

## Seasonal and short spatial patterns in European hake recruitment process at the Balearic Sea (NW Mediterranean): the role of environment on distribution and condition

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This study deals to evaluate the link between the recruitment process of European hake (*Merluccius merluccius*, L.) at the Balearic Islands (NW Mediterranean) and environmental conditions. A seasonal study was carried out monitoring the environment and hake since August 2003 to June 2004, evaluating the abundance and condition of fish on two locations under different oceanographic scenarios, one in the north (Soller, SO) and other in the south (Cabrera, CA) of Majorca Island. Individuals were divided in three size stages: recruits, post-recruits and adults. Hepatosomatic index (HSI), weight relative index ( $K_n$ ), gonadosomatic index (GSI) and fullness index (FI) were analysed. Environmental variables explored were hydrographical (temperature and salinity), sediment characteristics (percentage of silt, sand and clay,  $\emptyset$  median and organic matter), trophic resource (zooplankton, suprabenthos and fish) and phytoplankton pigment concentration (ppc). The arrival in spring of Winter Intermediate Water (WIW) formed in winter in the Gulf of Lions addressed the spatial-temporal variation in abundance and condition of hake. Recruitment season spreads from February to June (Fig. 1) consistently with other NW Mediterranean locations<sup>1</sup>. Maximum abundance of recruits was found in April, coinciding with the arrival WIW, although different 'pulses' of recruitment occurred through the season at both areas. Seasonal variability of adult's abundance in Cabrera was correlated with hydrographical variables suggesting also certain relationship with WIW variability. Of greater interest was ppc which was highly correlated with recruit one and two months before, and post-recruits three months before at both areas. It could point out that environmental-induced transitions provoked by bottom up forcing and changes in the ocean productivity<sup>2</sup> would produce math-mismatches between ppc and fish production<sup>3,4</sup>.

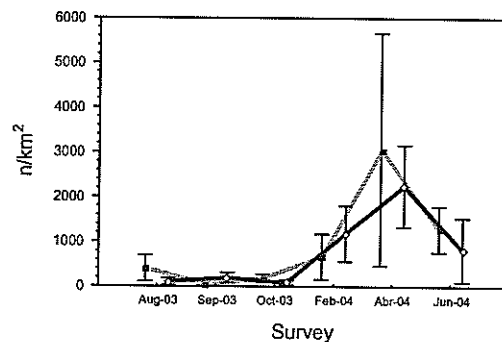


Figure 1. Abundances of recruits by season ( $n/km^2$ ) in the trawling surveys at both areas, Cabrera (dotted line) and Soller (straight line).

Hepatosomatic index (HSI) and relative condition index ( $K_n$ ) of recruits also exposed spatial-temporal variability, being higher values in the north (CA) than in the south (SO) (Fig. 2) consistently in all the size stages. Higher values of  $K_n$  seems to be related to the recruitment at the area of smallest recruits, during February in the north and April in the south. After that, HSI increased through the year and  $K_n$  decreased, suggesting a potential trade-offs in energy allocation along the recruitment process between energy storage and ecological advantage of increasing body size<sup>5</sup>. GSI showed spatio-temporal variability opposed to HSI.

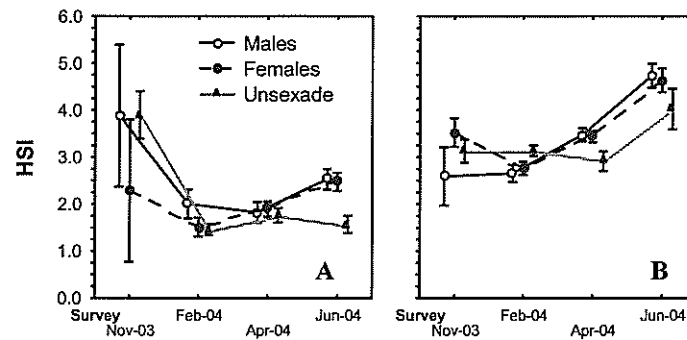


Figure 2. Seasonal variability of HIS by sex. Both areas are shown, Cabrera (A) as Soller (B).

Our research concluded that nurseries allocated at Balearic Islands have different recruitment pattern in the north and south of the Island, in the same way that fish condition, both addressed by the seasonal occurrence of WIW and the consequent biological processes

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