

Length-Weight and Length-Length Relationships of Red Scorpionfish (*Scorpaena scrofa* L. 1758) from İzmir Bay (Aegean Sea)

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Research Article

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Abstract

In this study, the length-weight and length-length relationships were investigated for *Scorpaena scrofa* from İzmir Bay. All fish sample lengths and weights were recorded to the nearest 0.01 cm and to 0.01 g. The measured total length values for females, males and combined sexes were 16.00-30.20 cm; 17.70-28.00 cm and 16.00-30.20 cm respectively. The weight values for females, males and combined sexes were 73.20-441.00 g; 89.80-378.00 g and 73.20-441.00 g respectively. According to t test results, there were no statistically significant differences for *S. scrofa* species ($P>0.05$); therefore, female and male samples were evaluated together. The length-weight relationship equations as $W=0.016TL^{2.993}$ ($r^2=0.914$) for all specimens. The 'b' value of LWR was not significantly different from 3.0 and their growth type was isometric. Total length-standard length relationship equation was determined as $TL=1.287SL+0.112$ ($r^2=0.970$). This study is helpful in providing information about length-weight and length-length relationships and the current study can be useful to compare stocks of the species in the different habitats

Key words: Red scorpionfish, *Scorpaena scrofa*, length-weight relationships, length-length relationships, Aegean Sea

İzmir Körfezi (Ege Denizi)'nden Lipsoz (*Scorpaena scrofa* L. 1758)'un Boy-Ağırlık ve Boy-Boy İlişkisi

Özet

Bu çalışmada, İzmir Körfezi'nden *Scorpaena scrofa*'nın boy-ağırlık ve boy-boy ilişkisi incelenmiştir. Tüm örneklerin boyları ve ağırlıkları 0.01cm ve 0.01 g hassasiyetle ölçülmüştür. Dişi, erkek ve tüm bireylerde ölçülen total boy değerleri sırasıyla 16,00-30,20 cm; 17,70-28,00 cm ve 16,00-30,20 cm'dir. Ağırlık değerleri ise 73,20-441,00 g; 89,80-378,00 g and 73,20-441,00 g'dır. *S. scrofa* türü için, t-test sonuçlarına göre önemli bir farklılık olmadığından dişi ve erkek örnekler birlikte değerlendirilmiştir. Tüm bireyler için boy-ağırlık ilişki denklemi $W=0,016TL^{2,993}$ ($r^2=0,914$) olarak hesaplanmıştır. Boy-ağırlık ilişkisinin 'b' değeri, 3'den önemli derecede farklı değildir, ve türün büyümesi izometriktir. Total boy standart boy ilişki denklemi $TL=1,287SL+0,112$ ($r^2=0,970$) olarak belirlenmiştir. Bu çalışma, boy-ağırlık ve boy-boy ilişkileri hakkında bilgi sağlamada faydalıdır ve mevcut çalışma, türlerin farklı habitatlardaki stoklarını karşılaştırmak için kullanışlı olabilir.

Anahtar kelimeler: Lipsoz, *Scorpaena scrofa*, boy-ağırlık ilişkisi, boy-boy ilişkisi, Ege Denizi

INTRODUCTION

Red Scorpionfish, *Scorpaena scrofa* L., 1758 (Scorpaenidae) is a demersal fish species. The species are widely distributed in the British Isles to Senegal including the Canary Islands, Madeira, and Cape Verde, and throughout the Mediterranean except Black Sea. They found on the solitary and sedentary over rocky, sandy or muddy bottoms from 20 to 200 m. They feed on fishes, crustaceans and mollusks (Hureau and Litvinenko, 1986). The conservation status of *S. scrofa* is "LC" according to the IUCN Red List (Froese and Pauly, 2019). This fish species is economically important and there are several studies such as embryonic and larval development (Dulcic et al., 2007), reproduction (Muñoz et al., 2013), age and growth (Matić-Skoko et al., 2015).

Length weight relationship (LWRs) studies have an important role in estimating population biomass, growth rate determination, determining the stock status of fishes and in many other subjects (Petrakis and Stergiou, 1995). Length-weight relationships (LWRs) are needed to estimate weight from length because direct weight measurements can be time-consuming in the field (Koutrakis and Tsikliras, 2003); these parameters are important in fish biology and can provide information on the stock condition (Bagenal and Tesch, 1978).

Comparison of the relationships between different length types (LLRs) in fisheries is especially important in terms of growth studies (Froese and Pauly, 1998). In some cases, the caudal fin deformation of fish can be observed and this makes it difficult to measure the total length accurately. Knowing the standard length/ fork length of a fish allows the determination of the total length of this fish.

In fisheries biology, LWRs and LLRs results can be useful in comparing the stocks of the same species in different habitats. These are useful tools when evaluating fish species living in both freshwater and marine habitats (Moutopoulos et al., 2013; Cengiz, 2013). There are several studies were conducted about length-length and length-weight relationships marine and freshwater species (Karachle et al., 2015; Tsagarakis et al., 2015; Yilmaz et al., 2015; Bostancı et al., 2017; Saygın et al., 2018; Yedier et al., 2019a, 2019b). In this study, we aimed to determine the LWRs and LLRs of red scorpionfish which sampled from İzmir Bay (Aegean Sea). The present study has provided baseline information on LLRs and LWRs analysis which could be useful for subsequent bioecological and population-based studies on *S. scrofa*.

MATERIALS and METHODS

In the current study, 199 red scorpionfish samples were obtained from commercial anglers in Güzelbahçe district (İzmir Bay) in May 2016 (Figure 1). Fish samples were transported to the hydrobiology laboratory in Ordu University. In the laboratory, each fish was cleaned, and then their body weight (nearest the 0.01 g), total length (TL) and standard length (SL) (nearest the 0.01 cm) were recorded. Sex was determined by macroscopic examination of the gonads.

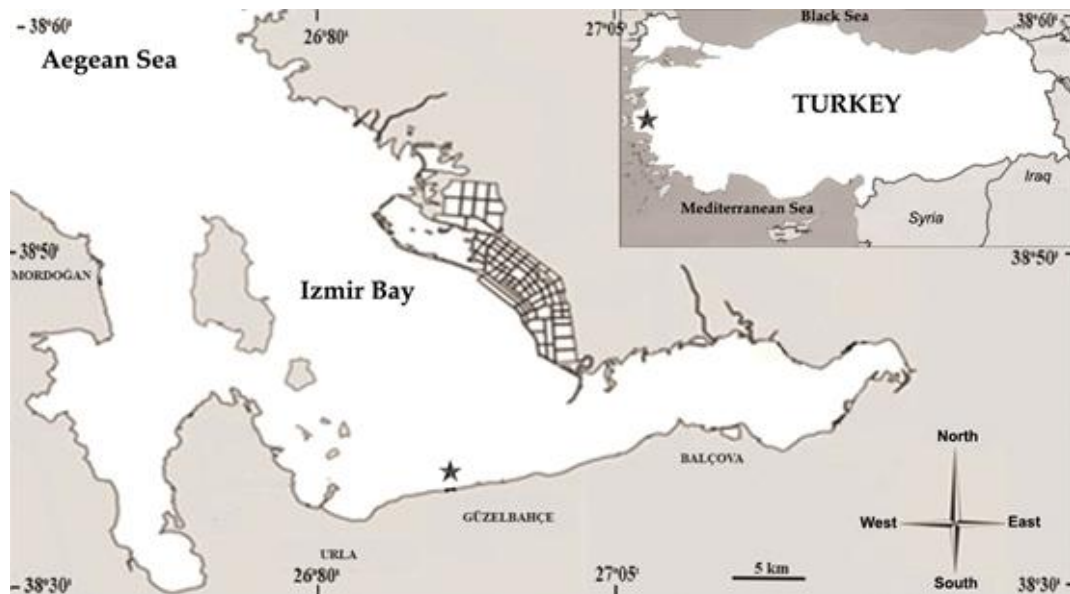


Figure 1. Sampling area.

Length-weight relationships were calculated using the equation $W=aL^b$, where L is the total length (cm), W is the total weight of the fish (g), a and b are the parameters of the equation (Bagenal and Tesch, 1978). The t-test was used to test whether the slopes (b) were significantly different from 3. There are three different growth types. The growth types are; negative allometric ($b<3$), positive allometric ($b>3$) and isometric ($b=3$). Analysis of variance (ANOVA) was employed to test differences length-weight relationship b values between sexes. In addition, length-length relationships were computed using linear regression analysis for the species. Statistical analyses were

tested at the 0.05 significance level. SPSS 20 and Minitab 15.0. Excel software was utilized in the evaluation of the data.

RESULTS and DISCUSSION

The descriptive statistics of red scorpionfish samples were presented in Table 1. There were no statistically significant differences in terms of TL or W between sex ($P>0.05$). Therefore, population was evaluated female and male samples together for further analyses. The length-frequency and weight-frequency distribution of all individuals was determined (Figure 2).

Table 1. Descriptive statistics of *S. scrofa* samples from the Aegean Sea.

	Total Length (cm)			Weight (g)		
	♀	♂	♀♂	♀	♂	♀♂
Mean±S.E.	23.22±0.27	23.19±0.26	23.22±2.64	215.69±7.66	212.62±7.47	214.4±76.25
Min.	16.00	17.70	16.00	73.20	89.80	73.20
Max.	30.20	28.00	30.20	441.00	378.00	441.00
	P>0.05			P>0.05		

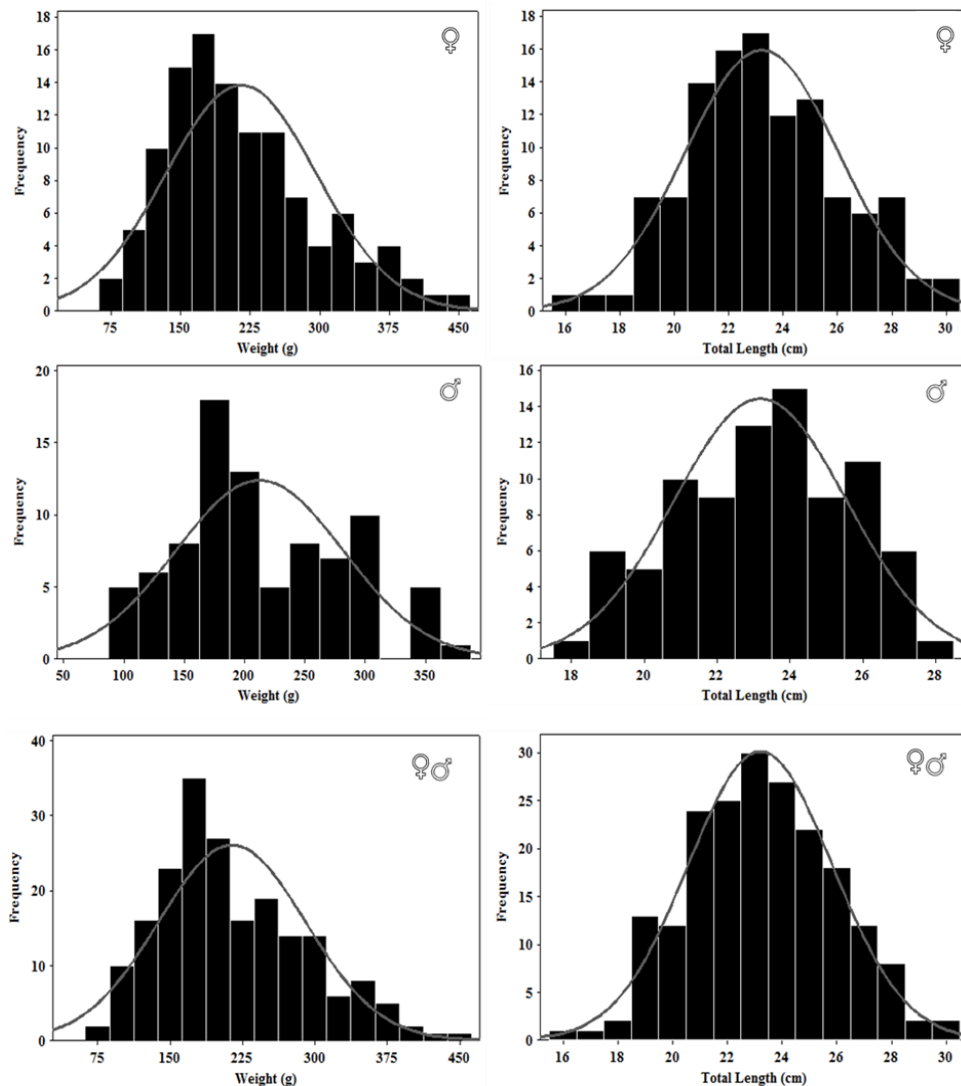


Figure 2. The weight-frequency and length-frequency distribution graphs for females, males and all individuals of *S. scrofa* from İzmir Bay.

The mean value of total length and weight were 23.22 ± 1.88 cm and 214.37 ± 5.41 g for all individuals. The length and weight distributions were 16.00-30.20 cm and 73.20-441.00 g for all individuals, respectively (Figure 2).

The length-weight relationship equation was determined as $W=0.016L^{2.993}$ ($r^2=0.914$) for all specimens (Figure 3). The “b” value was determined as 2.993 (95% Confidence Interval: 2.987-2.997) (Figure 3). The value was found within the expected range of 2.5-3.5 which was described by Froese (2006). The ‘b’ value of LWR was found not to be significantly different from 3.0 in red scorpionfish ($P>0.05$) and the growth type was isometric for all sex according to results of this study. *S. scrofa* total length-standard length relationship equations and their coefficient of determinations were presented for all individuals in figure 4. In fish with caudal fin deformation, it is possible to calculate the total length from the standard length.

When the literature was reviewed, a limited study was recorded about the *S. scrofa* length-length relationship. In Aegean Sea, *S. scrofa* length-length relationship equation was reported as $SL=-0.1+0.800TL$ for 37 samples (Moutopoulos and Stergiou 2002). In the current study, the length-length relationship equation was determined as $TL=1.287SL+0.112$ for 199 *S. scrofa*.

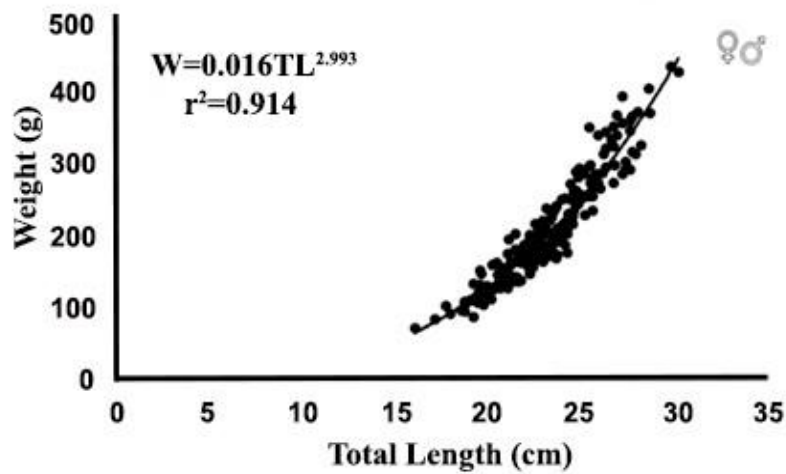


Figure 3. The length-weight relationship for all individuals of *S. scrofa* from İzmir Bay.

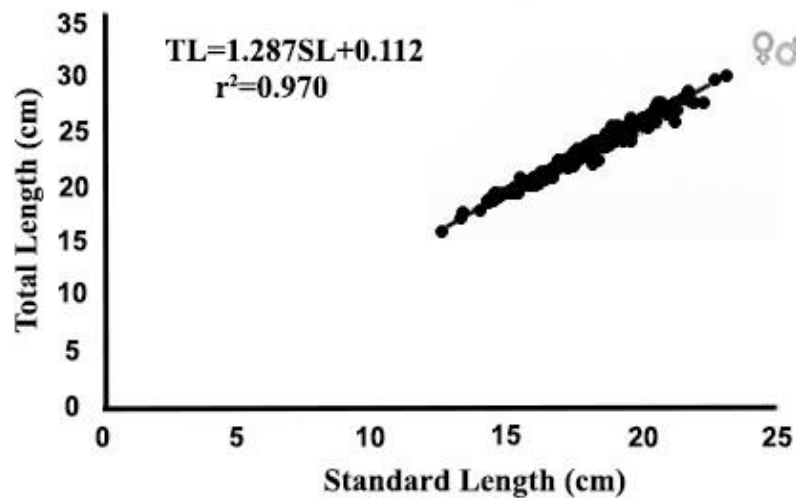


Figure 4. The length-length relationship for all individuals of *S. scrofa* from İzmir Bay.

When the b values of the *S. scrofa* living in different seas of the world are compared (Table 2), it is seen that b value is between 2.686 and 3.298. Özyayın et al (2007) calculated b value as a 2.686 for the same species from İzmir Bay. However, in the current study, the b value was calculated as a 2.993 for the *S. scrofa* from Güzelbahçe district in the İzmir Bay. Although these two studies were examined almost the same habitat and the same species, two different b values were determined. The main reasons can be differences in the sample sizes and numbers. Because Özyayın et al. (2007) worked with 12 samples whose total size distribution was 10.5 -28.3, we examined with 199 individuals whose total size distribution was 16.00-30.2. Moreover, the minimum and maximum length ranges of the specimens especially number of fish samples affect the parameters. Digestion or undigestion of fish stomach content affects the body weight of the fish and changes the length-weight relationship parameters.

Table 2. Comparison of length-weight relationships of *S. scrofa* from different habitats.

References	Locality	n	Relationship equations	r ²
Dulčić and Kraljević, 1996	Eastern Adriatic (Croatian waters)	125	$W=0.0000078L^{3.298}$	0.960
Moutopoulos and Stergiou, 2002	Cyclades; coastal waters off Naxos Island, Greece	37	$W=0.01692L^{2.999}$	0.980
Morey et al., 2003	Iberian Peninsula (Western Mediterranean)	359	$W=0.022L^{2.942}$	0.981
Valle et al., 2003	East coast of Spain	23	$W=0.03134L^{2.803}$	0.986
Mendes et al., 2004	Portuguese west coast	22	$W=0.0121L^{3.124}$	0.966
Karakulak et al., 2006	Gökçeada Island (Northern Aegean Sea), Turkey	15	$W=0.0180L^{3.005}$	0.985
Özyayın et al., 2007	İzmir Bay (Central Aegean Sea), Turkey	12	$W=0.0448L^{2.686}$	0.983
Ferreira et al., 2008	Madeira Archipelago (Eastern-central Atlantic)	12	$W=0.01526L^{3.039}$	0.974
Crec'hriou et al., 2012	French Catalan coast	32	$W=0.330L^{2.89}$	0.990
Cengiz, 2013	Gallipoli Peninsula and Dardanelles (Northeastern Mediterranean)	134	$W=0.0221L^{2.96}$	0.980
Moutopoulos et al., 2013	Korinthiakos Gulf (Central Greece)	53	$W=0.0169L^{3.002}$	0.981
Altın et al., 2015	Gökçeada, Northern Aegean Sea, Turkey	16	$W=0.012L^{3.135}$	0.983
Matić-Skoko et al., 2015	Costal middle Adriatic	1700	$W=0.0013L^{3.068}$	0.978
Öztekin et al., 2016	Gallipoli Peninsula, Turkey (Northern Aegean Sea)	12	$W=0.0337L^{2.794}$	0.990
This study	Güzelbahçe, İzmir Bay, Turkey	199	$W=0.0016TL^{2.993}$	0.914

It is known that stomach fullness, environmental condition, disease and parasite loads, geographic location can affect length-weight relationship (Bagenal and Tesch, 1978). Therefore, “ b ” values of most of the studies could be different from each other especially between regions. In many fish studies, fish length is often more rapidly and easily measured than weight. Thus, knowing the length-weight relationship makes it more convenient to determine weight where only the length is known (Froese and Pauly, 1998).

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