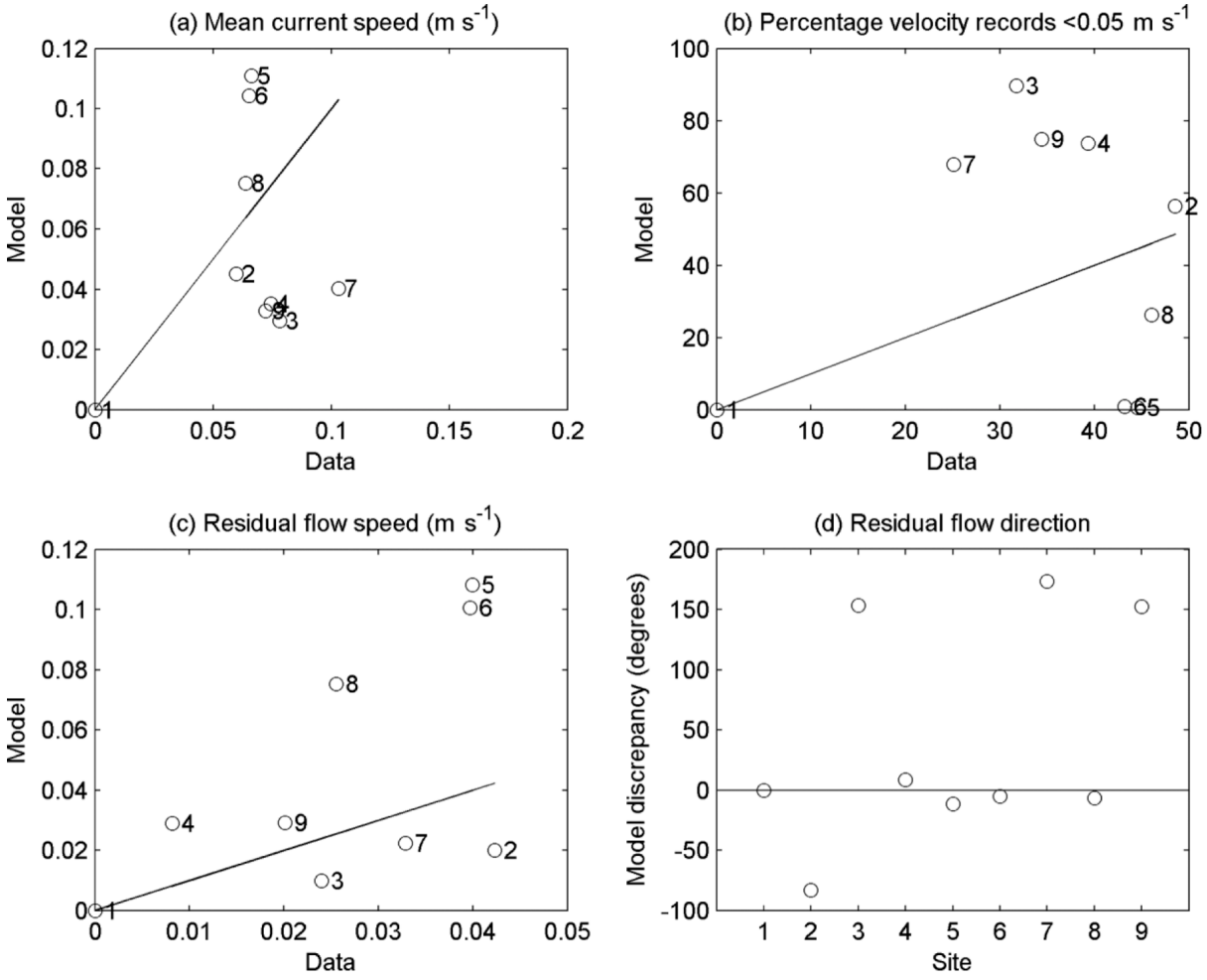

Fig. S3. Comparison of detailed hydrodynamic model output with observed timeseries from aquaculture sites (over a slightly shorter period of ca. 8 d). The solid line represents the ideal case where model = data. (a) Mean current speed. (b) Percentage of velocity records less than 0.05 m s^{-1}. (c) Residual flow speed. (d) Model discrepancy in residual flow direction