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Some biological aspects of brown comber, *Serranus hepatus* (L.) (Pisces: Serranidae), in the Sea of Marmara, Turkey

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Abstract: Age, growth, gonadosomatic index and condition factor of brown comber, *Serranus hepatus* (L.) were evaluated from 162 specimens collected in Bandırma Bay, the Sea of Marmara between the years of 2012 and 2013 by the hauls of trawls. Total length ranged between 6.5-11.1 cm, while weight varied between 3.62 and 21.52 g. The length-weight relationship was $W=0.0216*L^{2.84}$, showing negative allometry. According to otolith readings, samples were determined between 1–5 years. The von Bertalanffy growth parameters were estimated as L_∞=12.46 cm, k=0.19 year^{-1}, t_o=–4.32, W_∞=34.77 g, k=0.09 year^{-1} and t_o=-1.63. Although brown comber has no economic value for Turkish Seas, it is important in the view of biodiversity.

Keywords: *Serranus hepatus*, Sea of Marmara, Growth, Sex-ratio.

Introduction

The brown comber, *Serranus hepatus* (L.), is a small subtropical serranid species which occurs along the coasts of the Eastern Atlantic Ocean from Portugal to the Canary Islands and Senegal as well as throughout the Mediterranean Sea (Smith, 1990). It occurs as demersal fish inhabiting sandy, muddy and rocky bottoms and seagrass beds at depths generally not exceeding 200 m (Smith, 1981; Whitehead et al., 1986; Jardas, 1996) except for Black Sea (Mater et al., 2003). The brown comber has been considered to be among the most abundant fish species over the Adriatic continental shelf (Jardas, 1996). Furthermore, the feeding habits of the species were stated by Bilecenoğlu (2009) and Özgen (2012). They mentioned that the brown comber is a carnivorous species, mostly consuming benthic decapod crustaceans, Ophiurids and Polychateans for İzmir Bay.

In spite of its widespread occurrence, *S. hepatus* is of low commercial value, probably due to its small size (Dulcic et al., 2007). Very little is known about the species biology and ecology. While Bouain (1983) reported data on the linear growth of *S. hepatus* from the Tunisian coast, Wague and Papaconstantinou (1997) and Labropoulou et al. (1998) presented data on age, growth, mortality and feeding habits of the brown comber in the Thermaikos Gulf and on the Cretan shelf (Aegean Sea). Dulcic et al. (2007) determined growth and mortality of brown comber in the eastern Adriatic (Crotian Coast). The length-weight relationships of the species were given from several localities throughout the Mediterranean, i.e. Portuguese coasts (Gonçalves et al., 1997), Balearic islands (Merella et al., 1997), Greek coasts (Lamprakis et al., 2003), Spanish coasts (Valle et al., 2003) and Egyptian coasts (Abdallah, 2002).

The brown comber is generally captured by bottom trawling as a by-catch species throughout the year in the Aegean Sea and the Sea of Marmara, The annual total catch or total number of landings of the species is unknown for Turkey. Despite the species has low economic value, there are some publications concerning various aspects of biology, ecology, and fisheries of brown comber in Aegean Sea (Çiçek et al., 2006; Bilecenoğlu, 2009; Gürkan and Bayhan, 2010; Yapıcı et al., 2012; Soykan et al., 2013). Furthermore, Sangün et al. (2007) estimated von Bertalanffy growth equations of the species in the Mediterranean Sea while Düzbastılar et al. (2010) studied the survival of the species escaping from the cod-end of a bottom trawl.

The fact that the brown comber population has been evaluated as near threatened in Turkey (Fricke et al.,

Table 1. Age-length key of *Serranus hepatus* from Bandırma Bay in the years of 2012-2013.

Length intervals (cm)	Ages					
	1	**2**	**3**	**4**	**5**	**Total**
6.5-6.9	1					1
7.0-7.4	0					0
7.5-7.9	5					5
8.0-8.4	4	11				15
8.5-8.9		40				40
9.0-9.4		12	39			51
9.5-9.9			12	26		38
10.0-10.4					9	9
10.5-10.9					2	2
11.0-11.4					1	1
Total	10	63	51	26	12	162

2007) and little information on the species leads us to examine the population structure of *S. hepatus* to provide better knowledge and thus to protect the brown comber stock in Bandırma Bay, the Sea of Marmara. This study will be fundamental for understanding the growth potential of this stock.

Materials and Methods

The study was carried out, based on material collected from Bandırma Bay (40°25'3"N, 28°2'22"E), the Sea of Marmara during years of 2012 and 2013 on board the vessel Şükriye Ana equipped with a beam trawl and bottom trawl of 22 mm mesh size net.

In this study, a total of 162 brown comber specimens were captured. 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 $W = \alpha L^b$ was applied, where W is the weight (g), L is the total length (cm) and α and b are constants (Avşar, 2005).

Age determination was carried out from microscopic examination of sagittal otoliths. Growth was examined according to length and weight. The relative growth in length (RGL) and weight (RGW) were computed by the following formulas (Bagenal and Tesch, 1978; Avşar, 2005):

$$RGL(\%)=[(L_t - L_t\text{-}1) / L_t] \times 100$$

$$RGW(\%)=[(W_t - W_t\text{-}1) / W_t] \times 100$$

For the estimation of individual growth rate, the von Bertalanffy growth equation for length was used:

$$L_t=L_\infty [1-e^{-k(t- t_0)}]$$

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, while the von Bertalanffy growth equation for weight was used:

$$W_t=W_\infty [1-e^{-k(t- t_0)}]^b$$

Where W_t is the total weight at age t, W_∞ the asymptotic total weight, k the growth curvature parameter and t_0 the theoretical age when fish would have been at zero total length, b regression coefficency are (Sparre and Venema, 1992).

The growth performance index (φ', phiprime) was employed to compare growth rates, with the Formula (Munro, 1984):

$$\varphi'=\log k + 2\log L_\infty$$

Relative growth rate in length and weight were estimated as following:

The relationship between TL and W was calculated for all individuals using the allometric model: $W=\alpha * L^b$, (Avsar, 2005), where W is fish total body mass in grams, TL is total length in cm, α is constant and b the allometric coefficient.

Condition factor (CF) as $CF=[(W\text{-}GW)/L^3)*100$ and gonadosomatic index as $GSI=[GW/(W\text{-}GW)\times 100]$ were calculated (Avşar, 2005)

Results

Length–weight frequency distributions: Of 162 specimens measured, TL of males ranging from 6.5 to 11.1 cm while the weight varied from 3.62 to 21.52 g. (Figs. 1, 2, Table 1).

Age composition: The results of reading scale rings are given in Table 1 and Figure 3. The otoliths of 162 specimens were successfully aged. Age classes ranged from 2 to 5 years, with a predominance of age 2 in the catch Age 2, ranging in lengths from 8.0 to 9.4 cm TL (38.9%) dominated the sample. Because of selectivity of

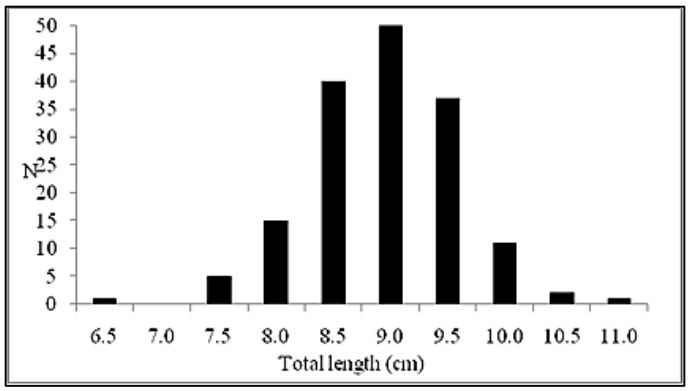

Figure 1. *Serranus hepatus* in Bandırma Bay. Length distribution as determined samples taken in the years of 2012-2013 (n= number of fish).

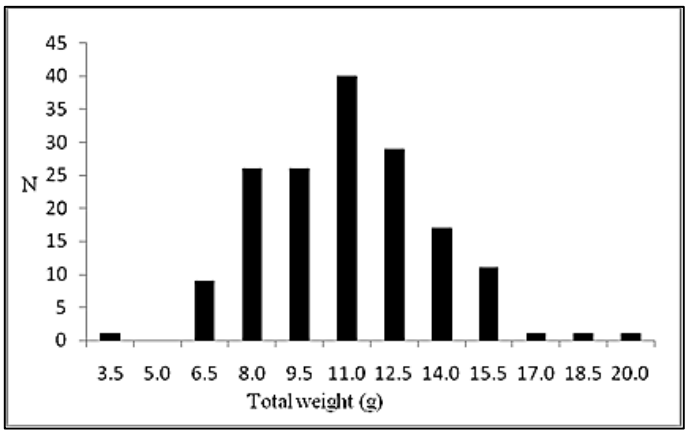

Figure 2. *Serranus hepatus* in Bandırma Bay. Weight distribution as determined samples taken in the years of 2012-2013 (n= number of fish).

the nets, the 0 age group was not represented in the samples. There was some overlapping of individuals with same lengths, especially for the ages from 1 to 4.

Growth: The von Bertalanffy growth equations (age-length, age-weight relationships) calculated with mean lengths and weights at different ages were found as:

$$L_t = 12.46\ (1\text{-}e^{-0.19(t+4.32)})$$

$$W_t = 34.77(1\text{-}e^{-0.09(t+1.63)})^{2.84}$$

The asymptotic length and weight, 12.46 cm and 34.77 g. are realistic since the largest specimen sampled were of 11.1 cm, and 21. 52 g. The phi-prime (ø') value was estimated as 1.48.

Relative Growth in Length: To determine the growth speed of age groups in Bandırma Bay the increase in length between age groups and the increase in ratio and growth characteristics were calculated and are shown in Table 2.

To determine the growth speed of ages in Bandırma Bay, the increase in length and weight between ages and

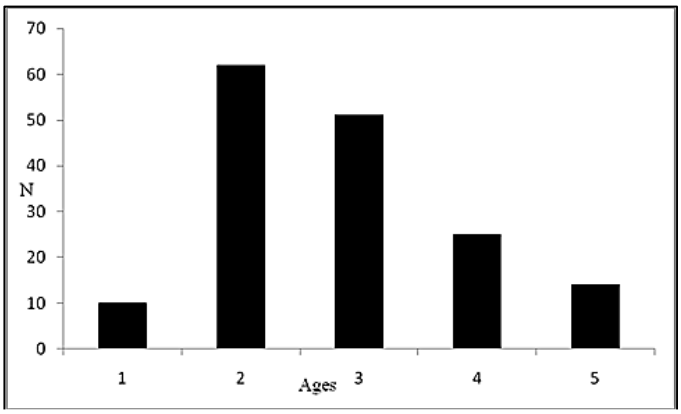

Figure 3. *Serranus hepatus* in Bandırma Bay. Age composition as determined samples taken in the years of 2012-2013 and based on otolith readings (n= number of fish).

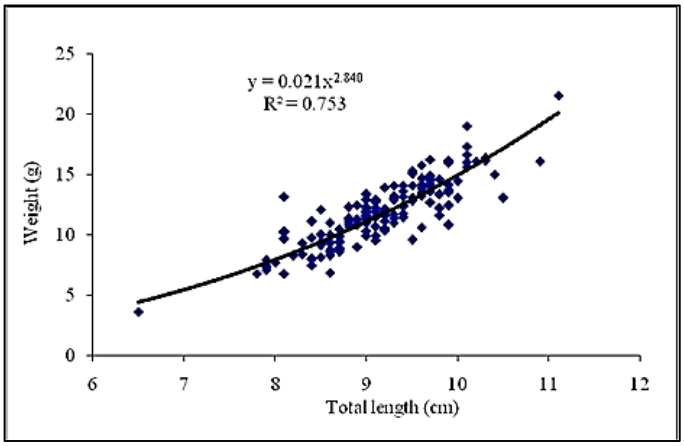

Figure 4. *Serranus hepatus* in Bandırma Bay. Length-weight relationship of samples taken in the years of 2012-2013.

the increase in ratio were calculated and are shown in Table 2. As seen, individuals in length and weight were more likely up to age II in the population.

Length-weight relationship: The length–weight relationship was calculated including both sexes, $W=0.021*L^{2.840}$. The slope *b* was significantly different from 3.0 (t-test, $P>0.05$), indicating negative allometric growth (Fig. 4).

Condition Factor: The condition factor values of the *S. hepatus* population according to age are shown in Table 1. Average condition factor (CF) differences were statistically insignificant among individuals in consecutive age groups in the population ($P>0.05$).

Gonadosomatic index (GSI%): The values of GSI in ages 2 and 5, were especially found to be statistically significant ($P<0.05$, t-test; Table 1).

Discussion

In this study, a total of 162 specimens of *S. hepatus* from

Table 2. Mean total length (cm), mean weight (g.), relative growth rate (RGR), mean condition factor (CF), and gonadosomatic index (GSI), Standard error (SE) for different ages of *Serranus hepatus* in Bandırma Bay as determined samples taken in the years of 2012-2013.

Age	N	TL±SE (min-max.)	RGR in L	W±SE (min-max.)	RGR in W	CF±SE (min-max.)	GSI±SE (min-max.)
1	10	7.82±0.15 (6.5-8.1)		7.44±0.56 (3.62-10.87)		1.50±0.05 (1.30-1.71)	3.49±0.36 (1.40-5.49)
			10.87		35.75		
2	63	8.67±0.03 (8.1-9.1)		10.1±0.20 (6.76-13.92)		1.43±0.02 (1.03-1.86)	3.72±0.19 (0.82-11.72)
			7.38		22.38		
3	51	9.31±0.03 (9.0-9.6)		12.36±0.04 (9.94-15.12)		1.48±0.03 (1.14-2.39)	3.51±0.16 (1.48-6.05)
			4.62		12.22		
4	26	9.74±0.02 (9.5-9.9)		13.87±0.30 (9.56-16.23)		1.51±0.03 (1.26-1.90)	3.57±0.26 (1.05-7.11)
			5.75		17.02		
5	12	10.3±0.10 (10.0-11.1)		16.23±0.66 (12.41-21.52)		1.53±0.04 (1.28-1.85)	3.17±0.38 (1.70-6.33)

Bandırma Bay were examined between the years of 2012 and 2013. Individuals of the stock ranged between 1 to 5 years of ages. Length at infinity (L_∞) was calculated as 12.46 cm while weight at infinity ($W\infty$) was 34.77 g, growth coefficients (k) were 0.19 and 0.09 y^{-1}, and the hypothetical times at which the length are equal to 0 (t_0) were –4.32 and -1.63y, respectively (α=0.021, b=2.84, R^2=0.753). The growth performance index (φ') of the samples was determined as 1.48. The t-test results showed that there were significant differences between the growth performance indexes of the other studies. Variations in fish growth in terms of length and weight can be explained as an adaptive response to different ecological conditions (Nikolsky, 1963; Wootton, 1992). The theoretical maximum length was close to this estimated for Uzunada, İzmir Bay in Turkey (Table 3). Minimum-maximum lengths recorded prior to our study were 2.4-18.9 cm (Table 3). This variation may be due to different stages in ontogenetic development, as well as differences in condition, length, age, sex and gonadal development (Ricker, 1975). Geographic location and some environmental conditions such as temperature, organic matter, quality of food, time of capture, stomach fullness, disease, parasitic loads (Bagenal and Tesch, 1978), temperature, organic matter, quality of food and the water system in which the fish live (Wootton, 1992) can also affect weight at- age estimates.

The ages of captured fish ranged between 1 and 5. The fact that 39.0% of the specimens was in age 2 indicated that the population was mostly young individuals. This situation was also reported for İzmir Bay population (Bilecenoglu, 2009). Labropoulou et al. (1998) determined the ages to be between 0 and 5 years. Furthermore, Dulčić et al. (2007) reported on individuals between 2 and 7 years old while Bilecenoğlu (2009) and Soykan et al. (2013) reported the maximum age as 4 years. These differences in the age distribution of the populations may be due to gill net selectivity, fishing activity, feeding habits and the ecological characteristics of the lakes and reservoirs (Nikolsky, 1980) (Table 3).

In this study, the values of condition were determined as 1.03-2.39 in both sexes. Özgen (2012) has reported a similar pattern for İzmir Bay. The slope (b) value of the length–weight relationship in all individuals (b=2.84) showed that weight increased with length in negative allometry. For the same species, the b values are shown in Table 3. As seen in Table 3, b value for Bandırma Bay was found to be close to estimates by Dulcic and Glamuzina (2006), Abdallah (2002), Özgen (2012) and Yapıcı et al. (2012) but also different from those found by Dulcic and Glamuzina (2007), Gürkan and Bayhan (2010), and Akalın et al. (2015). The b values are often 3.0 and generally between 2.5 and 3.5. As the fish grows, changes in weight are relatively greater than changes in length, due to approximately cubic relationships between fish length and weight. The b values in fish differ according to species, sex, age, seasons and feeding (Bagenal and Tesch, 1978; Froese, 2006). The fact that values of brown comber in the Bandırma Bay are closer to 3 CF means that the chub was in rich condition. As seen in Table 3, our findings in CF confirm the literature by Özgen (2012).

Gonad development was followed using the GSI. Differences in GSI between ages, especially age 2, was

Table 3. Age structure, parameters of length–weight relationship (α and *b*), growth (L_∞, *k*, t_0) of *Serranus* hepatus in this and previous studies (– indicates absence of data).

References	Locality	Age	Length	Weight	N	a	b	R^2	W∞	L∞	t_0	k	Φ
Bilecenoglu (2009)	İzmir Bay	0-4	5.2-11.7	1.89-24.97	603	0.0157	2.998	0.97	-	10.61	-1.14	0.56	1.90
Gonçalves et al.(1997)	Porteguese	-	8.5-13.8	-	69	0.00006	2.77	-	-	-	-	-	-
Abdallah (2002)	Eygpt	-	3.1-12.5	-	153	0.025	2.84	-	-	-	-	-	-
Borges et al. (2003)	-	-	6.7-13.1	-	123	0.0177	2.977	-	-	-	-	-	-
Valle et al. (2003)	Spain	-	3.4-7.9*	-	87	0.0111	3.12	-	-	-	-	-	-
Çiçek et al. (2006)	-	-	2.4-10.5	-	584	0.0161	3.29	-	-	-	-	-	-
Dulcic and Glamuzina (2006)	Adriatic	-	5.4-18.9	-	87	0.0112	3.123	-	-	-	-	-	-
Dulcic et al. (2007)	Adriatic	2-7	5.8-13.2	-	1218	0.010	3.19	-	-	14.82	-1.67	0.217	1.68
Özgen (2012)	İzmir Bay	-	6.3-11.7	-	2827	0.03-0.164	2.76	0.62-0.87	-	-	-	-	-
Waque and Papacon (1997)	Greek	-	-	-	-	-	-	-	-	14.66	-2.56	0.23	1.69
Labrapoulou et al. (1998)	Cretan Shelf	0-5	3.1-14.0	-	1268	-	-	-	-	15.20	-0.57	0.36	1.92
Sangün et al. (2007)	Mediterran	-	4.8-13.0	1.69-38.56	573	0.0143	3.044	0.95	-	-	-	-	-
Morey et al. (2003)	Spain	-	-	-	22	0.044	-	0.928	-	-	-	-	-
Irmak (2006)	İzmir Bay	-	-	-	-	0.0182	2.91	-	-	-	-	-	-
Birim (2009)	İzmir Bay	-	-	-	-	0.0004	2.33	-	-	-	-	-	-
Veiga et al. (2009)	-	-	4.1-10.5	-	64	0.0142	3.110	-	-	-	-	-	-
Gürkan and Bayhan (2010)	İzmir Bay	-	6.0-11.1	-	204	0.0096	3.223	-	-	-	-	-	-
Yapıcı et al (2012)	Uzunada	4	6.5-11.70	3.53-25.80	5222	0.02	2.89	0.85	-	12.59	-1.08	0.54	1.93
Soykan et al. (2013)	İzmir Bay	1-8	3.9-12.3	-	2410	0.013	3.11	-	39.38	13.19	-0.63	0.25	1.64
Akalın et al. (2015)	Çandarlı		5.6-15.0	2.03-47.3	762	0.0107	3.162	0.92	-	-	-	-	-
This study	Bandırma	1-5	6.5-11.1	3.62- 21.5	162	0.021	2.84	0.753	34.77	12.46	-4.32	0.19	1.48

also found to be statistically significant (P<0.05, t-test; Table 1).

Table 3. Age structure, parameters of length–weight relationship (α and b), growth (L_∞, k, t_0) of *S. hepatus* in this and previous studies (– indicates absence of data)

The maintenance of a well-balanced population is of importance in terms of economical fishing of this species in the region. Soykan et al. (2013) reported that the first sexual maturity in length is 7.8 cm. According to our findings in Bandırma Bay, the fishes under average 7.8 cm should not be caught during the fishing period. This will lead to improvements in both the productivity of the population and fishing.

References

Abdallah M. 2002. Length-weight relationship of fishes caught by trawl off Alexandria, Egypt. Naga. ICLARM Q, 25(1): 19-20.

Akalın S., İlhan D., Özaydın O. 2015. Length-weight relationships for 30 demersal fish species from Çandarlı Bay (North Aegean Sea, Turkey). Croatian Journal of Fisheries, 73: 73-76.

Avsar D. 2005. Fishery biology and population dynamics, Cukurova University, Handbook 5. Baki publishing, Adana, 303 p.

Bagenal T.B., Tesch F.W. 1978. Age and growth. In: T.B. Bagenal (Ed.). Methods for the assessment of fish production in fresh waters. Blackwell Scientific Publication, Oxford, UK. pp: 101-136.

Bilecenoglu M. 2009. Growth and feeding habits of the brown comber, *Serranus hepatus* (Linnaeus, 1758) in Izmir Bay, Aegean Sea. Acta Adriatica, 50(1): 105-110.

Birim D. 2009. Reproduction characteristics of combers, *Serranus cabrilla* (Linnaeus, 1758) and *Serranus hepatus* (Linnaeus, 1758) in İzmir Bay. M.Sc. thesis. University of Dokuz Eylül.

Bouain A. 1983. Croissance lineaire des serrans des cotes sud-est de la tunisie: proceedings of Rapp. Community international Mer Méditerranean, 28(5): 87-91.

Dulčić J., Matić-Skoko S., Paladin A., Kraljević M. 2007. Age, growth and mortality of brown comber, *Serranus hepatus* (Linnaeus, 1758) (Pisces: Serranidae), in the eastern Adriatic (Croatian coast). Journal of Applied Ichthyology, 23: 195-197.

Dulčić J., Glamuzina B. 2006. Length-weight relationships for selected fish species from three eastern Adriatic estuarine systems (Croatia). Journal of Applied Ichthyology, 22: 254-256.

Düzbastılar F.O., Ozgül A., Aydın İ., Gül B., Soykan O. 2010. A preliminary study on the survival of brown comber, *Serranus hepatus* (Actinopterygii, Perciformes, Serranidae), escaping from the codend of a bottom trawl. Acta Ichthyoogica Piscatoria, 40(1): 27-36.

Frickle R., Bilecenoglu M., Sarı H.M. 2007. Annotated checklist of fish and lamprey species (Gnathostoma and Petromyzontomorphi) of Turkey, including a Red List of threatened and declining species. Stuttg. Beitr. Nat. Kd. A Biology, 706: 1-169.

Gonçalves J.M.S., Bentes L., Lino P.G., Ribeiro I., Canário A.V.M., Erzini K. 1997. Weight-length relationships for selected fish species of the small-scale demersal fisheries of the south and south-west coast of Portugal. Fisheries Research, 30: 253-256.

Gürkan Ş., Bayhan B. 2010. Biometric properties of brown comber, *Serranus hepatus* (Linnaeus, 1758) in İzmir Bay. University of Süleyman Demirel. Journal of Eğirdir Fisheries and Water Products, 6 (1): 14-19. (In Turkish)

Irmak E. 2006. Investigation of some biological properties of brown comber, *Serranus hepatus* (L. 1758) in İzmir Bay. M.Sc. thesis, University of Ege.

Jardas I. 1996. Adriatic ichthyofauna. Sˇ kolska knjiga, Zagreb, 533 p.

Labropoulou M., Tserpes G., Tsimenidis N. 1998. Age, growth and feeding habits of the brown comber *Serranus hepatus* (Linnaeus, 1758) on the Cretan shelf. Estuarine Coast. Shelf Science, 46: 723-732.

Mater S., Kaya M., Bilecenoğlu M. 2003. Atlas of Turkish Marine Fishes, University of Ege, Fisheries and Water Products Faculty Publications, Bornova, İzmir, No: 68 (in Turkish).

Nikolsky G.V. 1963. The ecology of fishes (translated by L. Birkett). Academic Press, London, 352 p.

Nikolsky G.V. 1980. Theory of fish population dynamics as the biological background for rational exploitation and management of fishery resources. Koengstein, Otto Koeltz Science Publishers, 323 p.

Özgen Ö. 2012. An investigation on the feeding ecology of brown comber (*Serranus hepatus* (Linnaeus, 1758)) in İzmir Bay. M.Sc. thesis. University of Ege.

Pauly D., Munro J.L. 1984. Once more on the comparison of growth in fish and invertebrates. Fishbyte, 2 (1): 21.

Ricker W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish Res. Board Can. 191, 382 p.

Sangün L., Akamca E., Akar M. 2007. Weight-length relationships for 39 fish species from the north-eastern Mediterranean coast of Turkey. Turkish Journal of Fisheries and Aquatic Sciences, 7: 37-40.

Smith C.L. 1981. Serranidae. In W. Fischer, G. Bianchi and W.B. Scott (eds.) FAO species identification sheets for fishery purposes. Eastern Central Atlantic; fishing areas 34,

47 (in part). Department of Fisheries and Oceans Canada and FAO. Vol. 4. pag. var. (Ref. 2739).

Smith C.L. 1990. Serranidae. p. 695-706. In: J.C. Quero, J.C. Hureau, C. Karrer, A. Post and L. Saldanha (Eds.). Check-list of the fishes of the eastern tropical Atlantic (CLOFETA). JNICT, Lisbon; SEI, Paris; and UNESCO, Paris. vol. 2 (Ref. 3589)

Sokal R., Rohlf F.J. 1981. Biometry. The principles and Practice of Statistics in Biological Research, 2nd. ed. Freeman publishing, Newyork, 832 p.

Soykan O., Ilkyaz A.T., Metin G., Kınacıgil H.T. 2013. Growth and reproduction of brown comber (*Serranus hepatus* Linnaeus, 1758) in the central Aegean Sea, Turkey, Turkish Journal of Zoology, 37: 211-217.

Sparre P., Venema C.S. 1992. Introduction to tropical fish stock assessment, Part I: Manual, FAO Fisheries Technical Paper, 306, 376 p.

Valle C., Bayle J.T., Ramos A.A. 2003. Weightlength relationships for selected fish species of the western Mediterranean Sea. Journal Applied Ichthyology, 19: 261-262.

Wague A., Papaconstantinou C. 1997. Age, growth and mortality of the brown comber *Serranus hepatus* (L. 1758) (Pisces, Serranidae) in the Thermaikos Gulf (Aegean Sea, Greece). Marine Life 1/2: 39–46.

Whitehead P.J.P., Bauchot M.-L.,Hureau J.-C., Nielsen J., Tontonese E. (Editors), 1986, Fishes of the North-Eastern Atlantic and Mediterranean, vol. II., 780-793, Paris, Unesco.

Wootton R.J. 1992: Fish ecology. Blackwell, Glasgow, 203 p.

Yapıcı S., Filiz H., Özkan Ö. 2012. Age, growth, reproduction and feeding habits of brown comber, *Serranus hepatus* (L., 1758) in eastern Aegean Sea, Biharean Biologist, 6(2): 99-107.