

İskenderun Koyundan Monofilament Galsama Ağ ile Yakalanan Üç Ticari Balık Türünün Boy-Ağırlık İlişkileri ile Kondisyon İndeksleri, Türkiye

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ÖZET

Bu çalışmada, İskenderun koyunda ekonomik yönden önemli olan üç ticari balık türünün toplam boy ve ağırlık ilişkileri (LWRs) ile Fulton'un kondisyon faktörünün (K) belirlenmesi amaçlanmıştır. Bu amaçla, kırlangıç balığı (*Chelidonichthys lucerna*, Linnaeus, 1758), dil balığı (*Pegusa lascaris*, Risso, 1810) ve çipura (*Sparus aurata*, Linnaeus, 1758) İskenderun koyundan 2016 yılında Eylül aylarında profesyonel bir balıkçı tarafından monofilament galsama ağ (göz açıklığı: 28) ile 10-20 metrede dipten toplanmıştır. Toplamda, 82 balık örneğinin toplam boy ve ağırlıkları 0,01 cm ve 0,01 g hassasiyetle ölçülmüştür. Yakalanan balıkların minimum-maksimum uzunluğu ve ağırlığı *C. lucerna* için 14,0-24,5 cm ve 31,2-126,6 g, *P. lascaris* için 18,5-25,55 cm ve 37,7-125,5 g, *S. aurata* için 14,5-26,6 cm ve 55,8-180,0 g olarak belirlenmiştir. Üç balık türünün toplam boy-ağırlık ilişkisi *C. lucerna* için $W = 0,0837 * TL^{2,28}$, *P. lascaris* için $W = 0,0018 * TL^{3,45}$ ve *S. aurata* için $W = 0,0667 * TL^{3,30}$ olarak bulunmuştur. Fulton'un kondisyon faktörü *C. lucerna* için $1,05 \pm 0,04$, *P. lascaris* için $0,72 \pm 0,01$ ve *S. aurata* için $2,00 \pm 0,10$ olarak tespit edilmiştir. Bu çalışmanın sonuçları, bu alanda ekonomik açıdan önemli balıkların LWR parametrelerine ve K indislerine katkı sağlamakla birlikte, mevcut çalışma farklı zaman ve mekanlardaki benzer balık stoklarını karşılaştırmak için yararlı olacaktır.

Length-Weight Relationships with Condition Indices of Three Commercial Fish Species Caught by Monofilament Gillnets in the Iskenderun Bay, Turkey

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ABSTRACT

In this study, it was aimed to determine the length and weight relationships (LWRs) and Fulton's condition factors (K) for three commercial fish species in Iskenderun bay. For this purpose, tub gurnard (*Chelidonichthys lucerna*, Linnaeus, 1758), sand soles (*Pegusa lascaris*, Risso, 1810), and gilthead seabream (*Sparus aurata*, Linnaeus, 1758) were collected by a single artisanal fisherman during September- December months in 2016 by means of monofilament gill nets mesh size:28 mm) used at depths 10-20 m in Iskenderun bay. Totally, 82 fish samples captured and total lengths and weights of they were measured to the nearest 0,01 cm and to 0,01 g. Minimum-maximum length and weight of caught fishes were determined as 14,0-24,5 cm and 31,2-126,6 g for *C. lucerna*, 18,5-25,55 cm and 37,7-125,5 g for *P. lascaris*, 14,5-26,6 cm and 55,8-180,0 g for *S. aurata*. Total length-weight relationships of three fish species were found as $W=0,0837*TL^{2,28}$ for *C. lucerna*, $W=0,0018*TL^{3,45}$ for *P. lascaris*, and $W=0,0667*TL^{3,30}$ for *S. aurata*. Fulton's condition factors were detected as $1,05\pm0,04$ for *C. lucerna*, $0,72\pm0,01$ for *P. lascaris*, and $2,00\pm0,10$ for for *S. aurata*. Result of this study provides a contribution to parameters of LWRs and K indices of economically important fish in this area and the current study will be useful in order to compare

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1. Introduction

Aquaculture is one of the fastest expanding food production sectors in all around the world, by per annual growth rate of 5,8% during the period 2000-2016 [1]. Hundreds of millions of people in the world depend on artisanal fisheries to survive and live, and artisanal fishing is critically important for not only food, but also for jobs, alimentation, food security, and destitution decline [2].

Over the past years, climate change, habitat degradation and wasteful immoderate fishing have created negative effects on fishing population, and these circumstances have also negatively caused yield sea food according to the Food and Agriculture Organization of the United Nations [3]. Further, these environmental disasters and alien fish migration have caused bioecological changes on native fish in coast of East Mediterranean and Aegean Sea. Artisanal fisheries have been widely affected depending on this situation [4]. Iskenderun bay has been known to have proportionally rich fishing resources compared to other fishing areas of eastern Mediterranean since 1940s [5]. It is well known that the length and weight relationships (LWRs) and Fulton's condition factors (K) are quite useful in determining the fish condition, life history of fish and fish stock [6, 7]. They also provide useful equations to determine whether a somatic growth is isometric or allometric growth [8].

Tub gurnard, sand solea and gilthead seabream are economically important for many countries and there are several studies such as embryonic and larval development [9], reproduction [10, 11], length and weight relationships and growth [12, 10, 13, 14]. There is little current information and explanation for the Iskenderun bay obtained from LWRs, although it is a reliable calculation method for studied biological characteristics of fish populations in aquatic life. Basically, our objective was to contribute to up to date baseline information on LWRs and K analysis, which could be useful for subsequent bioecological and population-based studies on similar studies done in the eastern Mediterranean region.

2. Materials and Methods

This investigation was carried out near domestic area of Iskenderun, the sampling are located within 36°36'32.70"N-36°07'44.14" E in Iskenderun bay in Figure 1.



Figure 1. The study area, Iskenderun Bay

All fishes have been identified in the field by Whitehead et al. [15] and scientific names of samples were checked again according to FishBase [16]. Fishes were collected by monofilament gill nets mesh size 28 mm used at depths 10-20 m from Iskenderun bay in September and December 2016. Total length and wet weight were measured to the nearest 0,01 cm using callipers and 0,01 g using digital balance, respectively. Afterwards, fishes were immediately released at their natural habitats. In this study, sampling was made properly as the 4/1 notification regulates commercial fishery by the Ministry of Agriculture and Forestry of Turkey. The length and weight relationships were determined by using the equation $W=axL^b$, where W is total wet weight (g), L is total length (cm), the value a is the y-intercept and the value b is the slope of Ordinary Least Squares regression [17].

The association between length and weight was computed by the determination of coefficient r^2 [8]. Fulton's condition factors (K) were calculated by the formula $K=WxL^{-3}x100$ [18]. In order to identify the growth type (isometric or allometric) for all fish species, the value b of LWRs was tested for the deviation from the value of 3,0 by a t -test [8] and the b value of each species was

tested by *t*-test [19]. Data were evaluated by using Microsoft Office Excel 2010 and statistical packages of IBM SPSS 21 were used.

3. Results and Discussion

A total of 82 specimens belonging to three families were caught from Iskenderun port. The number of samples, minimum and maximum values of length and weight of specimens together with LWRs parameters and K indices of *Chelidonichthys lucerna*, *Pegusa lascaris*, *Sparus aurata* were presented in Table 1. Linear regressions were significant ($P < 0,001$), with the coefficient of determination r^2 values for three fish species. The values 95% confidence limits of b of three fish species were found as 2,001-2,567, 3,294-3,604, 3,106- 3,498.

Table 1. Descriptive statistics, estimated length-weight relationships and Fulton's condition factors of 3 commercial fish species caught by means of monofilament gill nets from Iskenderun Bay (Turkey), during September-December 2016.

Family	Species	n	TL (cm)		W (g)		LWRs			K	
			Min-Max	Min-Max	a	b	95%CI of b	r^2	GT	$\bar{X} \pm S\bar{x}$	
Triglidae	<i>C.lucerna</i>	25	14,0-24,5	31,2-126,6	0,0837	2,284	2,001-2,567	0,91	A-	1,05±0,04	
Soleidae	<i>P. lascaris</i>	30	18,5-25,5	37,7-125,5	0,0018	3,449	3,294-3,604	0,90	A+	0,72±0,01	
Sparidae	<i>S. aurata</i>	27	14,5-26,6	55,8-180,0	0,0667	3,303	3,106-3,498	0,95	A+	2,00±0,10	

n: number of individuals, TL: total length, Min: minimum, Max: maximum, a and b: intercept and slope in equation $W = \log(a) + b \log(L)$, 95%CI: confidence intervals, r^2 : coefficient of determination, GT: growth type, A+: positive allometry, A-: negative allometry, I: isometric, K: Fulton's condition factors, $\bar{X} \pm S\bar{x}$: Mean±SE.

In this study, total lengths of 75% of *C. lucerna*, 36,6% of *P. lascaris*, and 100% of *S. aurata* samples were found to be under the maturity lengths 21,6 cm, 22 cm, and 33 cm, respectively, according to Fishbase data [16]. Minimum-maximum length and weight of caught fishes were determined as 14,0-24,5 cm and 31,2-126,6 g for *C. lucerna*, 18,5-25,55 cm and 37,7-125,5 g for *P. lascaris*, 14,5-26,6 cm and 55,8-180,0 g for *S. aurata*. Total length-weight relationships of three fish species were found as $W=0,0837*TL^{2,28}$ for *C. lucerna*, $W=0,0018*TL^{3,45}$ for *P. lascaris*, and $W=0,0667*TL^{3,30}$ for *S. aurata*. Fulton's condition factors were detected as 1,05±0,04 for *C. lucerna*, 0,72±0,01 for *P. lascaris*, and 2,00±0,10 for *S. aurata* (see Table 1).

4. Conclusion

The value of parameter b was estimated at 2,28 for *C. lucerna*, 3,45 for *P. lascaris* and 3,30 for *S. aurata*. This data is compatible with the fact that the value of b must vary from 2 to 4 via Tesch [20]. Additionally, the value of b , as a characteristic of the species, is generally stable throughout the year [21]. All regressions were highly significant ($P < 0,001$), and the values of coefficient r^2 ranged from 0,90 (*P. lascaris*) to 0,95 (*S. aurata*), and the value of r^2 for *C. lucerna* was determined as 0,91. A species with the value of b different from 3 is said to have allometric growth; otherwise, the type of the growth is isometric.

In this study, negative allometric growth was determined for *C. lucerna*, since its b value was less than 3. In a similar work carried out in the west cost of Portugal, the growth for tub gurnard was determined to be negative allometric ($P < 0,05$) [12, 13].

We determine a positive allometry for the growth of *P. lascaris* as well as Tsagarakis et al. [22] have measured for sand soles sampled from Black Sea, Sinop ($P < 0,001$). Computations show that *S. aurata* has a positive allometric growth in this study, whereas gilthead seabream showed negative allometric growth in another study ($P < 0,05$), [13].

Table 2. Comparative results of summary of population biology data for *Chelidonichthys lucerna*, *Pegusa lascaris*, *Sparus aurata* from different times and locations.

Region	n	TL (cm) Min-Max	W(g) Min-Max	a	b	r ²	GT	K	Authors
<i>Chelidonichthys lucerna</i>									
Turkey (Iskenderun Bay)	2	22,3-23,7							[4]
Portugal (Algarve Coast)	75	14-34,4	35-368	0,0180	2,798	0,968	A-		[12]
Portugal (Western Coast)	169	13,4-75,1	30,0-2810,0	0,028	2,668	0,931	A-		[13]
Turkey (Iskenderun Bay)	342	8,0-18,7		0,009	2,99	0,98		0,221	[10]
Turkey (Marmara Sea)	224	14,27-41,5		0,009	3,019	0,989		0,863	[23]
Turkey (Edremit Bay)	262	12,70-32,55		0,005	3,206	0,989		0,106	[24]
Turkey (Aegean Sea)	546	12-34,4	20,58-439,4	0,005	3,240	0,987	A+	0,163	[25]
Portugal (the Arade Estuary)	49	6-32,4		0,00931	3,01	0,961	I		[26]
Italy (Adriatic Sea)	6616	12,2-37,4	17-425	0,007	3,057	0,967	A+	0,60-0,70	[14]
Turkey (Black Sea-Trabzon)	1	828	6640						[27]
United Kingdom (North West Wales)	970			0,007	3,10	0,966	A+	0,25	[28]
<i>Pegusa lascaris</i>									
Turkey (Iskenderun Bay)	1	22,4							[4]
Portugal (Western Coast)	22	20,3-33,4	90,0-420,0	0,0070	3,130	0,816	I		[13]
Croatia (Estuarine Systems)	15		9,8-30,6	0,0082	3,110	0,970			[29]
Portugal (the Arade Estuary)	140	3,3-24,2		0,00680	3,20	0,994	A+		[26]
Turkey (Black Sea-Sinop)	93	10,4-22,2	07,01-110,33	0,0024	3,484	0,95			[22]
<i>Sparus aurata</i>									
Turkey (Iskenderun Bay)	3	17,8-19,9							[4]
Turkey (South Coast of Iskenderun Bay)	21	16,90-32		0,0406	2,679	0,971	A-		[30]
Portugal (Algarve Coast)	210	23,5-67	175-3910	0,0204	2,872	0,957	A-		[12]
Greece (Northern Aegean Estuarine System)	13	5,7-10,9		0,0153	2,996	0,992			[31]
Algeria Mellah Lagoon	370	157-610	60-4000	0,0129	3,067	0,92	I	0,513	[32]
Portugal (the Arade Estuary)	99	6,6-37,3		0,01311	3,04	0,996	A+		[26]
Turkey (Central Black Sea)	109	15,7-21,2	62,2-136,8	0,035	2,70	0,86			[33]
Turkey (Black Sea-Ordu)	3	46,2-61,4	1500,6-3080,6						[34]

The length-weight relationship in fish is affected by a number of factors including season, habitat, sexual maturity, diet regimen, health, and conservation techniques [20]. The condition factor K was determined as 0,72 for *P. lascaris*, 2,00 for *S. aurata*, and 1,05 for *C. lucerna* (see Table 1.), which increases during the reproductive cycle of

the most of species, decreasing during the spawning season and increasing after that, and well matched with their reproductive cycle [16].

Statement of Conflict of Interest

Author has declared no conflict of interest.

Author's Contributions

The contribution of the author is 100%.

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