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Biological Properties of *Capoeta capoeta* (Guldenstaedt, 1773) Population Living in Karasu Stream (Van, Turkey)

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Abstract: This study was carried out between March 2007 and April 2008 in Karasu Stream. Total 472 individual sampled by hand nets and electroshock. Length, weight, sex and gonad weight were determined. Age was determined by scales. The age, length and weights of samples varied from I-VI, 4.0-37.5 cm and 0.7-676.2 g, respectively. It was determined that the most samples were in 12.0-13.9 cm (16.1%) and 0-24.9 g (21.2%) group. Condition factor, length-weight, age-length, age-weight equations, male:female ration were calculated as 1.452, $W = 0.0129 \times L^{3.039}$, $Lt = 52.58 \times [1-e^{-0.145 \times (t+0.464)}]$, $Wt = 2188.21 \times [1-e^{-0.145 \times (t+0.464)}]^{3.039}$, 2.603, 1:0.85, respectively. Sexual maturity size was determined as in males 11 cm, in females 23 cm. In the reproduction, period reproduction nods were seen on head and anal fins of males. Relative fecundity number calculated as 44494 number kg^{-1} fish and age diameter measured as 2.011 mm.

Key words: *Capoeta capoeta*, Karasu stream, growth, reproduction

INTRODUCTION

Karasu stream is in the Lake Van Basin, eastern Anatolia. The stream rises from frontier between Turkey and Iran. It flows into Lake Van from Citoren rush-bed (38°34'51.54"N and 43°13'21.42"E). On the stream, Sarimehmet Dam Lake was constructed in 1991 for the purpose of irrigation. There has been *Alburnus tarichi*, *Nemacheilus angorae*, *Cyprinus carpio* (introduced in the stream in 1980's) in Karasu stream, apart from *Capoeta capoeta* (Cetinkaya *et al*., 1994).

Capoeta genus is in the *Cyprinidae* family and widely disturbed from Afghanistan to Aegean coastal in Turkey. There has been amateur fishing in the stream and it has economic value in the region. There are 5 species and 6 subspecies of *Capoeta* in Turkey's waters. It may be 70 cm; its body is shaped like a spindle (fusiform). *Capoeta capoeta* has a pair of barbell on the edge of its mouth. The reproduction tubercles has seen on the body and head in the reproduction period (Geldiay and Balik, 2002).

This study was carried out for the purpose of determination of growth and reproduction properties and evolution situation of *Capoeta capoeta* population in Karasu Stream.

MATERIALS AND METHODS

A total 472 samples investigated in this research was captured from Karasu stream between March 2007 and April 2008. The samples were fished with hand nets and electroshock device. On the samples, total (W) and gonad weights (Gw) (±0.1 g), fork lengths (L) (±1 mm) of 472 specimens were recorded. Sex was determined via examination of specimens gonads. The eggs numbers were counted by the gravimetric method and the eggs diameters were measured with an ocular micrometer. Tubercles on head and anal fin of males were recorded (Karatas *et al*., 2005). The ages were determined on 280 individuals by scales with microfish devices (Turkmen *et al*., 2005). Age, length and weight frequencies were defined. The age-length and age-weight relationships were estimated by formulas $Lt = L\infty \times [1-e^{-k \times (t-to)}]$ and $Wt = W\infty \times [1-e^{-k \times (t-to)}]^b$, respectively. The length-weight relationship ($W = a \times L^b$) and condition factor of the samples ($CF = W/L^3 \times 100$) were calculated (Cetinkaya *et al*., 2005). Munro's phi prime index (growth performance index) was estimated by formula $Ø' = LogK + 2 \times LogL\infty$ (Avsar, 2005).

RESULTS

Sex determination was defined the 427 individuals of the 472 samples. Total 216 (50.6%) individuals were male,

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Table 1: Age composition of *Capoeta capoeta* depending on sex in Karasu stream

Age groups	Male		Female		Juvenile		All samples	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
I	17	6.1	11	3.9	20	7.2	48	17.2
II	42	15.0	36	12.9	02	0.7	81	28.9
III	58	20.7	39	13.9	00		98	35.0
IV	17	6.1	19	6.8	00		37	13.2
V	02	0.7	09	3.2	00		11	3.9
VI	00	0.0	05	1.8	00		05	1.8
Total	136	48.6	119	42.5	22	7.9	280	100.00

Table 2: Length frequencies of *Capoeta capoeta* in Karasu stream

Length groups (cm)	Male		Female		Juvenile		All samples	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
4-5.9	0	0.0	0		7	1.5	7	1.5
6-7.9	0	0.0	0		7	1.5	7	1.5
8-9.9	5	1.1	9	1.9	11	2.3	34	7.2
10-11.9	17	3.6	9	1.9	1	0.2	42	8.9
12-13.9	29	6.1	30	6.4	1	0.2	76	16.1
14-15.9	31	6.6	28	5.9	1	0.2	62	13.2
16-17.9	38	8.1	24	5.1	0	0.0	63	13.4
18-19.9	31	6.6	22	4.7	0	0.0	54	11.4
20-21.9	38	8.1	12	2.5	0	0.0	51	10.8
22-23.9	14	2.9	16	3.4	0	0.0	30	6.4
24-25.9	10	2.1	10	2.1	0	0.0	20	4.2
26-27.9	2	0.4	9	1.9	0	0.0	11	2.3
28≤	1	0.2	14	2.9	0	0.0	15	3.1
Total	216	45.8	183	38.7	28	5.9	472	100.00

Table 3: Weight frequencies of *Capoeta capoeta* in Karasu stream

Weight groups (g)	Male		Female		Juvenile		All samples	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
0-24.9	23	4.9	23	4.9	26	5.5	100	21.20
25-49.9	43	9.1	40	8.5	1	0.2	98	20.80
50-74.9	41	8.7	30	6.4	1	0.2	73	15.50
75-99.9	29	6.2	21	4.4	0	0	51	10.80
100-124.9	31	6.6	9	1.9	0	0	41	8.70
125-149.9	20	4.2	6	1.3	0	0	26	5.50
150-174.9	9	1.9	11	2.3	0	0	20	4.20
175-199.9	8	1.7	8	1.7	0	0	16	3.40
200-224.9	4	0.8	7	1.5	0	0	11	2.30
225-249.9	4	0.8	5	1.1	0	0	9	1.90
250≤	4	0.8	23	4.8	0	0	27	5.70
Total	216	45.7	183	38.8	28	5.9	472	100.00

183 (42.9%) specimens were female and 28 samples (6.5%) were juvenile. The age of the samples of Karasu Stream ranged from I-VI. The maximum age in males and females is V and VI, respectively. Third age group was dominant in all samples (35.0%), in males (20.7%) and also females (13.9%) (Table 1).

The samples were grouped into 2 cm and 25 g bands and its frequencies were investigated. The dominant length group was found as12.0-13.9 cm-group in both females (6.4%) and all samples (16.1%), but in males (8.1%) was found as 16.0-17.9 cm-group (Table 2). The largest weight group in all samples was found as 0-24.9 g-group, it was 25.0-49.9 g-group in males (9.1%) and females (8.5%) (Table 3).

Fork lengths in al samples varied from 4.0-37.5, in males 8.9-28.9 and in females 8.5-37.5 cm (Table 4). In all samples, total weight ranged between 0.7 and 676.2 g; 9.3 and 339.8 g in males and 9.0 and 676.2 g in females (Table 5). It was estimated that the females were bigger than the males, statistically ($p<0.05$).

Condition factor of *Capoeta capoeta* in Karasu stream was calculated depending on sex and sampling season. It calculated in all samples as 1.452±0.008 (1.069-2.135); in males as 1.461±0.011 (1.089-2.135); in females as 1.476±0.012 (1.124-2.130) and in juvenile as 1.415±0.039 (1.069-1.773). In both males and females, also in juveniles, condition factor reached a peak in March 2008. Average condition factor values of males and females were near to one another (Table 6).

Length-weight relationship of 472 *C. capoeta* specimens in Karasu stream was analyzed depend on sex. The equation of males was $W = 0.0143 \times L^{3.006}$ ($r^2 = 0.979$); of females as $W = 0.0162 \times L^{2.965}$ ($r^2 = 0.986$); of juveniles as $W = 0.0087 \times L^{3.234}$ ($r^2 = 0.984$) and of all samples as $W = 0.0129 \times L^{3.039}$ ($r^2 = 0.989$).

Von Bertalanffy growth equations were estimated on 280 specimens. The equations in males was found as $Lt = 40.49 \times [1-e^{-0.177 \times (t + 0.907)}]$ and $Wt = 970.42 \times [1-e^{-0.177 \times (t + 0.907)}]^{3.006}$, in females as $Lt = 54.65 \times [1-e^{-0.130 \times (t + 0.718)}]$ and $Wt = 2298.14 \times [1-e^{-0.130 \times (t + 0.718)}]^{2.965}$ and in all samples as $Lt = 52.58 \times [1-e^{-0.145 \times (t + 0.464)}]$ and $Wt = 2188.21 \times [1-e^{-0.145 \times (t + 0.464)}]^{3.039}$. Munro's phi prime index in males, females and all samples were calculated as 2.463, 2.589 and 2.603, respectively.

Sex was determined on 427 specimens, but, it could not on 45 samples because of decomposition of their internal organs. Of the 427 samples, 216 specimens were males (50.6%), 183 individuals were females (42.9%) and 28 samples were juveniles (6.5%). Male:female ratio was calculated as 1:0.85 and the differences is statistically important ($p<0.05$).

Sexual maturity was defined on 427 individuals. Total 237 of 427 samples was mature, 190 was immature. Of the mature samples, 191 were male, 46 were female; of the immature specimens, 25 were male, 137 were female and 28 were juvenile.

In the samples, the smallest matured individual was a 10.4 cm male. The smallest matured female was 16.1 cm. When the sexual maturation was examined according to age and 1 cm length group; males matured first age group (58.5%) and 11 cm length group; females matured 4th age group (100%) and 23 cm length group.

On the 99 male's head, tale stalk, anal fin and body, tubercle was searched and showed on head of 25 males and anal fin of 12 males. Tubercle was not showed on the body and tale stalk on any males.

On the spawning season, individual fecundity was found between 5684 and 12162 number/individual,

Table 4: According to sex and age, length of *C. capoeta* in Karasu stream (cm)

	Male		Female		Juvenile		All samples	
Age groups	No.	L±SE (min-max)	No.	L±SE (min-max)	No.	L±SE (min-max)	No.	L±SE (min-max)
I	17	11.4±0.33 (8.9-13.8)	11	10.9±0.56 (8.5-14.3)	20	07.4±0.40 (4.0-10.4)	48	09.6±0.36 (4.0-14.3)
II	42	16.2±0.42 (12.1-22.0)	36	16.5±0.59 (11.8-24.3)	2	14.2±0.90 (13.3-15.1)	81	16.3±0.34 (11.8-24.3)
III	57	20.3±0.31 (14.9-25.8)	39	20.1±0.52 (14.4-26.4)			97	20.2±0.28 (14.4-26.4)
IV	17	22.7±0.70 (16.1-26.9)	16	25.7±0.53 (21.4-29.3)			34	24.1±0.51 (16.1-29.3)
V	3	26.2±1.56 (23.5-28.9)	10	27.9±1.01 (23.6-32.3)			13	27.5±0.85 (23.5-32.3)
VI			7	31.9±1.30 (28.1-37.5)			7	31.9±1.30 (28.1-37.5)
Total	136	(8.9-28.9)	119	(8.5-37.5)	22	(4.0-15.1)	280	(4.0-37.5)

Table 5: Weights of *C. capoeta* in Karasu stream depend on age and sex

	Male		Female		Juvenile		All samples	
Age groups	No.	W±SE (min-max)	No.	W±SE (min-max)	No.	W±SE (min-max)	No.	W±SE (min-max)
I	17	022.9±2.01 (9.3-38.5)	11	021.7±3.22 (9.0-45.6)	20	07.1±0.98 (0.7-17.3)	48	016.1±1.54 (0.7-45.6)
II	42	068.8±5.75 (23.2-180.8)	36	077.3±9.20 (22.3-212.5)	02	45.5±9.10 (36.4-54.6)	81	071.9±5.07 (22.3-212.5)
III	57	125.8±6.54 (49.1-275.8)	39	130.2±9.97 (44.1-295.7)			97	127.2±5.54 (44.1-295.7)
IV	17	168.1±13.65 (64.9-256.6)	16	249.6±14.44 (145.7-371.3)			34	204.9±12.06 (64.9-371.3)
V	03	265.4±42.25 (193.5-339.8)	10	320.4±35.70 (164.2-473.5)			13	307.7±29.13(164.2-473.5)
VI			07	451.9±50.49 (310.5-676.2)			07	451.9±50.49(310.5-676.2)
Total	136	(009.3-339.8)	119	(009.0-676.2)	22	(00.7-54.6)	280	(00.7-676.2)

Table 6: According to sampling season, condition factor of *C. capoeta* living in Karasu stream

	Male		Female		Juvenile		All samples	
Sampling season	No.	CF±SE (min-max)	No.	CF±SE (min-max)	No.	CF±SE (min-max)	No.	CF±SE (min-max)
March 2007	23	1.429±0.027 (1.142-1.628)	25	1.421±0.016 (1.245-1.585)	1	1.357	52	1.422±0.015 (1.142-1.628)
April 2007	49	1.421±0.020 (1.089-1.906)	36	1.432±0.023 (1.200-1.718)	9	1.331±0.056 (1.094-1.720)	132	1.386±0.012 (1.089-1.906)
May 2007	28	1.416±0.032 (1.195-2.135)	25	1.346±0.021 (1.124-1.564)	5	1.388±0.107 (1.130-1.604)	62	1.386±0.019 (1.124-2.135)
Nov. 2007	53	1.431±0.019 (1.140-1.717)	38	1.493±0.021 (1.219-1.728)	3	1.590±0.026 (1.547-1.637)	94	1.462±0.014 (1.140-1.728)
March 2008	52	1.593±0.020 (1.236-1.964)	48	1.633±0.023 (1.325-2.130)	6	1.618±0.052 (1.435-1.773)	106	1.613±0.015 (1.236-2.130)
April 2008	11	1.345±0.037 (1.222-1.536)	11	1.299±0.037 (1.155-1.520)	4	1.220±0.052 (1.069-1.298)	26	1.306±0.024 (1.069-1.536)
Total	216	1.461±0.011 (1.089-2.135)	183	1.476±0.012 (1.124-2.130)	28	1.415±0.039 (1.069-1.773)	472	1.452±0.008 (1.069-2.135)

average 9599±1173 number/individual and relative fecundity was between 34616 and 55218 number kg^{-1} fish, average 44494±4145 number kg^{-1} fish. Egg diameter of *Capoeta capoeta* in Karasu stream was determined between 1.902 and 2.232 mm, average 2.011±0.063 mm.

DISCUSSION

In this research, age determination was defined on 280 specimens scales. The age of the samples ranged between I and VI. In the samples, dominant age group was found as III (35%). Age is one of the fundamental criteria in the determination of growth. Therefore, it must be defined correctly. In the earlier studies on Karasu stream, the maximum ages were determined as IX by Cetinkaya *et al.* (1995) and VIII by Evci (1997). Moreover, in the Lake Van Basin, it was informed as XI in Nazik Lake (Sen *et al*., 1999), as VII in Kockopru Dam Lake (Elp and Karabatak, 2007) and as VII in Zernek Dam Lake (Sen *et al*., 2008). Our data was younger than the others. The reason why our data was younger the others, DSI (General Directorate of State Hydraulic Works of Turkey) has done amelioration in the stream and some sand pits have picked in stream and there have over fishing on *Capoeta capoeta* by amateur fishermen. It may be say that DSI and sand pits have damaged ecological environment of the stream.

In the population, the largest and the heaviest sample were obtained as 37.5 cm and 676.2 g. In the Karasu stream, Cetinkaya *et al.* (1995) reported as 42.5 cm and 980 g; Evci (1997) as 31.5 cm and 373.3 g. In Nazik Lake, it was reported as 48.3 cm and 1379.5 g (Sen *et al*., 1999), in Kockopru dam Lake as 39.8 cm and 755.6 g (Elp and Karabatak, 2007), in Zernek dam Lake as 41 cm and 1060.4 g (Sen *et al*., 2008).

When age, length and weight values were examined, at younger ages, lengths and weights of males and females were close to each other, but, at older ages, females were larger than males ($p<0.05$).

Average condition factor of the samples were estimated as 1.452±0.008. Our findings were higher than other studies of Lake Van Basin (Evci, 1997; Sen *et al*., 1999, 2008; Elp and Karabatak, 2007).

Length-weight relationship was calculated as $W = 0.0129 \times L^{3.039}$. The b value of *C. capoeta* in Karasu stream was nearby 3. Consequently, growth of samples was isometric. Wootton (1992) have reported that the b value can be used as an indicator of food intake and growth regime and may differ according to some biotic and abiotic factors like water temperature, food availability and habitat type.

Von Bertalanffy growth equations was calculated as $Lt = 52.58\times[1-e^{-0.145\times(t+0.464)}]$ and $Wt = 2188.21\times[1-e^{-0.145\times(t+0.464)}]^{3.039}$. Age-length and age-weight relationships parameters change within same species and among different species, different ecological condition, feeding and between sex. K value shows that how fast fish reach to $L\infty$ value. If it is near to 1, that fish is short life. If it is near to 0, that fish is long life (Cetinkaya *et al*., 2005). K value was calculated as 0.145 in this study. This situation shows that *C. capoeta* living in Karasu stream is a long living species. But of late yeas, K and $L\infty$ values have appeared inadequate alone to appreciate about growth. Hence, Munro's phi prime index improved (Avsar, 2005). Munro's phi prime index was estimated as 2.603 in the study. It is reported as 2.643 in Nazik Lake (Sen *et al*., 1999), as 2.713 in Kockopru Dam Lake (Elp and Karabatak, 2007), as 2.688 in Zernek Dam Lake (Sen *et al*., 2008).

The samples consisted of 50.6 male, 42.9 female and 6.5% juvenile. The male:female ratio was 1:0.85, in the population, males were dominant, the difference was statistically significant ($p<0.05$). For most species, sex ratio is close to 1:1, but this situation may vary from species to species. It also may differ from one population to another in same species. It also may change from year to year in the same population (Nikolsky, 1963).

Sexual maturation was happened at first age and in 11 cm group in males and at 4th age and in 23 cm group in females in this study. Sexual maturation was reported as 14 cm in males and 20 cm in females from Nazik Lake (Sen *et al*., 1999); as 3rd age, 23 cm in males; 4th age, 33 cm in females from Kockopru Dam Lake (Elp and Karabatak, 2007), as second age, 14 cm in males; 1th age, 22 cm in females from Zernek Dam Lake (Sen *et al*., 2008). Female *Capoeta capoeta* in all resources in Lake Van Basin, have matured similar age and similar length, but in Karasu stream's males matured smaller than the others.

On some *Cyprinid* sp., spawning tubercles were seen on different regions of their body. Geldiay and Balik (2002), tubercles were seen on matured male *C. capoeta*'s head and nose. Sen *et al*. (1999, 2008) and Elp and Karabatak (2007), also reported to be seen on matured males. In this study, tubercles were seen on the heads of 25 males and tale stalks of 12 matured males.

Relative fecundity (44494±4145 number kg^{-1} fish) and average egg diameter (2.011±0.063 mm) were found higher than Sen *et al*. (1999, 2008) and Elp and Karabatak (2007).

CONCLUSION

As a result, it determined that growth of *C. capoeta* population living in Karasu Stream is good and its condition was higher than other sources in Lake Van Basin. Despite this species has long biological life, its life was shorter than populations living in the other sources in Lake Van Basin owing to fishing pressure and to be damaged to the stream from human i.e., DSI and sand pit. For a sustainable population, minimum fishing length must be 25 cm fork length. Sand pits and DSI have to stop their activities in stream.

REFERENCES

Avsar, D., 2005. Fisheries biology and population dynamics. Nobel Press, Adana, Turkey. ISBN: 975-8561-44-8 (in Turkish).

Cetinkaya, O., M. Sari, F. Sen, M. Arabaci and H.A. Duyar, 1994. Limnological properties of Karasu stream, Lake Van Basin, Turkey. J. Agric. Sci. Yuzuncu Yil University, 4: 151-168.

Cetinkaya, O., M. Sari, M. Arabaci, F. Sen and H.A. Duyar, 1995. Studies on fish populations of the Karasu stream, Lake Van Basin, Turkey. J. Agric. Sci., Yuzuncu Yil University, 5 (2): 189-202.

Cetinkaya, O. F. Sen and M. Elp, 2005. Growth and Growth Analysis in Fish. Research Techniques in Fish Biology. 1st Edn. In: Karatas, M. (Ed.). Nobel Pres, Ankara, pp: 93-120. ISBN: 9755917578 (in Turkish).

Elp, M. and M. Karabatak, 2007. A study on *C. capoeta* (Guldenstaedt, 1772) population living in Kockopru dam lake; Van-Turkey. J. Applied Biol. Sci., 1 (2): 57-62.

Evci, B., 1997. A study on population structure and growth properties of the *Capoeta capoeta* (*Cyprinidae*) populations living in some waters of Lake Van Basin, Turkey. Yucuncu Yil University, Science Institute, Master Thesis, Van (in Turkish).

Geldiay, R. and S. Balik, 2002. Freshwater fishes of Turkey. Ege Univ. Pres, Izmir, Turkey (in Turkish).

Karatas, M., N. Basusta and M.A. Gokce, 2005. Reproduction in Fish. Research Techniques in Fish Biology. 1st Edn. In: Karatas, M. (Ed.). Nobel Pres, Ankara, pp: 61-92. ISBN: 9755917578 (in Turkish).

Nikolsky, G.V., 1963. The Ecology of Fishes. Academic Press, London. ISBN: 0125197500.

Sen, F., O. Cetinkaya and M. Elp, 1999. A study on *Capoeta capoeta* (Guldenstaedt, 1773) population living in Nazik Lake (Ahlat-Bitlis, Turkey). X. Aquaculture Symposium, 22-24 September, Adana, Turkey, pp: 465-475 (in Turkish).

Sen, F., M. Elp, E. Kankaya, 2008. Growth and Reproduction Properties of *Capoeta capoeta* (Guldenstaedt, 1773) in Zernek Dam Lake, Van, Turkey. J. Anim. Vet. Adv., 7 (10): 1267-1272.

Turkmen, M., N. Basusta and S.A. Demirhan, 2005. Age Determination in Fish. Research Techniques in Fish Biology. 1st Edn. In: Karatas, M. (Ed.). Nobel Pres, Ankara, pp: 121-148. ISBN: 9755917578 (in Turkish).

Wootton, R.J., 1992. Fish Ecology. Thomson Litho Ltd. New York. ISBN: 0751403067.