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Research Article

Mean length-weight relationship and condition factor of some Cyprinid fishes in Göynük Stream, Murat River of Eastern Türkiye, Bingöl

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Keywords

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G. rufa
B. lacerta
A. marmid

ABSTRACT

The Length-weight relationships (LWRs) are very important to data for accurate estimate of populations in stock menagement. In this study, the length-weight relationships and Fulton's condition factor (K) of some fish in Göynük Stream, Murat River (Bingöl/Turkiye) were examined. The LWRs and condition factor (K) of *Cyprinon macrostomus, Garra rufa, Barbus lacerta,* and *Acanthobrama marmid* were analyzed between March 2017-February 2019. LWRs was estimated using the linear regression model. LWRs were obtained as total weight (TW) = $0.013L^{2.98}$, $0.057L^{2.40}$, $0.016L^{2.79}$ and $0.029L^{2.82}$ for *C. macrostomus, G. rufa, B. lacerta* and *A.marmid*, respectively. The b values acquired in the four fish species ranged from 2.13-2.57 (*G. rufa*-Male; Female) to 2.77-3.34 (*B. lacerta*-Female; Male). Only *B. lacerta* males had a positive allometric growth versus the males and females of all species had a negative allometric growth. The K of the fish species varied from 0.90-0.99 (*A. marmid*-Male; Female) to 1.27 (*G. rufa*-All), indicating that most of the fish were in good condition. However, *C. macrostomus* and *G. rufa* were better condition than *B. lacerta* and *A. marmid*. The study has provided baseline information on the LWR and K of the fish species in Göynük Stream. The data that would be useful to adapt the adequate regulations for sustainable fish stock estimation in the stream for fishery biologist.

Introduction

Length and weight data of fish are very important parameters for population dynamics (Krause et al., 1998), growth and death rates of the fish (Kohler et al., 1995). Also, the length-weight relationship (LWR) can also helps for stock management of the fish population (Sparre and Venema 1998, Blackwell et al., 2000). The LWR is important for calculating the present biomass of the fish population in a reservoir (Petrakis and Stergiou, 1995).

Studies of the LWR of fishes were performed for years. The LWRs has been studied by many researchers in different fish species viz., *Clarias gariepinus* (Ayo-Olalusi, 2014); *Oreochromis niloticus* (Silva et al., 2015); *Astyanax* aff. *fasciatus* (Furuya et al., 2014); *Pseudorasbora parva, Atherina boyeri, Aphanius danfordii, Tinca tinca,* and *Cyprinus carpio* (Kırankaya et al., 2014); *Capoeta umbla* (Serdar and Özcan, 2016); *Acanthobrama marmid, Capoeta trutta, Arbus luteus* and *Chalcalburnus mossulensis* (Başusta and Çiçek, 2006); *Carasobarbus luteus, Chondrostoma regium, Clarias gariepinus, Anguilla anguilla* and *Cyprinus carpio* (Özcan, 2008). In addition, the *a* and *b* values, which are the LWR parameters, allow the morphology of populations distributed in different habitats and the life processes of fish species to be compared (Yedier et al., 2019; Yılmaz et al., 2010).

Condition factor (K) is a parameter related to the body shape of the fish and serves as an important factor in understanding detailed properties of the habitat. This factor shows the nutrient

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density of the environment where fish live. Therefore, it is strongly affected by both biotic and abiotic environmental conditions (Saliu, 2001). Thus, it also provides the opportunity to compare the condition factors of fish populations of the same species in different environments. In addition, it provides an information to researchers according to sexual maturity status, population density, nutritional status and climate changes (Froese, 2006). Briefly, it is important to understanding of the quality of the ecosystem (Luff and Bailey, 2000; Anene, 2005). Condition factor has been studied for different fish species (Uysal et al., 2009; Ayyildiz et al., 2014; Emre et al., 2014; Keyombe et al., 2015; Maurya et al., 2018; Khristenko and Kotovska, 2017; Özcan, 2019; Özcan and Serdar, 2021; Alagöz Ergüden, 2021).

The Göynük Stream (Bingöl, Türkiye) has the 21 fish species (Koyun et al., 2018), but there is not a study concerning the LWR of fishes in this region. The present study aimed to find out the present status of LWR and K of some fish species in Göynük Stream. Consequently, results will contibute in the protection of natural fish stocks in this region.

Materials and Methods

Murat River is between the Tigris Euphrates Rivers and Asi Basin in Turkey and arises from hillside of Ararat Mount and carries in 2/3 of water of Euphrates River (42000 km^2). The length of Murat River is 722 km and its flow is 239.9 m^3/s (ÇDR, 2014; Kirici et al., 2016).

The fish samples (adult) were collected different location depending on fish abundant from March 2017 to February 2019 from the Göynük Stream, Murat River (Bingöl, Türkiye) using nets with different eye apertures. Caught fish were kept on ice, and delivered to the laboratory in 1 h. In the laboratory, total length (TL, cm) were measured, total weights (TW, g) were weighed. The total length and weight of each fish sample were determined to be the nearest 1 mm and 0.01 g scales, respectively. The sexes were determined by macroscopic observation of the gonads; when the gonads were thin and poorly developed the fish sex was considered as undetermined (Özcan and İspir, 2019). The sex of each specimen was determined by examining the gonads macroscopically. Chi-square ($\chi 2$) analysis was used to test the significant differences between the sex ratio. The LWR of a fish were expressed by the equation $W=aTL^b$, where *W* is the total weight, *TL* is the total length, *(a)* is the coefficient related to body form and *(b)* is an exponent indicating isometric growth when equal to 3 and allometric growth when different to 3 (the allometry is majorant if $b>3$ and minorant if $b<3$). The parameters *(a)* and *(b)* of the length–weight relationship was estimated by the least-square method, using *W* as the dependent variable and *TL* as the independent variable, $log(W)=log(a)+blog(TL)$. The *b*-value for each species was tested by Student t-test to verify if it was significantly different from the predictions for isometric growth ($b=3$) (Pauly, 1984). The relationships among the variables were identified using the regression analysis (Sparman Rank Correlation). The observed differences were evaluated statistically using STATISTICA software and t-test, independent, by groups.

The Fulton's condition factor *(K)* was calculated according to Bagenal and Tesch (1978) with the formula; $K=100W/L^3$, where *K* is the condition factor, *W* is the total body weight *(BW), L* is the length *(L)* and 3 is a constant.

Results and Discussion

Length-weight relationship gives an information on the condition and growth pattern of fish (Bagenal and Tesch, 1978). In morphometry, it is a valuable and standart result of fish sampling programmes. The relationship is used in estimate various morphological and physicological aspects (e.g. growth rate, length, age) (Kohler et al., 1995). Weight of fish is accepted to be function of length (Weatherely and Gill, 1987). The relationship parameter was "*b*" value and generally ranges between 2 and 4 (Bagenal and Tesch, 1978), often close to 3 (Jobling, 2002). Also, *K* is used as biological parameter. *K* indicates the suitability of a spesific water body for the gowth of fish an an index of species average size (Begenal and Tesch, 1978). *K* values change depending on enviromental (e.g. nutrition condition, seasonal variation) and physicological factors of fish (e.g. age, size, disease, stress, reproduction period, gonadol development) (Doddamani et al., 2001; Welcomme, 2001; Korkut et al., 2007). The coefficient of determination (R^2) values explaine the proper fit of the model for growth (Datta et al., 2013). All the parameters were used in four different cyprinidae species (*C. macrostomus, G. rufa, B. lacerta, A. marmid*) from Göynük Stream, Murat River.

It is well known that the female/male ratio *(F/M)* in most species is close to 1. However, while the ratio varies considerably from species to species, it can also differ from one population to another and from year to year in the same species (Nikolsky, 1963). 42 (48.28%) females and 45 (51.72%) males a total of 87 *C. macrostomus,* 78 (48.75%) females and 82 (51.25%) males a total of 160 *G. rufa,* 35 (79.55%) females and 9 (20.45%) males a total of 44 *B. lacerta* and 11 (45.83%) females and 13 (54.17%) males, a total of 24 *A. marmid* specimens were used in the study. *F/M* ratio was the lowest in *A. marmid* (1/1.18, p=0.34) while *F/M* ratio was the highest in *B. lacerta* (1/0.26, p=0.5). There was no significant difference in *F/M* of these species from the expected 1. Generally, the males were heavier and longer than the females except for *B. lacerta* (Table 1). There were significant differences between males and females in terms of both length (F/M=1/0.95, p=0.03) and weight (F/M=1/0.84, p=0.008) of *B. lacerta* ($p<0.05$). However, there were not significant differences between males and females length (F/M=1/2.77, p=0.21, $p>0.05$) of *A. marmid* whereas there were significant differences between males and females weight (F/M=1/2.29, p=0.03, $p<0.05$) of *A. marmid* ($p>0.05$). Additionally, there were significant differences between females and males length in both of *C. macrostomus* (F/M=1/2.71, p=0.11) and *G. rufa* (F/M=1/2.15, p=0.005) ($p<0.05$). Similarly, there were a significant difference between males and females weight in both of them. Although, they have the same p value for weight (p=0.02, $p<0.05$), their *F/M* weight was different. *F/M* weight

was 1/2.24 for *C. macrostomus* and 1/1.45 for *G. rufa*. We determined a negative allometry in isometric growth of all the species without distinction of sex (*b*<3, Student's t-test; p<0.05) LWR for *C. macrostomus* in Göynük Stream, Murat River (Table 2). "*b*" value is a parameter related to the growth pattern. The highest "*b*" value was with 2.98 in *C. macrostomus,* following *A. marmid* (*b*=2.82), *B. lacerta* (*b*=2.79) and *G. rufa* (*b*=2.40). *K* is a factor based on growth (Ricker, 1975). *K*>1 showes the well being of fishes fed with different diets and much robust fish (Datta et al., 2013). *K* varied between 0.94 and 1.27 for all fish specimens in our study. *K* was the highest in *G. rufa* (1.27) and *C. macrostomus* (1.20) (*K*>1) and the lowest with equal value (0.94) in *B. lacerta* and *A. marmid* (Table 2). According to the results, *C. macrostomus* and *G. rufa* were fed different and richer nutrient diets than *A. marmid* and *B. lacerta.* Therefore, we can say that *C. macrostomus* and *G. rufa* much more robust than the others fish. Additionally, Göynük Stream from Murat River had more suitable environmental conditions for *C. macrostomus* and *G. rufa* than *B. lacerta* and *A. marmid.* In the study, lowest R^2 was in *G. rufa* (0.77), whereas the highest R^2 was in with the equal value in *C. macrostomus* and *B. lacerta* (0.97) (Table 1).

Table 1. Mean length-weight relationship parameters of the species in Göynük Stream, Murat River (Türkiye) (p<0.05)

Species	Sex	n	$L_{min-max}$ (cm)	$W_{min-max}$ (g)	a	b	R^2
C. macrostomus	♀	42	8.5-18.5	8.00-72.00	0.013	2.97	0.975
	♂	45	9.8-18.8	10.00-87.00	0.012	2.99	0.957
	♀+♂	87	8.5-18.8	8.00-87.00	0.013	2.98	0.968
G. rufa	♀	78	9.0-18.0	11.10-68.50	0.038	2.57	0.897
	♂	82	8.1-19.0	6.50-60.00	0.011	2.13	0.606
	♀+♂	160	8.1-19.0	6.50-60.00	0.057	2.40	0.770
B. lacerta	♀	35	11.5-22.5	13.54-96.30	0.017	2.77	0.963
	♂	9	10.6-14.1	9.68-25.53	0.004	3.34	0.925
	♀+♂	44	10.6-22.5	9.68-96.30	0.016	2.79	0.966
A.marmid	♀	11	12.7-19.0	21.50-72.25	0.029	2.62	0.870
	♂	13	14.4-17.5	24.50-54.64	0.018	2.75	0.763
	♀+♂	24	12.7-19.0	21.50-72.25	0.016	2.82	0.818

Min-max total lengths and weights were between 8.5-18.8 cm and 8.0-72 g in the females of *C. macrostomus*, 9.8-18.8 cm ve 10.0-87.0 g in the males of *C. macrostomus,* respectively. The length and weight distributions of *C. macrostomus* were found as 2.50-15.50 cm and 0.43-85.21 g in the Shahpur River, Iran, and 2.80-17.70 cm and 0.51-126.15 g in the Dalaki River, Iran by Bibak et al. (2013). The length-weight relation of *C. macrostomus* was $W=0.013L^{2.97}$ for the females and $W=0.011L^{2.99}$ for the males. "*b*" had positive allometry (3.13, b>3) in Dalaki River and negative allometry (2.94, b<3) in Shahpur River for LWR for *C. macrostomus* (Bibak et al., 2013). The values of *b* in the Dalaki River were 3.27 for females and 3.02 for males in *C. macrostomus* (Sedaghat and Hoseini, 2012). We determined a negative allometry (b_{female}:2.97; b_{male}:2.99, Student's t-test; p<0.05) LWR for *C. macrostomus* in Göynük Stream, Murat River (Table 2). Similarly, the *b* values of both sexes were less than 3 (b_{female}: 2.95; b_{male}: 2.86) with negative allometry in Karakaya Dam Lake (Euphrates River), Türkiye (Uckun and Gokce, 2015). The mean condition factors *(K)* were 1.19 for females and 1.20 for males of *C. macrostomus*. Uckun and Gokce (2015) found that *K* was the highest 1.98 for females and 1.89 for males of *C. macrostomus*. Unlike Uckun and Gokce (2015), we found that *K* was higher in males (1.65) than females (1.38) of *C. macrostomus. K* was higher in the males (1.20) than in the females (1.19), with a slight difference. Although the research areas are in the same region, such the differences are an expected result as stated above. In the study, R^2 was 0.98 in the females while R^2 was 0.96 in the males. The regression analysis showed that male length of *C. macrostomus* had higher significant correlation than male length of *C. macrostomus* with weight (p<0.05, Sparman Rank Order Correlation Test) (Table 1). Length of *C. macrostomus* had a high correlation with weight of *C. macrostomus* in Dalaki River, Iran (R^2=0.98) and Shahpur River, Iran (R^2=0.997). R^2 was given as 0.88 for females and 0.87 for males of *C. macrostomus* in Euphrates River (Türkiye) by Uckun and Gokce (2015).

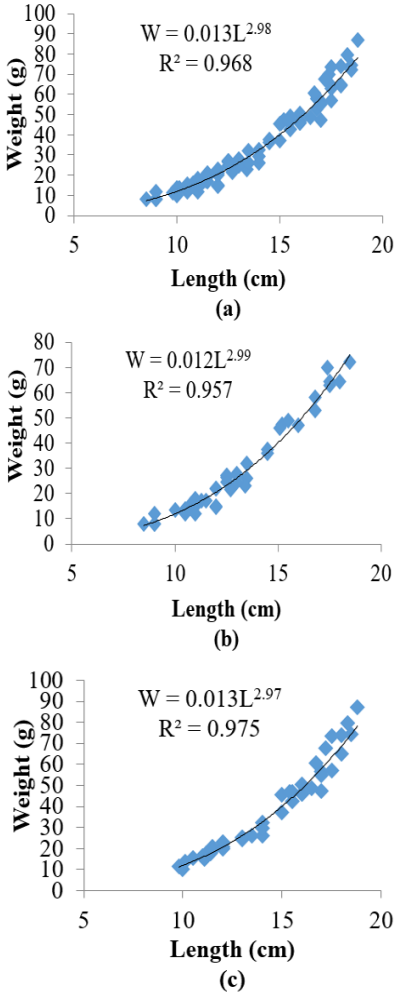

Figure 1. Mean total length-weight relationship of *C. macrostomus* for all individuals (a), male (b) and female (c) in Göynük Stream, Murat River (Türkiye)

Min-max total lengths and weights were between 9.0-18.0 cm and 11.1-68.5 g in the females of *G. rufa,* 8.1-19.0 cm and 6.5-60.0 g in the males of *G. rufa,* respectively. The total length of

G. rufa ranged from 8.5-19.1 cm in Goynuk Stream and the total weights ranged from 5.8-58.7 g (Koyun and Atici, 2021). The mean condition factor was determined as 1.126 (0.607-1.646) in the same sampling location by Koyun and Atici (2021). The length and weight distributions of *G. rufa* were found as 2.90-16.80 cm and 0.21-69.27 g in Merzimen Stream, Euphrates River by Cicek et al. (2021) and 3.00-17.10 cm and 2.00-35.00 g in the Dalaki River, Iran by Pazira et al. (2013). The maximum length were given as 16.8 cm in Merzimen Stream, Euphrates River by Cicek et al. (2021). Min-max total lengths and weights *G. rufa* were given as 3.50-17.00 cm and 4.00-35.00 g for the females and 2.00-16.50 cm and 3.00-32.00 g foor the males in Dalaki River, by Pazira et al. (2013). The length-weight relation of *G. rufa* was $W=0.038L^{2.57}$ for the females and $W=0.011L^{2.13}$ for the males with negative allometry (Student's t-test; $p<0.05$) (Table 2). *G. rufa* had positive allometric growth in the most the previous studies (Abedi et al., 2011; Birecikligil and Ciçek, 2011; Hamidan and Britton, 2013; Gerami et al., 2013; Ergüden, 2016; Çiçek et al., 2021). However, we found a negative allometry (b_{female}: 2.57; b_{male}:2.13, Student's t-test; $p<0.05$) LWR for *G. rufa* in Göynük Stream, Murat River (Table 2). Environmental conditions, existing habitat may have been effective in the difference in the results (Thoumani et al., 2006) ; Nazek et al., 2018). The values of "*b*" were between 2.63 and 3.40 in *G. rufa* collected from different rivers and basins of Iran (Keivany et al., 2015). The mean *K* were the same value with 1.27 for females and males of *G. rufa*. Similarly, Gerami et al. (2013) found almost close *K* values both of the females (1.22) and the males (1.21) in Cholvar River, Iran. Additionally, R^2 of *G. rufa* was >0.90 in the different regions in the previous studies (Keivany et al., 2015; Gerami et al., 2013; Esmaeili and Ebrahimi, 2006). However, R^2 was 0.90 in the females while R^2 was 0.61 for males in the study. The regression analysis showed that male length of *G. rufa* was weakly correlation with weight while female length of *G. rufa* was highly correlation with weight ($p<0.05$) (Table 1).

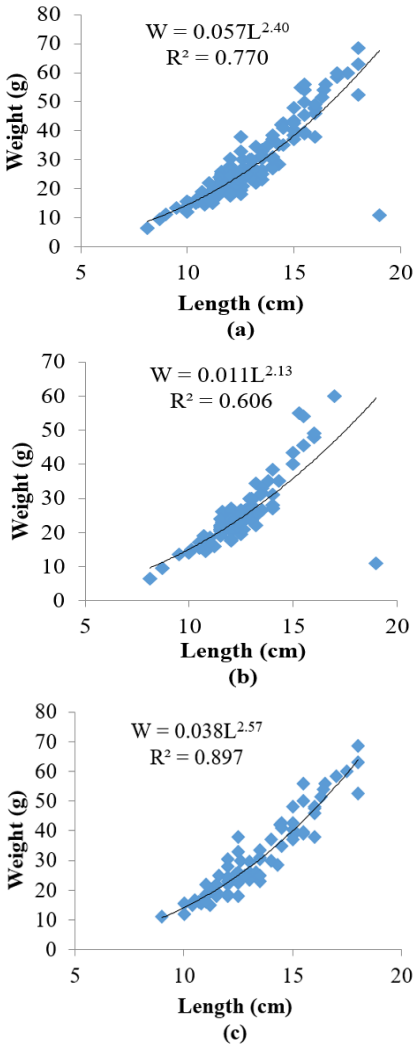

Figure 2. Mean total length-weight relationship of *G. rufa* for all individuals (a), male (b) and female (c) in Göynük Stream, Murat River (Türkiye)

Table 2. Mean total length, weight and condition factor values of the species in Göynük Stream, Murat River (Türkiye)

Species	Sex	L±SD	W±SD	K±SD	$K_{Min-Max}$	LWR*	Growth (t-test)
C. macrostomus	♀	14.33±2.77	38.89±21.58	1.19±0.11	0.95-1.38	$W=0.013L^{2.97}$	A (-)
	♂	12.88±2.66	28.87±18.47	1.20±0.15	0.84-1.65	$W=0.012L^{2.99}$	A (-)
	♀+♂	13.58±2.80	33.71±20.54	1.20±0.13	0.84-1.65	$W=0.013L^{2.98}$	A (-)
G. rufa	♀	13.27±2.13	30.97±13.65	1.27±0.2	0.90-1.95	$W=0.038L^{2.57}$	A (-)
	♂	12.60±1.73	25.92±9.86	1.27±0.2	0.16-1.67	$W=0.011L^{2.13}$	A (-)
	♀+♂	12.92±1.96	28.38±12.10	1.27±0.2	0.16-1.95	$W=0.057L^{2.40}$	A (-)
B. lacerta	♀	14.87±2.57	31.96±17.29	0.91±0.09	0.80-1.19	$W=0.004L^{2.77}$	A (-)
	♂	12.27±0.93	17.76±4.26	0.94±0.07	0.81-1.06	$W=0.016L^{3.34}$	I (+)
	♀+♂	14.34±2.55	29.66±16.54	0.94±0.09	0.80-1.19	$W=0.016L^{2.79}$	A (-)
A. marmid	♀	16.56±1.64	45.81±12.20	0.99±0.11	0.78-1.14	$W=0.016L^{2.62}$	A (-)
	♂	15.84±1.10	36.23±8.08	0.90±0.10	0.77-1.02	$W=0.018L^{2.75}$	A (-)
	♀+♂	16.17±1.39	40.63±11.07	0.94±0.11	0.77-1.14	$W=0.029L^{2.82}$	A (-)

Min-max total lengths and weights were between 11.5-22.5 cm and 13.54-96.30 g in the females of *B. lacerta,* 10.60-14.10 cm and 9.68-25.53 g in the males of *B. lacerta,* respectively. The length and weight distributions of *B. lacerta* were found as 6.0-22.6 cm and 2.14-133.0 g for the females, 5.4-25.7 cm and 2.02-158.3 g for the males in Pülümür River, Türkiye by Özcan (2019). The total length and weight distribution of *B. lacerta* was 30.4-47.4 cm and 271.8-981.6 g in Keban Dam Lake (Türkiye) (Dartay and Gül, 2013), 6.6-17.1 cm and 2.8-48.4 g in Zarrineh River (Iran) (Radkhah and Eagderi, 2015), 2.60- 23.23 cm and 0.17–123.17 g in Bibbi-Sayyedan River (Iran) (Keivany et al., 2016), 7.0-24.0 cm and 4.0-211 g (Serdar and Özcan, 2018) in the Karasu River (Türkiye). The length-weight relation of *B. lacerta* was $W=0.004L^{2.77}$ for the females with negative allometry and $W=0.016L^{3.34}$ for the males with positive allometry (Student's t-test; $p<0.05$) (Table 2). The length-weight relation of *B. lacerta* was found as positive allometric (isometric growth) both of females (b=3.11) and males (b=3.08) of *B. lacerta* by Serdar and Özcan (2018) in Karasu River. Özcan (2019) found $b<3$ in females (b=2.90) and males (2.97) of *B. lacerta*, Pülümür River. Different b values maybe depend on many factors such as number of samples, length and weight distribution of samples, sampling time and shape, ecological conditions of habitats, etc. (Yazioglu et al., 2013). The mean K were 0.91 for the females and 0.94 for the males of *B. lacerta. K*<1 indicated that both males and females of *B. lacerta* do not prefer mixed diets with rich nutrition and fed with diets with poor nutrient content. Similarly, Özcan (2019) found *K*<1 in both of the females (0.91) and the males (0.94) in Pülümür River. *K* values of *B. lacerta* were found between 1.77-2.17 in the Bibi-Sayyedan River, Iran by Dopeikar and Keivany (2015). Also, the mean *K* value of *B. lacerta* was determined as 1.011 in the Zarrineh River by Radkhah and Eagderi (2015) and 1.18 in Karasu River by Serdar and Özcan (2018). R^2 value was 0.94 for females and 0.96 for males of B. lacerta in Pulumur (Özcan, 2019), 0.98 for both of the females and males in Karasu River (Serdar and Özcan, 2018). Conversely, R^2 was 0.96 in the females while R^2 was 0.93 for males in the study. The regression analysis showed that length of *B. lacerta* male correlated higher with weight than *B. lacerta*'s female length correlated with weight ($p<0.05$, Sparman rank order correlations test) (Table 1).

Min-max total lengths and weights were between 12.70-19.00 cm and 21.50-72.25 g in the females of *A. marmid*, 14.40-17.50 cm and 24.50-54.64 g in the males of *A. marmid,* respectively. The length and weight distributions of *A. marmid* were found as 6.40-11.70 cm and 3.20-20.50 g for the females, 6.10-11.00 cm and 2.40-19.00 g for the males in Karasu River by Serdar et al. (2017). The length-weight relation of A. marmid was $W=0.016L^{2.62}$ for the females and $W=0.018L^{2.75}$ for the males with negative allometry (Student's t-test; $p<0.05$) (Table 2). The length-weight relation of *A. marmid* was found as positive allometric growth in both of females (b=3.25) and males (b=3.27) of *A. marmid* by Serdar et al. (2017) in Karasu River. Ünlü et al. (1994) found $b>3$ in females (b=3.40) and males (3.29) of *A. marmid*. Similarly, b was found 3.363 for females and 3.086 for males in Keban Dam Lake by Basusta (2000). Çoban and Yüksel (2013) indicated that

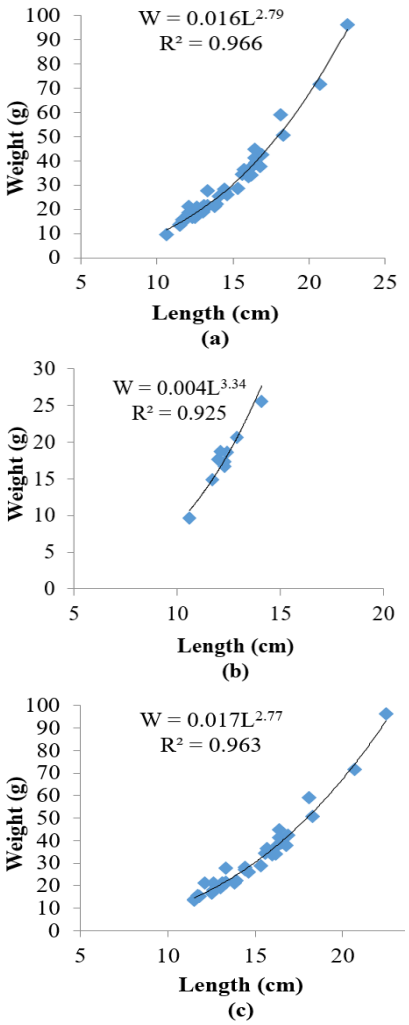

Figure 3. Mean total length-weight relationship of *B. lacerta* for all individuals (a), male (b) and female (c) in Göynük Stream, Murat River (Türkiye)

b was 2.926 for females (negative allometric) and 3.009 for males (positive allometric) in Uzuncayir Dam Lake of Eastern Türkiye. The mean *K* were 0.90 for the females and 0.94 for the males of *A. marmid* (*K*<1). The *K* values of *A. marmid* indicated that both the males and females do not prefer mixed diets with rich nutrition and fed with diets with poor nutrient content and to less favorable environmental conditions like *B. lacerta* in the Göynük Stream, Murat River. *K* was found between 0.77-1.14 for all *A. marmid* individuals in the study. Mean *K* was 0.99 (0.78-1.14) for the females and 0.90 (0.77-1.02) for the males. Similarly, Coban and Yuksel (2013) found *K*<1 in both of the females (0.23) and the males (0.24) for *A. marmid* in Uzuncayir Dam Lake. Similar results for *K* were found by Unlu et al. (1994) in Tigris River. *K* values were given as 0.69 for the males and 0.74 for the females by them. The highest *K* values were found in our study for *A. marmid*, compared with these studies conducted in eastern Turkey. *K* values of this study indicated that Göynük Stream, Murat River had more favorable environmental conditions than the others for *A. marmid.* R^2 value was 0.97 for the females and 0.96 for males in Karasu River (Coban and Yuksel, 2013). R^2 was higher (0.87) in females than the males (0.76) in the study (Figure 4). The regression analysis showed that *A. marmid's*

female length correlated higher with weight than *A. marmid's* male length correlated with weight ($p<0.05$) (Figure 4).

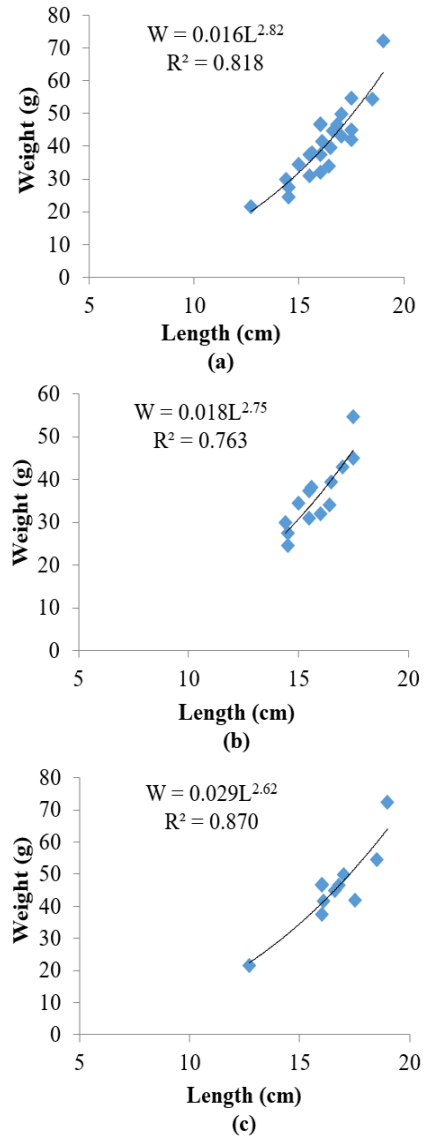

Figure 4. Mean total length-weight relationship of *A. marmid* for all individuals (a), male (b) and female (c) in Göynük Stream, Murat River (Türkiye)

Conclusion

This study included the basic information on the length-weight relationships and condition factor of *C. macrostomus, G. rufa, B. lacerta* and *A. marmid* from the Göynük Stream, Murat River that will be useful for the management of fishery resources. However, Göynük Stream, Murat River provided more favorable environmental conditions for *C. macrostomus* and *G. rufa* than *B. lacerta* and *A. marmid*. There are no data available on the species in Murat River. Thus, the study provides first informations, describing parameters related to length-weight relationships which are useful for fishery biologist in the sampling area.

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COMPLIANCE WITH ETHICAL STANDARDS

Authors' Contributions

Authors contributed equally to this paper.

Conflict of Interest

The author declare that there is no conflict of interest.

Ethical Approval

Fish catching and experimental protocol was approved by Bingöl University Animal Experiments Ethics Committee (Bingöl, Türkiye). (Approval Date: 13.10.2016, Approval No: 06/5)

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