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Observations on the age and growth of *Trachurus trachurus* (L.) in the middle Adriatic

Opažanja o rastu i starosti šnjura *Trachurus trachurus* (L.) u srednjem Jadranu

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INTRODUCTION

Horse mackerel (*Trachurus trachurus* L.) proportion in the Yugoslav commercial catches is very significant. They occur in trawl and seine catches all year round. This fish species is distributed throughout the Adriatic and particularly abundant in the area of Jabuka Pit (Karlovac, O. and Karlovac, J., 1971). Published data on this species biology are very scarce, particularly those on the population inhabiting the Adriatic. Alegria (1983) presented growth parameters and some biological parameters of this population.

This paper is a contribution to the knowledge of growth based on length and age structure of horse mackerel population from Blitvenica in the middle Adriatic.

MATERIAL AND METHODS

Results given in this paper are based on the data on length structure and age of horse mackerel captured during experimental trawling of the r/v BIOS at 200 m depths in the area of Blitvenica between July 1980 and November 1981.

Data on length refer to the total fish length.

Age was determined from otoliths from which the age of 4—5 years is rather easily identified since ring structure of otoliths is distinctly marked. Whole otolith was observed in a clearing agent under reflected light against a dark background. This technique cannot be applied to older specimens in which otolith structure is not clearly distinguished. Therefore, it was mainly pretty difficult to determine the age of fish except in a small number of specimens.

RESULTS AND DISCUSSION

Length-frequency distribution

Length-frequency distribution of horse mackerel from the area of Jabuka Fig. 1. Histogram shows a very significant peak which referes to 17—24 cm length range including several age groups. In addition to somewhat less marked modal value of 14 cm which mainly corresponds to the first year, the other two less marked modal values at 30 and 33 cm length are very likely to include a larger number of age groups.

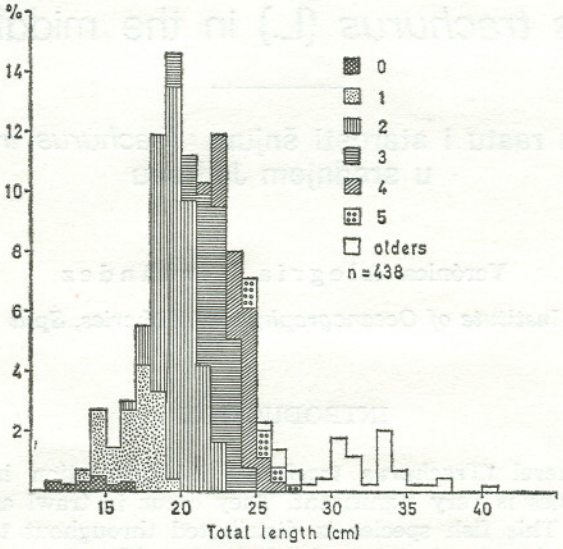

Fig. 1. Length frequency and age distribution of sampled *Trachurus trachurus* (L.) from Blitvenica in the Adriatica Sea in 1980—1981.

Length-frequency distribution of horse mackerel from the area of Jabuka Pit in the 1969—1970 is quite different. Namely, in addition to 6—16 cm length range, horse mackerel specimens of 9—12 cm were predominant (Jukić and Piccinetti, 1981). This means that samples principally contained O-group fish. During HVAR Expedition trawling specimens of 23—37 cm with 33 and 35 cm modal lengths were captured in autumn. However, specimens of 13—39 cm with two modal length of 17 and 35 cm (Karlovac, O. and J. Karlovac, 1971) ere predominant in spring.

Relationship between body length and otolith length

Relationship between body length and otolith length is expressed by the following equation:

$$D = 0.6396\, L^{0.8692}$$

where D is the length of otoliths. Allometric relationship between both characters is given in Fig. 2. Calculated ratio between total length and otolith

length (Table 1) is gradually reduced with the increase of body length. This is indicative of the possibility that in older specimens structural material of otoliths is deposited on the structure of otoliths rather than at the otolith edge and subsequently otoliths increase mainly in width.

Table 1. Otolith and total body length, otolith-total length ratio and estimated total body length of *Trachurus trachurus* (L.) from Blitvenica in 1980—1981.

Age	Mean total length (cm)	Mean otolith length (mm)	Otolith-body length ratio ($\times 10^4$)	Theoretical length (cm) A	B
1	16.79	6.02	358	15.44	14.81
2	20.49	6.91	337	18.95	19.31
3	22.89	7.52	328	21.32	22.91
4	24.67	7.89	323	23.11	25.80
5	26.33	8.40	319	24.77	28.12
6	27.22	8.76	322	26.14	29.98
7	28.05	9.16	327	27.71	31.48
8	31.10	9.52	306	29.10	32.68
9	32.34*	9.82*	304	30.27	33.64

* Mean from only 3 individuals, they are not used for calculation.
A Estimated from otolith-total length relationship.
B Estimated from von Bertalanffy's equation.

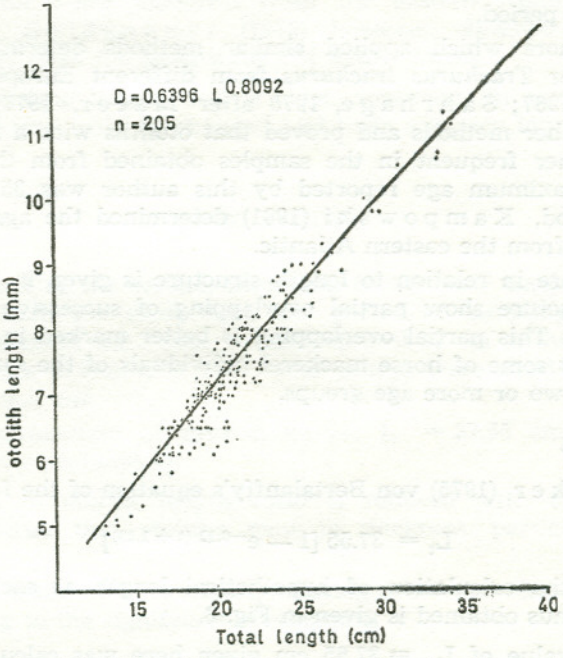

Fig. 2. Relationship between total length and otolith length of *Trachurus trachurus* (L.) from Blitvenica in the Adriatic Sea in 1980—1981.

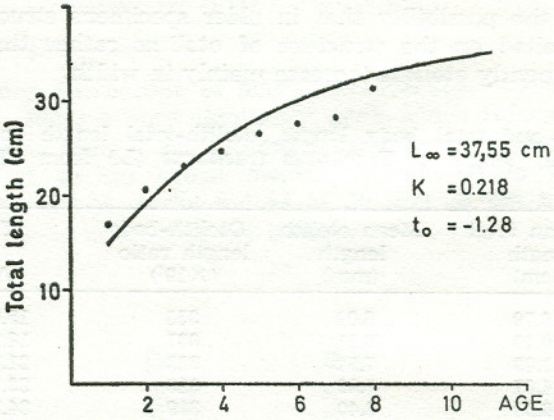

Fig. 3. Growth curve for *Trachurus trachurus* (L.) from Blitvenica in the Adriatic Sea in 1980—1981.

Age structure

Maximum age which could be determined in only three of the fish is 9 years. Apart from the difficulties in age-determination of larger specimens, they were also poorly represented in the catches realized from the study area in the sampling period.

Other authors which applied similar methods determined the age of 10—12 years for *Trachurus trachurus* from different European coastal areas (Polonski, 1967; Sahrhage, 1970 after Macer, 1977). Macer (1977) applied some other methods and proved that otoliths with a larger number of rings were rather frequent in the samples obtained from the region around Britain. The maximum age reported by this author was 35 years. Applying the same method, Kampowski (1981) determined the age of 22 years for horse mackerel from the eastern Atlantic.

Age structure in relation to length structure is given in Table 2. The age and length structure show partial overlapping of successive year groups for defined lengths. This partial overlapping is better marked in older specimens. This means that some of horse mackerel individuals of the same length groups may belong to two or more age groups.

Age and growth

After Ricker (1975) von Bertalanffy's equation of the form:

$$L_t = 37.55\,[1 - e^{-0.22\,(t+1.28)}]$$

was used for the calculation of hypothetical length at each age (Table 1). Growth curve thus obtained is given in Fig. 3.

Estimated value of $L_\infty = 37.55$ cm given here was calculated from mean length obtained for I to VIII age classes. This value is probably not the value representing maximum size of horse mackerel from Blitvenica since it is lower than maximum observed length of 40.5 cm. Values which Kampowski

Table 2. Length-frequency of age classes of *Trachurus trachurus* (L.) from Blitvenica in 1980—1981

Length class	Age class										
(cm)	0	1	2	3	4	5	6	7	8	9	Total
101—120	2										2
121—140	5	5									10
141—160	3	9									12
161—180		30	7								37
181—200		8	59	2							69
201—220			51	32	1						84
221—240			3	33	21	1					58
241—260					18	15	7				40
261—280					1	3	2	2			8
281—300						1	2	6	1		10
301—320							1	2	2	1	6
321—340									2	2	4
Total	10	52	120	67	41	20	12	10	5	3	340
Percentage	2.9	15.4	35.5	19.8	12.4	5.9	3.6	2.9	1.5	0.8	

(1981) obtained for horse mackerel from the eastern Atlantic were lower ($L = 36.19$ cm). Geldenhuys (1973), however, obtained $L = 54.29$ cm for horse mackerel from the open waters of South Africa.

Thus, by including larger, that is older, specimens in calculation already calculated parameters could be changed and their accuracy improved.

CONCLUSIONS

Horse mackerel of the second, third and fourth year classes predominated in the samples from the study area and period of sampling. Modal length of 19 cm corresponds to the 2 year old fish, that of 22 cm to the age 3 and that of 24 cm to the age 4. Fish of 0 and I year groups were poorly represented as well as V-group fish and older.

Calculated parameters of growth curve: $L = 37.55$ cm, $K = 0.22$ and $t_0 = -1.28$ are only preliminary.

Body length to otolith length ratio is reduced with the body length increase. This means that otoliths grow in thickness, particularly in larger individuals.

Age groups could not be clearly distinguished on the basis of length frequencies owing to the significant overlapping.

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OPAŽANJA O RASTU I STAROSTI ŠNJURA (*TRACHURUS TRACHURUS* L.) U SREDNJEM JADRANU

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Rad predstavlja doprinos poznavanju rasta šnjura (*Trachurus trachurus* L.) na osnovu dužinskog i starosnog sastava populacije iz područja Blitvenice u srednjem Jadranu, za razdoblje od 1980—1981. godine. Dužinska distribucija je unimodalna i obuhvaća primjerke od 17—24 cm dužine, tj. druge, treće i četvrte godišnje klase. Izračunate vrijednosti parametara von Bertalanffyjeve krivulje rasta $L = 37{,}55$ cm, $K = 0{,}22$ i $t_0 = -1{,}28$, smatraju se preliminarnima.

Starosne grupe nisu se mogle izdvojiti na osnovu distribucije dužinskih frekvencija zbog prisutnosti značajnog preklapanja sukcesivnih godišnjih grupa za određenu dužinu.