CHARACTERISTICS OF THE GROWTH OF THE ANCHOVY *ENGRAULIS ENCRASICOLIS* DURING A COMPLETE LIFE CYCLE

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Abstract

This paper presents the general form of the growth curve in length as a function of age of the anchovy *Engraulis encrasicolus*. This study is a compilation of several data from the literature concerning the life cycle from yolk-sac larvae to adults. Numerical tools were used to fit such heterogeneous data set and to assess the growth rate.

Keywords: Life cycle, growth, anchovy

Introduction

The biology of the anchovy *E. encrasicolis* has been studied to understand the role of this short living species (4-5 years) in the western Mediterranean ecosystems and to improve its management [1,2]. To improve management of these stocks, the life cycle strategy of *E. encrasicolus* should be better understood [2]. In the NW Mediterranean the spawning areas are localised in the most productive planktonic zones [1]. The demographic and growth processes during the early life stages are crucial for recruitment. However, only few studies have examined the demographic and growth processes of fishes during their ontogeny. The aim of this paper is to present the growth curve in length as a function of age from yolk-sac larvae to the last adult age-class. This analysis is a first step necessary before building complete life cycle models including demography and growth processes.

Methods

The age/length tables for larval, post-larval, pre-adults and adult phases were obtained from several studies realised in the Adriatic, the western Mediterranean and also in the Bay of Biscay [2]. Larvae were aged by means of daily growth increments in the otoliths. By putting all data of adults together a precision of 6 months was obtained. Most standard techniques of fitting empirical models cannot be used for such heterogeneous data. We used an alternative technique based on spline functions in order to fit the complete growth function. This procedure developed under Matlab Software is very flexible and may allow obtaining either integration or derivative of the obtained function [3].

Results and discussion

Figure 1A shows the shape of the growth curve of *E. encrasicolus* from larvae (<4 mm) to last age-class (170-200 mm). The length of metamorphosis (30 mm) is reached rapidly after one month. The general pattern of the variation of the specific growth rate as a function of length shows a like-hyperbolic curve (Figure 1C). This strategy of high growth rate during the first year and a first maturity around 110 mm may be explained by the high mortality encountered during this phase. The absence of clear relationship between stock and recruitment of these clupeid species is another reason for focusing on the complete life cycle processes. For a congeneric species *E. mordax*, Peterman *et al.* [4] used 13-year data of abundances of the first three stages: eggs, larvae (4-5 days) and early juveniles (19 days). They argued that the absence of correlations between these abundances and the number of recruits (1 year) was related to high variability (CV=171%) of the survival rate between 19 days and one year.

The results showed here represent a first step towards modelling of the growth rate of anchovy during the complete life cycle. To explain variability in the data, a bioenergetic model including the effects of environmental factors should be developed. Such a model may allow possible interactions between the environment, the recruitment and population dynamics to be better assessed.

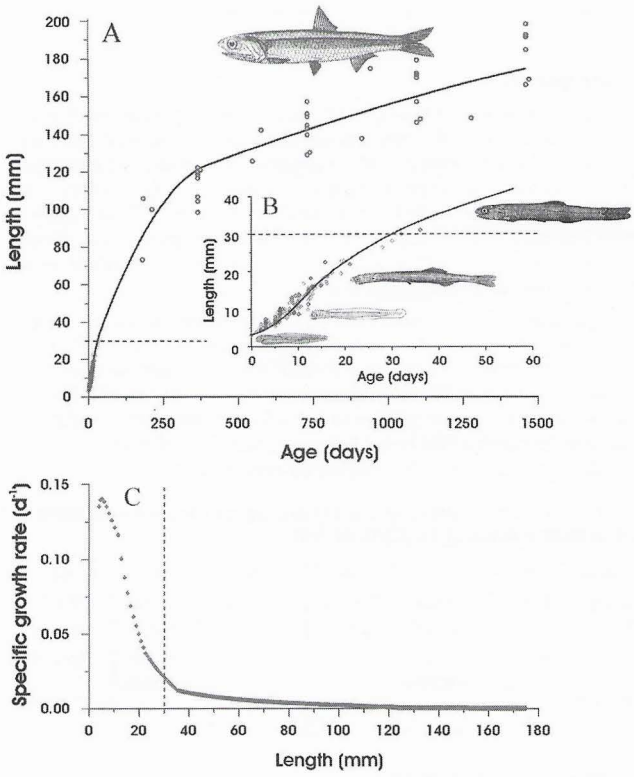

Fig. 1. A) Growth function of the anchovy *E. encrasicolus* during the complete life cycle. Symbols correspond to a compilation of the data from the literature [2]. Solid line is obtained by using the stepwise method of fitting based on spline functions. B) A zoom for the growth function during the first two months. C) Variation of the specific growth rate (d^{-1}) as a function of length of individuals. Discontinuous lines in all panels show the length of metamorphosis of this species.

References

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