

## **SOME ASPECTS OF THE BIOLOGY OF THE MEDITERRANEAN HORSE MACKEREL, *TRACHURUS MEDITERRANEUS* (STEINDACHNER, 1868) IN MONTENEGRIN WATERS (SOUTH ADRIATIC SEA)**

OLIVERA KASALICA<sup>1</sup>, SLOBODAN REGNER<sup>2</sup> and ZDRAVKO IKICA<sup>1</sup>

<sup>1</sup>*Institute of Marine biology, Dobrota bb, Kotor, Montenegro*

<sup>2</sup>*Institute for multidisciplinary research, Kneza Višeslava 1, Belgrade, Serbia*

### **NEKI ASPEKTI BIOLOGIJE ŠNJURA PUČINARA, *TRACHURUS MEDITERRANEUS* (STEINDACHNER, 1868) U VODAMA CRNOGORSKOG PRIMORJA (JUŽNI JADRAN)**

#### ***Abstrakt***

Šnjur pučinar, *Trachurus mediterraneus* (Steindachner, 1868) je semi-pelagična riba koja se u Jadranu najčešće lovi na dubinama od 20 do 200 m. U Jadranskom moru, ova vrsta je važan objekat i demerzalnog i pelagičnog ribolova. Iako su biloške karakteristike ove vrste dokumentovane za Jadran, ipak za Crnogorsko primorje nema takvih podataka. U radu se iznose rezultati analize nekih bioloških aspekata (raspodjela dužinskih frekvencija, dužinsko-težinski odnos, odnos polova, dužina pri kojoj 50% jedinki doživi polnu zrelost) šnjura pučinara, u vodama Crnogorskog primorja u okviru Pilot Studije FAO AdriaMed projekta. Uzorci su uzimani mjesečno sa komercijalnih brodova u periodu od jedne godine tj. od septembra 2007 do septembra 2008. Ukupno je analizirano 429 jedinki, odnosno 287 ženki i 162 mužjaka. Totalna dužina uzorkovanih jedinki je bila od 11.0 do 31.0 cm sa srednjom vrijednošću od 17.66 cm TL. Dužinski raspon kod ženki je bio od 11.0 do 31.0 cm, a kod mužjaka od 11.5 do 28.6 cm. Kod ženki, u ulovu su najzastupljenije bile jedinke od 15.5 do 18.0 cm dok su kod mužjaka bile od 15.5 do 19.0 cm. Odnos polova je bio 0.38. Ženke su procentualno zastupljenije skoro u svim dužinskim klasama. Zrele jedinke šnjura (stadijumi 2-sazrijevanje, 3-zrele i 4-i-zmriješćene) se nalaze u dužinskom rasponu od 14.4 do 28.6 cm kod mužjaka i od 13.9 do 29.4 cm kod ženki. Nezrele jedinke (stadijum 1) sačinjavaju skoro 23% ukupnog uzorka, dok je najveći dio uzorkovanih jedinki bio u drugom stadijumu zrelosti. Dužina pri kojoj 50% jedinki dostigne prvu polnu zrelost je procijenjena na 13.38 cm TL, od-

nosno 16.24 cm kod mužjaka i 14.32 cm kod ženki. Koeficijent b dužinsko-težinskog odnosa je kod ženki iznosio 2.8546, a kod mužjaka 3.0413.

**Ključne riječi:** šnjur pučinar, biološki aspekti, Crnogorsko primorje

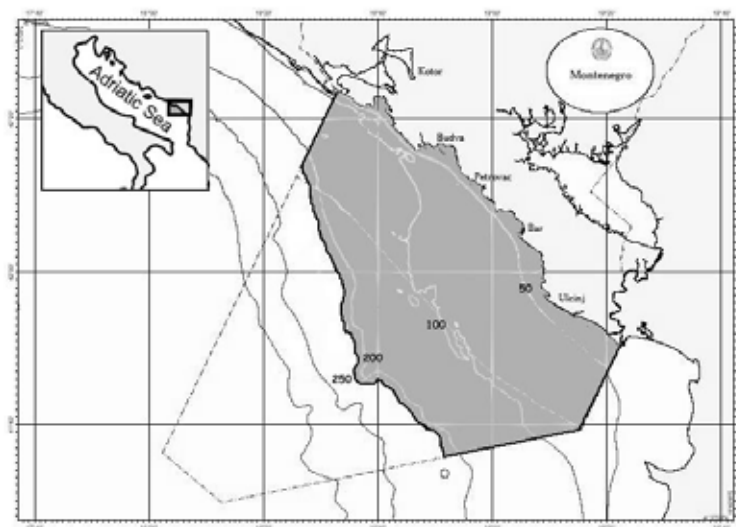
## INTRODUCTION

*Trachurus mediterraneus* is a semi-pelagic carnivorous fish, living in both the Mediterranean and Black Seas as well as along the eastern coasts of the Atlantic from the English Channel to Morocco (Viette *et al.*, 1997). In the Adriatic Sea, this species is important object of pelagic and demersal fishing (Šantić *et al.*, 2002). According to Jardaš (1996) this species is most commonly found at about 20-200 m depth. Despite fact that the biology of this species has been well documented for the Adriatic (Arneri, 1984; Viette *et al.*, 1997; Šantić *et al.*, 2002), biological studies of this species in Montenegrin coast are very limited.

So, the aim of this paper is to investigate some biological aspects of *T. mediterraneus* such as length-weight relationship, length frequency distribution, sex ratio, size at first maturity in Montenegrin territorial waters.

## MATERIALS AND METHODS

Specimens of Mediterranean horse mackerel were caught monthly from September 2007 to September 2008 on Montenegrin shelf (Fig. 1), using commercial bottom trawls. Hauls were performed during the day at depths ranging from 50 to 200 m. Immediately after capture, specimens were processed. Total length (TL) of fish examined was measured to the nearest 0.1 cm and weight to the nearest 0.01 g. The sex ratio was expressed as a fraction of males over the total of males and females combined. According to MEDITS protocol, four different maturity stages were established for females and males, based on the macroscopic observations of gonads: immature (1), in maturation (2), spawning (3) and post-spawning (4). Length at first maturity was estimated by sexes and for the entire population, based on the length and maturity stage data.

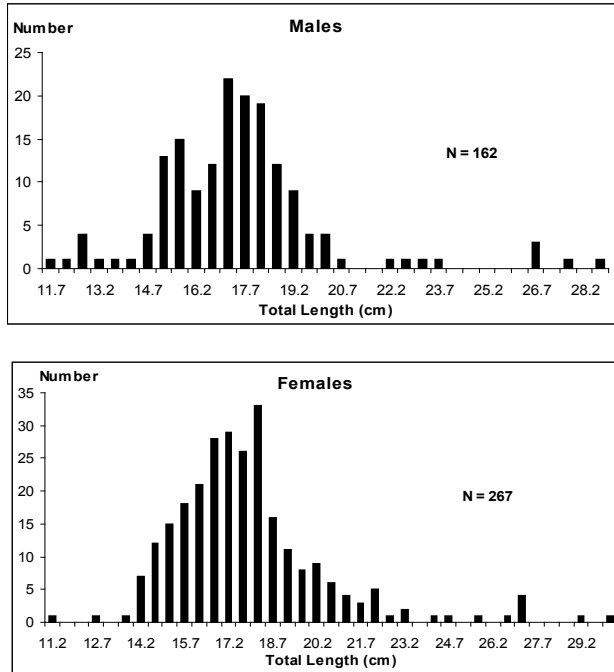


**Figure 1.** Map of the investigated area

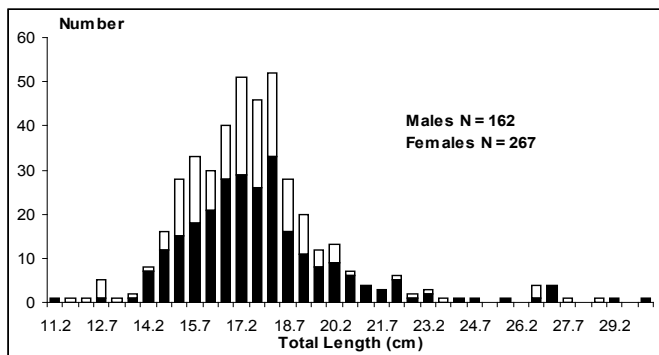
Maturity stages 2, 3 and 4 were included in the mature category while maturity stage 1 was included in the immature category. Length-weight relationship of horse-mackerel was estimated by equation:  $W = aL^b$  (Ricker, 1975), where  $W$  is the total body weight (in g) and  $L$  is the total length (in cm),  $a$  is coefficient related to the body form and  $b$  is coefficient of allometry.

## RESULTS AND DISCUSSION

During the time of investigation, 429 specimens of Mediterranean horse mackerel were analyzed. The total length ranged from 11.0 to 31.0 cm with an overall average length of 17.66 cm. This length range does not correspond with the maximum limit of 10-50 cm proposed by Fisher *et al.* (1987) for the size range of *T. mediterraneus*. Length frequency distribution of males shows that the size range extended from 11.5 to 28.6 cm with size groups of 15.0 and 19.0 cm dominating in the catch while the length frequency distribution of females ranged from 11.0 to 31.0 cm with size groups 15.5 to 18.0 cm dominating the catch (Figure 2). Females showed a higher median length than males (17.82 versus 17.41 mm). The LFD of the whole sample (pooled data) showed that the majority of catches consist of individuals ranging in length from 15.0 to 18.5 cm TL (Figure 3).



**Figure 2.** Length frequency distribution by sexes of *Trachurus mediterraneus* caught in national waters of Montenegro during 2007-2008 sampling period.



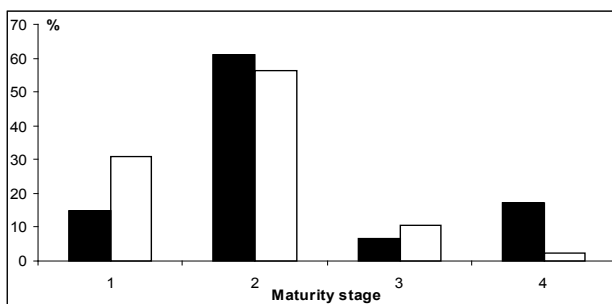
**Figure 3.** Length frequency distribution for the whole sample of *Trachurus mediterraneus*. Black bars = females; white bars = males

The sample was composed of 267 females (62.2%) and 162 males (37.8%). The overall sex ratio during the period of investigation was in favour of females (0.38). The sex ratio by size class showed female predominance in almost all length classes (Figure 3). Mature specimens of *T. mediterraneus* were found at wide size range, TL varying between 14.4 and 28.6 cm TL in males and 13.9 and 29.4 cm TL in females (Table 1).

**Table 1.** Gonad maturity stages by sex of *Trachurus mediterraneus* during the 2007-2008 sampling period. F = female; M = male; TL = total length in cm; 1-4 = gonad maturity stage.

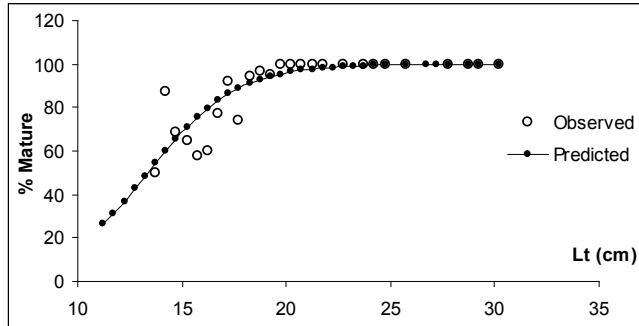
<i>Trachurus mediterraneus</i>	M				F			
	No	%	TL		No	%	TL	
			min	max			min	max
1	50	30.86	11.5	26.5	40	14.98	11.0	31.0
2	91	56.17	14.4	27.7	163	61.05	13.9	25.6
3	17	10.49	15.2	26.8	18	6.74	16.2	24.6
4	4	2.47	17.2	28.6	46	17.23	16.7	29.4
Total	162	100.00			267	100.00		

During the whole sampling period very small number of mature specimens (in maturity stage 3) was found, and only 4 post-spawning males were recorded. The largest fraction of caught specimens was in the maturity stage 2 (Figure 4). In the Gulf of Trieste, the smallest mature male was 15.6 cm long and the smallest mature female 16.0 cm long (Viette *et al.*, 1997). Different results were also reported by Demirel (2010) in the Marmara sea, where the smallest size of mature individuals was found as 11.5 cm for both sexes.



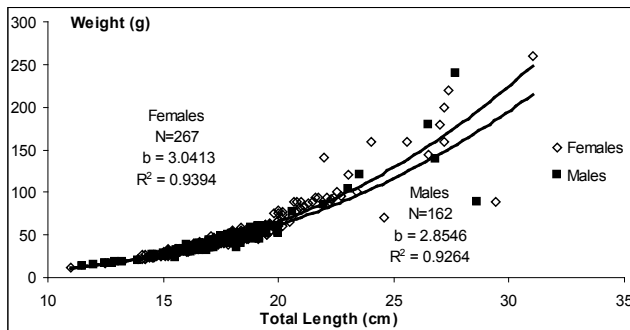
**Figure 4.** Gonad maturity stages proportion by sex of *Trachurus mediterraneus* during the 2007-2008 sampling period. Black bars = females; white bars = males.

The size at first maturity ( $L_{50\%}$ ) estimated for both sexes combined was 13.38 cm TL (Figure 5) while the size at first maturity is reached at 16.24 cm for males and 14.32 cm for females. Our results do not match with Demirel (2010) who was reported that the first maturity length was calculated to be 12.2 cm for females and 12.5 cm for males in the Marmara Sea.



**Figure 5.** Length at first maturity (50%) for both sexes of *Trachurus mediterraneus*

The length-weight relationships of horse-mackerel in Montenegrin territorial waters were: for females  $W=0.0072*L^{3.0413}$  and for males  $W=0.0119*L^{2.8546}$  (Fig. 6). A similar result for females was reported by Šantić *et al.*, (2002) for the eastern central Adriatic. These authors reported that the L-W relationship, which differs between sexes, was estimated for males  $b = 2.9929$ ,  $a = 0.0087$  and for females  $b = 3.0598$ ,  $a = 0.0069$ , indicating negative deviation from ideal allometric growth ( $b < 3$ ) for males, and positive deviation ( $b > 3$ ) for females.



**Figure 6.** Length-weight relationship for males and females, and their respective estimated slopes ( $b$ ) for *Trachurus mediterraneus* caught in Montenegrin national waters during the 2007–2008 sampling period. N = number of specimens.

## CONCLUSIONS

Some biological aspects of *T. mediterraneus* has been studied for the first time in the Montenegrin coast (South Adriatic Sea). These results will provide the basis for future stock assessment and management studies on this species.

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