V-III5

FOOD REQUIREMENTS OF THE ATHERINA BOYERI LARVAE AND POSTLARVAE,
IN NATURAL ENVIRONMENT

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Summary. The stomach contents analysis of the Atherina boyeri (Risso, 1810), at its larval and postlarval stages, with sizes between 10 to 40 mm, showed an alternation of their feeding behaviour, depend   upon the occurrence of low and high tides, in the sampled area. The main food intake activity had almost been completed by the middle of the day, as far as the amount of items eaten, was concerned. The mean food requirement has been calculated as 54.5 items, per individual, per day. From this value, the portion of 36.6 items was strictly copepods and the 26.8 of the copepods   consisted of the species Microsetella norvegica.

Sampling took place, during July and August 1977, on an almost daily basis, from 8^{00} to 11^{00} and 17^{00} to 20^{00} hours. 165 specimens of Atherina boyeri (Risso, 1810) or Atherina mochon (C.V., 1829) larvae and postlarvae have been collected, in shallow waters, with a modified WP-2 plankton net. One set of observations carried out on days with no tidal movements and the other on days with high and low tides. The mean values of the items eaten by each larva/postlarva, are given in the table that follows.
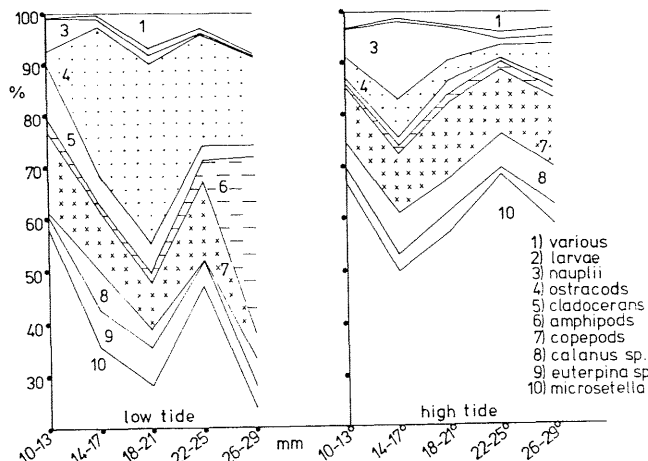
		per larva - postlarva		
		items	eaten	size (mm) of larva-postlarva
		mean ± SD	min:, max:,	
8^{00} – 11^{00} no tide	total	38.9 ± 38.1 (1) 33.4 ± 19.3 (2)	min: 7 12	
	copepods	32.5 ± 38.0 (3) 25.8 ± 18.9 (4)	max: 197 25	
	M. norv.	26.6 ± 35.3 (5) 20.2 ± 15.9 (6)	(2), (4), (6), when 197 value excluded (M. norvegica mainly)	
17^{00} – 20^{00} no tide	total	54.2 ± 31.5 (7)	min: 6 10	
	copepods	46.1 ± 29.4 (8)	max: 112 22	
	M. norv.	39.6 ± 28.1 (9)		
8^{00} – 11^{00} low tide	total	67.1 ± 60.9 (10) 54.0 ± 29.7 (11)	min: 10 .... 15, 29 max: $\begin{cases}215, 219 ..... 15 \\ 355 .... 18\end{cases}$	
	copepods	34.9 ± 19.7 (12)		
	M. norv.	21.2 ± 14.9 (13)	(11), when all max values excluded (ostracods, amphipods)	
17^{00} – 20^{00} high tide	total	42.6 ± 18.7 (14)	min: 10 14	
	copepods	34.6 ± 15.4 (15)	max: 70 13	
	M. norv.	24.9 ± 12.5 (16)		

Comparing the mean values (2) and (7), we obtain $T_{2,7} = 2.79$, which shows that there is a significant difference between the means, $P < 0.001$, that is, during periods with no tidal currents there is a declining increase, of the items of food eaten, from morning to the afternoon.

From the means (2) and (11), we have $T_{2,11} = 3.47$, value which is significant for $P < 0.0001$, indicating that during low tides there is a bigger amount of items of food eaten, in comparison with the same morning period with "calm" water . Since there is little increase, at low tide , of the items of copepods eaten, $T_{4,12} = 1.89$, $P < 0.05$ and no increase of M. norvegica, it is obvious that for A. boyeri, there is an extra food supply, from ostracods and amphipods (see figure), probably due to their emergence as a physiological response to low tides.

At low and high tides there are no differences as far as the copepods, $T_{12,15} = 0.07$, or M. norvegica items eaten are concerned; a slight decrease may be observed when the total means were compared, $T_{11,14} = 1.95$, $P < 0.05$.

An important observation is based on the lack of evidence that evacuation of the items eaten the same day takes place. Of cource, towards the "end" of the stomach, items eaten were fully digested, as indicated by ghost-copepods. In relation to this observation, the mean food requirements estimated to 54.5 items, per larva postlarva, per day.

1) various
2) larvae
3) nauplii
4) ostracods
5) cladocerans
6) amphipods
7) copepods
8) calanus sp.
9) euterpina sp.
10) microsetella

V-IV1

A NOTE ON THE GROWTH AND NATURAL MORTALITY
OF BOOPS BOOPS (L.) FROM THE ADRIATIC SEA

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The growth of the bogue was estimated from age determined by otolith readings and size frequency distribution. Otoliths of 128 specimens were examined, but the age could be determined without significant errors in not more than 25%. Mean length-at-age was determined by the integral method recommended by PAULY (1982). Results are based on total length data of fish collected during trawl surveys carried out in the middle Adriatic in 1963/67. Agreement between length-at-age estimates by the integral method and otoliths was generally good:

Age classes	1^+	2^+	3^+	4^+
Integral method	142.5	173.0	200.0	221.5
Otoliths	153.5(4)	175.7(10)	199.8(14)	219.9(3)

In parentheses number of specimens

Several methods for solving the von Bertalanffy growth equation were applied:

Method	L_∞	K	t_0	Σd^2
Ford Walford	343.69	0.169	-2.147	1.001
Beverton 1	343.69	0.167	-2.206	0.410
2	321.74	0.194	-1.998	0.873
3	350.00	0.158	-2.299	3.372

L_∞ obtained by: 1-integral method, 2-otoliths, 3-maximum observed length

Theoretical length-at-age values calculated by growth parameters estimated by the Beverton method and L_∞ obtained by integral method showed smallest deviations from the observed mean values. The equation applied to describe the age-length relationship is:

$$L_t = 343.69 \left[1 - e^{-0.167 (t + 2.206)} \right]$$

Low growth rate points to the slow growth of this species, proved also by the lifespan of 15.73 years, at which age the bogue attain 95% of their asymptotic length.

Instantaneous rate of natural mortality of the population was estimated after Taylor equation: M = 0.190. PAULY (1982) gives an empirical equation to obtain an indicative estimate of the natural mortality from the L_∞ and K values and the mean environmental temperature. With the mean annual temperature $14.5^\circ C$ at 100 m depth for the Adriatic Sea, it was estimated that M = 0.207.

Length-weight relationship was computed as GM functional regression for both sexes and whole sampled population in the period of sexual inactivity:

	N	Regression	r
Males	68	logW = -5.58 + 3.230 logL	0.987
Females	97	logW = -5.25 + 3.038 logL	0.991
Total	165	logW = -5.19 + 3.113 logL	0.989

where W is the weight in grams and L total length in millimetres. A non significant difference was found in length-weight relationship between males and females.

The growth pattern of the bogue from the Adriatic is in close agreement with that reported by ZUÑIGA (1967) for the bogue from the western Mediterranean. However, it is important to emphasize that the results of this study are an estimate based on the available data, and can vary from other more complete sets of data.

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V