SOMATIC AND OTOLITH GROWTH RATES OF ANCHOVY LARVAE FROM THE SICILIAN CHANNEL

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Abstract

Anchovy larvae (*Engraulis encrasicolus*) from the Sicilian Channel were collected in July 1997 in the area of Cape Passero under the framework of the EU project 96/052. Otolith microstructure, nucleic acids and protein content were analysed in the same larvae. Otolith and somatic growth rates showed a linear increase with larval age. Daily length increments (mm/day) were higher than those observed for anchovy larvae in NW Mediterranean. The relatively high rates of growth and the low values of the RNA/DNA ratio found could be due to the high regime of temperature found during the cruise. The RNA/DNA and protein/DNA ratios were related with recent otolith growth rate, indicating that for anchovy larvae both ratios were good predictors of recent larval growth.

Keywords : Sicilian Channel, Ichthyoplankton, Larvae, Growth

Introduction

The nursery grounds of anchovy larvae in the Sicilian Channel are located in the southern coasts of Sicily. As a result of the cyclonic circulation in this region, larvae are retained in this area. Otolith microstructure and larval condition analysis provide an insight on the effect of environment on the early life stages. Changes in the surrounding environment are reflected as changes in the width of the microincrements. In addition, the width of the most recently formed increments is used as a measurement of recent larval growth (1,2). The RNA/DNA ratio represents the rate of cellular metabolic rate, and as such, it is an indicator of the nutritional condition and the growth rates in larvae (3). Under experimentally controlled conditions, it has been shown that the RNA/DNA ratio is highly affected by environmental factors, namely temperature and prey density (3). Well-fed larvae and fast growing larvae show higher RNA/DNA ratios and wider daily increment deposition than starving larvae (1,3). This link between the condition analysis and the daily growth of the Sicilian Channel anchovy is shown in this document.

Material and Methods

During 19/07/97 to 8/08/97, a fish egg and larval survey (ANSIC-797) was carried out. In the region off Cape Passero, plankton tows were made with a Bongo 90 net. The tows were short in duration (~10 minutes). All tows were carried out during one night in shallow waters (~20 m depth). After capture, larvae were immediately sorted and conserved in liquid nitrogen. In the laboratory, anchovy larvae were thawed, measured for standard length by means of image analysis system, and weighed. The sagittae were extracted, mounted and increments were counted as described by 4. Nucleic acids and protein content were determined according to the results of a set of intercalibration exercises carried out under the EU funded project (PARS)(5). Standard length-at-age data were fitted using a power model where the intercept was fixed at 2.71 mm (6) in order to minimise any possible bias due to growth rate effects. Daily growth rates were calculated as described in Ramírez *et al* (7).

Results and Discussion

Standard length, wet-weight and otolith radius showed a power increase with larval age (R^2=0.81, R^2=0.80 and R^2=0.85, respectively). DNA (μg larva^{-1}), RNA (μg larva^{-1}), protein (μg larva^{-1}) also showed a power increase with larval age (R^2=0.73, R^2=0.81 and R^2=0.73, respectively). Somatic growth rates expressed as daily length increments (mm/day), daily wet-weight increase (mg/day), daily DNA increase (μg/day), daily RNA increase (μg/day) and daily protein increase (μg/day), showed a linear increase with age (Table 1). The daily length increment for an 8 mm larva was 0.62 mm/day. This rate is higher than daily growth rates reported for the Catalán Sea by García *et al*. (4), but lower than that reported by 6 for the Adriatic Sea anchovy.

Table 1. Linear regression analysis of the relationships between somatic growth rates and larval age (days).

Dependent variable (y)	Regression equation	R^2
Daily length increments (mm d^{-1})	y = 0,0107x + 0,5603	0,19
Daily wet-weight increase (mg d^{-1})	y = 0,1429x - 0,9656	0,89
Daily DNA increase (µg d^{-1})	y = 0,1467x + 0,1507	0,74
Daily RNA increase (µg d^{-1})	y = 0,5883x - 2,1499	0.88
Daily protein increase (µg d^{-1})	y = 13,647x - 98,967	0.89

The RNA/DNA ratios varied from a minimum of 0.98 to a maximum value of 4.24. The mean value of the population was 2.35. With respect to the Protein/DNA ratios the minimum and maximum values were between 4.61 and 86.73, respectively, with a mean value of 26.8. The RNA/DNA ratios were lower in comparison to those found by the other authors in anchovy larvae from the Mediterranean Sea (4; 8). The critical value of RNA/DNA ratio for most of fish larvae is around 1 (9). In this study 21% of the anchovy larvae analysed had a RNA/DNA value from 1-2, which can be considered near critical levels. This result may indicate that at least a 21% of anchovy larvae were under starving conditions. However, several authors have found a negative relationship between RNA/DNA ratio and water temperature (8; 10), where fish acclimated to cold temperature had higher RNA/DNA ratio than warm acclimated ones. The decrease of the RNA/DNA ratio with temperature is due to a compensatory mechanism for lower RNA activity, which produces an increase in RNA concentration (10). The high temperatures observed during the cruise (24.5°C±1.0), could explain the low values of the RNA/DNA ratio found in this study and the relatively high rates of growth for anchovy larvae. Since RNA/DNA ratios is considered an indicator of recent larval growth, the relationship between average RNA/DNA ratios by age classes and recent otolith growth ROG were analysed. The RNA/DNA was positively correlated with ROG (μm) (R^2=0.55), indicating that the ratio was a good predictor of recent growth.

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