

# Length-Weight Relationships for Ten Fish Species Collected by Trawl Surveys from Black Sea Coast, Turkey

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**Abstract** – Length-weight relationships were estimated for ten pelagic and demersal fish species caught with pelagic trawl: *Pomatomus saltatrix*, *Engraulis encrasicolus*, *Trachurus mediterraneus*, *Alosa immaculata*, *Sprattus sprattus* and demersal trawl: *Merlangius merlangus euxinus*, *Mullus barbatus ponticus*, *Psetta maxima*, *Gobius niger*, *Raja clavata* from the Black Sea coast. The samples sizes, minimum and maximum lengths and weights, length-weights relationships,  $\pm 95\%$  CI of  $b$ ,  $r^2$ , growth type, and statistical analysis of the relationship were determined.

**Keywords**– Black Sea, Demersal fish, Length-Weight Relationships, Pelagic fish

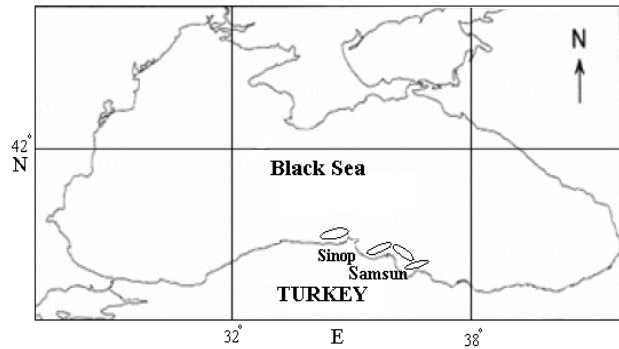


Fig 1. Trawl survey fields

## I. INTRODUCTION

LENGTH and weight data is very important parameter for fisheries science and estimating population dynamics such as growth rates, length, and age structures and for the improvement of the knowledge regarding fish population dynamics [1-3]. These parameters are also useful for between area comparisons of life stage of fish species [4]. In this study, the length-weight relationships were determined for 5 pelagic fish species that are the most commercial species captured by pelagic trawl and 5 demersal species captured by demersal trawl from the Black Sea coast of Turkey.

## II. MATERIAL AND METHOD

The fishes used in this study were collected from commercial fisheries, using demersal and pelagic trawl nets during 2010-2011 fishing season. The trials were carried out on board commercial fishing boats in the Black Sea coast (Fig. 1).

Length was measured in millimeters (mm) and weight was measured in gram (g). The minimum and maximum lengths and weights were also estimated. The length-weight relationship was established by the equation  $W=a.L^b$  where  $W$  is the weight of the fish,  $L$  is the total length of the fish, 'a' is the exponent describing of the rate of change of weight with respect to length and 'b' denotes the weight at unit length [5].

The 'a' and 'b' were also calculated from the  $W=a.L^b$  equation. When the parameter 'b' is equal to 3, the growth is called isometric but the growth is positive allometric when the 'b' value is more than 3 and negative allometric when the 'b' value is less than 3 [6].

## III. RESULTS AND DISCUSSION

The length-weight relationship of 3269 individual fishes of ten different species have been detailed on Table I. The number of specimens, length ranges (minimum and maximum), parameters of lengthweight relationships (a and b), 95% confidence intervals of b and the coefficient of determination (r) are given in Table I.

Where the 'b' values are 3.2501, 3.3018, 3.2126, 3.3757, 3.1781, 3.1831 and so the growth of *Pomatomus saltatrix*, *Trachurus mediterraneus*, *Alosa immaculate*, *Psetta maxima*, *Gobius niger* and *Raja clavata* are observed to be positive allometric in nature. Conversely, the 'b' values are 2.6182, 2.9278, 2.9819 and 2.8555 so the growth of *Engraulis encrasicolus*, *Sprattus sprattus*, *Mullus barbatus ponticus* and *Merlangius merlangus euxinus* are determined to be negative allometric in nature.

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Even though the change of b values depends primarily on the shape and fatness of the species, various factors may be responsible for the differences in parameters of the length-weight relationships among seasons and years, such as temperature, salinity, food (quantity, quality and size) sex and time of year and stage of maturity [5, 7, 8].

### III. CONCLUSION

The length-weight relationship is very important for proper exploitation and management of the population of fish species [6]. The length-weight relationship of these commercially important marine fishes helps to manage their stock in the Black Sea of Turkey.

From the length weight relationship study it is clear that the growth of *Pomatomus saltatrix*, *Trachurus mediterraneus*, *Alosa immaculata*, *Psetta maxima*, *Gobius niger* and *Raja clavata* are positive allometric in nature and in case of *Engraulis encrasicolus*, *Sprattus sprattus*, *Mullus barbatus ponticus* and *Merlangius merlangus euxinus* it is negative allometric in nature and the length and the weight of all the ten species are significantly correlated.

Previous studies providing length–weight relationships for some of the sprat and allis shad are given in Table II for comparative purposes.

It indicates that the all the ten species maintain their shape throughout their life.

### ACKNOWLEDGEMENT

The authors are grateful to the Atif Malkoc, Cemal Malkoc, Mustafa Malkoc and crews from Black Sea coast for their help during trawl surveys collection.

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TABLE I  
LENGTH AND WEIGHT RELATIONSHIPS FOR OF 10 FISH SPECIES CAUGHT FROM THE BLACK SEA COAST

Gear Type	Species	N	Length (cm)		Weight (g)		Relationship parameters			
			min	max	min	max	a	b	95 % CL of b	r <sup>2</sup>
Pelagic Trawl	<i>Pomatomus saltatrix</i>	207	12.2	24.0	15.4	127.2	0.0045	3.2501	3.1901-3.3327	0.9762
	<i>Engraulis encrasicolus</i>	696	8.0	13.6	3.5	16.4	0.0180	2.6182	2.5282-2.7903	0.8784
	<i>Trachurus mediterraneus</i>	526	9.4	15.1	4.6	25.2	0.0032	3.3018	3.2047-3.3998	0.8953
	<i>Alosa immaculata</i>	489	13.6	35.2	10.2	300.3	0.0035	3.2126	3.1676-3.2534	0.9780
	<i>Sprattus sprattus</i>	599	5.9	10.9	1.4	8.1	0.0072	2.9278	2.8829-3.0001	0.9433
Demersal Trawl	<i>Mullus barbatus ponticus</i>	225	9.3	20.1	8.59	87.9	0.0108	2.9819	2.8860-3.0514	0.9703
	<i>Merlangius merlangus euxinus</i>	426	9.4	17.0	6.0	34.5	0.0104	2.8555	2.7336-2.9774	0.9333
	<i>Psetta maxima</i>	97	32.5	80.0	444.2	9456	0.0069	3.3757	3.2801-3.4475	0.9292
	<i>Gobius niger</i>	127	19.1	30.3	55.0	283.3	0.0048	3.1781	3.0130-3.3431	0.9267
	<i>Raja clavata</i>	102	27.8	88.2	97.2	3444.8	0.0027	3.1832	3.0840-3.2771	0.9783

N: sample size; a: intercept; b: slope; CL: confidence limits; r<sup>2</sup>: coefficient of determination (all significant P < 0.001)

TABLE II  
COMPARISON OF FISHES LENGTH-WEIGHT RELATIONSHIP PARAMETERS IN VARIOUS AUTHORS

Species	Authors	Length (cm) Min-Max	Weight (g) Min-Max	a	b	r <sup>2</sup>
<i>Merlangius merlangus euxinus</i>	[9]	7.7-22.7	2.99-79.79	0.0067	3.0248	0.96
	[10]	8.4-31.5	4.57-76.77	0.0043	3.2016	0.97
	[11]	9.0-24.0	5.70-118.65	0.0039	3.2384	0.96
<i>Mullus barbatus ponticus</i>	[9]	6.6-18.4	2.94-60.16	0.0111	2.9633	0.98
	[12]	7.3-18.7	-	0.0107	2.9717	0.98
	[13]	5.9-22.6	5.9-114.4	0.0700	3.1500	0.98
<i>Gobius niger</i>	[9]	8.0-25.3	5.37-168.7	0.0166	2.8690	0.96
	[14]	5.6-15.7	1.69-45.0	0.0090	3.0410	0.79
	[15]	13.6-19.2	37.5-113.0	0.0060	3.3460	0.98
<i>Alosa immaculata</i>	[9]	11.9-27.6	5.37-168.7	0.0046	3.1237	0.94
	[16]	13.6-33.6	9.99-177.0	0.0039	3.1800	0.99
	[17]	8.5-39.9	2.99-503.3	0.0027	3.3379	0.99
<i>Engraulis encrasicolus</i>	[9]	8.0-14.7	2.85-19.14	0.0174	2.6014	0.85
	[15]	10.3-15.7	8.26-24.5	0.0240	2.5070	0.99
	[16]	7.6-14.6	2.7-18.80	0.0093	2.8345	0.96
<i>Pomatomus saltatrix</i>	[9]	13.2-21.7	23.21-88.19	0.0130	2.8621	0.92
	[14]	11.6-22.2	12.0-131.0	0.0030	3.3360	0.96
	[18]	9.2-23.4	10.1-135.5	0.0037	3.3268	0.99
<i>Trachurus mediterraneus</i>	[9]	7.3-18.3	3.34-47.37	0.0086	2.9849	0.96
	[14]	6.0-15.7	1.75-44.3	0.0040	3.2490	0.90
	[16]	7.8-18.0	3.6-49.8	0.0074	3.0445	0.96
<i>Sprattus sprattus</i>	[9]	5.6-12.6	0.95-12.4	0.0079	2.8676	0.88
	[15]	6.0-11.5	1.32-7.99	0.0100	2.7330	0.95
	[16]	5.9-11.3	1.5-8.4	0.0092	2.8121	0.99
<i>Psetta maxima</i>	[14]	10.0-61.0	14.6-4494.4	0.0070	3.2480	0.95
	[15]	44.7-71.7	139.0-5960.0	0.0010	3.2780	0.84
	[19]	23.9-81.0	212.1-9500.0	0.0074	3.2200	0.92
<i>Raja clavata</i>	[15]	56.0-79.0	120.0-5500.0	0.0010	2.3020	0.86
	[20]	27.3-83.2	92.7-3430.0	0.0026	3.1980	0.98
	[21]	20.50-99.0	28.9-2614.3	0.0016	3.2914	0.93