A Lagrangian IBM model for modelling Early Life Stages of different fish species

Manuel Ruiz Villarreal*[1], Sofía González Pérez[1], Adrián Sanjurjo[1], Gonzalo González-Nuevo[1], Paz Sampedro[1], Cristina García[1], Gonzalo González-Nuevo[1], and Luz María García García[1]

[1]Centro Oceanográfico da Coruña, IEO-CSIC, *manuel.ruiz@ieo.csic.es

Abstract

In recent years, the use of Early Life Stages (ELS) models of fish species, which simulate eggs and larvae as Lagrangian particles evolving in an environment described by an oceanographic model coupled to an ecological one, has become widespread in oceanography. The model accounts for advection and dispersion of particles, and also for biological behavior from a IBM approach simulating biological processes such as changes in buoyancy throughout the development of the egg stages, vertical larval migration, larval growth as a function of larval stage, with effects of temperature and food availability... These models have become tools to analyse the variability of oceanographic conditions and their effect on plankton as well as on egg and larval survival. Therefore, these models allow the study of recruitment and connectivity of fish stocks, which are issues of great scientific and fisheries management interest.

Particle models for larval population dispersal studies are highly dependent on the target species, although from a numerical point of view if a model is available for a species with a pelagic phase, the work required to get a model for other species is just to adapt the numerical code to the life history characteristics of the other species. In this contribution we will show how this approach can be used to simulate early life stages of different species: the Iberian sardine [1], the European anchovy and the European hake . In the framework of the Spanish project DEMON, together with ICM-CSIC colleagues, we have revised the available information on egg and larval stages for these species and we have reviewed the mathematical functions to simulate the different processes involved in the Early Life Stages. A common code to simulate the ELS of the different fish species is available in the open source offline particle tracking model OpenDrift. Finally, we will report how differences in hydrodynamical model configuration (initiation, resolution, forcing, and simulation domain) result in differences in the transport of Lagrangian particles [2] and how this fact impacts the distribution of fish larvae.

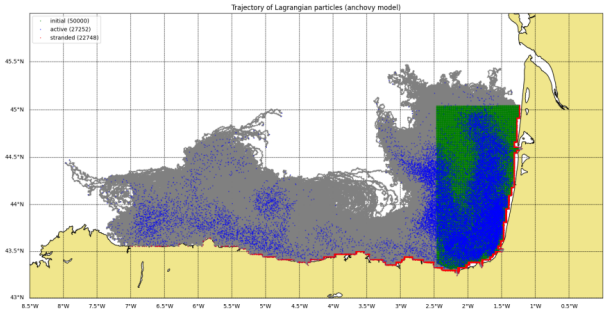

Figure 1: Dispersion of anchovy eggs and larvae in the Bay of Biscay

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References

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