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BIOLOGICAL TRAITS OF A DATA DEFICIENT SPECIES IN THE ASI RIVER: *BARBUS LORTETI* (SAUVAGE, 1882)

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ABSTRACT

This study was realized with 201 *Barbus lorteti* (Sauvage, 1882) individuals, caught in different regions of orontes (or Asi) River in 1997-1998. According to this research, the length-weight, age-length and age-weight parameters of the species concerning that period, were determined according to the von Bertalanffy growth equations. The distribution of the total length for the individuals in the sample varies in the 7.4 and 31.0 cm interval and was determined as 18.37 (\pm 4.8) cm in average. And the distribution of the weight was fixed as 3.8 and 274.9 g and 82.57 (\pm 4.3) g in average. The length weight relationship of the species found in the population, was estimated as $W=0.013*L^{2.97}$ ($R^2=0.98$). In the age readings made on the scales of the individuals in the sampling, it was fixed that the age classes were ranging between I-IV. For the species, von Bertalanffy equation in length growth was estimated as $L_t=28.45 [1-e^{-0.43(t+(-0.23))}]$, and the equation in weight growth was estimated as $W_t=382.76*[1-e^{-0.34(t+(-0.19))}]^{2.97}$.

Keywords: Population dynamics, Freshwater fish, Growth parameters, *Barbus lorteti*

Introduction

By its special geographical position, Turkey contained so many endemic and cosmopolit fish species within itself with the fresh water potential (Innal and Erk'akan, 2006). Over two third of approximately about 310 freshwater fish species were determined as endemic (Froese and Pauly, 2000). *Barbus lorteti* is an endemic species, belonging to the family of Cyprinidae, which only distributed in the lower parts of Asi River in Syria to Turkey. IUCN (2016) assessed this species as data deficient (DD) because of gap in reliable data on distribution, abundance, trend and threats of this species. The population of this species has decreased after collection of the specimens in 1997-1998 and the various attempts to collect this species is wasted in last decade. The population of this species has decreased dramatically in the last 25 years. The changes and deteriorations occurred in the freshwater ecosystems, emerged more devastatingly by the impacts such as the extinction of the biological diversity (Sala et al., 2000). the excessive use of the water and extreme low tide for to be used in applications such as dam and set which were made on the river and agricultural irrigation change the habitat characteristics of the river Crivelli (1995) and it is asserted that this destruction in Asi river caused the deterioration of the species as bringing over exploitation with it. According to the commercial fishing activities, the existence of this species could be mentioned especially as being in the lower parts of Asi river till the years of 1990s (Demirci and Demirci, 2009). After this term, following the negativities (partial water reduction, drying, domestic waste, industrial pollution, agricultural activities and irrigation) occurred in Asi river, no *B. lorteti* individuals were encountered in the main river bed (Yalçın, 1999).

In our research, specimens caught in the artisanal fishing activities in the branches of Asi in the period between 1997-1998 were used.

Though there was so little information concerning the checklist and systematic features of this species (Krupp, 1985; Çiçek et al., 2015), there was no information about the population structure, habitat and ecological features of this species. Age-length and weight features belonging to this species were given for the first time. Besides, in this study, information concerning the deterioration reasons of this species, would be given by making a comparison with the biological features of *Barbus luteus* whose existence is still continuing in the region (Yalçın et al., 2004; Gökçek and Akyurt, 2008).

Thus, with this study, it was aimed to reveal some biological

specialities of this hardly observed species in nature.

Materials and Methods

The Asi River, also named as Orontes, was located in both the borders of Syria and Turkey. The river rose from the Bekaa Valley in Lebanon and reached to the borders of Turkey after in Syria. Its part within the borders of Turkey, was 88 km long. In the last set, it flowed into Mediterranean from Samandag (Yalçın, 1999; Demirci et al., 2016). The mean water flow rate of Asi River is 30 m³/sec. As the depth of the river varied according to the seasons, increased in the level of winter and spring, are appeared. This increase was formed due to releasing too much water Syria. This situation caused the floods. The research region is seen in Figure 1 four different catching area is shown in this Figure 1. *Barbus lorteti* samples were obtained from the local fishers who threw fyke net, electro-shocker and trammel net between the dates of June 1997-April 1998. These catching gears were thrown in the evening and then were collected in the next morning. The sampled 201 individuals were brought to the laboratory by being fixed in the 4% of formalin solution following after the preliminary studies. The length measurements of the fish samples were realized by fish measuring scale with 1 mm interval and the weight measurements were done with digital scale with 0.1 g sensitivity. In age determination, scales were used. With this aim, the scales which were taken from the left anterior-dorsal region of the fish, were kept in 3% of NaOH solution for 3-6 hours, after being washed with distilled water, soaked into the 96% of ethyl alcohol for a period of 30 minutes, and again after being washed with distilled water, were brought to be ready for examination as being dried and fixed between two lames (Lagler, 1966). Preparations, on the small magnifier binocular microscope, age determinations were made. In the estimation of the length-weight relationship, the regression analysis method was used (Ricker, 1975).

$$W = a L^b$$

Here the 'W' indicated the total weight of the fish in gram, the 'L' indicated the total length of the fish in cm, 'a' and 'b' coefficients indicated the regression parameters which vary according to the species. von Bertalanffy growth equation was estimated by the least squares method based on the lengths and weights, observed in every age groups (Beverton and Holt, 1957).

$$L_t = L_\infty * [1 - e^{-K*(t-t_0)}]$$

$$W_t = W_\infty * [1 - e^{-K*(t-t_0)}]^b$$

Here the "L_t", the fish length in t age, L_∞", the asymptotic

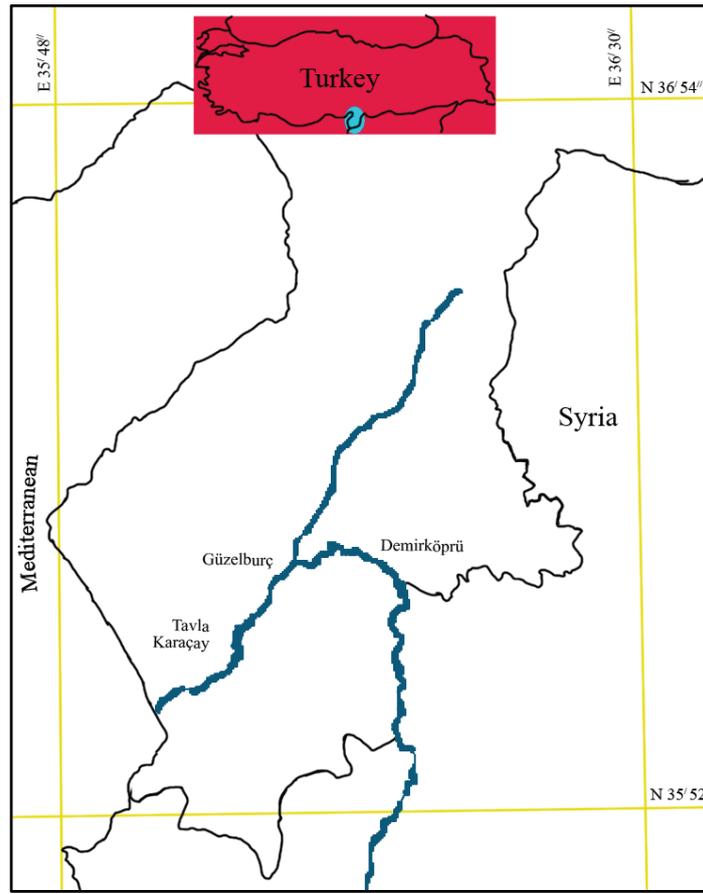


Figure 1. Map of the research area with four different catching region.

length based on the growth gradient in fish, “ K^{-1} ” the growth coefficient in length and the “ t_0 ” the hypothetical age, as based upon the weight is zero. Similarly “ W_t ”, the fish weight in t age, “ W_∞ ”, the asymptotic weight based on the growth gradient in fish, “ K^{-1} ” indicates the growth coefficient in weight and the “ t_0 ” indicates the hypothetical age, as based upon the weight is zero.

The growth performance index used in the comparison of the growth rate in fish was fixed as take advantage of the formula of $\Phi = \log K^{-1} + 2 \log L_\infty$ (Sparre and Venema, 1998). In this equation; Φ =shows the growth performance index, L_∞ =asymptotic length (cm), K^{-1} =Brody’s growth coefficient (year⁻¹).

Fulton’s condition factor was estimated and the arithmetical average of these were taken. The fulton condition factor was stated in the below formula (Holden and Raitt, 1974).

$$K = (W * 100) / L^b$$

In this equation; it shows that W =total weight (g), L =total length (cm) and b constant of regression. As the species has currently not observed in nature, the genetic analyses were prove that the samples obtained in the research were belonging to the species of *B lorteti*. In the genetic

structure analysis, from the preferred molecular methods, the mtDNA-RFLP analysis method was used.

Results

It was found that 201 *Barbus lorteti* which were obtained from four different regions of Asi river, the age distribution ranged between I-VI. The majority of the population belonging to this species in the region was constituted by the individuals in the age intervals of II and III (73 and 65) Respectively, the number of species and age; there were 43 items of *B. lorteti* samples in I. age, 14 in IV. age, 6 in V. age, 4 items of VI. age. The number of the individuals based on the ages were shown in Table 1. The mean length and weight values in the age group in every age were given with the estimated standard errors. It was determined that the length distribution of the samples obtained from the population of *B. lorteti* in that period was between 7.4 and 31.0 cm. When all the individuals were taken into consideration, the mean total lengths as per the age groups of this population, starting from the I. Age, were respectively found as 12.37 cm, 17.62 cm, 20.67 cm, 24.14 cm, 24.55 cm, 28.35 cm. When the length distribution of the sampled population was examined, the majority of the stock was constituted by the individuals in

the 17-20 cm total length interval.

The weight distributions of the sampled population as per the age were respectively found starting from the I. age, as 19.90 g, 52.13 g, 117.69 g, 175.69 g, 203.55 g and lastly for the VI. age group, it was found as 268.95 g (Table 2). According to the measured weights, the minimum and the maximum values were measured as respectively 3.8 and 299.0 g. As the result of the measurements that were made, the mean weight value of the population was estimated as 82.57 g. According to the 201 items obtained from the Asi River *B. lorteti* population, the total length (cm) and

weight (g) regression parameters were determined. At the end of this regression analysis made, the relationship was found as $W=0.013 L^{2.94}$. According to the b coefficient estimated in this formula, it was determined that the weight and the length regarding this species revealed an isometric increase (Figure 2).

According to the von Bertalanffy equation, the growth model of the mentioned population in age and in length was found as: $L_t=28.45*[1-e^{-0.43(t+(-0.23))}]$ (Figure 3). The growth performance index for the fish species was estimated as $\Phi=2.56$. Likewise, the growth model in weight estimated

Table 1. Length size distributions of *Barbus lorteti* from between June 1997 and April 1998 in Asi River.

Length class (cm)	Age Groups (year)						Totally
	I	II	III	IV	V	VI	
8	2						2
10	16						16
12	19	13					32
14	6	6	5				17
16		23	12				35
18		11	11				22
20		15	8	1			24
22		5	11	2			18
24			14	10	2		26
26				1	3	2	6
28						2	2
30					1		1
Number	43	73	61	14	6	4	201
Mean	12.37	17.62	20.67	24.14	27.00	28.35	18.37
	1.52	2.97	3.20	1.36	1.82	0.74	4.80

Table 2. Weight distributions of *Barbus lorteti* from between June 1997 and April 1998 in Asi River.

Weight class (gr)	Age Groups (year)						Totally
	I	II	III	IV	V	VI	
25	36	1					37
50	7	33					40
75		34	2				36
100		5	17				22
125			21				21
150			11				11
175			6	11	1		18
200			3	1			4
225			1	1	4		6
250				1	1	1	3
275						2	2
300						1	1
Number	43	73	61	14	6	4	201
Means	19.90	52.13	117.69	175.69	203.55	268.95	82.57
	5.21	14.15	31.65	22.69	17.69	21.58	60.99

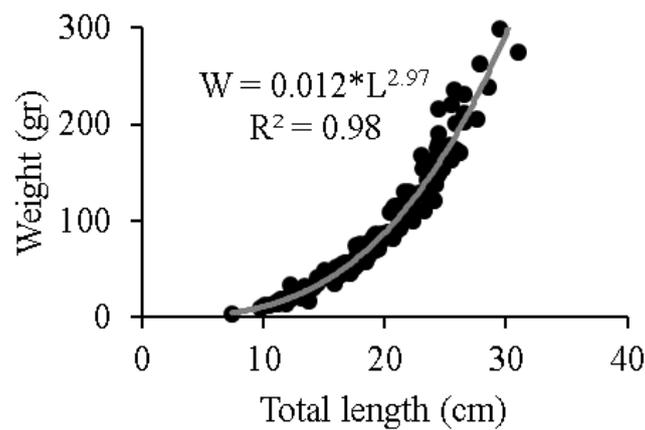


Figure 2. Weight and length relationship of *Barbus lorteti* from between June 1997 and April 1998 in Asi River.

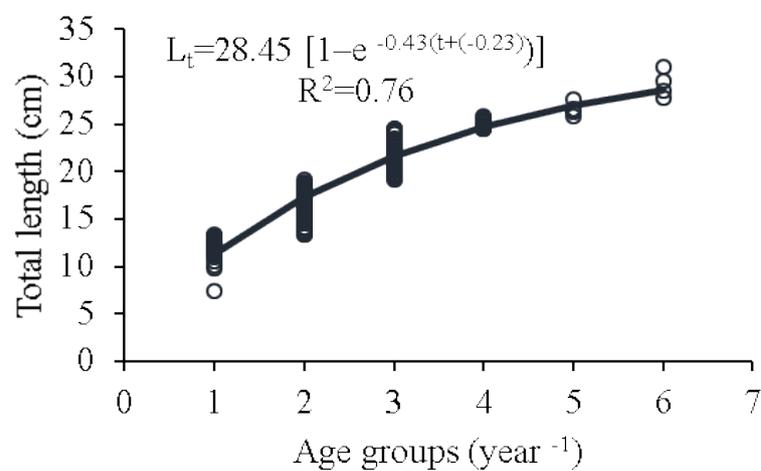


Figure 3. Length size and age vonBertalanfy Growth Parameter of *Barbus lorteti* from between June 1997 and April 1998 in Asi River.

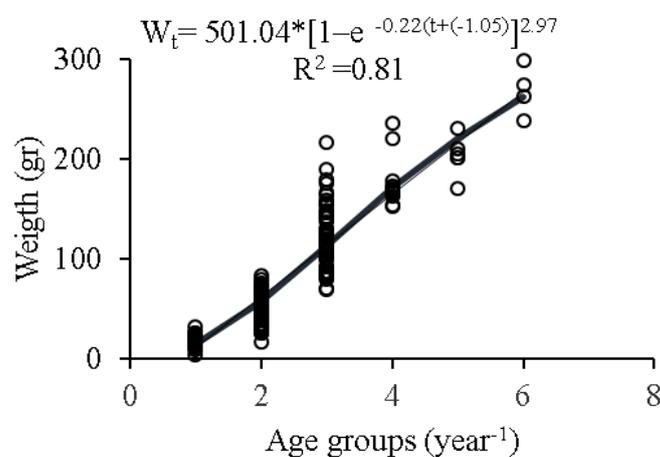


Figure 4. Weight and age von Bertalanfy Growth Parameter of *Barbus lorteti* from between June 1997 and April 1998 in Asi River.

in accordance to von Bertalanffy equation was fixed as:

$$W_t = 501.04 [1 - e^{-0.22(t+(-1.05))}]^{2.97} \text{ (Figure 4).}$$

The condition factor estimated from the *B. lorteti* population is shown in Figure 5. While the mean condition factor was estimated as 1.11 (\pm 0.01), the maximum and the minimum condition factor was found as 1.82 and 0.68.

Whether there was any statistical difference between the measured length and weight values estimated with the help of the equations, were determined by Khi Square (X^2) Test.

Discussion

In this study, the reasons of the stock's precipitation and even the removal of it from the ecosystem, though *B. lorteti* has an important population in Asi River, was tried to be determined. Accordingly, it was also aimed to reveal the biology of the species. Again the *B. luteus* population, which was sampled in Asi river in a similar way in the same and near period, was still continuing its stock. (Yalçın Ozdilek et al., 2004). In this context, it would be beneficial to discuss some of the biological and population features of the samples regarding these two species in this part of the article. Also, as there was not adequate information concerning the age and length features of *B. lorteti*, the comparisons were made referring to *B. luteus*, which lived in the same river ecosystem and was caught in the same period.

In the *B. lorteti* population in Asi river, individuals between the ages of I-VI, were encountered. In the same period, especially in the research that was made by Yalçın Ozdilek et al. (2004), the age distribution of the *B. luteus* population, changed between the ages of I-V. Gokçek and Akyurt (2008) encountered to *B. luteus* individuals up to the 9 age group. In this case, when the environmental conditions were convenient, they showed a longer length of time compared to *B. lorteti*. As this species involved in the group living long, continued its population density in our day, as well. As in both of the studies, in *B. luteus*

age 3 was evaluated as the dominant group, for *B. lorteti* age 2 group, there were more dominant individuals. Mean individual sizes in age groups were higher in length and weight for *B. lorteti*. Especially the individual weights as per the age, was nearly twice as much compared to the *B. luteus*. This comparison was presented in Figure 5. When the growth features of both species were compared, besides a great difference was not noticed, when the Φ prime indexes were evaluated, *B. lorteti* (2.56) was found low than *B. luteus* (2.65).

In this context, though the age distribution of the *B. lorteti* population was low in the Asi river environment which had negative habitat conditions during the process of time, it was thought that it entered a deterioration process as giving negative reaction due to its being relatively high in weight. As an example to negative conditions, reduction of the average in rainfall in Asi river and the increase of the agricultural irrigation in summer months, could be given. As the reduction in water level made catching in this region easy, it was thought that the population might have limited the age composition (Yalcin, 1997).

In the samples done throughout one year, the individuals in the length group of 7.4 and 31.0 cm, were caught by using the fyke net, electroshocker, trammel net and throw net. Yalcin Ozdilek et al., (2004) obtained the *B. lorteti* species in the length group of 5.1 and 24.7 cm in the same region with fyke net, electroshocker and a 17 \times 17-30 \times 30 mm of throw nets. Gokçek and Akyurt (2008) caught the individuals in the length group of 7.5 and 38.4 cm, with 12 -34 mm of gillnet, 12-22 mm of cast net. In *B. lorteti* population, no 0 age group individuals were encountered. It was thought that this case was resulted from the catching tool selectivity occurred basing on the mesh openness in the fyke and trammel net. In both of the studies made in the same region in different times, this case was observed in *B. luteus* population, as well.

In the length-weight relationship which was formed by

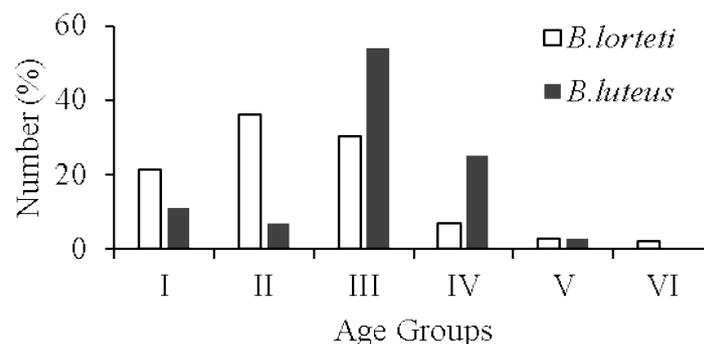


Figure 5. The comparison of condition factor as per the ages of *Barbus lorteti* and *Barbus luteus* in the Asi River.

B. lorteti individuals in Asi river, b value was found as 2.97. Yalcin Ozdilek et al. (2004) estimated the b value as 3.08 in the study which they made in the same river system. Gokcek and Akyurt (2008) found the values of respectively as 2.97 and 3.0 by estimating the female and male individuals separately. It could be said that when the b value was taken into consideration, the *B. lorteti* individuals which were living in Asi river, achieved isometric growth. The sample population obtained from Asi river, was fixed to be ranged between 3.8 g and 299.0 g.

Yalcin Ozdilek et al., (2004) found that the *B. luteus* population in this region varied between 2.1 g and 187 g. The weight of the species as per their length was seen to be much more compared to the *B. luteus* population. In *B. lorteti* population, L_{∞} value was found as 28.45 cm. In *B. luteus* population which was caught from the same environment, Yalcin Ozdilek et al., (2004) found the value of 25.89 cm, Gokcek and Akyurt (2008) found the value of 38.77 cm for female individuals, 38.77 cm, 40.32 cm for the male individuals. In *B. lorteti* population, when the K^{-1} values were looked in the length growth, it was found as 0.43, while in *B. luteus* the values of 0.23, 0.30 were found.

W_{∞} value in the *B. lorteti* population was determined as 501.04 g. *B. luteus* individuals revealed the 318.53 g W_{∞} value (Yalcin Ozdilek et al., 2004). Gokcek and Akyurt (2008) were found *B. luteus* W_{∞} value as 750.40 g. When the condition factor was examined as per the ages, it was seen that there was significant difference (Figure 5).

Studying the population dynamic parameters of *B. lorteti* living in Asi river, has provided the exposure of the growth features. And this shall contribute to the explanation of the deterioration of this species. Especially, the determination of growth and other biological features of the species living in this type of river systems, shall be beneficial for both the sustainability of the natural populations and the fishing management studies. This species might have been subjected to over catching in that period unlike from *B. luteus*. As it is a hardly encounter species, it is difficult to get information about the minimum legal catching size due to its first reproduction size. Particularly, determining the growth and other biological features of the populations which faced with the danger of extinction, would be beneficial in respect to take the protective measures of the stock.

As a result, this study was very important as it was the first data which gave the growth features of the rarely

encountered species and in determining the history of the river ecosystem. In addition, this paper confirms that the population of *B. lorteti* is rarely encountered species in the River Asi and this species might be represented by small isolated populations or really extinct in the River. Asi river have been exposed to various anthropogenic threats such as pollution, water restrictions, barriers, invasives, overexploitation etc. (Yalçın Özdilek et al., 2004). These adverse conditions might be responsible for decreasing populations not only for *B. lorteti*, but also for decreasing other endemic/native fish species. We suggest further detailed survey for determining living populations along the river and its tributaries. We also suggest to be arranged an effective management plan for sustainable use of freshwater fish species for river basin.

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