Araştırma Makalesi
Research Article

Length-Weight and Length-Length Relationships of *Alburnus mossulensis* and *Acanthobrama marmid* (Heckel, 1843)in the Karasu River (Turkey)

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Abstract

In this study, the length-weight relationships and length-length relationships were determined for *A. mossulensis* and *A. marmid* (Heckel, 1843))collected in the 15 different site of Karasu River (Tributary of Fırat River). A total of 228 individuals for *A. mossulensis* and 365 for *A. marmid* were caught by electroshocker between October 2014 and September 2015. The total length-weight relationships were estimated as W=0.0128 $L^{2.81}$(r^2=0.93) for *A. mossulensis* and W=0.0055 $L^{3.30}$ (r^2=0.97)for *A. marmid*. The types of growth for all specimens were found negative allometric for *A. mossulensis* and positive allometric for *A. marmid*. Length-length relationships were calculated as TL=0.3611+1.0737 FL, FL=0.3132+1.0549SL and SL=0.0709+0.8325 TL for *A. mossulensis* and TL=0.2043+1.0767 FL, FL = 0.1062 + 1.0999 SL and SL=0.1125+0.8047 TL for *A. marmid*.

Öz

Karasu Nehri'ndeki (Türkiye) *Alburnus mossulensis* ve *Acanthobrama marmid* (Heckel, 1843) 'in Boy-Ağırlık ve Boy-Boy İlişkileri

Bu çalışmada, Karasu Nehri'nin (Fırat Nehri kolu) 15 farklı istasyonundan yakalanan *A. mossulensis* ve *A. marmid* (Heckel, 1843)'in boy-ağırlık ve boy-boy ilişkileri belirlenmiştir. Ekim 2014-Eylül 2015 tarihleri arasında elektroşoker ile 228 *A. mossulensis* ve 365 *A. marmid* yakalanmıştır. Total boy-ağırlık ilişkileri *A. mossulensis* için W=0,0128$L^{2.81}$ (r^2=0,93); *A. marmid* için W=0,0055$L^{3.30}$ (r^2=0,97) olarak tespit edilmiştir. *A. mossulensis*'in tüm bireylerinde negatif allometrik ve *A. marmid*'te ise pozitif allometrik büyüme bulunmuştur. *A. mossulensis*'in boy-boy ilişkisi TB = 0,3611+1,0737 ÇB, ÇB=0,3132+1,0549 SB ve SB=0,0709+0,8325 TB; *A. marmid*'in ise TB=0,2043+1,0767 ÇB, ÇB = 0,1062+1,0999 SB ve SB=0,1125+0,8047 TB olarak hesaplanmıştır.

Introduction

The length-weight relationship study is an approach that is widely applied in fisheries management as it provides information on stock condition (Bagenal and Tesch, 1978). In addition; length-weight relationships (LWRs) used widely to provide information on the condition isometric or allometric growth, ontogenic changes, and life histories of fish species

(Binohlan and Pauly, 1998; Can *et al.,* 2002; Moutopoulos and Stergiou, 2002; Başusta and Çiçek, 2006). Many studies were doneconducted on growth properties of fish these species (Ünlü *et al.,* 1994; Özdemir et al.,1996; Başusta (Girgin), 2000;Türkmen and Akyurt, 2000; Yıldırım *et al.,* 2003; Çoban and Yüksel, 2013; Alkan Uçkun and Gökçe, 2015). Length-length relationships (LLRs) are important for contrast growth researches in fisheries management (Başusta *et al.,* 2013).

In this study, carried out the length-weight relationships (LWRs) and length-length relationships (LLRs) of *Alburnus mossulensis* and *Acanthobrama marmid* (Heckel, 1843) in the 15 different site of Karasu River (Tributary of Fırat River). The findings of this study will be a basis for the future population dynamics studies about the distribution, growing up, amount and stock composition of *A. mossulensis* and *A. marmid* in the Karasu River.

Materials and Methods

The study areasare chosen tributariesof Karasu River (Yeşildere, Köşk, Ağasuyu, Sincan, Poik, Çiğdemli, Han, Karahasan, Taşağıl, Karataş, Büyükgöze, Deli, Eriç, Kırık, Karnı streams) located in the East Anatolia of Turkey. *Alburnus mossulensis* (228) and *Acanthobrama marmid* (365) were collectedmonthly during October 2014 to September 2015 by electroshocker from Karasu River (Figure 1).

The fish samples were immediately preserved with ice and fixed with 5% formaldehid on arrival in the laboratory. All individuals were measured for total length (TL, in cm), fork length (FL, in cm), standard length (SL, in cm) to the nearest mm and weighted (W, total weight in g) to the nearest 0.01 g.

The length-weight relationship was calculated using the expression: $W = a L^b$ (Sparre and Venema, 1998), where the *W* is the body weight (g), *L* the total length (cm), "*a*" the
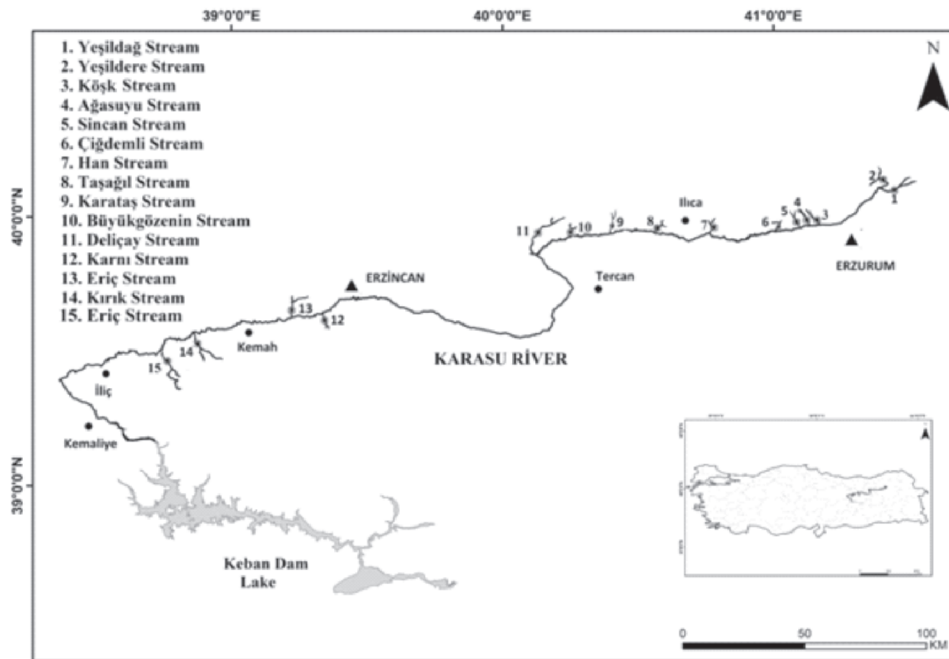
Figure 1. Sampling sites on the Karasu River.

Intercept of the regression and "*b*" is the regression coefficient. Student t-test was used determine whether the difference between length and weight are significant all individuals. In the length weight equation a and b are intercept and the slope (exponent) of the length weight curve, respectively (Başusta *et al.,* 2012).

The student's t-test used to test whether the slope (*b*) was importantly different from 3, indicate the growth type: isometric (*b* = 3), positive allometric (*b*> 3) or negative allometric (*b*< 3). Additionally, standard error of the parameter *b* and the statistical significance level of r^2 were estimated. Length-length relationships were calculated using linear regression analysis. LLRs were measured as FL = a+bSL, SL=a+bTL and TL=a+bFL equations in all individuals.

Results

In this study 228 *A. mossulensis* were caught (103 females, 125 males) for the study. The total lengths and weights of specimens varied 7.5-21.4 cm and 5.0-71.2 g, respectively. 365 *A. marmid* werecaught (196 females, 169 males) for the study. The total lengths and weights of *A. marmid* specimens were ranged 6.1-11.7 cm and 2.4-20.5 g, respectively (Table 1).

In this study, all individuals of *A. mossulensis and A. marmid* were determined between length and weight very strong positive relationship in the Karasu River. The high values of r^2 indicate that the length-weight relationships are linear distribution of values. The *b* values of *A. mossulensis* were determined as 2.80 for females, 2.82 for males and 2.81 for all individuals in the Karasu River. The growth of all individuals was negative allometry (b<3) in the Karasu River (Figure 2; Table 1).

No significant differences were found between total length-weight of males and (p < 0.05). The *b* values of *A. marmid* were determined as 3.35 for females, 3.27 for males and 3.30 for all individuals in the Karasu River. The growth of all individuals was positive allometry (b›3) in the Karasu River (Figure 3; Table 1).

No significant differences were found between total length-weight of males and females (p < 0.05).

Length-length relationships and the coefficient of determination of *A. mossulensis and A. marmid* are presented in Table 2. LLRs were significant (p<0.001) for all specimens with all r^2 values greater than 0.93.

Table 1. Total length-weight relationships of *A. mossulensis* and *A. marmid* in the Karasu River

Species	Sex	n	Total Length (cm)(min-max)	Weight (g)(min-max)	*a*	*b*	r^2
A. mossulensis	F	103	7.5-19.9	5.0-62.2	0.0131	2.80	0.93
	M	125	8.0-21.4	5.3-71.2	0.0125	2.82	0.92
	All	228	7.5-21.4	5.0-71.2	0.0128	2.81	0.93
A.marmid	F	196	6.4-11.7	3.2-20.5	0.0050	3.35	0.97
	M	169	6.1-11.0	2.4-19.0	0.0058	3.27	0.96
	All	365	6.1-11.7	2.4-20.5	0.0055	3.30	0.97
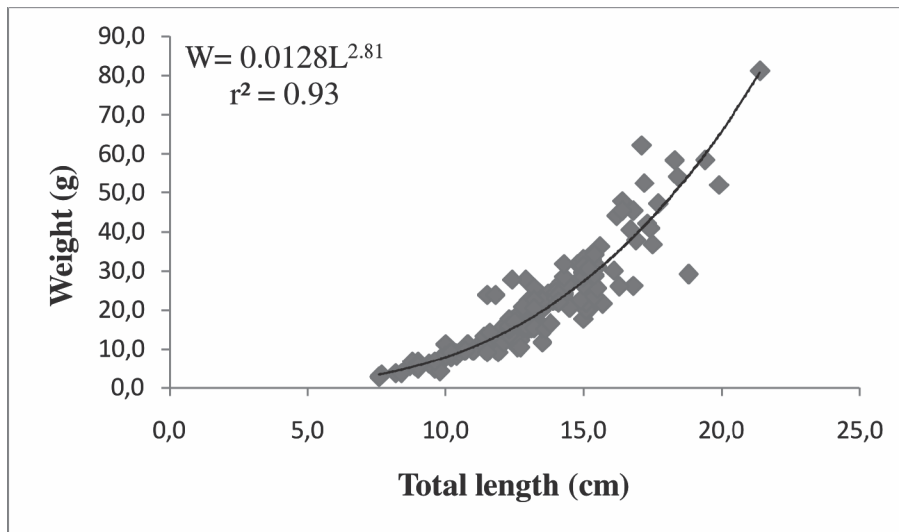
Figure 2. Length-weight relationship all individuals of *A. mossulensis* in the Karasu River.
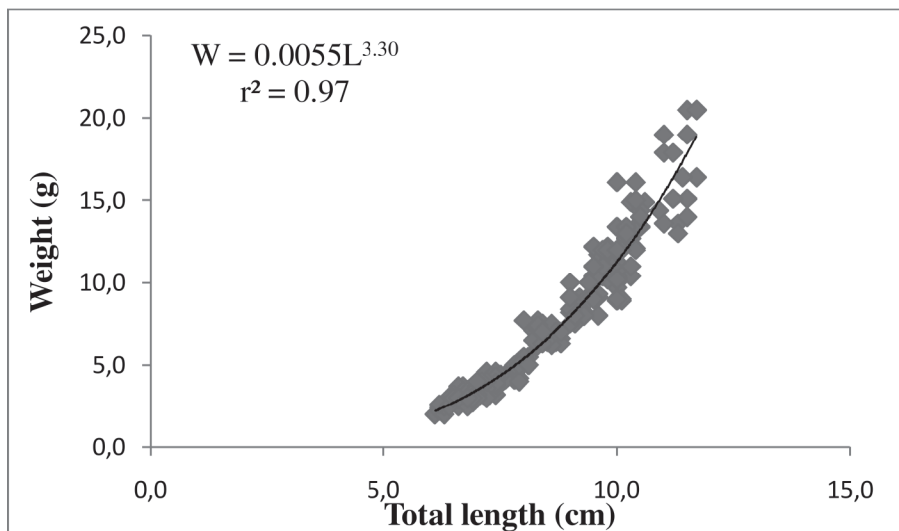
Figure 3. Length-weight relationship all individuals of *A. marmid* in the Karasu River.

Discussion

Türkmen and Akyurt (2000) were determined b as 3.082 for females and 2.828 for males of *A. mossulensis*. Yıldırım *et al.* (2003) stated that b was found 3.136 for females and 2.913 for males of *A. mossulensis*. Özdemir *et al.* (1996) determined that b was estimated as 2.046 for allindividuals for *A. mossulensis* in Keban Dam Lake. Alkan Uçkun and Gökçe

(2015) determined that b was calculated 2.065 for females and 2.138 for males of *A. mossulensis*. The weight and length values of this study, *A. mossulensis* were same to those of studies.

Ünlü *et al.* (1994) stated thatb was determined as 3.40 and 3.29 for females and males of *A. marmid*. Başusta (Girgin) (2000) determined that b was found 3.363 for females and 3.086 for males in Keban Dam Lake. Çoban and Yüksel

Table 2. Length-length relationships of *A. mossulensis and A. marmid* in the Karasu River

Species	Sex	Equation	*a*	*b*	*r²*
A. mossulensis	F	TL= a + bFL	0.5502	1.0543	0.97
		FL= a + bSL	0.4937	1.0388	0.98
		SL= a + bTL	-0.4827	0.8766	0.96
	M	TL= a + bFL	0.1683	1.0930	0.94
		FL= a + bSL	0.1229	1.0719	0.99
		SL= a + bTL	0.5617	0.7936	0.93
	All	TL= a + bFL	0.3611	1.0737	0.95
		FL= a + bSL	0.3132	1.0549	0.99
		SL= a + bTL	0.0709	0.8325	0.94
A.marmid	F	TL= a + bFL	0.5829	1.0286	0.95
		FL= a + bSL	0.1384	1.0978	0.98
		SL= a + bTL	-0.2223	0.8410	0.96
	M	TL= a + bFL	0.0069	1.1017	0.96
		FL= a + bSL	0.0644	1.1038	0.98
		SL= a + bTL	0.2866	0.7862	0.97
	All	TL= a + bFL	0.2043	1.0767	0.95
		FL= a + bSL	0.1062	1.0999	0.98
		SL= a + bTL	0.1125	0.8047	0.96

(2013) stated that b was determined 2.926 for females and 3.009 for males *A. marmid* inhabiting Uzuncayır Dam Lake. In our study area, the b was estimated 2.80 ($r^2 = 0.93$) for females and 2.82 ($r^2 = 0.92$) for males in the *A. mossulensis* population ($P < 0.05$), and the b was found 3.35 ($r^2 = 0.97$) for females and 3.27 ($r^2 = 0.96$) for males in the *A. marmid* specimens ($P < 0.05$) (Table 1).

This equations of the lengths measurements presented may enable researchers to gain useful information about length conversions. Length-weight relationships may show temporal or spatial variations due to their size range, reproductive activities and stage or environmental factors such as water temperature and quality, food quality and availability, diseases, and competition (Wootton, 1990).All LLRs were highly correlated. There are no data available on LLRs of *A. mossulensis* and *A.marmid*. Thus, this study provides first information LLRs which are useful for fishery biologist.

This study provided the basic information on the length-weight and length-length relationships of *A. mossulensis and A. marmid* from the Karasu River that will be useful for the management of fishery resources.

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