

# BIOMETRIC PROPERTIES OF MEDITERRANEAN HORSE MACKEREL *TRACHURUS MEDITERRANEUS* (OSTEICHTHYES: CARANGIDAE) FROM THE CENTRAL ADRIATIC SEA

<sup>1</sup>IVAN JARDAS, <sup>2</sup>MATE ŠANTIĆ & <sup>3</sup>ARMIN PALLAORO

<sup>1</sup>Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63,  
PO Box 500, 21000 Split, Croatia (e-mail: jardas@izor.hr)

<sup>2</sup>Department of Biology, Faculty of Science, University of Split,  
Teslina 12, 21000 Split, Croatia (e-mail: msantic@pmfst.hr)

<sup>3</sup>Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63,  
21000 Split, Croatia (e-mail: palloro@izor.hr)

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The relationship between morphometric measurements (15) and meristic characters (8) were examined in 237 specimens of Mediterranean horse mackerel (105 females, 101 males and 31 immature specimens) caught in the central Adriatic Sea. The goal of this paper was to investigate: whether there are morphological differences between males and females; the existence of homogenous or heterogeneous morphology stock; changes in morphometric characters with an increase in body length.

Morphological differences between males and females were not marked. Modal values specific for *Trachurus* species morphologic characters, such as number of lateral line scales, maximum height of scales in anterior and posterior part of lateral line, point at which dorsal accessory lateral line is terminated and values of other biometric properties indicated a possible homogeneous morphology stock of *T. mediterraneus* in the central Adriatic Sea. Changes in some morphometric characters obtained in conjunction with an increase in body length showed that smaller specimens have longer head, anal and ventral fin than adult specimens. On the other hand, with an increase in total length, the fish have larger preorbital and postorbital distance, smaller eye and maximum height of scales in the lateral line than smaller fishes. The negative correlation recorded for the maximum and minimum body depth indicates that the body becomes progressively elongated. The meristic

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<sup>1</sup> corresponding author

characters of Mediterranean horse mackerel from different Mediterranean and NE Atlantic areas are mostly in agreement with the data in our study.

**Key words:** *Trachurus mediterraneus*, morphometric and meristic characters, Adriatic Sea

Jardas, I., Šantić, M. & Pallaoro, A.: Biometrijske osobine šnjura pučinara, *Trachurus mediterraneus*, (Osteichthyes: Carangidae) u srednjem Jadranu. Nat. Croat., Vol. 13, No. 4., 343–355, 2004, Zagreb.

Na 237 primjeraka šnjura pučinara (105 ženki, 101 mužjak i 31 spolno nezrelih jedinki) ulovljenih u srednjem Jadranu analizirana su morfometrijska (15) i meristička obilježja (8). Cilj ove studije bio je istražiti morfološke razlike između mužjaka i ženki, postojanje morfološki homogenog ili heterogenog stoka i promjene morfometrijskih osobina tijekom rasta ribe.

Morfološke razlike između mužjaka i ženki nisu izražene. Modalne vrijednosti specifičnih morfoloških obilježja, kao što su broj ljustaka u bočnoj pruzi, najveća visina ljustaka u prednjem i stražnjem dijelu bočne pruge i točka gdje završava dodatna leđna bočna pruga te vrijednosti ostalih biometrijskih osobina ukazuju da u Jadranu vjerojatno obitava morfološki homogena populacija ove vrste. Uočene su promjene morfometrijskih odnosa u vezi s porastom tjelesne dužine. Manji primjerci imaju veću dužinu glave, podrepnu i trbušne peraje nego veći primjerci. S druge strane veće ribe imaju veću predočnu i zaočnu udaljenost, manju veličinu oka i manju visinu ljustaka u bočnoj pruzi u odnosu na manje ribe. Negativna korelacija zabilježena kod najmanje i najveće visine tijela pokazuje da se tijelo ribe progresivno izdužuje. Merističke osobine šnjura pučinara s različitih područja Mediterana i sjeveroistočnog Atlantika uglavnom se podudaraju s podacima dobivenim u ovom radu.

**Ključne riječi:** *Trachurus mediterraneus*, morfometrijska i meristička obilježja, Jadransko more

## INTRODUCTION

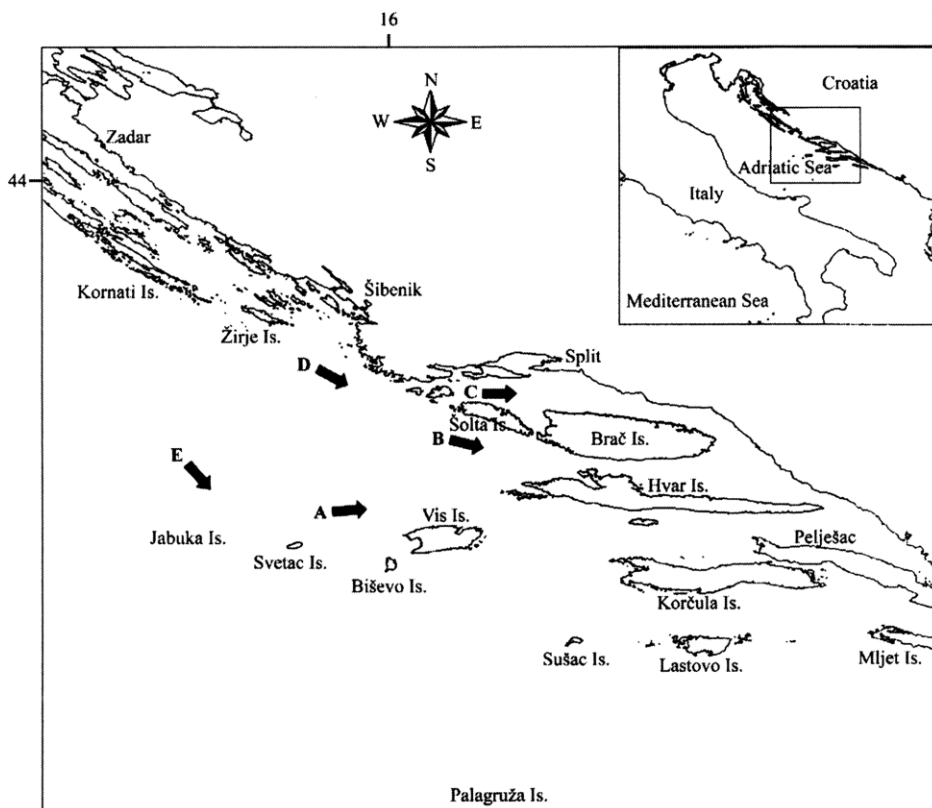
Members of the genus *Trachurus* (Perciformes, Carangidae) are common and widely distributed in the Mediterranean Sea (SMITH-VANIZ, 1986). In the Adriatic Sea this genus is represented by three species: the Atlantic horse mackerel, *T. trachurus* (L.), the Mediterranean horse mackerel, *T. mediterraneus* (Steind.) and the blue jack mackerel, *T. picturatus* (Bowd.). *T. mediterraneus* is a schooling semi-pelagic species, most common at about 20–200 m depth (JARDAS, 1996). There are no reliable statistical data on *T. mediterraneus* landings in the eastern Adriatic, but the annual catch can be tentatively estimated at around 400 tons (FAO, 2000). In the Mediterranean, this species is of major importance in the pelagic and demersal fisheries where annual landings fluctuated from 5120 to 109560 tons in the period from 1989 to 1998 (FAO, 2000). Presently, this species is still abundant in the Adriatic Sea, compared to other economically important species that are currently considered to be overfished (VRGOČ, 2000). The biology of this species has been well documented for the Adriatic (ARNERI 1984; ARNERI & TANGERINI, 1984; VIETTE *et al.*, 1997), Mediterranean (KYRTATOS, 1998; KARLOU-RIGA, 2000) and Black Seas (DEMIR, 1961; PORA, 1979). However, their morphometric along with meristic characters have not been thoroughly studied. Some data on individual meristic characters are available (POLJAKOV *et al.*, 1958; TORTONESE, 1975; BEN-SALEM *et al.*, 1981; SMITH-VANIZ, 1986; FISCHER *et al.*, 1987; JARDAS, 1996) but morphometric data are very scarce. Detailed data about the morphological characters of the *Trachurus* genus are given in SHABONEYEV (1980).

The goal of this paper is, by an analysis of the morphometric and meristic characters of the Mediterranean horse mackerel in the central Adriatic Sea, to investigate:

a) whether there are morphological differences between males and females; b) the existence of a possible homogenous or heterogeneous morphology stock; c) changes of morphometric characters with increase in body length.

## MATERIALS AND METHODS

A total of 237 Mediterranean horse mackerel specimens sampled from commercial trawl catches were subjected to biometric analysis. The sample consisted of 105 females, 101 males and 31 immature individuals. Material was collected from five trawling grounds in the central Adriatic: the areas of Svetac and Vis islands, the area of Maslinica, Split Channel, around Jabuka Islet and Blitvenica in 1996 (Fig. 1).



**Fig. 1.** Study area and sampling localities of Mediterranean horse mackerel from the Adriatic Sea: A – areas of Vis and Svetac islands, B – area of Maslenica, C – Split Channel, D – Blitvenica fishing area, E – area of Jabuka island. Arrows represent the fishing direction.

The investigated areas are situated on the circumlittoral shelf at a depth of 60 to 125 m. Total length ( $L_t$ ) of all samples ranged from 11.7 to 36.8 cm. Total length of females ranged from 13.7 to 36.7 cm and males from 13.9 to 36.8 cm. The entire sample was categorized into centimetre length classes.

Biometric measurements were performed on fresh fish. Specimens were boiled to facilitate the separation of the muscular tissue from the spine and vertebrae counted.

Some characters specific to *T. mediterraneus* used were as follows (SHABONEYEV, 1980; SMITH-VANIZ, 1986): number of lateral line scales (L.lat.), maximum height of scales in anterior and posterior part of the lateral line, distance between ultimate and penultimate rays of anal fin and point at which dorsal accessory lateral line terminates. Other morphometric and meristic body characters were also examined (LAEVASTU, 1965).

The morphometric characters analysed were (Fig. 2): total length ( $L_t$ ), standard length ( $L_s$ ), head length ( $C$ ), dorsal fin length ( $L_d$ ), anal fin length ( $L_a$ ), pectoral fin length ( $L_p$ ), ventral fin length ( $L_v$ ), maximum body height ( $T$ ), minimum body height ( $T_{pc}$ ), eye diameter ( $O$ ), preocular distance ( $P_o$ ) and postocular distance ( $O_{lo}$ ).

The analysed meristic characters were: number of spined and branched rays in dorsal ( $D$ ), ventral ( $V$ ) and anal ( $A$ ) fins, number of pectoral rays ( $P$ ), number of vertebrae (Vert.), total number of branchiospines (Brsp.), and number of pyloric appendices (A.p).

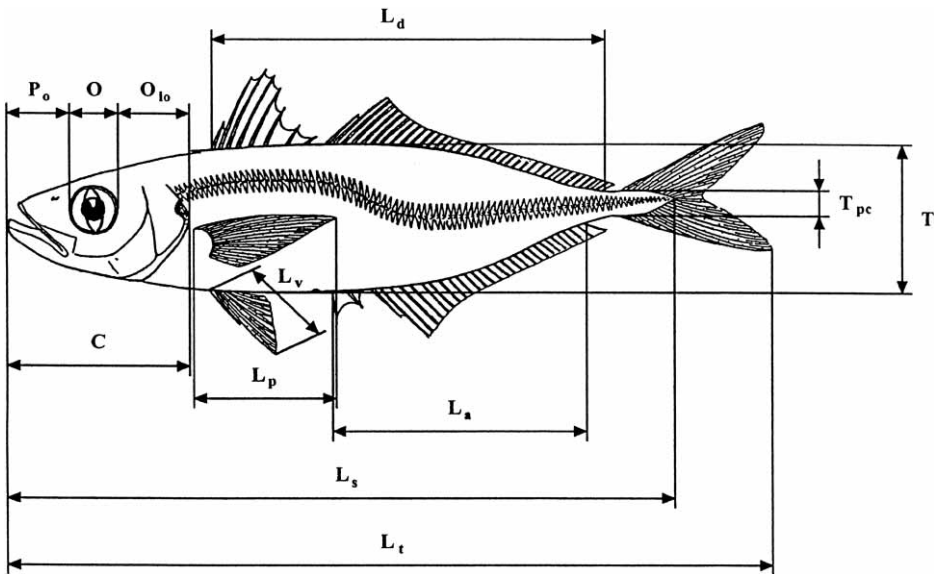


Fig. 2. Morphometric measurements taken on Mediterranean horse mackerel:  $L_t$  – total length,  $L_s$  – standard length,  $C$  – head length,  $L_d$  – dorsal fin length,  $L_a$  – anal fin length,  $L_p$  – pectoral fin length,  $L_v$  – ventral fin length,  $T$  – maximum body height,  $T_{pc}$  – minimum body height,  $O$  – eye diameter,  $P_o$  – preocular distance,  $O_{lo}$  – postocular distance.

**Tab. 1.** Relative relations of morphometric characters for females (N=105) and males (N=101) of Mediterranean horse mackerel. Explanations: Lt-total length; Ls-standard length; C-head length; Ld-dorsal fin length; La-anal fin length; Lp-pectoral fin length; Lv-ventral fin length; T-maximum body height; Tpc-minimum body height; O-eye diameter; Po-preocular distance; Olo-postocular distance.

Morph. characters	Sex	Range (in %)	$\bar{x} \pm SD$	$\Delta \bar{x}$	t	V(%)	$\Delta V$
Ls / Lt	F	82.76 – 86.95	84.75 $\pm$ 0.8828	0.01	0.08	1.04	0.02
	M	82.15 – 86.43	84.74 $\pm$ 0.8974			1.06	
C / Ls	F	25.54 – 29.40	26.86 $\pm$ 1.9330	0.17	1.01	4.46	0.21
	M	24.48 – 30.74	26.96 $\pm$ 1.2476			4.67	
Ld / Ls	F	51.26 – 57.74	54.67 $\pm$ 1.4396	1.96	0.20	2.63	0.17
	M	51.74 – 57.78	56.63 $\pm$ 1.5329			2.80	
La / Ls	F	34.40 – 41.07	38.32 $\pm$ 1.6082	0.19	0.76	4.19	1.02
	M	34.13 – 41.04	38.13 $\pm$ 1.9884			5.21	
Lp / Ls	F	22.64 – 28.77	26.36 $\pm$ 1.3368	0.28	1.45	5.07	0.29
	M	23.68 – 29.17	26.64 $\pm$ 1.4300			5.36	
Lv / Ls	F	12.63 – 16.10	14.15 $\pm$ 0.8253	0.11	0.95	5.83	0.03
	M	12.79 – 16.50	14.26 $\pm$ 0.8363			5.86	
T / Ls	F	17.97 – 23.37	20.70 $\pm$ 1.6846	0.08	0.41	8.13	3.03
	M	18.52 – 24.16	20.78 $\pm$ 1.0585			5.10	
Tpc / Ls	F	2.37 – 3.71	2.86 $\pm$ 0.2016	0.03	1.03	7.04	0.87
	M	2.43 – 3.80	2.89 $\pm$ 0.2287			7.91	
O / C	F	25.07 – 31.43	28.34 $\pm$ 1.7020	0.31	1.40	6.00	0.26
	M	25.23 – 30.74	28.03 $\pm$ 1.6106			5.74	
Po / C	F	28.17 – 32.88	30.88 $\pm$ 0.9450	0.23	0.55	3.06	0.03
	M	28.44 – 32.90	31.11 $\pm$ 0.9438			3.03	
Olo / C	F	37.29 – 43.68	40.60 $\pm$ 1.8254	0.40	1.63	4.50	0.29
	M	37.43 – 43.92	41.00 $\pm$ 1.7287			4.21	
Tpc / T	F	11.20 – 16.70	13.83 $\pm$ 0.9877	0.08	0.41	8.13	3.03
	M	12.22 – 16.95	13.97 $\pm$ 1.1667			5.10	
*m.h.s anterior L.l. / C	F	14.84 – 16.56	15.76 $\pm$ 0.5044	0.17	0.41	3.20	0.59
	M	14.90 – 16.20	15.59 $\pm$ 0.4040			2.61	
**m.h.s. posterior L.l. / C	F	15.85 – 17.57	16.90 $\pm$ 0.3919	0.12	1.27	2.31	0.84
	M	15.90 – 17.66	16.78 $\pm$ 0.5288			3.15	

F = females      \* m. h. s. anterior L.l. = maximum height of scales in anterior part of lateral line  
M = males      \*\* m. h. s. posterior L.l. = maximum height of scales in posterior part of lateral line

$\bar{x}$  = mean values

SD = standard deviation

$\Delta \bar{x}$  = differences of mean values between males and females

t = values of t-test

V=variability coefficient

The total and standard lengths were measured with a fish meter to the nearest 0.1 cm. The rest were measured with the caliper to the nearest 0.01 mm. Measurements of the head were expressed as percentages of head length whereas the other body measurements were expressed as percentages of standard length (Ls). The standard length was expressed as percentage of total length (Ls/Lt) and minimum height was expressed as percentage of maximum body height (Tpc/T). Maximum height of scales in the anterior and posterior parts of the lateral line was expressed as a percentage of head length. Specific characters and some biometric properties were expressed in range and modal values.

Arithmetic mean, standard deviation and variability coefficient were the methods used in processing numerical data. Significance of the differences in the characters studied between males and females were tested with *t*-test (SOKAL & ROHLE, 1981). Polynomial regression was applied to the examination of morphometric relations in comparison with an increase in total length (KOVAC *et al.*, 1999).

## RESULTS AND DISCUSSION

Differences in mean values of measured morphometric relations between males and females were not statistically significant in any individual case (Tab. 1). In ad-

**Tab. 2.** Relative relations of morphometric characters for total sample (females, males and immature specimens) of Mediterranean horse mackerel (N=237) and polynomial regression. Explanations for coefficients: a, b, c = regression coefficients of the polynomial regression ( $y = a + bx + cx^2$ ),  $R^2$ =determination coefficient.

Morph. characters	Range (in %)	$\bar{x} \pm SD$	V (%)	a	b	c	$R^2$	Form of curve
Ls/Lt	82.15 – 86.95	84.72 ± 0.8963	1.05	83.156	0.1517	-0.0021	0.8802	parabola
C/Ls	24.48 – 30.93	27.22 ± 1.6320	5.99	31.165	-0.0131	0.0047	0.9796	hyperbola
Ld/Ls	50.00 – 57.78	54.31 ± 1.6744	3.08	48.705	0.3754	-0.0026	0.9884	parabola
La/Ls	34.13 – 41.07	38.19 ± 1.7249	4.51	39.552	-0.1749	0.0013	0.9206	hyperbola
Lp/Ls	22.64 – 29.17	26.48 ± 1.3392	5.05	23.402	0.1798	-0.0005	0.9630	parabola
Lv/Ls	12.63 – 17.12	14.43 ± 1.0137	7.02	19.281	-0.2553	0.0024	0.9623	hyperbola
T/Ls	17.95 – 24.16	20.83 ± 1.3777	6.61	23.734	-0.1465	0.0014	0.9266	hyperbola
Tpc/Ls	2.37 – 3.80	2.90 ± 0.2200	7.58	3.7004	-0.0532	0.0006	0.9474	hyperbola
O/C	25.07 – 31.43	28.21 ± 1.6141	5.72	28.797	0.0309	-0.0016	0.9285	parabola
Po/C	28.17 – 32.90	31.01 ± 0.9496	3.06	28.833	0.1933	-0.0019	0.9317	parabola
Olo/C	37.29 – 43.92	40.68 ± 1.7663	4.34	41.107	0.0547	0.0027	0.9339	hyperbola
Tpc/T	11.20 – 16.95	13.96 ± 1.0525	7.53	16.936	-0.1617	0.0012	0.9589	hyperbola
*	14.43 – 16.20	15.52 ± 0.5452	3.51	16.902	0.0961	-0.0003	0.9767	parabola
**	15.80 – 17.66	16.70 ± 0.4765	2.85	17.143	0.0899	-0.0004	0.9892	parabola

\* = maximum height of scales in anterior part of lateral line

\*\* = maximum height of scales in posterior part of lateral line

**Tab. 3.** Meristic characters for females (N=105) and males (N=101) of Mediterranean horse mackerel. Explanations: D = number of rays in dorsal fin; A = number of rays in anal fin; P = number of rays in pectoral fin; V = number of rays in ventral fin; Brsp. = total number of branchiospines; L.lat. = number of scales in linea lateralis; Vert. = number of vertebrae; A.p. = number of pyloric appendices.

Peculiarity	Sex	Range	$\bar{x} \pm SD$	D	t	V (%)	DV
D	F	39 – 43	40.04 ± 1.1265	0.03	0.18	2.74	0.09
	M	39 – 43	41.07 ± 1.1634			2.83	
A	F	29 – 33	31.02 ± 1.0233	0.04	0.28	3.29	0.33
	M	29 – 33	30.98 ± 1.1223			3.62	
P	F	20 – 22	20.61 ± 0.5438	0	0	2.63	0.27
	M	20 – 22	20.61 ± 0.5995			2.90	
V	F	6	6.00 ± 0	0	0	0	0
	M	6	6.00 ± 0			0	
Brsp. (total)	F	52 – 56	54.80 ± 1.6630	0.08	0.39	2.33	0.70
	M	52 – 56	54.88 ± 1.6630			3.03	
L. lat.	F	79 – 92	85.72 ± 3.1024	0.70	1.75	3.61	0.46
	M	80 – 91	86.42 ± 2.7252			3.15	
Vert.	F	24	24.00 ± 0	0	0	0	0
	M	24	24.00 ± 0			0	
A. p.	F	15	15.00 ± 0	0	0	0	0
	M	15	15.00 ± 0			0	

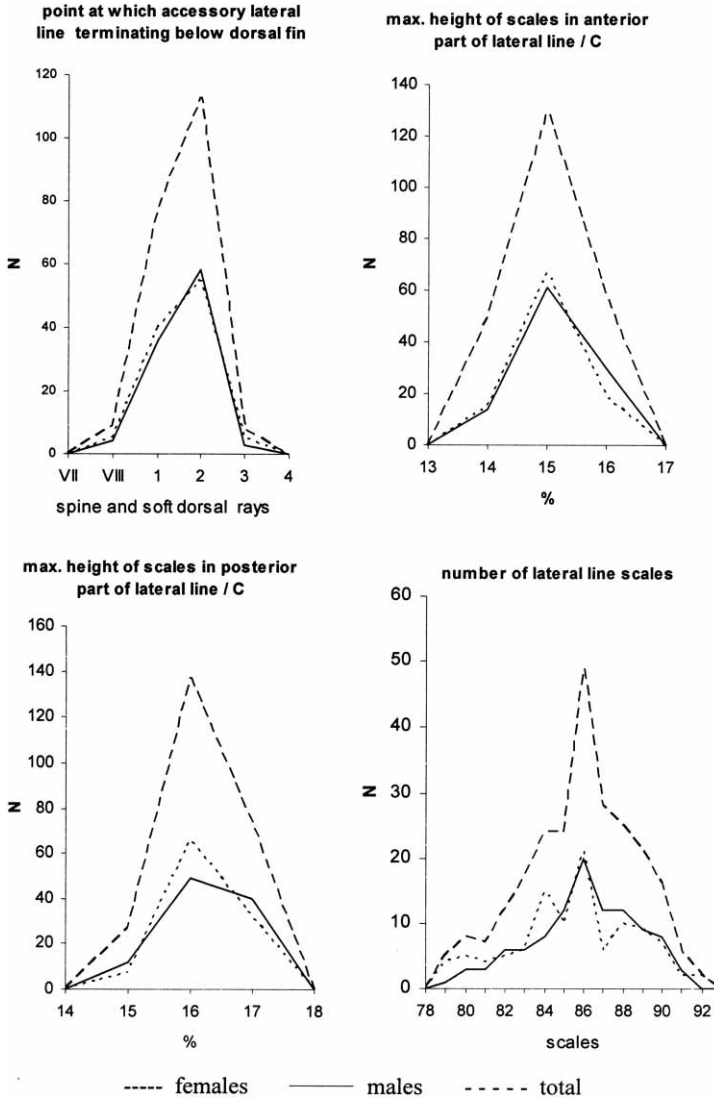
F = females

M = males

dition, morphometric relations for males, females and the total sample showed relatively low values of variability coefficient (Tab. 1 and 2). No differences in meristic characters were recorded between sexes either (Tab. 3).

Specific characters of the Mediterranean horse mackerel show that the mean value of maximal height of scales in the anterior part of the lateral line is 15.5 % of the head length. The mean value of maximal height of scales in the posterior part of the lateral line is 16.7 % of the head length (Tab. 2). This value is close to the figures given by SHABONEYEV (1980) (15.0% and 16.6%). Total number of scales in the lateral line ranges from 79–92. Other authors (Tab. 5) also give, more or less, the same range, but the number of scales in the lateral line does not exceed 93, which is a characteristic of *T. mediterraneus*. In this paper the mean value of the lateral line scale number is  $86.2 \pm 2.8$  (Tab. 4). This value is very close to the mean number of scales in the lateral line ( $\bar{x} = 83.2$ ) given by SHABONEYEV (1980).

Modal values of some specific morphologic characters are displayed in Figure 3. All characters are unimodal. Other morphometric (Fig. 4) and meristic characters (Fig. 5) are also unimodal. The existence of a single mode shows that possibly there is no morphological difference between the collected specimens. Probably, these re-



**Fig. 3.** Some specific characters of Mediterranean horse mackerel – number of lateral line scales; point at which the accessory lateral line terminates below the dorsal fin; maximal height of scales in anterior and posterior part of the lateral line (in percentage of head length), for female, males and total samples.

sults indicate the possibility of a homogenous morphology stock in the Mediterranean horse mackerel in the central Adriatic Sea. On the basis of branchiospines, vertebrae and dorsal fin rays analysis, KRPO (1987) reported that a homogenous morphology stock in the Atlantic horse mackerel exists in the central Adriatic.



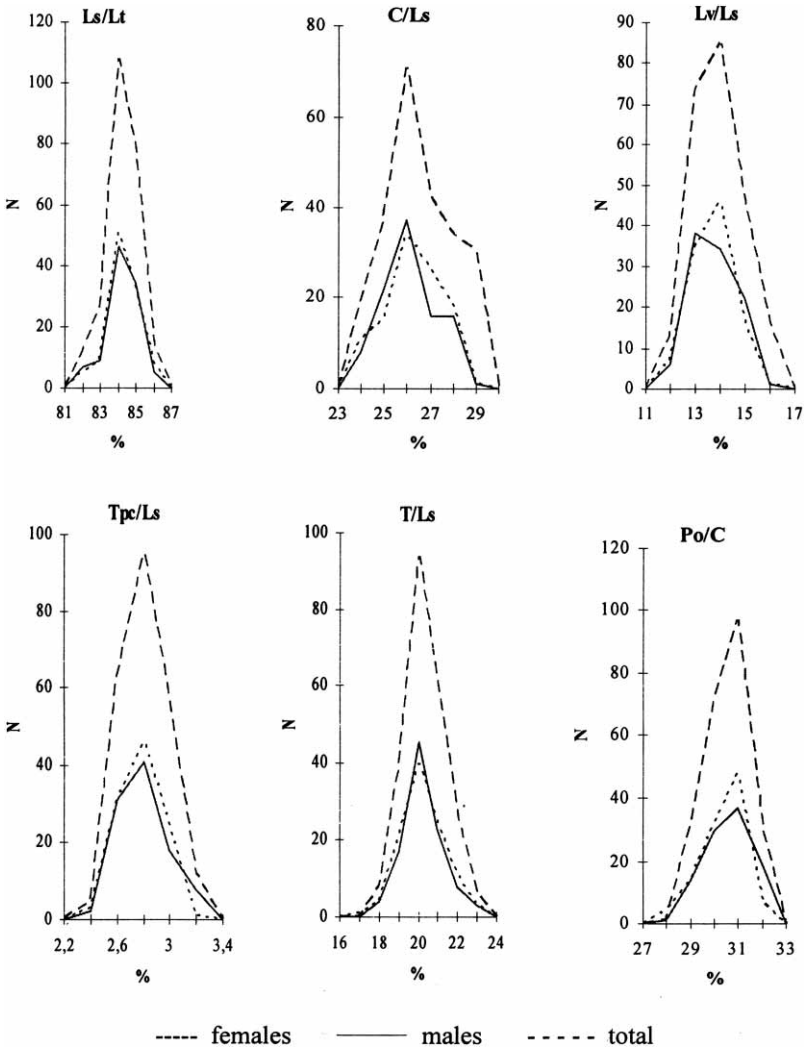


Fig. 4. Percentage distributions of some morphometric characters (Ls/Lt, C/Ls, Lv/Ls, Tpc/Ls, T/Ls Po/C) for female, males and total samples of Mediterranean horse mackerel.

The coefficients of polynomial regression indicate that fish with a lesser body length have longer head (C/Ls), anal (La/Ls) and ventral fins (Lv/Ls) as well as greater maximum (T/Ls) and minimum (Tpc/Ls) body height (Tab. 2). At the same time they have shorter dorsal (Ld/Ls) and pectoral (Lp/Ls) fins than adult fishes. As to the other morphometric relations, smaller specimens have smaller preorbital (Po/C) and postorbital (Olo/C) distances, bigger eye diameter (O/C) and maximum height of scales in the lateral line than larger specimens. Preorbital and po-

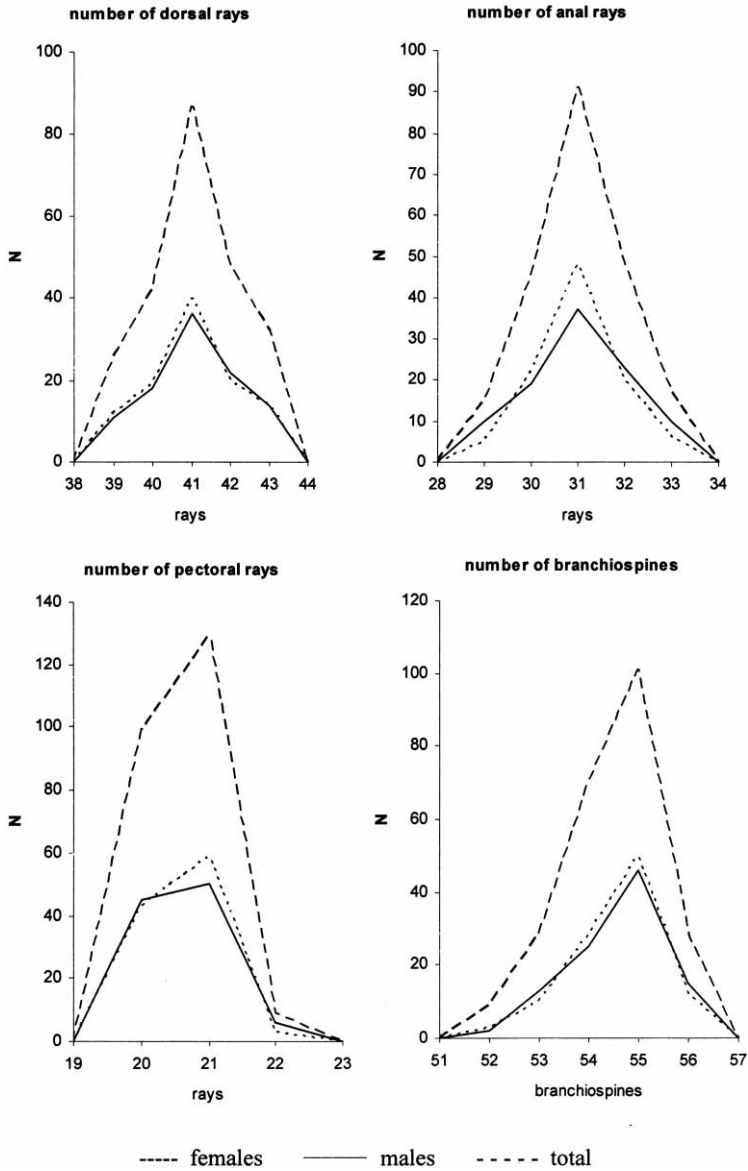


Fig. 5. Meristic characters (number of dorsal, anal and pectoral rays and number of branchiospines) for female, males and total samples of Mediterranean horse mackerel.

storbital distances and maximum height of lateral line scales increase relatively to Mediterranean horse mackerel body length. The negative correlation recorded for the maximum (T/Ls) and minimum body depth (Tpc/Ls) indicates that the body becomes progressively elongated.

**Tab. 4.** Meristic characters for total sample (females, males and immature specimens) of Mediterranean horse mackerel (N=237).

Peculiarity	Range	$\bar{x} \pm SD$	V (%)
D	39 – 43	41.05 ± 1.1560	2.81
A	29 – 33	31.03 ± 1.0286	3.31
P	20 – 22	20.22 ± 0.5592	2.71
V	6	6.00 ± 0	0
Brsp.	52 – 56	54.86 ± 1.4404	2.62
L. lat.	79 – 92	86.22 ± 2.8267	3.27
Vert.	24	24.00 ± 0	0
A. p.	15	15.00 ± 0	0

**Tab. 5.** Meristic characters of Mediterranean horse mackerel from the Adriatic Sea, Mediterranean and NE Atlantic.

Area and data of authors	D	A	P	V	L.lat.	Brsp.	Vert.
Central Adriatic (our results)	VIII+I/30–34	II+I/26–30	20–22	I/5	79–92	52–56	10+14
Eastern Adriatic Jardas (1996)	VIII+I/29–35	II+I/26–39	20–21	I/5	76–93	–	10+14
Poljakov <i>et al.</i> (1958)	VIII+I/30–34	II+I/27–28	–	–	80–92	–	10+14
Italian coast Tortonese (1975)	VIII+I/32–33	II+I/26	20–21	I/5	78–95	–	–
Mediterranean Fisher <i>et al.</i> (1987)	VIII+I/29–35	II+I/26–39	–	–	75–89	49–59	10+14
Mediterranean and NE Atlantic Smith – Vaniz (1986)	VIII+I/29–35	II+I/26–39	–	–	75–89	49–58	–

In the available literature, data about other morphometric characters are very rare. Only SHABONEYEV (1980) gives the mean value of the body depth, which he states to be 21.7% of the standard length (T/Ls). These data are close to the data (20.8%) in our study (Tab. 2).

Meristic characters of *T. mediterraneus* from the central Adriatic Sea (Tab. 4) were compared with the available literature data (Tab. 5). The same numbers of vertebrae and rays of ventral (V) and pectoral fins (P) are recorded for *T. mediterraneus* from different localities. The variations in the range of branched rays in dorsal (D) and anal (A) fins were also very small. It was experimentally established that the number of vertebrae is genetically fixed within narrow limits, and that the aberrations of smaller extent that may occur are probably affected by temperature during the so-called sensitive period (BLAXTER, 1957). The number of spin rays in the dor-

sal fin (D) was also constant in fish from different areas (Tab. 5). The mean numbers of branchiospines in the Mediterranean horse mackerel from Tunisian coast (55.56), Malta (56.50), Aegean Sea (55.35) and Gulf of Lyons (55.76) are very similar (BEN-SALEM *et al.*, 1981). These data are very close to the mean value obtained in our study (54.86).

The meristic characters of Mediterranean horse mackerel from different Mediterranean and north-eastern Atlantic areas are mostly in agreement with the data obtained in our study.

In conclusion, results in this study show that there are no morphological differences between males and females. Biometric analysis indicated changes in some morphometric characters during fish growth as well as the possibility of the existence of a homogenous morphology stock in the Mediterranean horse mackerel in the central Adriatic.

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## SAŽETAK

### Biometrijske osobine šnjura pučinara, *Trachurus mediterraneus*, (Osteichthyes: Carangidae) u srednjem Jadranu

I. Jardas, M. Šantić & A. Pallaoro

Šnjur pučinar (*T. mediterraneus*) je semipelagična riba koja se u Jadranu nalazi na dubinama od 20 do 200 m. Biologija ove vrste uglavnom je poznata, ali morfometrijsko-merističke raščlambe nisu sustavno istražene. Za istraživanje je ulovljeno 237 primjeraka u komercijalnom kočarskom ulovu u srednjem Jadranu. Uzorak je sadržavao 105 ženki, 101 mužjaka i 31 spolno nezrelu jedinku. Istraženo je 15 morfometrijskih i 8 merističkih osobina. Cilj ove studije bio je istražiti morfološke razlike između mužjaka i ženki, postojanje morfološki homogenog ili heterogenog stoka šnjura pučinara u srednjem Jadranu i promjene morfometrijskih osobina tijekom rasta ribe.

Nisu utvrđene morfometrijske i merističke razlike između mužjaka i ženki, tj. nije izražen spolni dimorfizam. Modalne vrijednosti specifičnih karktera, kao što je broj ljustaka u bočnoj pruzi, najveća visina ljustaka u prednjem i stražnjem dijelu bočne pruge, točka gdje završava dodatna leđna bočna pruga i ostale morfometrijsko-merističke osobine ukazuju da u srednjem Jadranu vjerojatno obitava morfološki homogena populacija ove vrste. Koeficijenti polinomijalne regresije pokazuju da manji primjerci šnjura pučinara imaju dužu glavu, podrepu i trbušne peraje te veću najmanju i najveću tjelesnu visinu. Kod ostalih morfometrijskih odnosa manji primjerci imaju kraći predočni i zaočni prostor, a veći promjer oka u odnosu na velike primjerke. Negativna korelacija zabilježena kod najveće i najmanje visine tijela ukazuje da se porastom tijelo sve više izdužuje uz istodobno smanjivanje glave. Merističke osobine šnjura pučinara s različitih područja Mediterana i sjeveroistočnog Atlantika uglavnom se podudaraju s podacima dobivenim u ovom radu.