Growth and feeding habits of the brown comber, *Serranus hepatus* (Linnaeus, 1758) in Izmir Bay, Aegean Sea

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Age, growth and diet of brown comber, Serranus hepatus*, were determined from specimens collected in Izmir Bay, Aegean Sea. Total length ranged from 5.20 to 11.70 cm, while weight varied between 1.89 and 24.97 g. The length-weight relationship was* $W=0.0157*L^{2.998}$*. Age was determined by otolith readings, where a maximum age of 4 years was observed. The von Bertalanffy growth parameters were estimated as* $L_\infty=11.90$ *cm,* $k=0.56$*,* $t_o=-1.14$*. Stomach content analysis revealed that the species is carnivorous, with benthic crustaceans constituting the main food in the overall diet composition.*

Key words: age, growth, diet, *Serranus hepatus*, Aegean Sea

INTRODUCTION

The brown comber, *Serranus hepatus* (L., 1758), is a small sized demersal fish inhabiting sandy, muddy bottoms and seagrass beds at depths generally not exceeding 200 m (BAUCHOT, 1987). It occurs in the eastern Atlantic from Portugal to the Canary Islands and African coasts southward to Senegal, and also throughout the Mediterranean excluding the Black Sea (TORTONESE, 1986; BILECENOGLU *et al.*, 2002).

In most parts of the Mediterranean Sea, *S. hepatus* is a common species of the bottom trawl catch composition. Unlike its two other congeneric species (*S. scriba* and *S. cabrilla*), the brown comber has no commercial value primarily due to its small size, and generally becomes part in the discarded catch. As a consequence, knowledge of its biology and ecology are limited. Studies on age and growth of the species are available from Tunisian coasts (BOUAIN, 1983),

Thermaikos Gulf (WAGUE & PAPACONSTANTINOU, 1997), the Cretan shelf (LABROPOULOU *et al.*, 1998) and Adriatic Sea (DULČIĆ *et al.*, 2007). Information on the diet of brown comber is available from Marseille Gulf (BELL & HARMELIN-VIVIEN, 1983) and the Cretan shelf (LABROPOULOU & ELEFTHERIOU, 1997; LABROPOULOU *et al.*, 1998). The length-weight relationship of the species was given from several localities throughout the Mediterranean, i.e. Portuguese coasts (GONÇALVES *et al.*, 1997), Balearic islands (MERELLA *et al.*, 1997), Greek coasts (STERGIOU & MOUTOPOULOS, 2001; LAMPRAKIS *et al.*, 2003), Spanish coasts (VALLE *et al.*, 2003) and Egyptian coasts (ABDALLAH, 2002).

Despite its abundance along Turkish coasts, no studies concerning the population dynamics parameters of *S. hepatus* exists. The species is not consumed as food, yet due to its high proportion in the bottom trawl discard, the brown comber population has been evaluated as near

threatened in Turkey FRICKE *et al.* (2007), thus making any biological data that we could possess of great importance. In this study, information on the age, growth and feeding habits of *S. hepatus* are presented for the first time from Turkish coasts, based on material collected in Izmir Bay, Aegean Sea.

MATERIAL AND METHODS

The study was based on material collected from Izmir Bay during January, May and October 2002 on board the R/V Hippocampus equipped with a bottom trawl of 22 mm mesh size net (Fig.1).

Twelve trawling hauls were carried out at a cruise speed of 2 miles/hr at depths ranging from 20 to 50 m during the daytime. Each hauling period was restricted to 60 minutes.

A total of 603 brown comber specimens were captured during the study period. Total lengths (TL, cm) were measured to the nearest 0.1 cm and wet weights (W, g) to the nearest 0.01 gram. The commonly used length-weight relationship $W = aL^b$ was applied, where W is the weight (g), L is the total length (cm) and a and b are constants (SPARRE & VENEMA, 1992).

All sagittal otoliths were removed, their excess tissues cleaned and kept in labeled envelopes. Otoliths were examined after being placed in a concave black dish under the reflected light of a stereomicroscope at a magnification of ×20. For the estimation of individual growth rate, the von Bertalanffy growth equation for length was used:

Fig. 1. Sampling locality of Serranus hepatus *in Izmir Bay (shaded zone indicates the bottom trawling ground)*

$$L_t = L_\infty \left[1 - e^{- k (t - to)}\right]$$

where L_t is the total length at age t, L_∞ the asymptotic total length, k the growth curvature parameter and t_0 the theoretical age when fish would have been at zero total length (SPARRE & VENEMA, 1992).

The growth performance index (φ', phiprime) was employed to compare growth rates, with the formula

$$\varphi' = \log k + 2\log L_\infty \quad (\text{PAULY \& MUNRO, 1984})$$

Stomachs were removed from 207 specimens, and prey items were identified to the lowest possible taxon. Prey were counted under a stereomicroscope and weighed to the nearest 0.01 g. Percentage frequency of occurrence (F%), percentage numerical abundance (N%), percentage gravimetric composition (W%) and index of relative importance

$$[IRI = (N\% + W\%) \times F\%]$$

were determined (HYSLOP, 1980). IRI was expressed as a percentage

$$[IRI\% = (IRI \times 100) / \textstyle\sum IRI]$$

RESULTS

The brown comber specimens had total lengths ranging from 5.2 to 11.7 cm, with a mean value of 9.02 cm (std.dev. = 1.17). Modal length group was 9.0 – 9.9 cm, which represents 56.6% of the total number of specimens (Fig. 2). Concerning their wet weight, obtained specimens ranged between 1.89 and 24.97 g, with a mean value of 11.93 g (std.dev. = 4.12). The 10.0–11.9 g weight group was abundant, representing 21.9% of the whole sample. The total length – weight relationship was calculated as

$$W = 0.0157 * L^{2.998} \quad (r^2 = 0.97)$$

The results of otolith readings are given in Table 1. A total of 45 specimens could not be aged. The dominant age group was 2 years
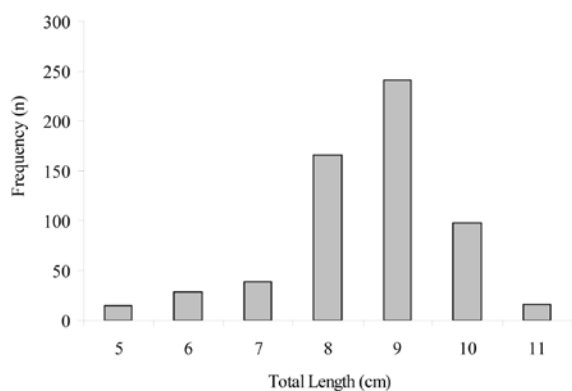
Fig. 2. Total length frequency distribution of Serranus hepatus

(51.3% of the population), and the maximum observed age was 4 years. Specimens younger than 1 year and those older than 3 years were poorly observed in the examined samples. Length at age data obtained was used to calculate von Bertalanffy growth parameters as follows: L_∞=11.90 cm, k=0.56, t_o= −1.14. The phi-prime (ø') value was estimated as 1.90.

Stomach contents of brown comber specimens with lengths ranging from 5.5 to 11.0 were examined (mean total length = 9.04 cm), from which 76.3% included prey at different stages of digestion. Prey belonging to four major groups (Polychaeta, Crustacea, Echinodermata and Teleostei) were determined (Table 2). Natantia was the most important group (%IRI = 38.31), followed by Amphipoda (%IRI = 33.70) and Brachyura (%IRI = 20.20). In general, crustaceans constitute 94.42% of the diet. Other prey items had remarkably lower IRI values and can be regarded as accessory food. Among the teleost prey, only juvenile specimens of two demersal species (*Callionymus* sp. and *Lesueurigobius friesii*) were encountered, both of which are commonly observed over sandy and muddy bottoms of Izmir Bay.

DISCUSSION

There are different records concerning the maximum length of brown comber from the Mediterranean Sea. According to TORTONESE (1986), the species usually have sizes of 10–12 cm, attaining a maximum of 15 cm standard length. BAUCHOT (1987) mentions a higher maximum length of 25 cm. In previous studies conducted in the Aegean Sea, the largest brown comber specimens collected were 12.1 cm (LAMPRAKIS *et al.*, 2003), 12.7 cm (STERGIOU & MOUTOPOULOS, 2001), 14.0 cm (LABROPOULOU *et al.*, 1998) and 14.5 cm (WAGUE & PAPACONSTANTINOU, 1997). The largest fish obtained in the present study (11.7 cm) is somewhat smaller than previous records, but appears to be within the reported range.

The "*b*" values of the length-weight relationship equation of *S. hepatus* differed largely according to localities. STERGIOU & MOUTOPOULOS (2001) found b=1.89, whereas LAMPRAKIS *et al.* (2003) noted three different *b* values as 2.75, 3.12 and 3.16, indicating that these variations

Table 1. Age–length key for Serranus hepatus *from Izmir Bay, based on otolith readings*

Length Groups (cm)	Age Groups (year)					
	0+	1	2	3	4	Σ
5.0-5.9	13	2				15
6.0-6.9	3	25				28
7.0-7.9		39				39
8.0-8.9		107	27			134
9.0-9.9		30	211			241
10.0-10.9			48	37	3	88
11.0-11.9				9	4	13
Σ	16	203	286	46	7	558
Mean TL	5,68	8,35	9,81	10,75	11,23	
Std.dev.	0,29	0,78	0,45	0,35	0,42	

Table 2. Diet composition of Serranus hepatus *(N%: numerical composition, F%: frequency of occurrence, W%: gravimetric composition, IRI%: percentage index of relative importance)*

Prey Category	N%	F%	W%	IRI%
Polychaeta	7.73	7.73	2.92	4.04
Crustacea				
Mysidacea	4.83	1.93	0.29	0.59
Isopoda	1.45	1.93	0.29	0.18
Amphipoda	39.13	13.53	2.98	33.70
Anomura	0.48	0.97	0.57	0.04
Brachyura	10.14	17.39	39.97	20.20
Natantia	17.87	24.15	35.42	38.31
Crustacea (unidentified)	11.59	1.93	0.04	1.40
Echinodermata				
Ophiuroidea	3.86	2.90	6.29	0.94
Teleostei				
Callionymus sp.	1.69	1.93	9.33	0.44
Lesueurigobius friesii	1.21	1.45	1.90	0.15

may be due to different length ranges, seasons and number of specimens examined. A negative allometry was observed along Portuguese (b=2.72; GONÇALVES *et al.*, 1997) and Egyptian coasts (b=2.84; ABDALLAH, 2002), and a positive allometry along Spanish coasts (b=3.12; VALLE *et al.*, 2003), Balearic Islands (b=3.24; MERELLA *et al.*, 1997) and in the Adriatic Sea (b=3.19; DULČIĆ *et al.,* 2007). Izmir Bay specimens had exponent *b* values close to 3, indicating that the fish grows almost isometrically.

Mean length at ages and the resulting growth data parameters derived for *S. hepatus* showed distinct variations among previous studies. BOUAIN (1983) found the oldest brown comber specimen to be 4 years of age along Tunisian coasts and the growth parameters were calculated as L_∞=10.61 cm, *k*=0.25 (φ' = 1.45). According to results obtained by WAGUE & PAPACONSTANTINOU (1997), the brown comber is a short lived species attaining a maximum age of 4 years, where the von Bertalanffy parameters were estimated as L_∞=14.66 cm and *k*=0.23 (φ' = 1.69). LABROPOULOU *et al.* (1998) computed growth parameters separately by seasonalised, non-seasonalised equations and back calculated

lengths at age, and who found a rapid growth of *S. hepatus* to a maximum age of 5 years. A recent study conducted in the Adriatic Sea revealed that the brown comber is a relatively long lived species, where the oldest specimen was 7 years of age (DULČIĆ *et al.*, 2007). Growth data from Izmir Bay is similar to the results of LABROPOULOU *et al.* (1998), considering close values of phi-prime, i.e. 1.90 in Izmir Bay vs. 1.92 on the Cretan shelf, although different from *S. hepatus* populations on the Tunisian coast (BOUAIN, 1983) and in the Adriatic Sea (DULČIĆ *et al.*, 2007). Such growth variations may be related to habitat characteristics, physico-chemical parameters of the environment or abundance and accessibility of prey items.

Diet composition of *S. hepatus* from Izmir Bay revealed that the species is carnivorous, especially consuming benthic decapod crustaceans as primary food. In terms of percentage weight, natantians and brachyurans made up almost 75.0% of the overall diet. Although amphipods had low W% values, their numerical abundance was high, thus representing an important prey group in terms of IRI% values, following natantians (Table 2).

Similar results were obtained from the Cretan shelf, where decapods constituted the major proportion of the diet composition (IRI%=60.90), followed by Mysidacea (IRI%=12.60) and Amphipoda (IRI%=10.90) (LABROPOULOU *et al.*, 1998). A previous study along northern Crete again indicated crabs and shrimps as the main food items, followed by teleost prey such as *Boops boops*, *Aphia minuta*, *Gobius* spp., *Sardina pilchardus* and *Spicara* sp. (LABROPOULOU & ELEFTHERIOU, 1997). According to a study on a low number of brown comber specimens from Marseille Gulf, the species prefers crabs as the main food (W%=57.0), followed by other crustaceans, amphipods and mysids (BELL & HARMELIN-VIVIEN, 1983).

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Rast i prehrambene navike vučića, *Serranus hepatus* (Linnaeus, 1758) u zaljevu Izmir, Egejsko more

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SAŽETAK

Starost, rast i prehrambene navike vučića, *Serranus hepatus*, su ustanovljene na primjercima prikupljenim u Izmirskom zaljevu, Egejsko more. Ukupna duljina kretala se od 5.20 do 11.70 cm, a težina od 1.89 do 24.97 g. Duljinsko-maseni odnos je iznosio $W=0.0157*L^{2.998}$. Starost je određena prema očitanju otolita, te je ustanovljena maksimalna starost od 4 godine. Von Bertalanffy-ijevi parametri rasta su iznosili kao što slijedi: $L_\infty=11.90$ cm, $k=0.56$, $t_0=-1.14$. Analiza sadržaja želudaca je otkrila da ova vrsta spada u mesoždere jer su u njezinoj prehrani najzastupljeniji bili raci.

Ključne riječi: starost, rast, prehrana, *Serranus hepatus*, Egejsko more