ID24 PATHWAYS OF ECONOMICALLY RELEVANT DEMERSAL SPECIES IN THE IBIZA CHANNEL FROM A LAGRANGIAN BACKTRACKING APPROACH

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ABSTRACT

This work studies the most probable spatial origin of demersal species that eventually reach the Ibiza Channel after a dispersion stage, a region where water masses with different characteristics choke. Demersal species are assumed to be in a planktonic stage in which they behave as passive particles, being only advected by the dominant ocean currents. To find the origin we have performed a set of backward Lagrangian simulations using a high-resolution model of currents. As a result, we obtain the preferred pathways of dispersion for demersal species. A careful analysis of pathways provides useful information on the spatiotemporal variability of demersal and their origin weeks ago before they reach the Ibiza Channel. This information is very valuable from a conservation standpoint to determine the key regions that should be protected as eggs and larvae exportation areas.

Keywords – Ibiza Channel, Mediterranean Sea, Lagrangian simulations, demersal, fishing

INTRODUCTION

Among the most interesting demersal species fished in the Ibiza Channel we can find the red shrimp (Aristeus antennatus), the white shrimp (Parapenaeus longirostris), and the hake (Merlucius merlucis). These three species are economically the ones that contribute the most to a fishing port like Denia (Alicante, Spain). As a consequence, it is critical to identify the preferred pathways of those species, and their temporal variability, in order to ensure future recruits and sustainable fishing in the region. Trajectories are obtained through a Lagrangian backtracking approach in which passive particles are advected using daily outputs of a high resolution numerical model of ocean currents, which allows us to obtain their favorite water mass conditions (temperature, salinity) and their potential spatial origin [1-3]. To conclude, the final aim of this research would be to identify those regions that should become marine reserves because of their importance in the propagule supply of the studied area in order to preserve both, biodiversity and fishing activity.

METHODS

Virtual particles simulating the horizontal passive advection of planktonic stages of demersal species following the main currents have been launched every day for 1 year, from 2023-02-28 to 2022-03-01, and then tracked backwards in time. Three different depths are considered for the simulations: surface, ~50 m and ~110 m, thus covering the whole range of depths in which species of interest could be found. Once deployed, particles are horizontally advected using an output velocity field from IBI-MFC model, provided by Copernicus with a spatial resolution of 1/36º [4]. Forecasting fields include zonal and meridional velocity components, as well as salinity and potential temperature for the 50 vertical layers. About 12000 particles are launched every day in the Ibiza Channel at each depth. A diffusive term modelled by a random walk approach is applied to reduce the number of particles that get stuck in land. Lagrangian simulations have been performed with Ocean Parcels, a freely available package developed in Python language [5-6].

RESULTS

The initial distribution of launched particles in the Ibiza Channel are shown in Figure 1 (left panel). As seen, particles are located between Denia and Ibiza, off the coastal shelf, in a region with bottom depths between 300 and 1000 m.

With the daily maps of the final position of particles, we calculate the percentage of particles within squares of 0.25º x 0.25º for each of the three depths of study. As a result, daily maps of probability are obtained for 1 year and for the selected time horizon of simulations (90 days). The annual mean percentage of particles launched at a depth of 110 m are displayed in Figure 1 (right panel). Interestingly, 90 days before reaching the Ibiza Channel most of particles originate from the North, being mainly distributed off the Gulf of Valencia, the Catalan shelf and around Ibiza Island. One reason to further explore is the semipermanent location of a gyre at the southern side of Ibiza Channel, which can be delaying several weeks particles from the Alboran Sea to reach the North. In contrast, many more particles come from the south when they are deployed at the surface (not shown).

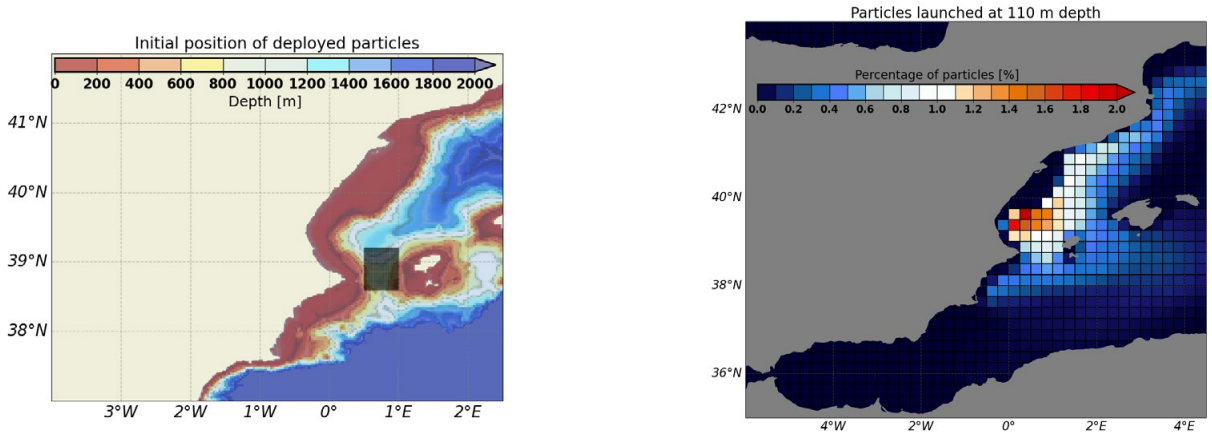

Fig 1. (Left) Map showing the initial location of deployed particles in the Ibiza Channel (black dots). Bottom depth is displayed in colour (unit in m). (Right) Annual mean of the percentage of particles according to their location 90 days before reaching the Ibiza Chanel.

CONCLUSIONS

Preliminary conclusions suggest the relevance of oceanic structures in modulating the geographical origin of recruits of demersal species that may eventually reach the Ibiza Channel, a region with an intense fishing activity. As these structures vary throughout the year, a spatiotemporal analysis is required. Therefore, we plan to decompose the variability of the spatial distribution of the percentage of particles using an EOF analysis. With this approach we will be able to detect the moment of the year in which particles come from a certain region for each depth. This will provide information on those regions from which planktonic stages come from, and consequently, which areas should be prioritised to preserve in order to boost bigger sizes of individuals and thus a much higher number of eggs and help to preserve both biodiversity and fishing productivity.

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