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LENGTH-WEIGHT RELATIONSHIPS FOR 30 DEMERSAL FISH SPECIES FROM ÇANDARLI BAY (NORTH AEGEAN SEA, TURKEY)

Sencer Akalın, Dilek İlhan*, Okan Özaydın

Ege University, Faculty of Fisheries, 35100 Bornova-İzmir, Turkey

*Corresponding Author, E-mail: dilek.ilhan@ege.edu.tr

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ABSTRACT

Length-weight relationships were investigated for 30 demersal fish species from Çandarlı Bay in the North Aegean Sea. Fish samples were caught from depths of 30-95 m in five different stations by bottom trawl between March 2003 and August 2004. The *b* values in the length-weight relationship varied between 1.654 and 3.977, over 50% of which between 2.968 and 3.265 with a mean value of 2.949 (SE = ±0.05). The growth type was determined by t-test: 13 species (43%) showed positive allometries (b > 3; t-test, P < 0.05), 13 species (43%) isometric growth (b=3; t-test, P > 0.05) and the remaning 4 species (14%) negative allometries (b<3; t-test, P < 0.05).

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INTRODUCTION

Length-weight relationship is an important component in fish and fisheries biology and very useful for fish population dynamics and fisheries management (Froese et al., 2011). In spite of several studies on the length-weight relationship of various fish species in different parts of the Aegean Sea (Papaconstantinou and Tsimenides, 1979; Papaconstantinou and Tortonese, 1980; Kaya, 1993; Kaya and Mater, 1994; Petrakis and Stergiou, 1995; Cihangir et al., 1998; Benli et al., 1999; Kara and Gurbet, 1999; Bilecenoğlu et al., 2002; Moutopoulos and Stergiou, 2002; Özaydın and Taşkavak, 2006; Özaydın et al., 2007, Acarlı et al., 2014), fishes of Çandarlı Bay have not yet been studied in this respect. The present study described the length-weight relationships for 30 fish species from Çandarlı Bay (North Aegean Sea).

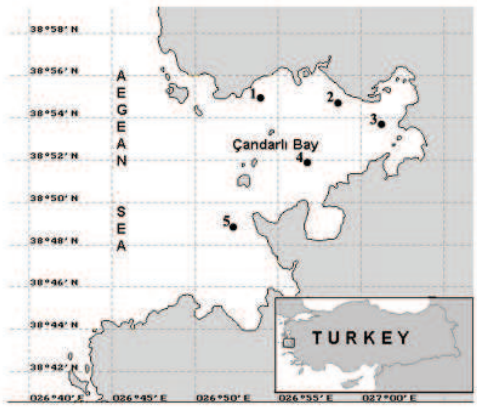

Fig 2. Sampling sites in Çandarlı Bay

MATERIAL AND METHODS

Fish samples were collected from March 2003 to August 2004 at five different stations in Çandarlı Bay using a conventional bottom trawl with a cod-end mesh size of 22 mm. Çandarlı Bay is located on the coast of the North Aegean Sea (38°58› – 38° 44› N and 26° 45› - 27° 05› E) with an area of 325 km^2 and a maximum depth of 138 m in the west entrance of the bay (Fig. 1).

Depth range of the fishing ground was 30 – 95 m. Trawl operations were carried out approximately 2.5 mile/hour of a steady speed aboard RV EGESÜF (27 m LOA, 500 HP main engine) for periods of thirty minutes per haul. Bottom-trawling excursions captured 6.177 specimens from 60 species

Table 1. Length-weight relationships for 29 fish species from Çandarlı Bay (North Aegean Sea) (n, sample size; L, length type; min, minimum; max, maximum; ave, average; C,: Confidence interval; *a* and *b* relationship parameters; SE(b), Standart error b; R^2, Coefficient of determination; G, Growth type (I: Isometric, A+: Positive allometric, A-: Negative allometric)

			Length Characteristics (cm)	Weight Characteristics (g)	LWR parameters				
Species	**n**	**L**	**Min-max (Ave±CI(95%))**	**Min-max (Ave±CI(95%))**	**a**	**b**	**SE(b)**	**R^2**	**G**
Blennidae									
Blennius ocellaris	23	TL	7.6-16.5 (11.13±2.256)	2.70-77.30 (20.92±16.672)	0.0009	3.977	0.205	0.980	+A
Bothidae									
Arnoglossus laterna	155	TL	5.7-17.9 (11.08±0.361)	1.22-38.65 (10.91±1.179	0.0045	3.185	0.042	0.975	+A
Carangidae									
Trachurus trachurus	242	FL	5.6-25.2 (9.53±0.217)	1.92-200.62 (9.93±1.903)	0.0077	3.101	0.039	0.962	-A
Centracanthidae									
Spicara maena	46	FL	11.4-17.0 (13.79±0.464)	14.8-54.1 (29.41±3.178)	0.0114	2.959	0.110	0.943	I
Spicara smaris	18	FL	9.2-16.4 (12.53±0.846)	2.70-77.30 (16.25±1.003)	0.0375	2.950	0.058	0.981	I
Cepolidae									
Cepola macrophthalma	213	TL	15.6-43.1 (28.97±0.849)	4.67-40.70 (24.44±1.004)	0.0736	1.654	0.035	0.849	-A
Citharidae									
Citharus linguatula	829	TL	5.7-24.0 (14.18±0.207)	1.22-111.09 (15.94±1.087)	0.0043	3.172	0.019	0.970	+A
Congridae									
Conger conger	11	TL	36.0-50.6 (42.98±2.425)	59.35-182.46 (112.41±21.929)	0.0004	3.337	0.302	0.931	I
Engraulidae									
Engraulis encrasicolus	26	FL	7.5-13.0 (9.45±0.569)	1.91-10.00 (3.63±0.738)	0.0064	2.791	0.156	0.930	I
Gadidae									
Trisopterus minutus	195	TL	7.9-21.2 (12.93±0.357)	4.15-118.9 (26.58±2.655)	0.0055	3.265	0.036	0.979	+A
Gobiidae									
Gobius niger	211	TL	8.0-15.5 (11.55±0.201)	4.68-40.62 (17.07±1.414)	0.0055	3.258	0.050	0.954	+A
Lesueurigobius friesii	96	TL	5.1-8.0 (5.10±0.101)	1.03-3.66 (2.77±0.111)	0.0073	3.009	0.120	0.870	I
Gymnuridae									
Gymnura altavela	7	TL	37.5-72.0 (49.09±10.26)	1188-9000 (3063.86±2474.5)	0.0156	3.090	0.147	0.988	I
Lophiidae									
Lophius piscatorius	14	TL	17.1-41.7 (30.79±4.199)	76.57-1353.6 (522.17±191.95)	0.0351	2.745	0.153	0.989	-A
Merluccidae									
Merluccius merluccius	676	TL	9.0-39.8 (20.91±0.765)	3.55-520.38 (91.43±9.847)	0.0027	3.329	0.023	0.989	+A
Mullidae									
Mullus barbatus	970	FL	5.2-22.4 (11.9±0.186)	1.50-146.10 (30.90±1.543)	0.0064	3.334	0.012	0.989	+A
Serranidae									
Serranus cabrilla	103	TL	11.7-22.2 (16.31±0.017)	14.52-130.66 (56.03±0.046)	0.0091	3.092	0.144	0.963	I
Serranus hepatus	762	TL	5.6-15.0 (9.37±0.003)	2.03-47.3 (13.12±0.011)	0.0107	3.162	0.034	0.920	+A
Soleidae									
Solea solea	7	TL	18.6-28.0 (25.09±2.934)	36.38-157.27 (111.35±39.729)	0.0010	3.609	0.101	0.993	+A
Sparidae									
Boops boops	10	FL	10.2-16.5 (15.06±1.381)	7.60-61.09 (40.39±10.99)	0.0009	3.909	0.387	0.927	+A
Diplodus annularis	824	FL	6.5-17.3 (10.75±0.127)	7.7-96.96 (26.68±1.055)	0.0220	2.968	0.462	0.910	I
Pagellus acarne	83	FL	9.4-14.4 (11.53±0.233)	12.49-42.40 (24.75±1.740)	0.0078	3.281	0.006	0.878	+A
Pagellus bogaraveo	185	FL	7.0-13.4 (9.93±0.179)	5.46-40.19 (16.21±1.027)	0.0148	3.027	0.061	0.931	I

Table 1. Continued

Species	n	L	Length Characteristics (cm) Min-max (Ave±CI(95%))	Weight Characteristics (g) Min-max (Ave±CI(95%))	LWR parameters a	b	SE(b)	R^2	G
Pagellus erythrinus	50	FL	5.1-22.0 (14.95±0.028)	1.96-148.7 (53.11±8.084)	0.0301	2.691	0.193	0.801	-A
Torpedinidae									
Torpedo marmorata	10	TL	9.6-17.5 (14.8±1.118)	22.8-144.11 (103.15±17.297)	0.0208	3.094	0.673	0.999	I
Triglidae									
Chelidonichthys lucerna	16	FL	12.6-30.3 (22.64±2.822)	23.71-336.02 (142.12±52.113)	0.0109	2.989	0.110	0.982	I
Eutrigla gurnardus	16	TL	12.1-24.3 (16.18±2.106)	13.41-126.04 (42.49±21.345)	0.0101	2.944	0.105	0.982	I
Lepidotrigla cavillone	269	FL	6.2-14.8 (11.72±0.177)	2.36-41.80 (21.56±0.867)	0.097	3.109	0.044	0.950	+A
Trigla lyra	9	FL	12.1-24.3 (18.91±4.318)	13.41-156.04 (50.38±42.116)	0.0079	3.017	0.202	0.974	I
Uranoscopidae									
Uranoscopus scaber	52	TL	11.8-28.0 (20.08±1.054)	28.71-442.18 (157.80±27.222)	0.0053	3.389	0.081	0.973	+A

composed of 11 cartilaginous and 49 bony fishes from 33 families.

Length of each fish (total or fork length) was measured to the nearest 1.0 mm. Total weight of each specimen was measured with a digital balance with an accuracy of 0.01 g. Length–weight relationships were calculated for only those species represented by ≥ 7 individuals in the study.

Generally, length–weight relationships in fish have the formula $W = aL^b$, where W is the total weight (g), L the length (cm), a the intercept (feeding status) and b the slope (growth type) (Ricker, 1975; Sparre et al., 1989).

All taxa and familia were defined under Whitehead et al. (1984) and Fischer et al. (1987). Systematic category of the fish species were also given by Eschmeyer (1999).

RESULTS AND DISCUSSION

The surveys captured and examined 6.177 individuals of 60 fish species of 33 families, the most abundant of which were Sparidae (18.80%), Mullidae (15.83%), Serranidae (14.2%), Citharidae (13.53%) and Merluccidae (11.05%). Table 1 shows length and weight characteristics and length-weight relationships for 6.128 individuals of 30 fish species represented by ≥ 7 individuals from 20 families.

Determination coefficient values (r^2) ranged from 0.801 for *Pagellus erythrinus* to 0.999 for *Torpedo marmorata* with $r^2 > 0.900$ for 25 species (83%) and also $r^2 > 0.950$ for 19 species (63%).

The exponent *b* ranged between 1.654 for *Cepola rubescens* and 3.977 for *Blennius ocellaris* with a mean value of 2.949 (±0.05) and a median value of 3.094. In addition, for 26 species (87%) *b* values were within the interval 2.500-3.500 and *b* values lower than 2.500 for only one species (*Cepola rubescens)* but higher than 3.500 for three species (*Blennius ocellaris*, *Solea solea* and *Boops boops*).

Growth type was determined by t-test: 13 species (43%) showed positive allometries ($b > 3$; t-test, $P < 0.05$), 13 species (43%) isometric growth ($b = 3$; t-test, $P > 0.05$) and the remaning 4 species (14%) negative allometries ($b < 3$; t-test, $P < 0.05$). In terms of ecological and biological factors such as temperature, salinity, food, sex and maturity stage in one year period, length-weight relationship parameters of a species could be varied in seasons and years (Shephard and Grimes, 1983; Pauly, 1984; Wheatherley and Gill, 1987). Due to limited studies on the fishes of Çandarlı Bay, the study presents important data of the W-L relationship for 30 fish species.

Sažetak

DUŽINSKO-MASENI ODNOS ZA 30 PRIDNENIH VRSTA RIBA İZ ZALJEVA ÇANDARLİ (SJEVERNO EGEJSKO MORE, TURSKA)

U ovom članku prikazani su dužinsko-maseni odnosi za 30 pridnenih vrsta riba iz Zaljeva *Çandarli* u sjevernom Egejskom moru. Uzorci riba su lovljeni pridnenom koćom na dubini od 30-95 m na pet različitih postaja od ožujka 2003. do kolovoza 2004. godine. Vrijednost *b* parametra dužinsko masenih odnosa varirao je između 1,654 i 3,977, od čega se preko 50% vrijednosti nalazilo između 2,968 i 3,265, sa srednjom vrijednosti od 2,949 (SE = ± 0,05). Vrsta rasta je određena pomoću t-testa: 13 vrsta (43%) pokazalo je alometrijski ($b > 3$; t-test, $p < 0,05$), 13 vrsta (43%) izometrijski ($b = 3$, t-test, $P < 0,05$), a preostale 4 vrste (14%), negativno alometrijski rast ($b < 3$; t-test, $p < 0,05$).

Ključne riječi: dužinsko-maseni odnosi, pridnene ribe, Zaljev Çandarlı, sjeverno Egejsko more

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