





# Modeling Iberian sardine Early Life Stages dynamics

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## Introduction

The Iberian sardine (*Sardina pilchardus*) constitutes a traditional target species in western Iberia that remains to be economically important in Portugal and, to a lesser extent, in Galicia (NW Spain).

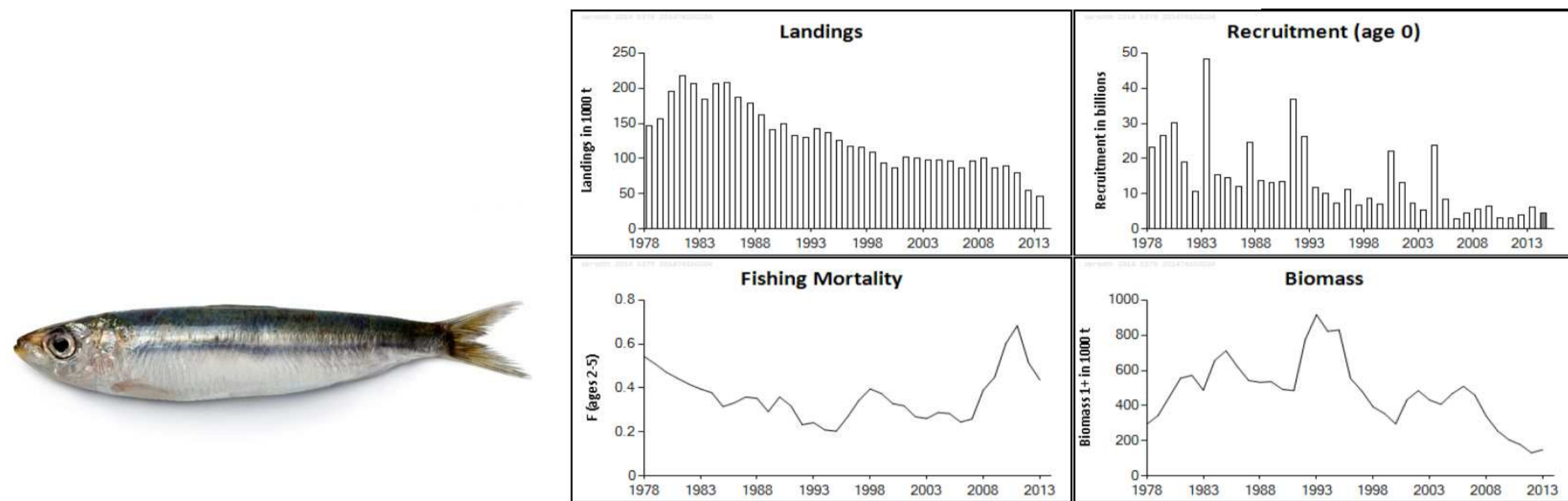


Fig. 1: ICES Advice for sardine in areas VIIIc and IX a (July 2014)

Recruitment results from a complex interplay between oceanographic conditions varying on a long period from spawning to the incorporation of juveniles to the population. The Early Life Stages (ELS), defined as the **egg and larval stages**, are believed to be the most critical period for recruitment for being more affected by the environmental conditions.

**OBJECTIVE:** Get some insight on the processes that could have influenced recruitment for years 2006-2007 by means of a Lagrangian and a biophysical model.

## What do we know about Iberian Sardine ELS?

In order to simulate sardine ELS for the period 2006-2007 we need to know:

- The processes that affect **egg stages**
  - Physical processes: horizontal and vertical advection and diffusion.
  - Biological processes: growth, mortality and other biological processes that have an influence on the previous ones:

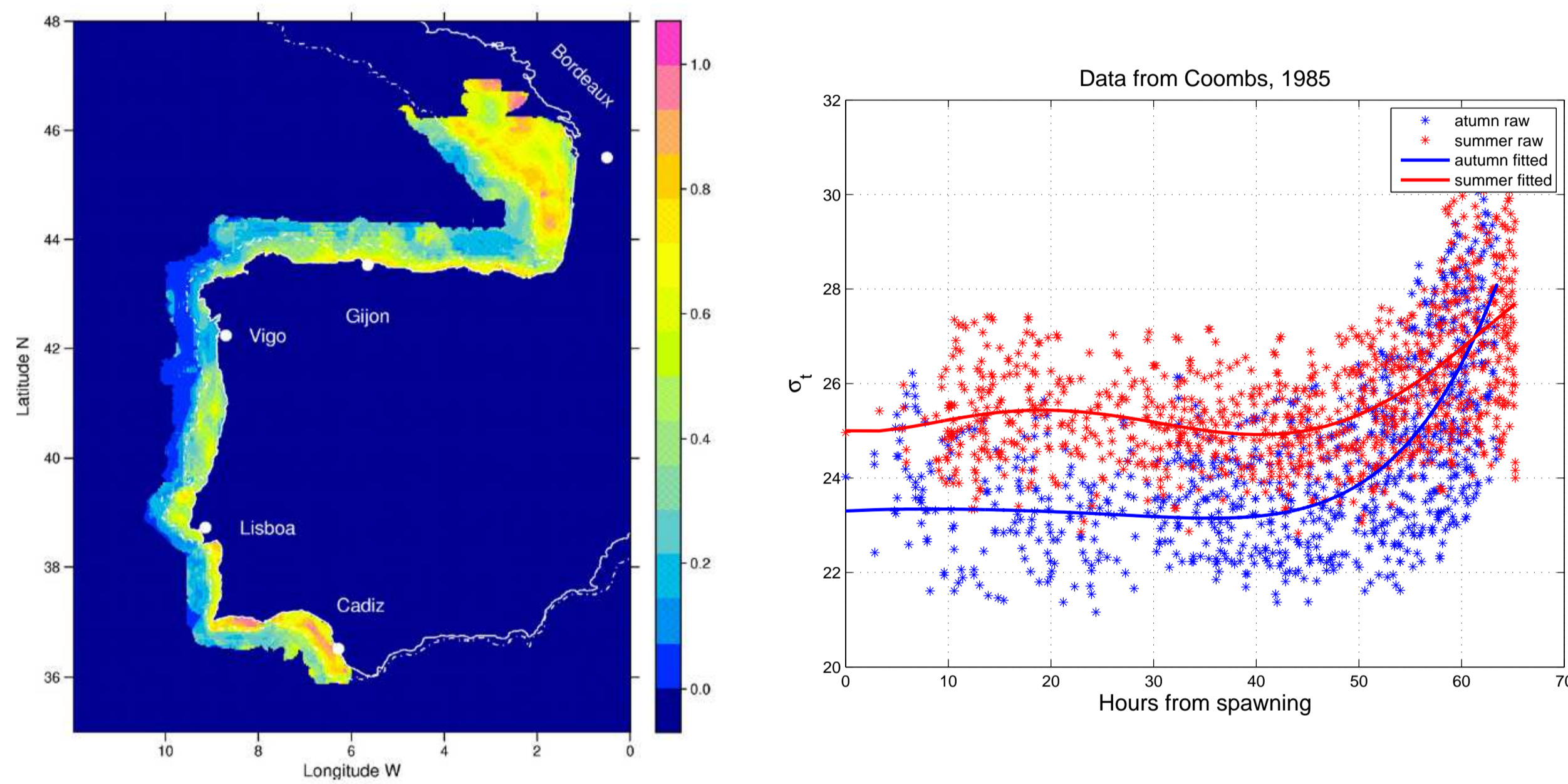


Fig. 2: Iberian sardine spawning grounds (Bernal et al., 2007)

Fig. 3: Sardine egg density evolution (Coombs et al., 1985)

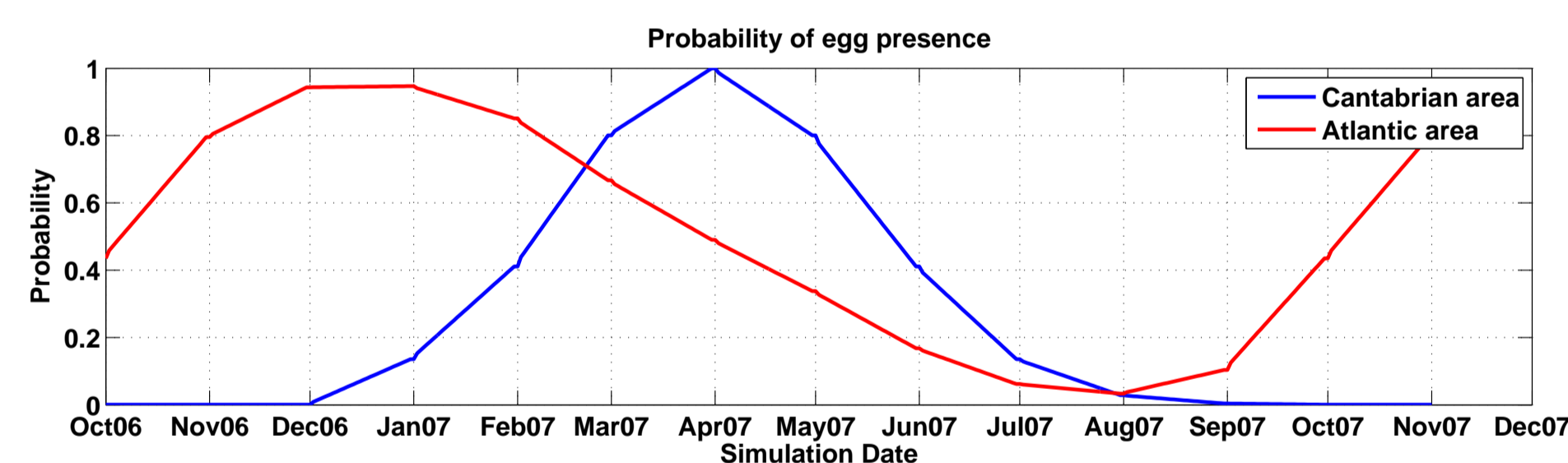


Fig. 4: Spawning period (Stratoudakis et al., 2007)

- The processes that affect **larval stages**
  - Physical processes: horizontal and vertical advection and diffusion.
  - Biological processes: growth, mortality and other biological processes that have an influence on the previous ones:

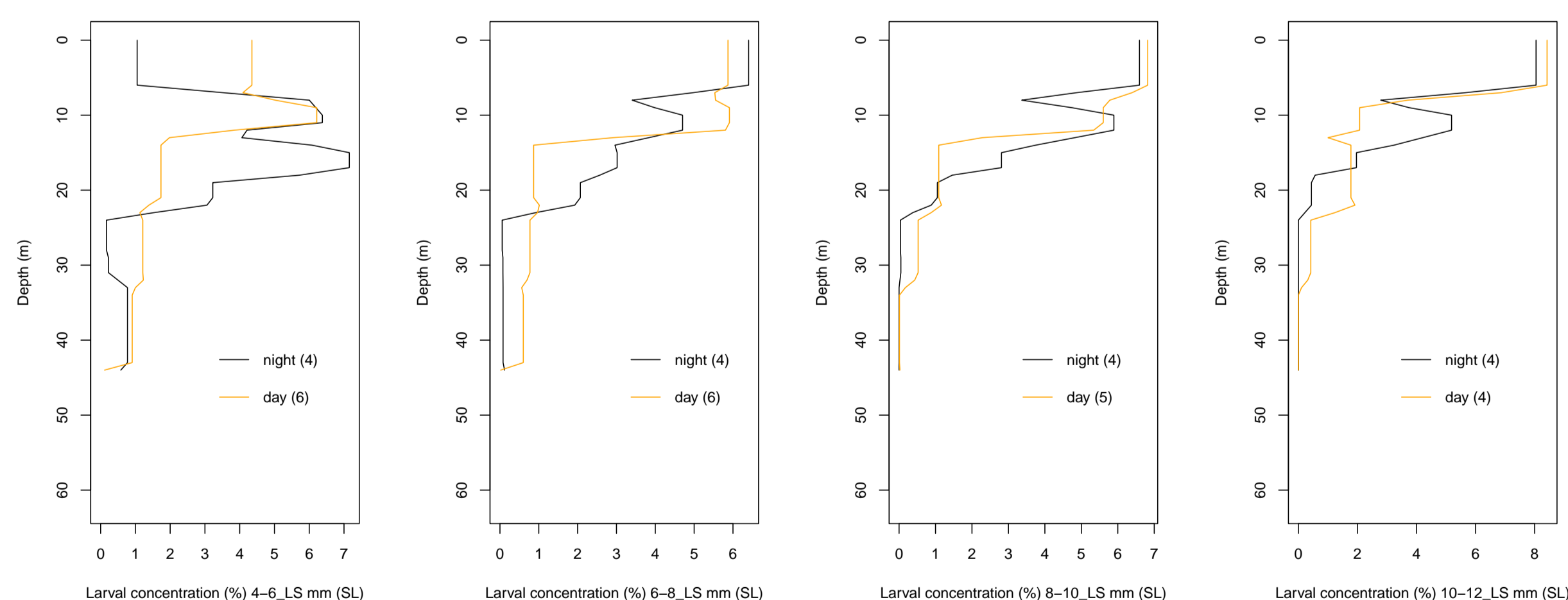
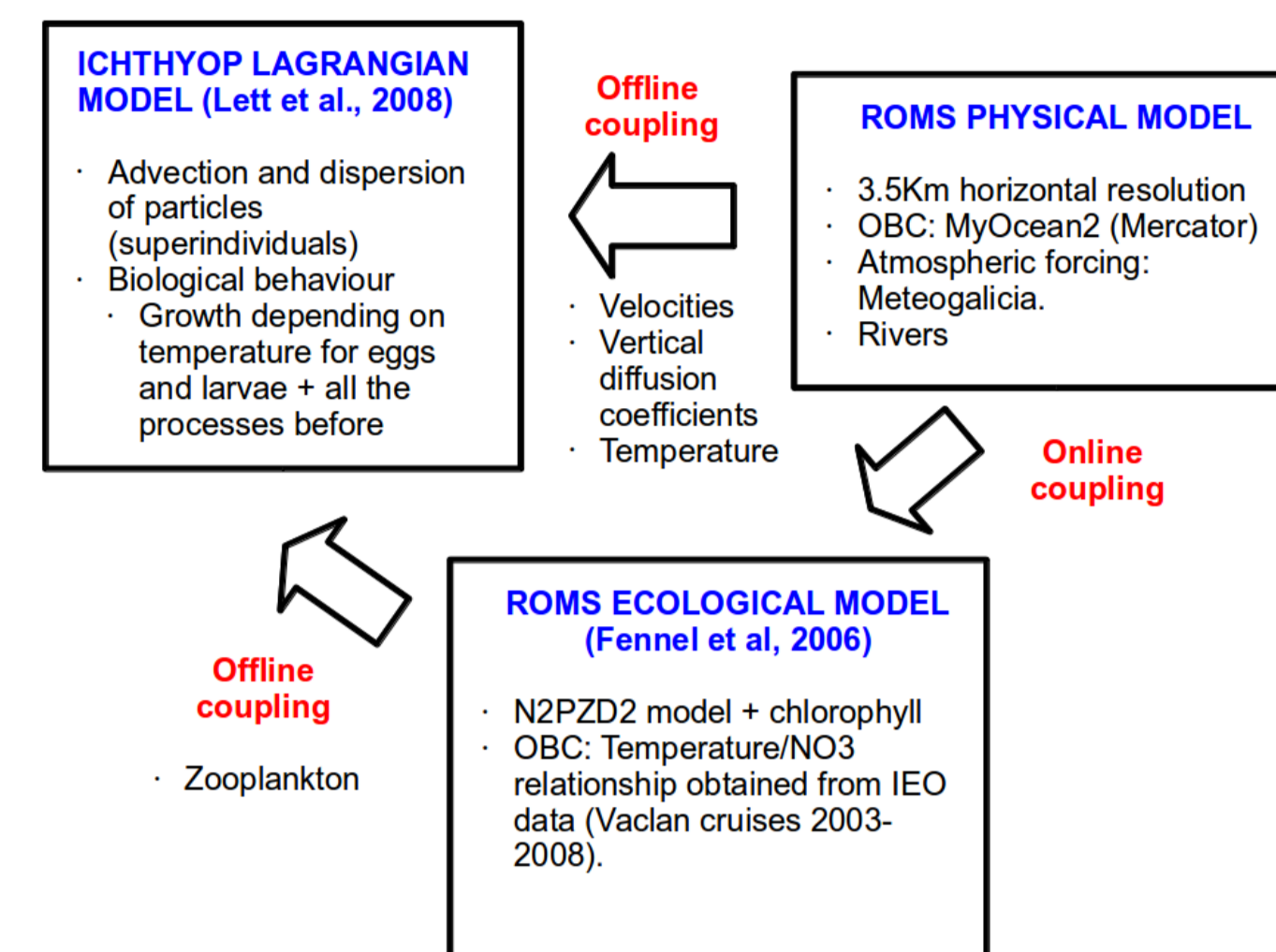


Fig. 5: Larval vertical migration patterns (from the French Pelgas cruise)

## Modeling sardine ELS



Physics drive the biological modules. We need to be confident in the model results. **And we are!**

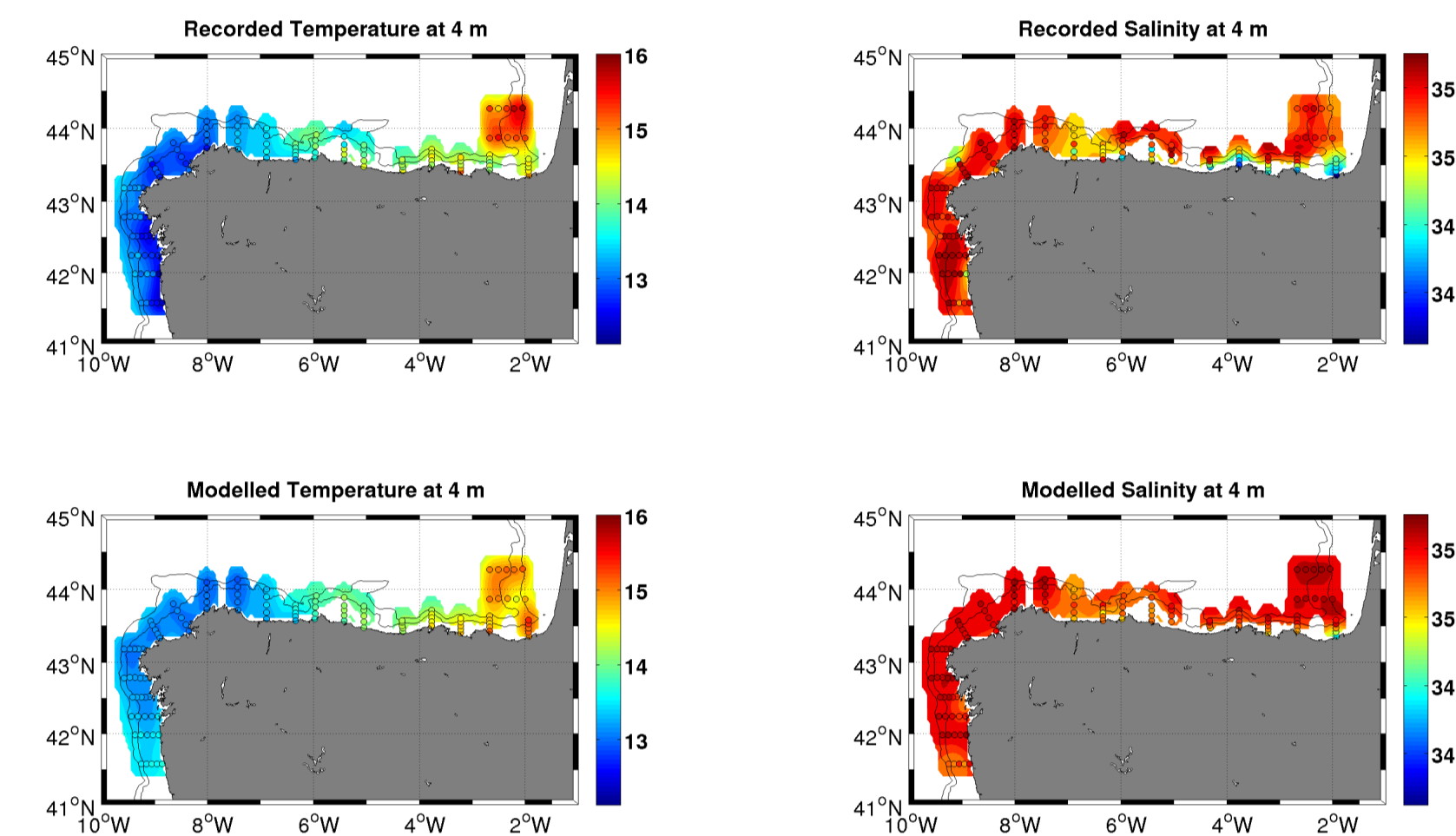


Fig. 6: Comparison of observed and model SST and salinity during the Pelagus2007 cruise

### Lagrangian model configuration details:

- More than 50000 particles were released: 25000 at the Portuguese coast and 25000 at the Cantabrian coast.
- Particles were released every week from November 2006 until November 2007 and were followed for 30 days.

## Results

Some hypothesis on Recruitment:

- Low offshore transport during the spawning period is positive for recruitment.

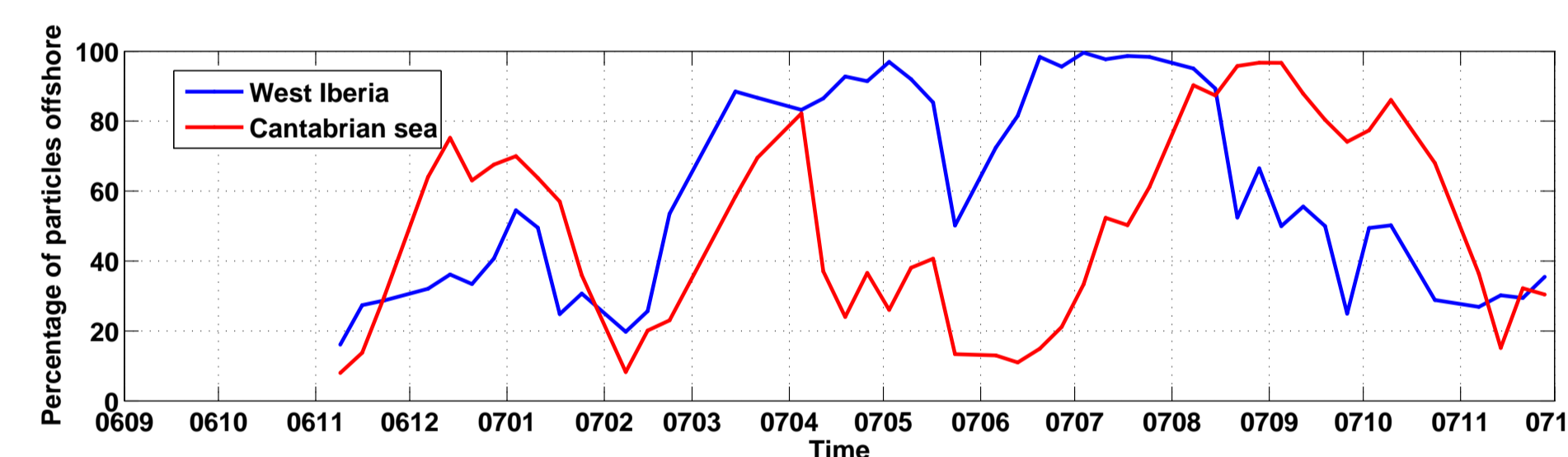


Fig. 7: Offshore transport depending on the spawning period

Figure 7 shows that offshore transport was at minimum level during autumn-winter 2006-2007 at the Portuguese coast (high retention due to the intense Poleward current this year and the presence of fresh water on the shelf). At the Cantabrian sea, offshore transport was also low at the spring spawning peak.

- Food availability (related to mortality)

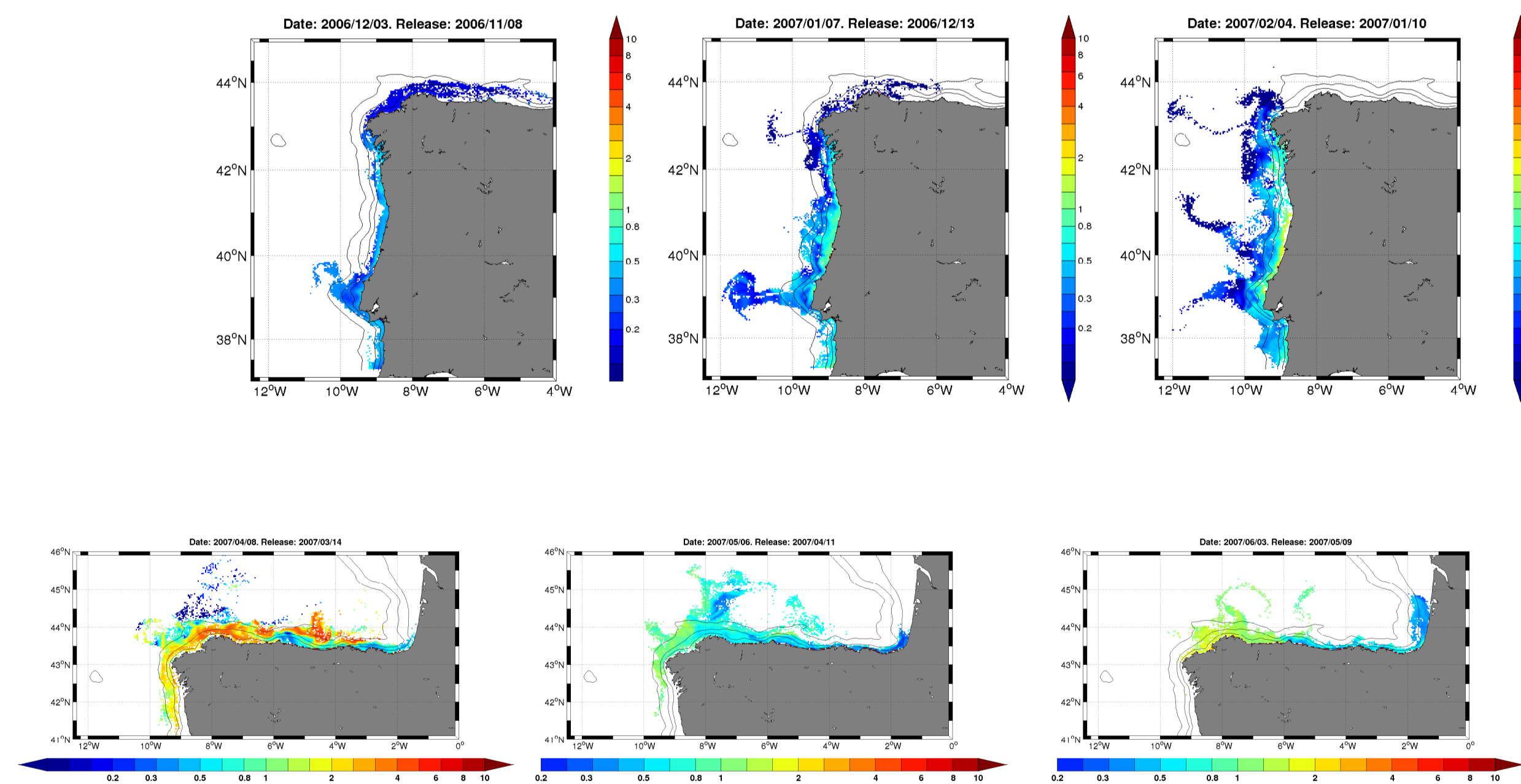


Fig. 8: Concentration of modeled chlorophyll-a (a proxy for food availability) on top of the particle positions after 29 days of simulation

Figure 8 reinforces the idea of the positiveness of retention, specially for the particles that were released during the winter spawning peak in W Iberia. If the particles remain close to the coast, enough food would be available. In the Cantabrian sea, the spawning peak takes place in spring, coinciding with the spring bloom. Therefore, high concentrations of chlorophyll are expected and not only on the shelf.

**CONCLUSION:** Results suggest that conditions were favourable for recruitment during spawning and that enough food was available for larvae to grow. However, recruitment was not succesful in 2007. Anomalous intense and sustained upwelling conditions took place in July-August 2007 in W Iberia and in September 2007 in NW and N Iberia, leading to strong offshore transport and low temperatures (the lowest during summer/early autumn of the period 1985-2009). This fact could have affected the survival of sardine larvae by increasing mortality.

## References

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