

Influence of trophic pathways on daily growth patterns of western Mediterranean anchovy *Engraulis encrasicolus* larvae

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ABSTRACT: Late larval stages of anchovy *Engraulis encrasicolus* ranging from 10 to 20 mm standard length were sampled in the 2009 Mediterranean Acoustic Surveys project carried out during the spawning season off the Ebro River plume (NW Mediterranean [NWM] population) and the Bay of Málaga (SW Mediterranean [SWM] population). A combined study of environmental variables, daily growth, otolith biometry and stable isotope analysis (SIA) was undertaken to differentiate the trophic influence on larval growth rates. An inter-population comparative analysis determined trophic-based differences in their growth patterns. The NWM population showed a specialized prey selectivity associated with a low productive ecosystem in contrast to the SWM population, which showed a more generalist feeding behavior associated with an ecosystem of higher food resources. Moreover, $\delta^{13}\text{C}$ values were significantly different between populations, indicating the different origin of carbon sources. The intra-population analysis, differentiating between an optimum and deficient growth group as defined by a prior residual analysis, showed a direct relationship between growth potential and feeding behavior. Higher growth rates registered significantly greater $\delta^{15}\text{N}$ values and thereby showed a higher trophic position, indicating a greater feeding specialization in larvae originating from less productive regions. Such was not the case in the area of higher productivity. Furthermore, both populations showed that carbon sources were decisive in defining better growth potential. Finally, otolith biometry clearly differentiated between growth rates in the optimum and deficient larval growth groups.

KEY WORDS: European anchovy larvae · Western Mediterranean · Daily growth increments · Otolith microstructure analysis · Stable isotope analysis · Trophic position · Feeding behavior

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INTRODUCTION

Among the small pelagic species inhabiting the western Mediterranean waters, anchovy *Engraulis encrasicolus* and sardine *Sardina pilchardus* are the most abundant. From the socio-economic standpoint, anchovy is by far the more valuable economically (Leonart & Maynou 2003), thereby a preferential target of the fishery sector. These small pelagics are key species of the coastal pelagic ecosystems, channelling energy flow through a wasp-waist way to the upper and lower trophic levels (Cury et al. 2000, Bakun 2006). Moreover, they are fundamental to the

sustainability of top predators such as tunas by forming part of their diet (Logan et al. 2011), while exerting control on lower trophic levels by grazing and/or preying on the lower phytoplankton and zooplankton trophic levels (Tudela et al. 2002, Costalago et al. 2012).

In the Spanish NW Mediterranean (NWM) these species are mainly concentrated along the Catalanian and Gulf of Valencia shelf; and in the Alboran Sea located in the SW Mediterranean (SWM). On the basis of their physiographic and oceanographic regional differences, the General Fisheries Commission for the Mediterranean (GFCM) has determined

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