Growth of Poor Cod Trisopterus minutus capelanus (Lacepede) (Pisces, Gadidae) in the Central Adriatic Sea

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The poor cod (*Trisopterus minutus capelanus*) is a very common species in the Central Adriatic Sea, living on soft bottoms at depths ranging from 40 to 250 m, and it is actively exploited by bottom trawlers.

In spite of its commercial importance, data on biology of the species in this area were supported only by Froglia (1981).

To investigate on age and growth of *Trisopterus minutus capelanus* otoliths (Sagitta) from 747 specimens, ranging between 3 and 25 cm of total length, were collected during trawl fishery investigations in 1986 and 1987 in a coastal area 15 miles NNW of Ancona at 50-55 m depth.

Fish total length was recorded to the centimeter below, weight to the 0.1 gram.

Specimens were sexed by macroscopical observation of gonads, but especially in summer samples the youngest immature specimens born in the same year could not be sexed without gonad sectioning, and were recorded as "indeterminate".

To determine age, we used thin otolith sections (0.25-0.40 mm thickness), obtained with the "thin cross section technique" (see GFCM, 1982), placed in ethanol 75% and examined under reflected light with a stereomicroscope by both authors. Unreadable otoliths and discordant readings were discarded. Finally 639 otolith readings were retained for length-age computations.

The rings pattern (alternance of opaque and hyaline zones) was find to be the classic one of cold-temperate species.

In the Mediterranean Sea sexual maturity is reached at the end of the first year of life; ripe females are found from January to early May and probably the species is a partial spawner (Vives and Suau, 1956; Froglia, 1981). Owing to this, conventional birthday was allocated at the first of January. Age was computed in months.

Parameters of the von Bertalanffy growth equation were computed separately for the two sexes, using the program VONBER by K.R. Allen (Sims, 1985). The young specimens (n = 93) up to a size of 12 cm T.L. which could not be sexed were used in computing both the equations (Tab. 1).

Tab. 1 - Parameters (with 95% confidence limits) of the von Bertalanffy growth equations obtained for males and females of *T. m. capelanus*.

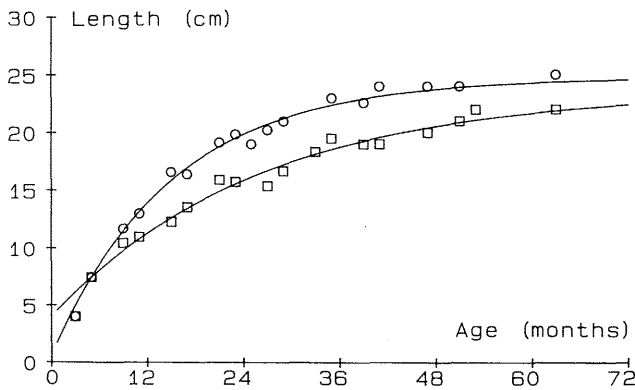| SEX	L_∞ (cm)	K	t_0 (months)	N
♂	23.59 (±1.73)	0.0387 (±0.0065)	-4.778 (±1.165)	210+93
♀	24.72 (±1.00)	0.0668 (±0.0074)	-0.348 (±0.594)	336+93

Fig. 1 - Von Bertalanffy growth curves and experimental average length/age values for males (□) and females (O) of *Trisopterus minutus capelanus* in the Adriatic Sea.

A significative difference in growth rate between males and females can be noted (Fig. 1); at the same age females attain a larger size than males. Our data show a faster growth compared with that of the nominal species reported by Menon (1950) for the Plymouth area, while are in good agreement with those given for the Mediterranean Sea (Vives and Suau, 1956; Froglia and Zoppini, 1981).

Finally the length-weight relationship was computed as G.M. Functional Regression for the two sexes separately:

MALES W = 0.005986 L$^{3.186}$ FEMALES W = 0.005098 L$^{3.265}$

where W is weight in grams and L is total length in centimeters.

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Age and growth of Anchovy, Engraulis encrasicolus (L.) in the Middle Adriatic

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INTRODUCTION

Anchovy, Engraulis encrasicolus (L.) are rather widely distributed in the Adriatic and play an important role in Yugoslav commercial fisheries. The knowledge of growth parameters are of utmost importance in biology and fisheries studies. Nevertheless, growth parameters of the anchovy from the Adriatic has not been studied at all. Hence, the present paper deals with anchovy growth parameters.

MATERIAL AND METHODS

Anchovy data were collected between April and December 1979. from Kaštela Bay (inshore waters) and from the region of Vis and Biševo Islands (offshore waters). A total of 1510 individuals were examined. Data on anchovy length reffering to their total length are expressed in centimetres. Age of anchovy was studied by sagitta readings.

RESULTS

Anchovy specimens ranged from 7.0 to 19.0 cm. in total length. Four age classes were found.

Values of growth parameters were obtained from mean anchovy lenths at a defined age class. Mean lengths as well as length range in each age class for males, females and combined sexes for anchovy in the middle Adriatic are presented in table 1.

Table 1. Number of fish sample size (n) and their mean length ($\bar{x}_t$) ± standard deviation in centimetres as well as length range in each age class for males, females and combined sexes for anchovy in the middle Adriatic in 1979.

Age class	Male n	$\bar{x}$ s	Female n	$\bar{x}$ s	Combined sexes n	$\bar{x}$ s	Length range (cm)
1	25	11.8 ± 0.90	65	12.4 ± 0.56	90	11.9 ± 0.98	10.2 – 14.1
2	310	14.7 ± 0.26	295	15.2 ± 0.27	605	14.8 ± 0.28	11.8 – 16.7
3	215	16.5 ± 0.32	540	17.0 ± 0.33	755	16.8 ± 0.36	13.1 – 17.7
4	5	17.3 ± 0.95	55	17.8 ± 0.34	60	17.6 ± 0.97	16.8 – 18.4
Total	555		955		1 510		

Calculated growth parameters for anchovy population from the middle Adriatic are:

	Male	Female	Combined sexes
L_∞	= 18.6 cm.	19.3 cm.	19.4 cm.
K	= 0.58	0.56	0.57
t_0	= -0.6	-0.7	-0.5

According to these parameters, exponential growth equation for anchovy population in the middle Adriatic has this form,

for male:
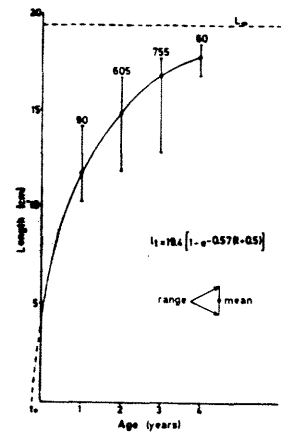
$$l_t = 18.6 \left[1 - e^{-0.58 (t + 0.6)} \right]$$

for female:

$$l_t = 19.3 \left[1 - e^{-0.56 (t + 0.7)} \right]$$

and for combined sexes:

$$l_t = 19.4 \left[1 - e^{-0.57 (t + 0.5)} \right]$$

Growth rate varied with area as well as with sex. Namely, anchovy from Vis and Biševo area grew faster than those from Kaštela Bay. Males grew faster too (K = 0.58) but attain to lower asymptotic length (L_∞ = 18.6 cm) than females (L_∞ = 19.3 cm).

Growth curve of anchovy

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