

A coastal monitoring and forecasting system for Galway Bay and Dublin Bay, Ireland – services for aquaculture, biodiversity restoration and environmental monitoring.

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Abstract

Ostrea edulis populations in Galway Bay have depleted significantly from their one-time substantial abundance due to a combination of factors including disease outbreaks, poor fisheries management and increased mortalities owing to low salinity and siltation events in the bay due to high volumes of discharge from the surrounding land-based water catchments. The episodes of low salinity or elevated water temperatures often lead to increased oyster mortality rates and subsequent economic loss for the farming sector. Dublin Bay, in turn, is adjacent to the biggest population agglomeration in Ireland, its capital, Dublin, and as such is subjected to significant anthropogenic pressures. Dublin Bay is one of 17% of Irish estuarine and coastal waterbodies that exhibit unsatisfactory condition for the Dissolved Inorganic Nitrogen (DIN) under the EU Water Framework Directive monitoring. Access to real-time data and marine forecasts provided in an accessible, user-friendly and interactive way can be a significant aid to aquaculture farmers, environmentalists working on biodiversity restoration and institutions involved in water quality monitoring.

This contribution will demonstrate a web service NAUI (biodiver.naui.io) where real-time observational data, forecasts and c. 10 years hindcast data are currently provided for Galway Bay with similar service for Dublin Bay being under development under a project called BIODIVER-COAST.

A high resolution ROMS (70 m) hydrodynamic model of Galway Bay has been developed, covering inner Galway Bay. In parallel, a SWAN application has been developed to provide wave data for Galway Bay and adjacent shelf waters. A 2012-2022 hindcast was run to obtain static, climatological data on seawater temperature, salinity, bottom stress, and wave kinetic energy. Both models (hydrodynamic and wave models) run operationally, delivering a 3-day forecast every day. Marine conditions mapping and low salinity warning services have been implemented in NAUI. The coupled CROCO-PISCES model of Dublin Bay at 100 m resolution has been developed with its physical component running operationally. Current developments include the extension of the BIODIVER-COAST NAUI service to include biogeochemical variables, marine heatwaves, and indicators of the rates of change of temperature and salinity during extreme events. .

This application constitutes an excellent example of the increasing efforts to extend the number of marine observations and forecasts available as actionable information to interested stakeholders and it can become an important tool for management of water resources, aquaculture activity and for biodiversity preservation in the region. We are planning an integration with the European Digital Twin of the Ocean since the service was selected as a coastal demonstrator in the Digital Ocean Forum 2024. Integrating into the European DTO would allow for a faster service and for an easy extension of the service to new geographical locations, enhancing its scalability and replicability.