

1-1-2013

Length-weight relationships of 22 fish species from the Gallipoli Peninsula and Dardanelles (northeastern Mediterranean, Turkey)

ÖZGÜR CENGİZ

Follow this and additional works at: <https://journals.tubitak.gov.tr/zoology>



Part of the [Zooology Commons](#)

Recommended Citation

CENGİZ, ÖZGÜR (2013) "Length-weight relationships of 22 fish species from the Gallipoli Peninsula and Dardanelles (northeastern Mediterranean, Turkey)," *Turkish Journal of Zoology*. Vol. 37: No. 4, Article 5. <https://doi.org/10.3906/zoo-1209-30>

Available at: <https://journals.tubitak.gov.tr/zoology/vol37/iss4/5>

This Article is brought to you for free and open access by TÜBİTAK Academic Journals. It has been accepted for inclusion in Turkish Journal of Zoology by an authorized editor of TÜBİTAK Academic Journals. For more information, please contact academic.publications@tubitak.gov.tr.

Length–weight relationships of 22 fish species from the Gallipoli Peninsula and Dardanelles (northeastern Mediterranean, Turkey)

Özgür CENGİZ*

Faculty of Marine Science and Technology, Çanakkale Onsekiz Mart University Çanakkale, Turkey

Received: 26.09.2012 • Accepted: 28.01.2013 • Published Online: 24.06.2013 • Printed: 24.07.2013

Abstract: Length–weight relationships are presented for 22 fish species from the Gallipoli Peninsula and Dardanelles between September 2006 and October 2009. The b values ranged between 2.78 and 3.28. All species' length–weight relationships were highly significant ($P < 0.001$).

Key words: Length–weight relationship, Gallipoli Peninsula, Dardanelles, Turkey

1. Introduction

Length–weight relationships (LWRs) have several applications. Establishment of a relationship between length and weight is necessary for the calculation of fish condition and biomass of a fish population (Anderson and Gutreuter, 1983; Petrakis and Stergiou, 1995). LWRs are also useful for life history and morphological comparisons of populations from different locations (Moutopoulos and Stergiou, 2002), and these relationships allow conversion of a growth equation in length to a growth equation in weight (Gonçalves et al., 1997).

Information concerning the LWRs of the fish species in the study area is incomplete. The current data from previous investigations of LWRs for fish species comes from Saros Bay by İşmen et al. (2007), İşmen et al. (2009), Özekinci et al. (2009), and Yiğın and İşmen (2009); Gökceada by Karakulak et al. (2006); Edremit Bay by Çakır et al. (2008); and Çanakkale by Özen et al. (2009). For this reason, the present study provides data on LWRs of 22 fish species from the Gallipoli Peninsula and Dardanelles.

2. Materials and methods

Samples were collected by handlines, gill nets, and trammel nets at depths of 0–40 m from the Gallipoli Peninsula and Dardanelles, between September 2006 and October 2009 (Figure).

Fish were identified based on Mater et al. (2003). The scientific name for each species was checked according to Froese and Pauly (2012). Fish were weighed to the nearest gram (total weight) and measured to the nearest centimeter (total length). LWRs were estimated by fitting

an exponential curve, $W = aL^b$ (Le Cren, 1951). Parameters a and b of the exponential curve were estimated by linear regression analysis over log-transformed data $\log W = \log a + b \log L$, where W is the total weight (g), L is the total length (cm), a is the intercept, and b is the slope, using the least-squares method. The degree of association between the variables was computed by the determination coefficient, r^2 . The growth type was identified by Student's t -test. The coefficients obtained were analyzed with SPSS 19.0.

3. Results and discussion

A total of 2524 individuals of 22 species belonging to 10 families were sampled. The sample size, minimum and maximum lengths and weights, estimated parameters of LWR (a and b), standard error of b , determination coefficient (r^2), and growth type (GT) are given in Table 1 for each species, respectively.

The b coefficient provides an indication of the growth pattern for a specific population (Bagenal and Tesch, 1978). More precisely, when the b parameter has value greater than 3.0 the species presents a positive allometric growth; values of b lower than 3.0 display negative allometric growth. If b equals 3.0, isometric growth is indicated. In this study, the b values ranged from 2.78 for *Pagellus bogaraveo* to 3.28 for *Sardinella aurita*. All species' LWRs were highly significant ($P < 0.001$).

Comparison of LWRs between the present study and other studies is shown in Table 2. LWR parameters (a and b) of the fish could be attributed to the degree of gonad maturity, sex, diet, sample preservation techniques,

* Correspondence: ozgurcengiz17@gmail.com

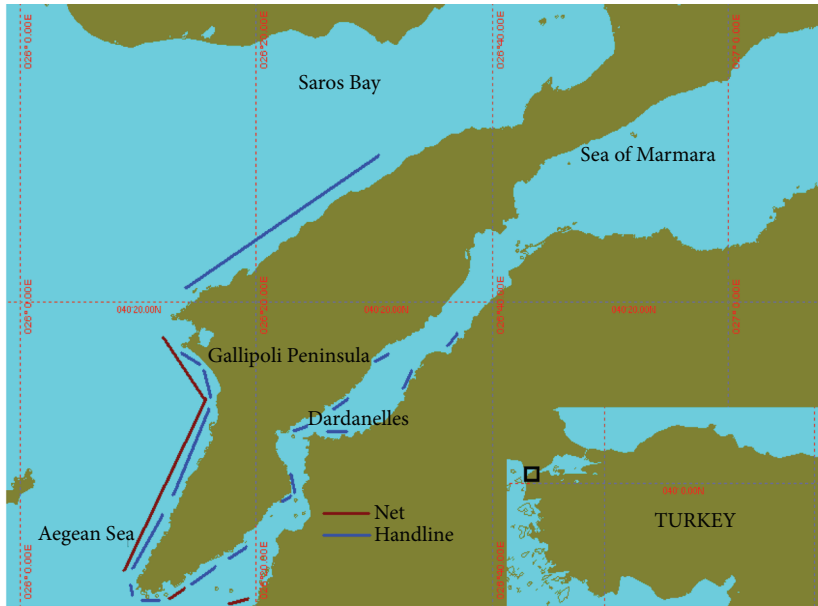


Figure. Study area.

Table 1. Length–weight relationships for 22 fish species from the Gallipoli Peninsula and Dardanelles.

Family	Species	N	Length range		Weight range		a	b	SE(b)	r ²	GT
			L _{min}	L _{max}	W _{min}	W _{max}					
Belonidae	<i>Belone belone</i>	30	30.7	71.5	28.59	446.87	0.0005	3.19	0.065	0.98	+
Carangidae	<i>Trachurus mediterraneus</i>	489	11.6	27.1	8.95	172.28	0.0060	3.13	0.018	0.98	+
	<i>Trachurus trachurus</i>	151	10.2	19.0	9.49	64.56	0.0086	3.01	0.022	0.96	0
Centracanthidae	<i>Spicara smaris</i>	114	11.3	18.9	14.91	73.69	0.0105	3.01	0.073	0.94	0
Clupeidae	<i>Sardina pilchardus</i>	146	11.6	16.1	7.55	34.14	0.0055	3.12	0.075	0.92	+
	<i>Sardinella aurita</i>	26	16.4	24.6	37.58	144.89	0.0014	3.28	0.163	0.95	+
Labridae	<i>Coris julis</i>	30	14.5	20.2	31.89	84.87	0.0063	3.18	0.154	0.94	+
Mullidae	<i>Mullus barbatus</i>	102	8.7	20.1	6.83	99.13	0.0062	3.22	0.051	0.98	+
	<i>Scomber japonicus</i>	69	15.0	26.4	23.56	157.88	0.0039	3.23	0.089	0.98	+
Scombridae	<i>Scomber scombrus</i>	58	16.4	29.0	31.74	191.30	0.0061	3.08	0.104	0.94	0
Scorpaenidae	<i>Scorpaena scrofa</i>	134	8.6	29.1	15.11	454.42	0.0221	2.96	0.035	0.98	-
Serranidae	<i>Serranus cabrilla</i>	41	11.9	23.5	20.26	181.27	0.0116	3.03	0.079	0.97	0
	<i>Serranus scriba</i>	53	12.0	22.6	25.02	203.79	0.0093	3.16	0.075	0.97	+
Sparidae	<i>Diplodus annularis</i>	282	8.7	19.4	10.63	126.22	0.0153	3.05	0.025	0.98	0
	<i>Diplodus vulgaris</i>	50	9.9	28.4	16.71	347.08	0.0199	2.92	0.037	0.99	-
	<i>Lithognathus mormyrus</i>	45	18.6	28.1	83.01	259.65	0.0187	2.86	0.083	0.97	-
	<i>Oblada melanura</i>	97	12.7	26.1	27.66	222.36	0.0180	2.89	0.037	0.98	-
	<i>Pagellus acarne</i>	228	11.2	23.8	18.36	182.23	0.0119	3.03	0.041	0.96	0
	<i>Pagellus bogaraveo</i>	92	11.4	20.9	19.31	105.62	0.0238	2.78	0.086	0.92	-
	<i>Pagellus erythrinus</i>	32	11.1	24.2	21.11	164.21	0.0209	2.84	0.062	0.98	-
	<i>Sarpa salpa</i>	99	8.1	32.0	7.4	442.00	0.0126	3.02	0.027	0.99	0
	<i>Spondyliosoma cantharus</i>	156	9.4	31.7	12.75	659.18	0.0083	3.26	0.045	0.97	+

N = Sample size; min and max = minimum and maximum; a and b = the parameters of the relationships; S.E. = standard error; r² = the coefficient of determination; GT = growth type; 0 = isometric; + = positive allometry; - = negative allometry.

assisted in both field work and the laboratory.

Table 2. Comparison of length-weight relationships between the present study and other studies.

Species	This study ¹			Saros Bay ²			Gökçeada Island ³			Edremit Bay ⁴		
	N	L _{min}	L _{max}	W-L equation	N	L _{min}	L _{max}	W-L equation	N	L _{min}	L _{max}	W-L equation
<i>Belone belone</i>	30	30.7	71.5	W = 0.0005L ^{3.19}	-	-	-	-	-	-	-	-
<i>Coris julis</i>	30	14.5	20.2	W = 0.0063L ^{3.18}	16	16.4	22.1	W = 0.0039L ^{3.15}	35	13.4	18.2	W = 0.0082L ^{3.05}
<i>Diplodus annularis</i>	282	8.7	19.4	W = 0.0153L ^{3.05}	108	8.8	15.6	W = 0.0160L ^{3.01}	372	7.7	17.7	W = 0.0068L ^{3.31*}
<i>Diplodus vulgaris</i>	50	9.9	28.4	W = 0.0199L ^{2.92}	23	10.2	19.1	W = 0.0092L ^{3.13*}	93	9.0	25.0	W = 0.0858L ^{2.43*}
<i>Lithognathus mormyrus</i>	45	18.6	28.1	W = 0.0187L ^{2.86}	-	-	-	-	-	-	-	-
<i>Mullus barbatus</i>	102	8.7	20.1	W = 0.0062L ^{3.22}	3386	6.0	24.7	W = 0.0076L ^{3.09*}	76	12.5	22.3	W = 0.0049L ^{3.27}
<i>Oblada melanura</i>	97	12.7	26.1	W = 0.0180L ^{2.89}	-	-	-	W = 0.0034L ^{3.46*}	316	9.1	19.8	W = 0.0034L ^{3.46*}
<i>Pagellus acarne</i>	228	11.2	23.8	W = 0.0119L ^{3.03}	-	-	-	-	-	-	-	-
<i>Pagellus bogareveo</i>	92	11.4	20.9	W = 0.0238L ^{2.78}	2355	6.5	25.1	W = 0.0074L ^{3.19*}	-	-	-	-
<i>Pagellus erythrinus</i>	32	11.1	24.2	W = 0.0209L ^{2.84}	2480	7.2	27.0	W = 0.0105L ^{3.05*}	169	9.9	29.8	W = 0.0124L ^{3.01*}
<i>Sarpa sarpa</i>	99	8.1	32.0	W = 0.0126L ^{3.02}	-	-	-	W = 0.0087L ^{3.13*}	80	11.1	31.2	W = 0.0087L ^{3.13*}
<i>Sardina pilchardus</i>	146	11.6	16.1	W = 0.0055L ^{3.12}	-	-	-	-	87	8	14.2	W = 3.10 ⁻⁵ L ^{2.76*}
<i>Sardinella aurita</i>	26	16.4	24.6	W = 0.0014L ^{3.28}	-	-	-	W = 0.0062L ^{3.07*}	50	16.4	26.2	W = 0.0062L ^{3.07*}
<i>Scomber japonicus</i>	69	15.0	26.4	W = 0.0039L ^{3.23}	45	12.2	22.0	W = 0.0016L ^{3.32*}	25	18.1	31.2	W = 0.0064L ^{3.10*}
<i>Scomber scombrus</i>	58	16.4	29.0	W = 0.0061L ^{3.08}	100	13.6	24.0	W = 0.0028L ^{3.29*}	54	22.0	31.1	W = 0.0025L ^{3.38*}
<i>Scorpaena scrofa</i>	134	8.6	29.1	W = 0.0221L ^{2.96}	-	-	-	W = 0.0180L ^{3.00}	15	12.3	39.1	W = 0.0180L ^{3.00}
<i>Serranus cabrilla</i>	41	11.9	23.5	W = 0.0116L ^{3.03}	34	11.0	27.5	W = 0.0086L ^{3.06}	91	11.9	19.8	W = 0.0112L ^{2.99}
<i>Serranus scriba</i>	53	12.0	22.6	W = 0.0093L ^{3.16}	-	-	-	W = 0.0065L ^{3.24}	311	10.2	21.3	W = 0.0065L ^{3.24}
<i>Spicara smaris</i>	114	11.3	18.9	W = 0.0105L ^{3.01}	1449	8.2	18.6	W = 0.0118L ^{2.91}	130	11.5	18.7	W = 0.0138L ^{2.87*}
<i>Spondyliosoma cantharus</i>	156	9.4	31.7	W = 0.0083L ^{3.26}	45	9.6	22.7	W = 0.0092L ^{3.17}	46	8.2	28.7	W = 0.0192L ^{2.87*}
<i>Trachurus mediterraneus</i>	489	11.6	27.1	W = 0.0060L ^{3.13}	446	7.5	20.9	W = 0.0031L ^{3.33*}	31	14.2	26.6	W = 0.0047L ^{3.17}
<i>Trachurus trachurus</i>	151	9.7	19.0	W = 0.0086L ^{3.01}	1205	7.5	33.0	W = 0.0046L ^{3.19*}	264	10.5	24.3	W = 0.0113L ^{2.90*}

*b-values significantly different from those of this study. 1 = using gill net, handline, and trammel net; 2 = İşmen et al. (2007) using bottom trawl; 3 = Karakulak et al. (2006) using gill net and trammel net; 4 = Çakur et al. (2008) using bottom trawl; N = sample size; W = weight; L = length; min = minimum; max = maximum.

stomach fullness (Wootton, 1990), number of specimens analyzed, area/season effects, sampling duration (Moutopoulos and Stergiou, 2002), fishing gear used (Kapiris and Klaoudaos, 2011), and size selectivity of the sampling gear (İşmen et al., 2007). Therefore, the possible reasons for differences in LWRs between other studies and this study may be related to one or more factors given above.

According to Froese et al. (2011), a sample size of about 100 specimens is considered to be adequate for the estimation of LWRs; there is no need to kill thousands of specimens only for LWR estimates.

Özen et al. (2009) reported the LWRs of 17 less-studied fish species from Çanakkale sampled using a beach seine. Although sampling area and, naturally, environmental conditions are very similar, none of the species that they mentioned were present in this study. Cengiz et al. (2011,

2012) emphasized that the variety of species within a region and/or between regions may be related to environmental conditions and different fishing gears used for sampling. The probable reason for differences in the variety of species between Özen et al. (2009) with this study is most likely due to different fishing gears used.

In conclusion, the data of this study could be used as a reference by biologists in surveys regarding fisheries management in the area, and to compare similar parameters in ongoing fishery studies for different Turkish and Mediterranean areas.

Acknowledgments

The present study was carried out with the financial support of TÜBİTAK (Project No: 106Y021 and 106O097). The author thanks Uğur ÖZEKİNCİ, Adnan AYAZ, Alkan ÖZTEKİN, Cahit CEVİZ, and Can Ali KUMOVA, who

References

- Anderson, R. and Gutreuter, S. 1983. Length, weight, and associated structural indices. In: Fisheries Techniques, American Fisheries Society (Eds., L. Nielsen and D. Johnson), American Fisheries Society, Bethesda, Maryland, USA, pp. 283–300.
- Bagenal, T.B. and Tesch, F.W. 1978. Age and growth. In: Methods for Assessment of Fish Production in Fresh Waters, 3rd ed. (Ed. T. Bagenal). IBP Handbook No. 3, Blackwell Science Publications, Oxford, pp. 101–136.
- Çakır, D.T., Koç, H.T., Başusta, A. and Başusta, N. 2008. Length-weight relationships of 24 fish species from Edremit Bay, Aegean Sea. E-journal of New World Sciences Academy. 3(1): 47–51.
- Cengiz, Ö., İşmen, A., Özekinci, U. and Öztekin, A. 2011. An investigation on fish fauna of Saros Bay (Northern Aegean Sea). AKU-J. Sci. 11: 31–37 (In Turkish with abstract in English).
- Cengiz, Ö., Öztekin, A. and Özekinci, U. 2012. Gelibolu Yarımadası ve Çanakkale Boğazı (Kuzeydoğu Akdeniz, Türkiye) Kıyılarında Dağılım Gösteren Balıklar Üzerine Bir Araştırma. Fırat Üniv. Fen Bilimleri Dergisi 24(2), 47–55 (In Turkish).
- Froese, R., Tsikliras, A.C. and Stergiou, K.I. (2011). Editorial note on weight-length relations of fishes. Acta Ichthyol. Pisc. 41(4): 261–263.
- Froese, R. and Pauly, D. (2012). FishBase. Available at: www.fishbase.org, version 10/2012.
- Gonçalves, J.M.S., Bentes, L., Lino, P.G., Ribeiro, J., Canário, A.V.M. and Erzini, K. 1997. Weight-length relationships for selected fish species of the small-scale demersal fisheries of the south and southwest coast of Portugal. Fish. Res. 30: 253–256.
- İşmen, A., Özen, O., Altınağaç, U., Özekinci, U. and Ayaz, A. 2007. Weight-length relationships of 63 fish species in Saros Bay, Turkey. J. Appl. Ichthyol. 23: 707–708.
- İşmen, A., Yiğın, C.C., Altınağaç, U. and Ayaz, A. 2009. Length-weight relationships for ten shark species from Saros Bay (North Aegean Sea). J. Appl. Ichthyol. 25 (Suppl. 1): 109–112.
- Kapiris, K. and Klaoudatos, D. 2011. Length-weight relationships for 21 fish species caught in the Argolikos Gulf (central Aegean Sea, eastern Mediterranean). Turk. J. Zool. 35(5): 717–723.
- Karakulak, F.S., Erk, H. and Bilgin, B. 2006. Length-weight relationships for 47 coastal fish species from the northern Aegean Sea, Turkey. J. Appl. Ichthyol. 22: 274–278.
- Le Cren, E.D. 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). J. Anim. Ecol. 20 (2): 201–219.
- Mater, S., Kaya, M. and Bilecenoglu, M. 2003: Türkiye Deniz Balıkları Atlası (III. Baskı), Ege Üniversitesi Su Ürünleri Fakültesi Yayınları, No. 68, İzmir (In Turkish).
- Moutopoulos, D.K. and Stergiou, K.I. 2002: Length-weight and length-length relationships of fish species from the Aegean Sea (Greece). J. Appl. Ichthyol. 18: 200–203.
- Özen, O., Ayyıldız, H., Öztekin, A. and Altın, A. 2009. Length-weight relationships of 17 less-studied fish species from Çanakkale, Marmara region of Turkey. J. Appl. Ichthyol. 25: 238–239.
- Özekinci, U., Cengiz, Ö., İşmen, A., Altınağaç, U. and Ayaz, A. 2009. Length-weight relationships of thirteen flatfishes (Pisces: Pleuronectiformes) from Saros Bay (North Aegean Sea, Turkey). J. Anim. Vet. Adv. 8(9): 1800–1801.
- Petrakis, G. and Stergiou, K.I. 1995. Weight-length relationships for 33 fish species in Greek waters. Fish. Res. 21: 465–469.
- Wootton, R.J. 1990. Ecology of Teleost Fish. Chapman and Hall, London.
- Yiğın, C.C. and İşmen, A. 2009. Length-weight relationships for seven rays from Saros Bay (North Aegean Sea). J. Appl. Ichthyol. 25 (Suppl. 1): 106–108.