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Spatial dynamics of juvenile anchovy in the Bay of Biscay

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Objectives

- In the year 2009, two consecutive scientific surveys studied the spatial distribution and abundance of juvenile anchovy in the Bay of Biscay with acoustic-trawl methodology: JUVENA 2009 and PELACUS10 2009.

- Both surveys were coordinated and shared a common sampling strategy and methodology.

- Given the temporal delay of 20 days between them, they also provided the infrequent opportunity of taking two consecutive “snapshots” of the spatial distribution of juvenile anchovy in autumn, thus providing direct insight of the temporal evolution of the juvenile stock.

- The objective of this work is to study the spatial dynamics of juvenile anchovy in autumn in the Bay of Biscay based on these two surveys, by comparing their spatial distribution, aggregation patterns, size and age structure.

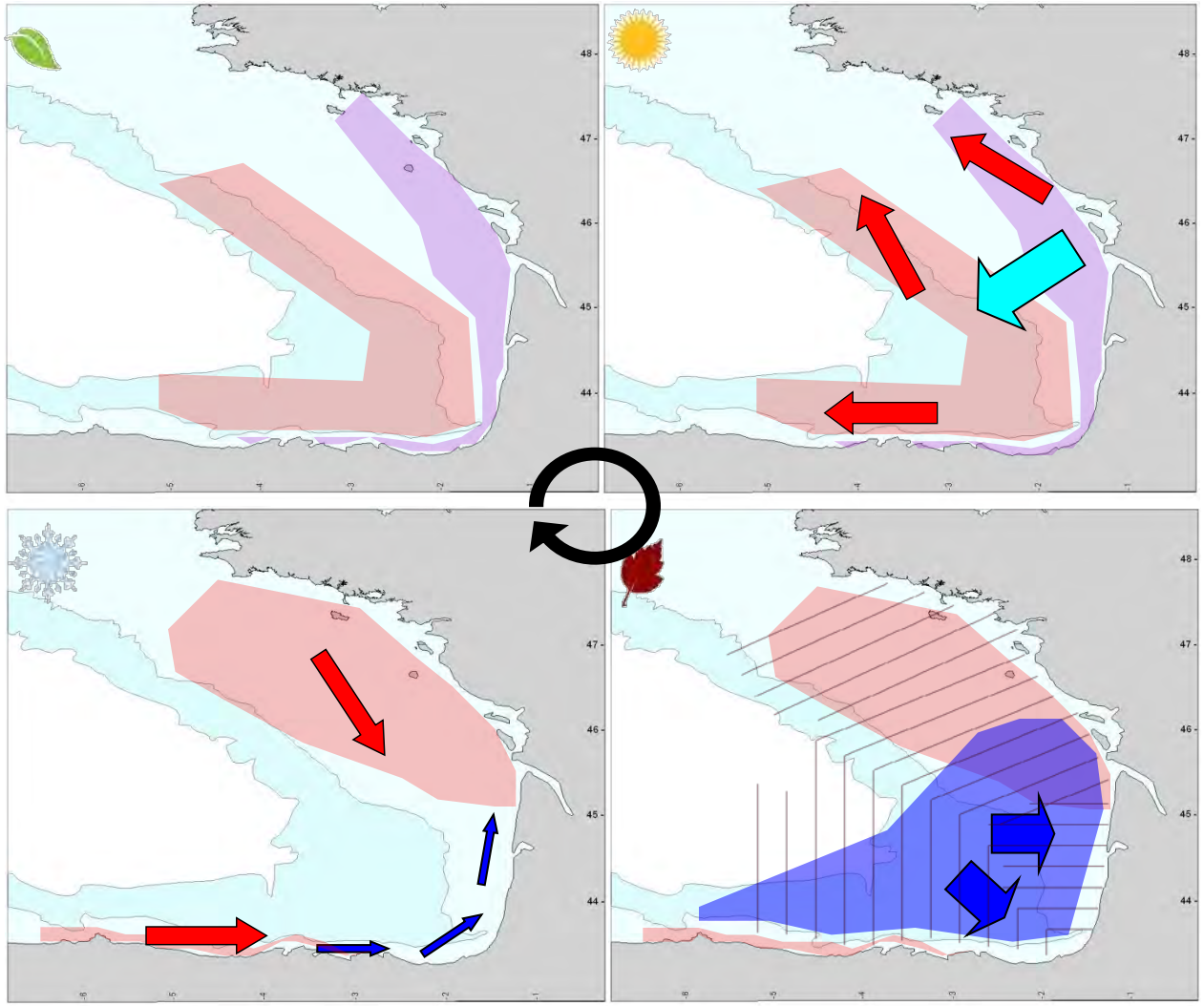
Life cycle of Bay of Biscay anchovy

Spawning of large-old anchovy

Spawning of anchovy recruits

Adult homing migrations

Juveniles' homing migrations



Trophic migration of the adults

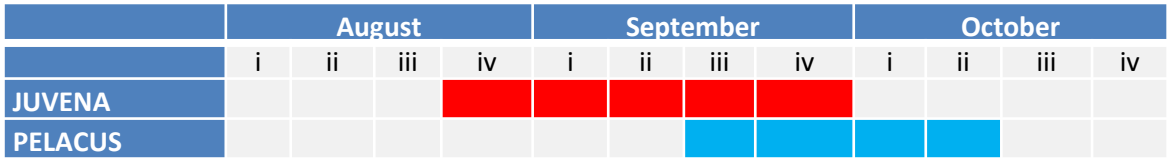
Advective transport of eggs and larvae

Adult anchovy

Juvenile anchovy

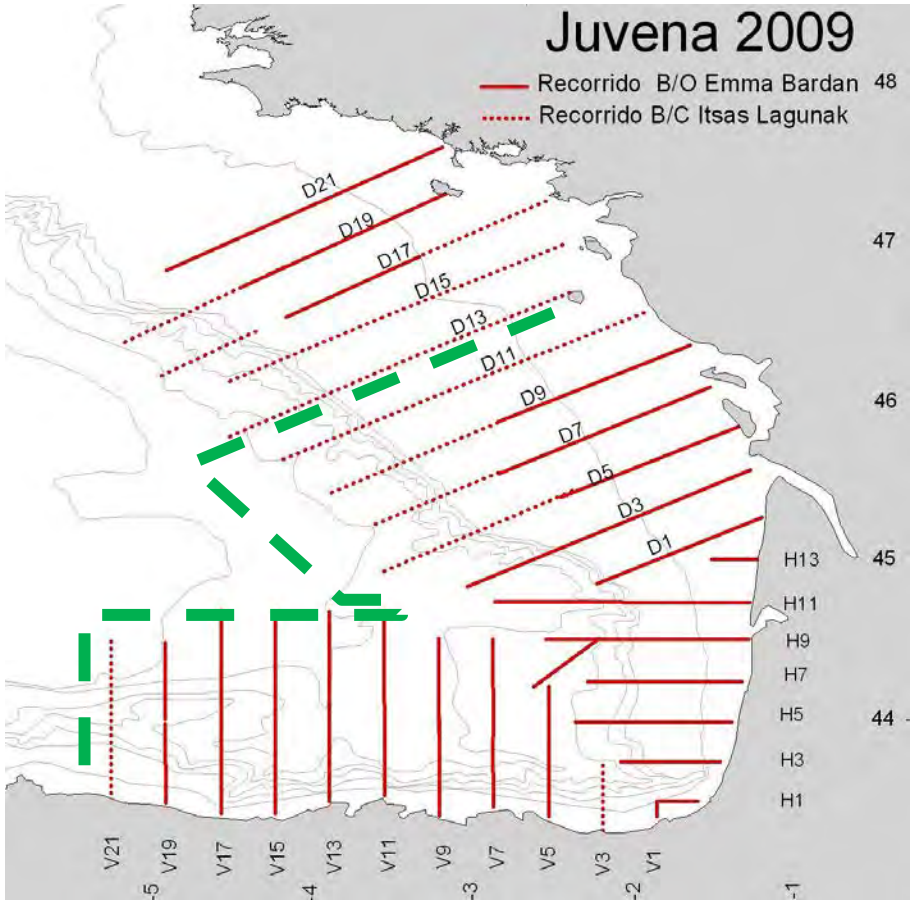
Methodology

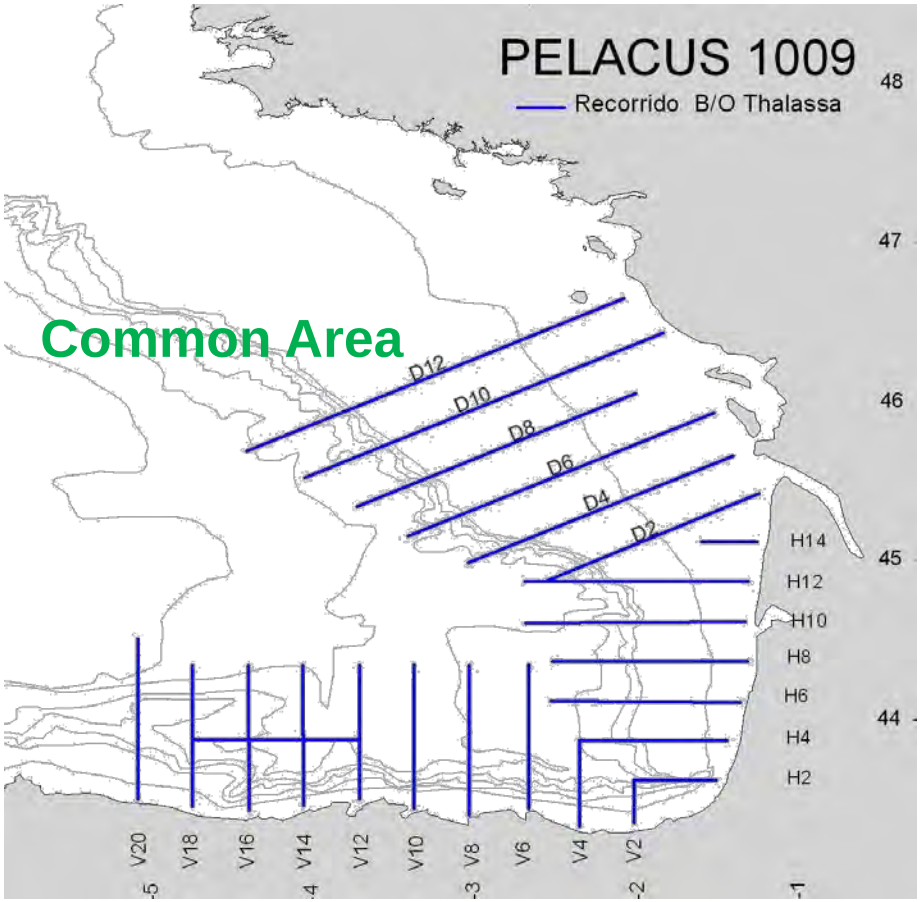
- The surveys were carried out with about three weeks of delay between them.



- Both surveys were coordinated and shared a common sampling design (ICES, 2009) of transects perpendicular to the bathymetry with an inter-transect distance of 15 nautical miles (n.mi.). The surveys followed alternate transects, JUVENA following the odd numbered transects and PELACUS10 the even ones.

Methodology





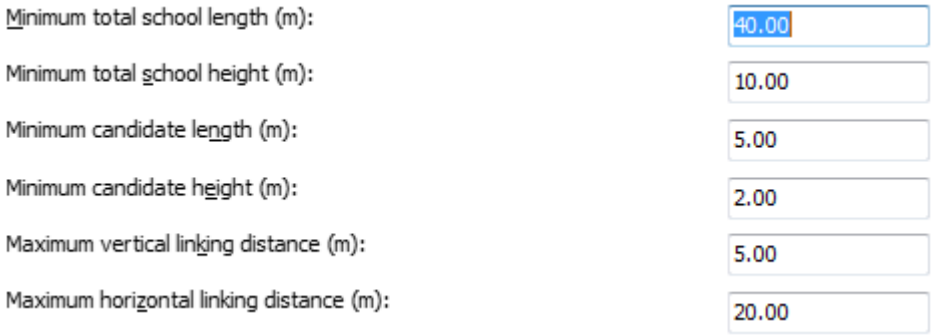
Methodology

- Both surveys applied acoustic-trawl methodology
  - JUVENA used two vessels:
    - R/V Emma Bardán (pelagic trawler)
    - F/V Itsas Lagunak (purse seiner)
  - PELACUS used one vessel:
    - R/V Thalassa (pelagic trawler)
- Acoustic data based on Simrad EK60 38 kHz
- All the echosounders were calibrated using the standard sphere method (Foote, 1987).

SURVEY	PELACUS	JUVENA	
Research vessel	Thalassa	Emma Bardán	Itsas Lagunak
Acoustic instalation - depth (m)	Drop keel - 7	Hull - 3	Side perch - 3
Power (W)	2000	1200	1200
Pulse length (ms)	1.024	1.024	1.024
Gain (dB)	25.46	24.43	22.26
Sa correction (dB)	-0.55	-0.6	-0.41
Minor-axis beam width (degrees)	7.06	6.72	6.75
Major-axis beam width (degreees)	6.98	6.76	6.75
Absorption coefficient (dB/m)	0.009	0.007	0.007

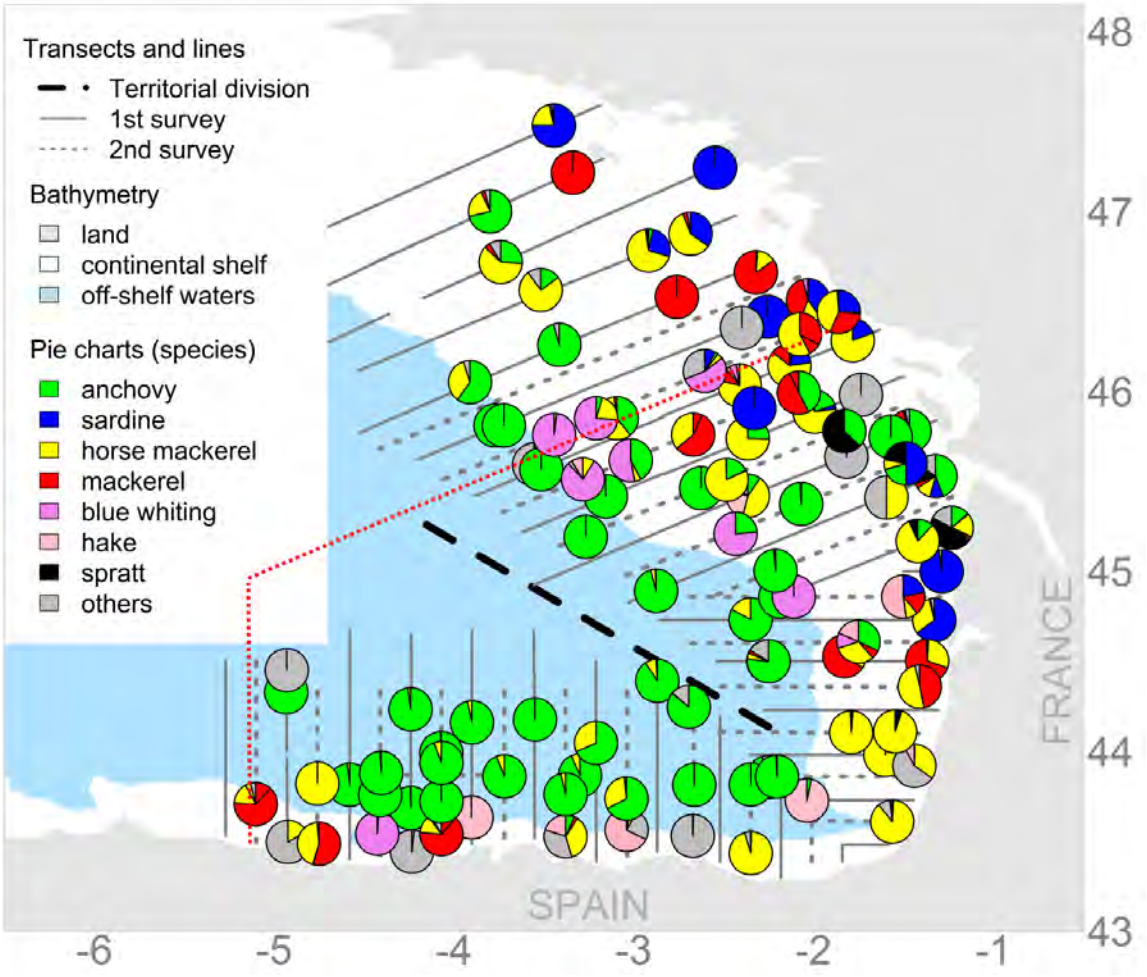
Methodology

- The main acoustic data processing method was school echointegration using Echoview (Myriax, inc.)
  - School detection algorithm parameters:



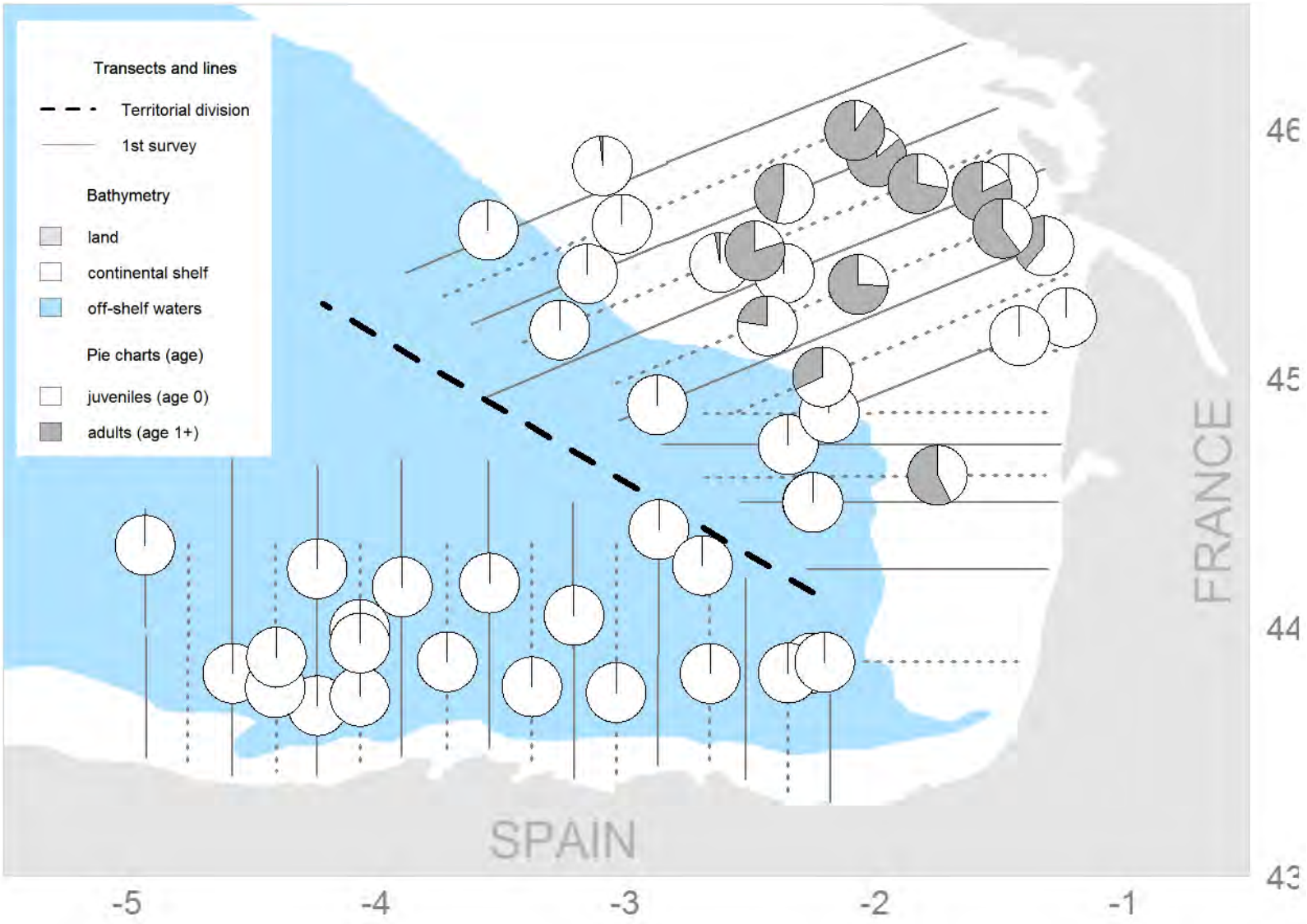
- Fishing stations were done for species identification and size composition
- Age of the anchovies was assigned by otolith reading.

Results



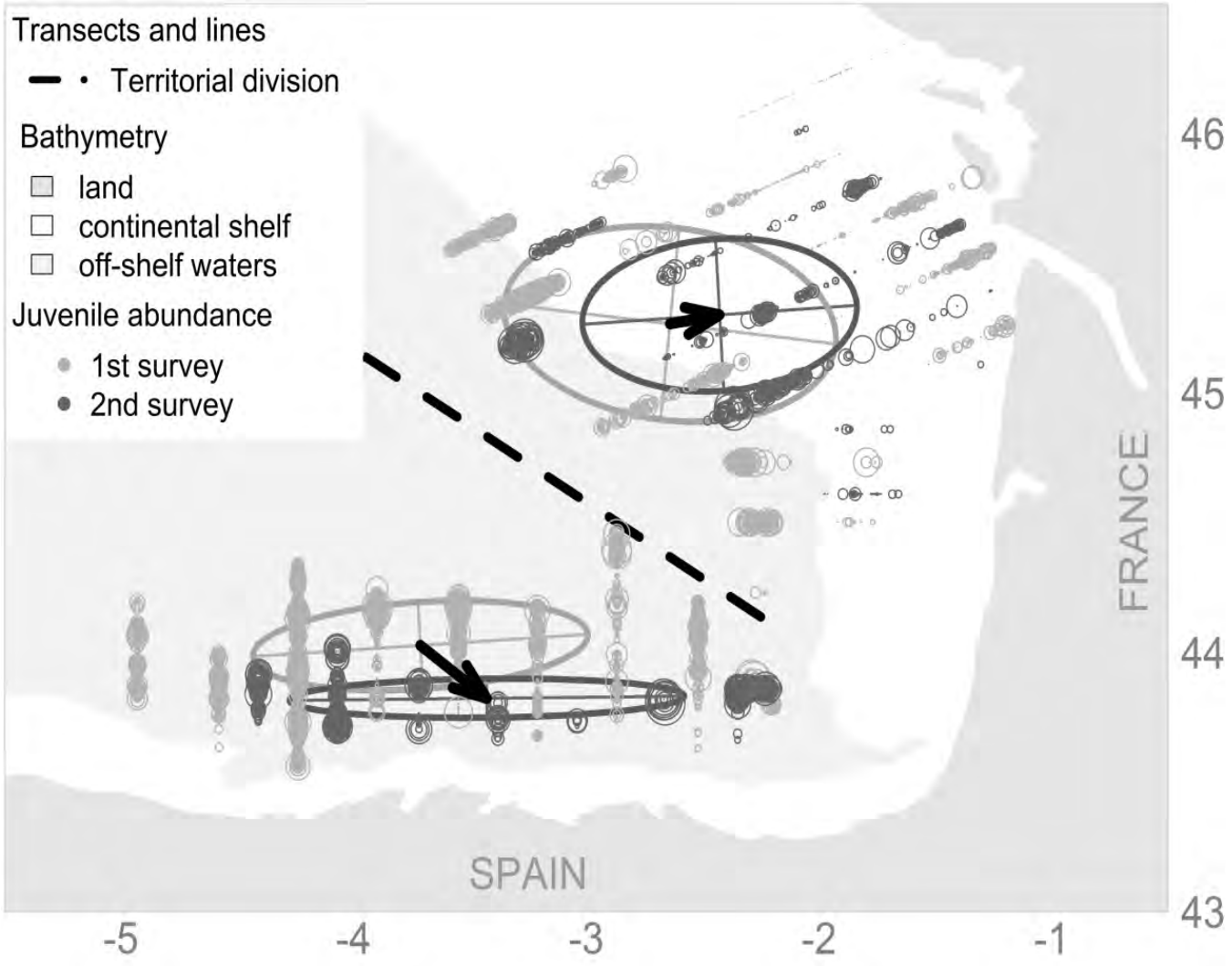
Species composition of the hauls of both surveys

Results



Age composition of the hauls of both surveys in the common sampled area

Results

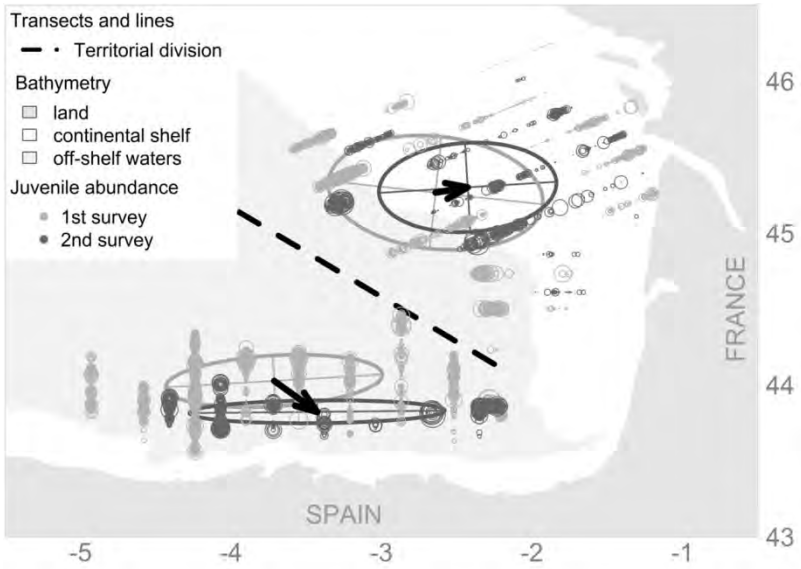


Horizontal centers of gravity and inertial axis and ellipses of the biomasses of juvenile anchovy in the two main regions.

Results

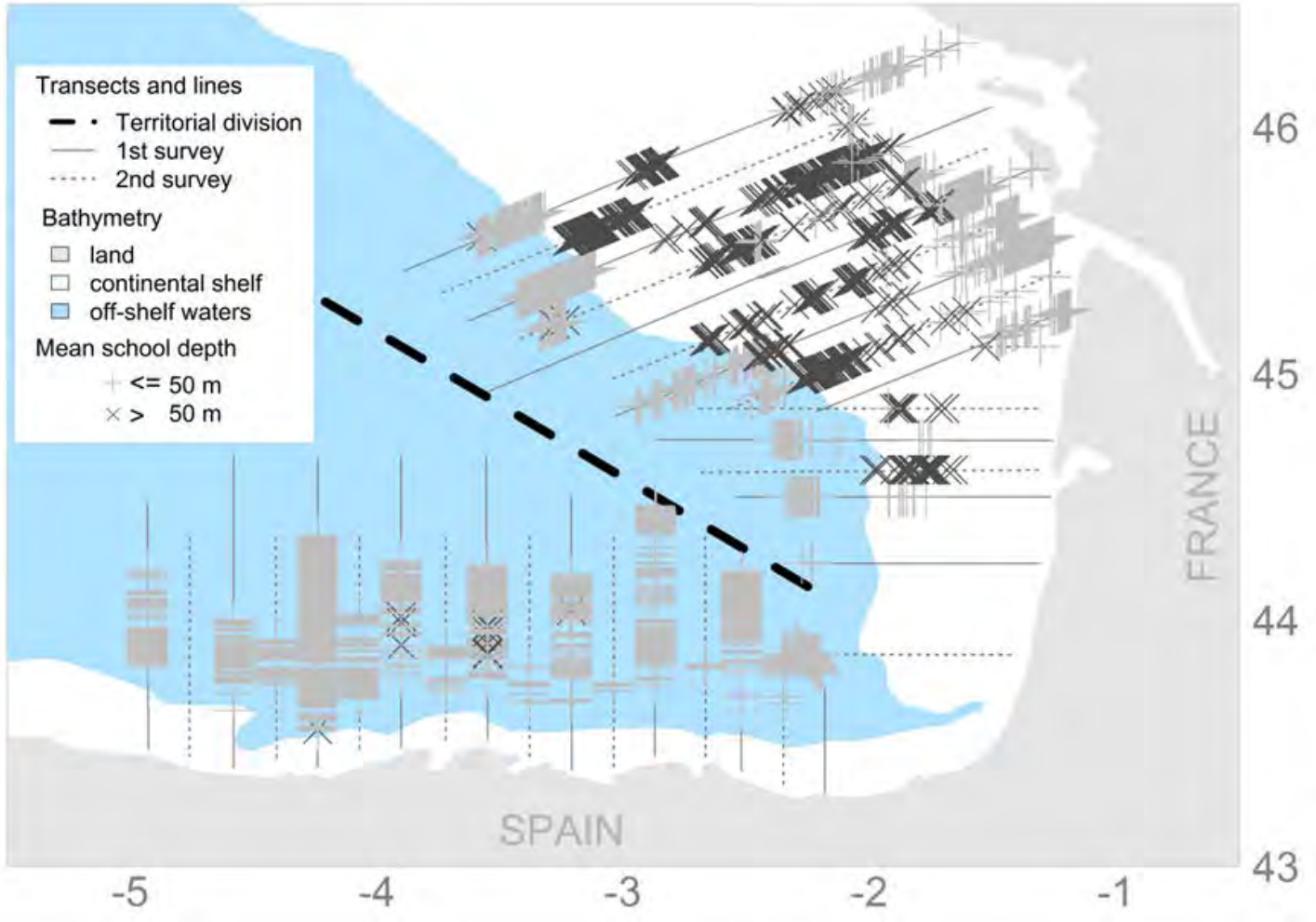
The displacement of the CG towards the coast, could be caused by:

- A real displacement of the juveniles or
- A superior mortality of the furthest off-shelf juveniles.



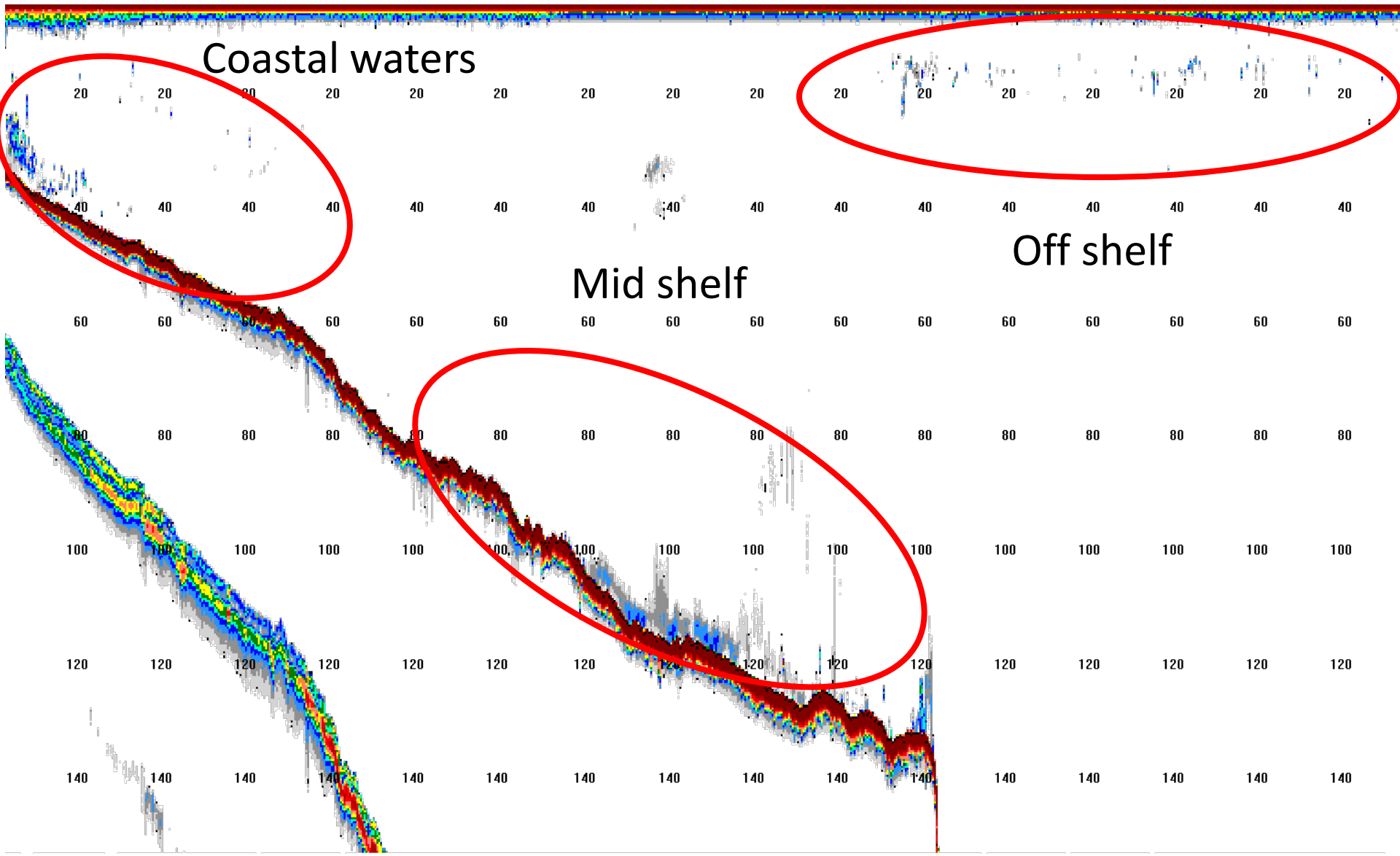
1. The total estimated biomass was about the same in the first and the second surveys (in fact slightly higher in the second survey). So the mortality was not the cause and, thus, the displacement of the CG is caused by **a real displacement of the juveniles towards the coast**.
2. **Moreover**, given that the displacement is produced against the main current regime in the BoB in this season (which is towards the West), we conclude that the displacement of the juveniles is due to **an active migration towards the coast**.

Results

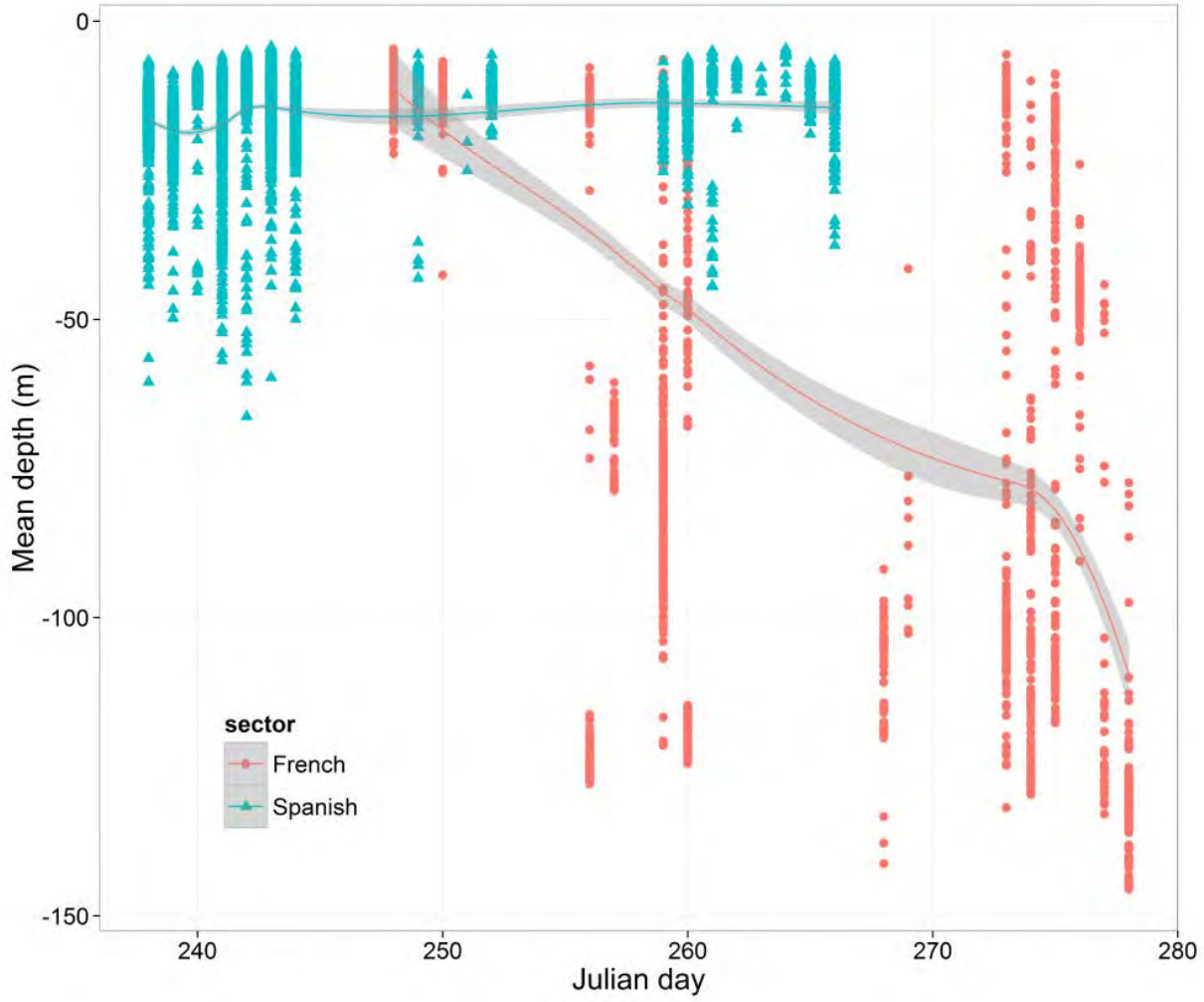


Spatial organization of juvenile anchovy in coarse vertical layers (surface and bottom) in the common sampling area of both surveys.

The juveniles in the water column

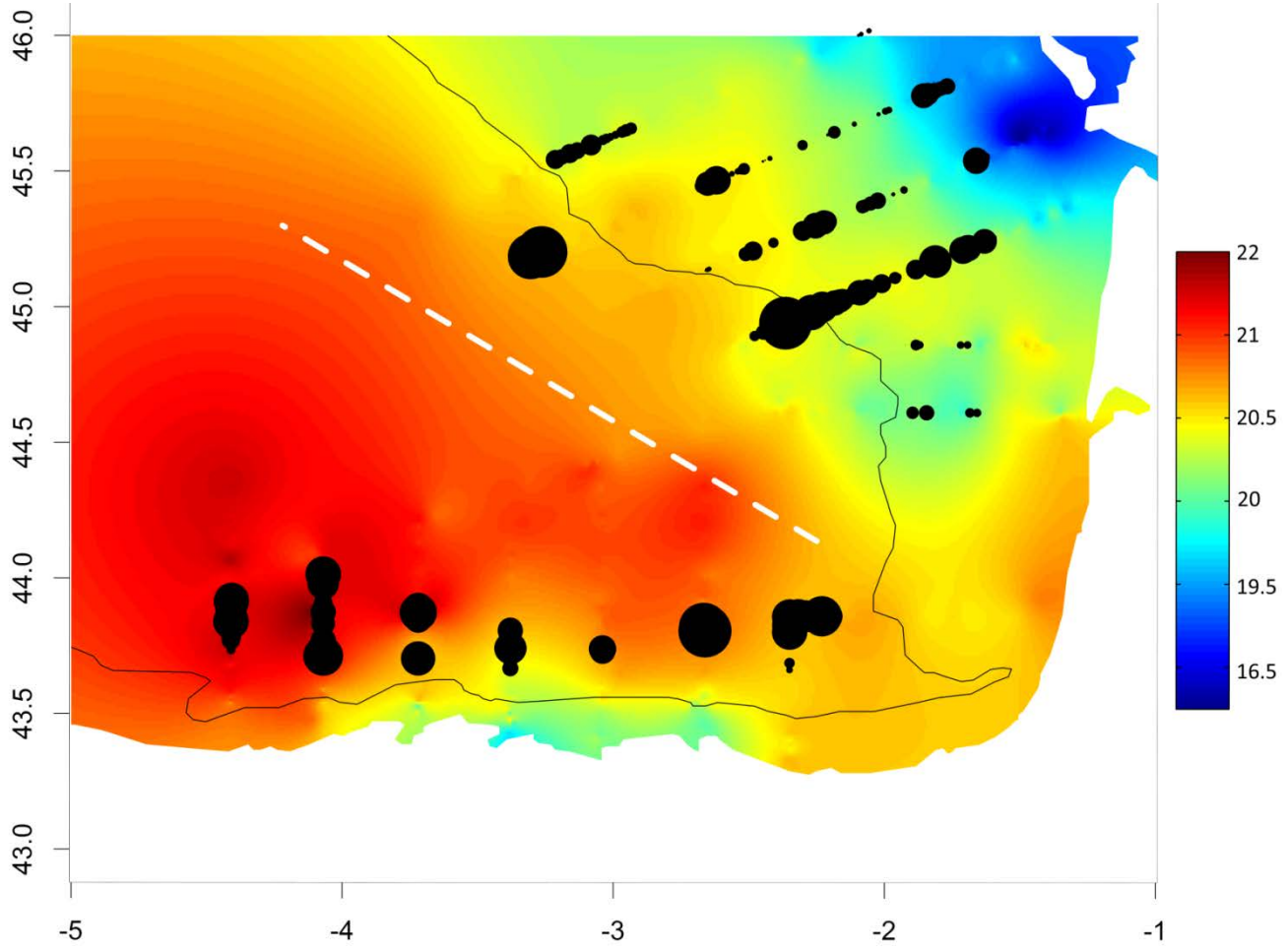


Results



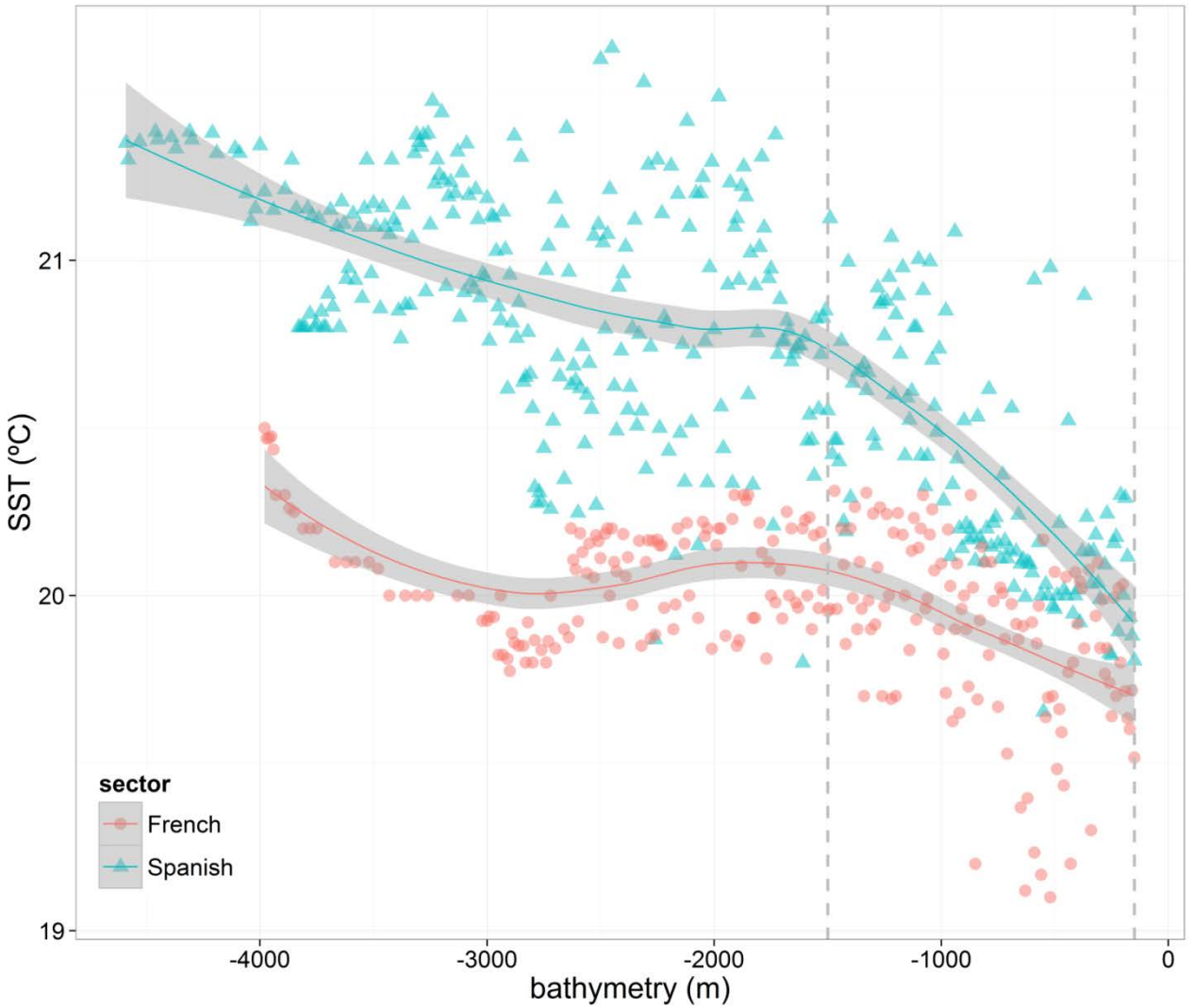
Temporal evolution of the school depth per sector

Results



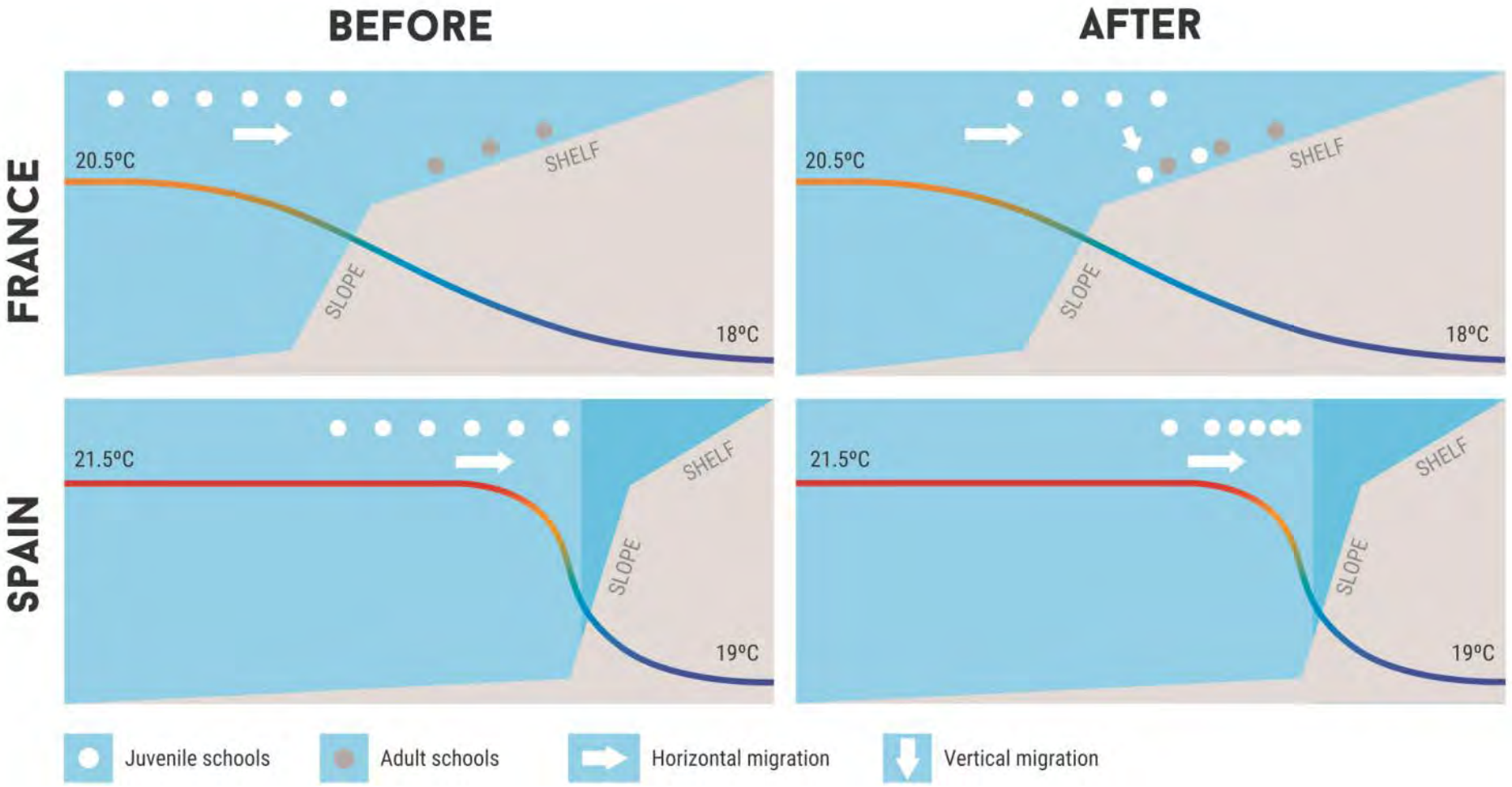
Juvenile anchovy biomass distribution in PELACUS10 survey (black bubbles) against a concurrently recorded SST in the same survey (ºC).

Results



Scatterplot of temperature against bathymetry in each sector for the PELACUS10 survey, including a loess smoothing line for each.

Synoptic diagram of spatial dynamics of juvenile anchovy in the Bay of Biscay



CONCLUSIONS

- There is an active migration of the juveniles from offshore to inshore waters at an average pace of around 1 n.mi. per day
- In the narrow shelf shores, the migration stops at the shelf break compressing the schools, perhaps due to the influence of the temperature.
- In the wide shelf shores the migration continues through the shelf break onto the continental shelf.
- While they are in oceanic waters, the juveniles stay isolated and close to the surface in warm waters.
- Whereas on the shelf the juveniles join the small pelagic community and start following them in their vertical nyctemeral migrations.

THANKS FOR YOUR ATENTION!