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

VARIATION OF CEPHALOPOD PARALARVAE IN THE RÍA OF VIGO, NW SPAIN

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1. INTRODUCTION

Cephalopods represent a valuable resource whose commercial importance increases annually (Caddy and Rodhouse, 1998). Integration of environmental and biological data for baseline studies of cephalopod fishery resources remains an incipient field that needs in depth research. Direct studies of planktonic (paralarvae) stages and their responses to oceanographic variation are scarce (Zeidberg and Hamner, 2002). The most comprehensive studies of the early life history were carried out in Japanese waters where data on *Todarodes pacificus* paralarvae, oceanographic parameters and cephalopod catches have been recorded since 1954 (Okutani and Watanabe, 1983). In the north-eastern Atlantic, there have been only a few studies on cephalopods embracing some of the disciplines afforded in the present study (Rocha *et al.*, 1999). The western coast of the Iberian Peninsula experiences wind regimes that favour seasonal upwelling of water originated from either subpolar or subtropical branches of Eastern North Atlantic Central Water, ENACW (Ríos *et al.*, 1992). Upwelling influences the distribution patterns of different larvae dynamics (Fusté and Gili, 1991), the reared mussel production (Blanton *et al.*, 1987) and is also able to support large sardine fisheries (Tenore *et al.*, 1995).

The present work studies the influence of oceanographic parameters on the abundance of *Octopus vulgaris* and *Loligo vulgaris* paralarvae.

2. MATERIAL AND METHODS

A total of 17 surveys were undertaken by the R/V *Mytilus* during the upwelling favourable period from May to October in 2000 (9 cruises) and 2001 (8 cruises). Biological and hydrographic sampling was undertaken in each survey, which consisted of five stations in waters located in two different areas east and west of the Cíes Islands (Ría of Vigo, NW Spain). Zooplankton samples were collected by towing, from near-bottom to the surface, a 750 mm diameter bongo net of 370 µm mesh. The zooplankton samples were fixed onboard with 4% buffered formalin for 24 hours and preserved in 70% alcohol. Paralarvae were separated and later classified. The mantle length (ML) of 178 individuals was recorded to the nearest 0.05 mm. Vertical temperature-salinity profiles were obtained in each station using a SEA-BIRD 19 CTD with an accuracy of ± 0.005 psu and ± 0.01°C. Additional oceanographic data on sea surface temperature (SST) was obtained from the Silleiro buoy located at station 42º07.2'N 9º24'W. Cross-shore ($-Qx$) component of the Ekman transport was calculated by means of geostrophic wind speed obtained from atmospheric pressure fields for a position 43ºN 11ºW, following the methodology adapted for the Iberian Peninsula by Lavín *et al.* (1991).

3. RESULTS

A total of 229 paralarvae belonging to the families Octopodidae, Loliginidae, Ommastrephidae and Sepiolidae were collected during the period studied. Paralarvae abundance in 2000 and 2001 ranged from 0.7 to 4.02, and from 0 to 4.71 ind x 1000 m^{-3}, respectively. The 96.5% were identified as *Loligo vulgaris* and *Octopus vulgaris*. Significant differences were found between years in *L. vulgaris* abundance ($p<0.05$, Student's t-test), whereas no significant differences occurred in *O. vulgaris* abundance ($p>0.05$, Student's t-test). During 2000, higher abundance of paralarvae was observed in July, September and October for *L.vulgaris* and *O. vulgaris*. In 2001, abundance of both species was higher in May and also in September for *O. vulgaris*. Although bongo hauls revealed east-west differences in abundance, with highest catches in station 4, these patterns were not statistically significant for *L. vulgaris* and *O. vulgaris* paralarvae among stations sampled during 2000 and 2001 ($p>0.05$, Kruskal-Wallis test). The mantle length ranged from 1.0 to 4.9 mm (2.32 ± 0.933, n = 58), and from 1.5 to 3.25 mm (2.23 ± 0.515, n = 24) for *L. vulgaris* paralarvae in 2000 and 2001, respectively. Concerning *O. vulgaris*, ML varied from 1.25 to 2.25 mm (1.62 ± 0.199, n = 51) in 2000, and from 1.25 to 2.0 mm (1.6 ± 0.204, n = 45) in 2001. No significant differences were found between mean sizes among stations undertaken in 2000 and 2001 cruises, for both paralarvae species ($p>0.05$, Kruskal-Wallis test). In 2000, both $-Qx$ and SST clearly showed consecutive upwelling pulses from May to mid-August, followed by an extended relaxation period and a further upwelling event in October. In 2001, two clear events of upwelling occurred in May and September. During summer, northerly winds were not very intense, provoking a stable period of low upwelling. From late September on, southerly winds began to prevail (Figure 1).

4. DISCUSSION

Paralarval surveys must be emphasized as they are fundamental in studying distribution, biology, spawning areas and population structure of cephalopods. However, the relatively small samples obtained with the bongo net are the principal limitation in paralarval studies. It is well documented that collection of larvae is biased due to various factors, comprising hydrographic conditions, which are able to provoke the transport of hatchlings and larvae from the spawning grounds, avoidance effects and seasonal occurrence of early life stages affecting paralarvae abundance that can vary significantly within only a few days (Piatkowski, 1998). Spawning of *L. vulgaris* takes place from December to April (Guerra and Rocha, 1994). Since hatching of paralarvae occurs approximately 70 days after spawning at 10ºC (Boletzky, 1974), it should be expected that the maximum of paralarval abundance would be centred from March to July. Concerning the Atlantic populations of *O. vulgaris*, there are two peaks of spawning in late spring-summer and autumn (Gonçalves, 1993). Our results confirm a similar reproductive pattern in Galician waters, defined by an intense hatching period in autumn coming from the previous spawning spring-summer months and a lower one in late spring-summer. In Galicia, seasonal cycles of upwelling/relaxation periods occur as a result of coastal winds with a periodicity of ~10-20 days during the upwelling season. This situation of stress and relaxation of upwelling determine the depth to which ENCAW rises (Álvarez-Salgado *et al.*, 1993). The higher abundance of paralarve of both species is related with the presence of the ENACW, although the differences in abundance of *Loligo vulgaris* in 2000 and 2001 suggest the possibility that both species occupy different ecological niches. The upwelling increases the availability of food for the paralarvae (Fusté and Gili, 1991), which feed upon live zooplankton (Villanueva *et al.*, 1995).

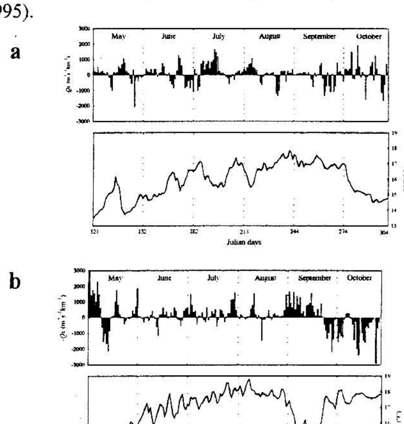

Figure 1: Daily cross-shore component of the Ekman transport (-*Qx*) and SST during 2000 (a) and 2001 (b).

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