4º SIMPOSIO sobre el MARGEN IBÉRICO ATLÁNTICO / 4º SIMPOSIO sobre a MARGEM IBÉRICA ATLÂNTICA / 4th SYMPOSIUM on the IBERIAN ATLANTIC MARGIN

HYDROLOGICAL STRUCTURES ALONG THE N AND NW IBERIAN SHELF DURING THE WINTER-SPRING TRANSITION

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1. INTRODUCTION

The analysis of the spatial characteristics (nature, position and dimensions) and modes of temporal variability (from short-term to decadal) of hydrological structures is basic to understand the complex physico-biogeochemical interactions that occur among the components of the pelagic ecosystem (Koutsikopoulos and Le Cann, 1996).

Due to its location, size, coastline and topography, the NW and N Iberian shelf conforms a complex oceanographic system where a variety of micro-, meso- and macroscale physical proceses occur, including decadal north Atlantic climatic oscillations (Fromentin and Ibanez, 1994), seasonally varying slope and shelf currents (Alvarez-Salgado *et al*., 2003), coastal upwelling-downwelling (Fraga, 1981; Botas *et al*., 1990), eddies (Pingree, 1994), density currents in the vicinity of estuaries and river discharges (Jegou and Lazure, 1995) and tidal fronts (Le Cann, 1990). These physical processes modulate many ecosystem processes, from the dynamics and productivity of plankton (Alvarez-Salgado *et al*., 2003) to the recruitment of fisheries stocks (Sanchez and Gil, 2000).

2. MATERIAL AND METHODS

Hydrological sampling was carried out on board of R/V *Thalassa* as part of the activities conducted in the PELACUS 0302 cruise, which main objective was the estimation of biomass of pelagic fisheries resources in the NW and N Iberian shelf using multifrequency acoustic techniques. Temperature, salinity and fluorescence data were acquired at night (between 21 and 05 GMT), during the winter-spring transition (14 to 30 March of 2002), using a *Sea Bird 25* CTD equipped with a *SeaPoint* fluorometer. An optical plankton counter (OPC) (*Focal Technologies*) was attached to the CTD to obtain simultaneous profiles of particle-size distributions on the (nominal) range 0.2-20 mm. We have considered these four variables to identify hydrological structures. A total of 110 stations were profiled, distributed in sections perpendicular to the coastline extending from the coast (z <100 m) through the coastal transition zone (CTZ, 100-200 m) to the slope (z >200 m). Horizontal and vertical distributions of the variables were obtained using an objective interpolation method.

3. RESULTS AND DISCUSSION

We could discern the hydrological signature of two regional-scale features: the Portugal coastal counter current (PCCC) in the NW Iberian shelf, and the general anticyclonic oceanic circulation (AC) on the easternmost part of the southern Bay of Biscay. The PCCC could be identified primarily by its characteristic high salinity (35.7-35.8) (Fig. 1a) and, secondarily, by its relatively high temperature (*ca*. 13.4 °C) (Fig. 1b), while the AC displayed lower salinity and temperature (*ca*. 35.55 and <12.8 °C).

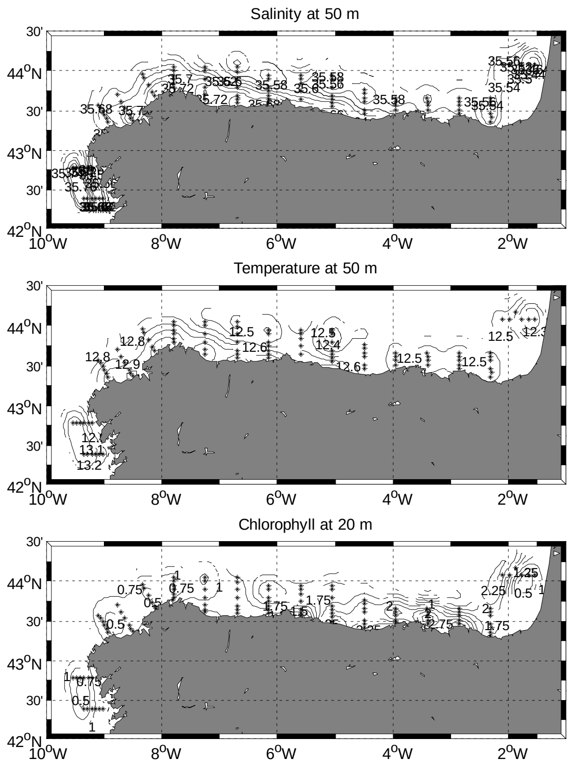

Figure 1. Horizontal distributions of salinity and temperature at 50 m depth and chlorophyll-*a* at 10 m depth.

Off the Rias Baixas, the high salinity core of the PCCC was located over the CTZ, being appreciable from the surface to the bottom of the water column (section 1; Fig. 2a). The interaction of the poleward flow and the surface seaward flow from the Rias Baixas generated a convergence front located over the

100 m isobath. This front would diminish the strength of shelf-ocean exchange processes (Alvarez-Salgado et al., 2003). North of Cape Finisterre, where data were not acquired due to bad weather conditions, the higher salinity values were measured at the coast (z <100 m). In this area, topographic features and the intensification of S-SW winds during this phase of the cruise pushed the PCCC towards the coast, as indicated by the high salinity cores (>35.75) inside the Artabro Gulf and in the Cape Estaca de Bares area (between 9° and 7° W). The PCCC narrowed as it flowed eastward. The haline front that formed between the PCCC and the AC was located 45 km away from the coast at 7° 15' W and only at 9 km away at 4° 30' W, in the Central Cantabrian Sea.

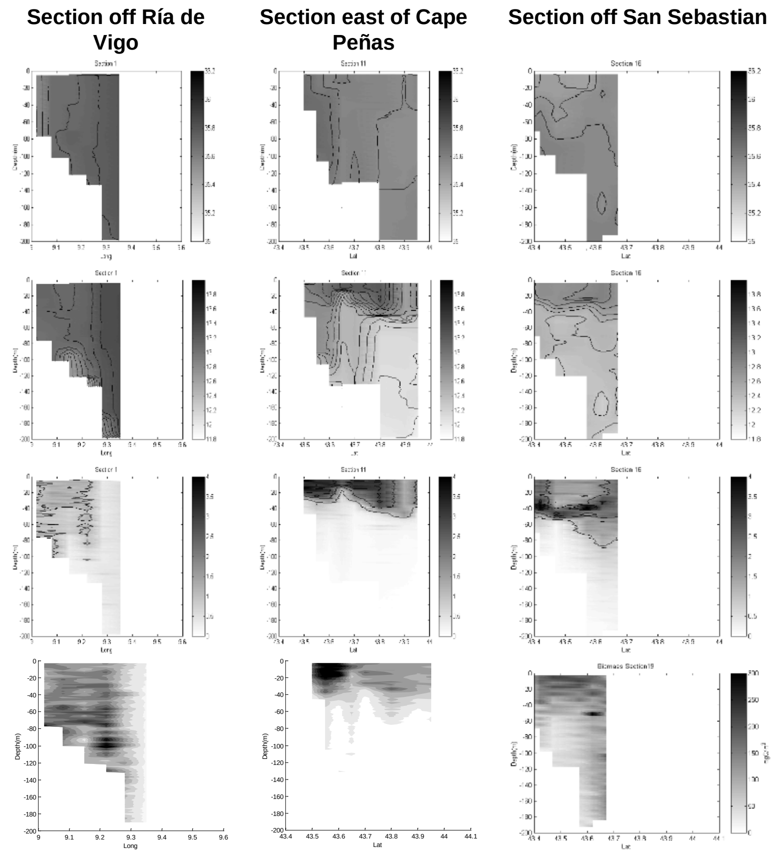

Figure 2. Selected section. From top to bottomn, salinity, temperature, chlorophyll-*a* and biomass of particles in the 0.2-20 mm ESD range.

A salient mesoescale structure formed east of Cape Peñas (around 5° W) (section 11; Fig. 2b), where the PCCC interacts with the AC. According to the distribution of the four variables considered, it seems that these oppossing flows gave rise to a divergence front (upwelling) in the area of interaction, and to two anticyclonic cells (downwelling), one on the coast associated with the PCCC and the other over the CTZ associated with the AC, of about 10 and 25 km diameter respectively.

A well-mixed water column typical of winter conditions prevailed in the PCCC domain; the density difference between surface and 100 m depth was <0.05 kg/m^3. Surface chlorophyll-*a* values (Fig. 1c) kept below 0.5 μg/l, except in some coastal areas where continental freshwater inputs induced haline stratification, such as off the Rías Baixas, Ría del Eo (ca. 7° W) and Ría de Avilés (ca. 6° W). Surface chlorophyll-*a* concentration at these locations reached values around 1.2 μg/l.

In the Central Cantabrian Sea, where the PCCC and the AC interacted over the shelf, surface chlorophyll-*a* attained intermediate values (0.5-1.5 μg/l). The increase in surface chlorophyll-*a* as we moved eastward (>1.5 μg/l) was associated with the progressive consolidation of the seasonal thermocline, located at *ca*. 30 m depth. In the easternmost section sampled (section 16; Fig. 2c), a conspicuous subsurface chlorophyll maximum developed. Chlorophyll values in the pycnocline (3 μg/l) were almost twice that in the surface mixed layer. In contrast, particles in the 0.2-20 mm ESD size, the range of mesozooplankton that could be sampled with the OPC, were higher in the surface layer, likely suggesting a plausible top-down control of the phytoplankton bloom.

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