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Condition factors of seven *Cyprinid* fish species from Çamligöze dam lake on central Anatolia, Turkey

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In this study, condition factors were determined for seven *Cyprinid* fish species from Çamligöze dam lake located at central Anatolian region of Turkey. The obtained results were compared with other studies from different habitats in Turkey. Fish samples were collected seasonally with nets of various mesh sizes from April 2010 to January 2011. *Cyprinus carpio* (1.6362 ± 0.2785) was determined to have the greatest mean condition factor followed by *Capoeta tinca* (1.3126 ± 0.1927), *Leuciscus cephalus* (1.2915 ± 0.3021), *Barbus plebejus* (1.1142 ± 0.1973), *Chalcalburnus chalcoides* (1.1138 ± 0.1251), *Capoeta sieboldii* (1.0214 ±0.1547) and *Chondrostoma nasus* (0.9894 ± 0.2281) in Çamligöze dam lake. For Çamligöze dam lake, condition factors of *Cyprinid* fish species are given for the first time. Condition factors of seven *Cyprinid* fish species around "1" showed a good level of nutrition of fish and nutritional capacity in Çamligöze dam lake.

Key words: Çamligöze dam lake, Turkey, condition factor, cyprinid fish species.

INTRODUCTION

Cyprinds belong to the order *Cypriniformes* and the family Cyprinidae. The family Cyprinidae is one of the most important families of fish distributed throughout the world. The fish of this family are distributed throughout Africa, Asia, Europe, and North America and live almost exclusively in freshwater. A vast majority of boned fish belong to this family in Turkey, and they are distributed widely in freshwater sources. *Cyprinids* are highly important food fish; they are fished and farmed across Eurasia. Cyprinids appear in various sizes and shapes and can be found in almost every type of waters; small streams, rivers, lakes and pools (Blanc et al., 1971; Howes, 1991; Geldiay and Balik, 1996). In fisheries science, the condition factor is used in order to compare the "condition", "fatness" or well-being of fish. It is based on the hypothesis that heavier fish of a particular length are in a better physiological condition. Condition factor is also a useful index for monitoring of feeding intensity, age, and growth rates in fish. It is strongly influenced by

both biotic and abiotic environmental conditions and can be used as an index to assess the status of the aquatic ecosystem in which fish live. Condition factor also gives information when comparing two populations living in certain feeding, density, climate, and other conditions when determining the period of gonad maturation, and when following up the degree of feeding activity of a species to verify whether it is making good use of its feeding source (Bagenal, 1978; Oni et al., 1983; Anene, 2005; Kumolu-Johnson and Ndimele, 2010; Abowei, 2010). To date, condition factors of fish species of Çamligöze dam lake has not been directly studied. For Çamligöze dam lake, condition factors of *Cyprinid* fish species were given for the first time. In this study, condition factors were calculated for seven *Cyprinid* fish species from Çamligöze dam lake located at central Anatolian region of Turkey.

MATERIALS AND METHODS

The study area is Çamligöze dam lake (Figure 1) located at central Anatolian region of Turkey. Geographical coordinates of Çamligöze dam lake are 40° 13' 45" N, 38° 04' 36" E). Çamligöze dam lake is

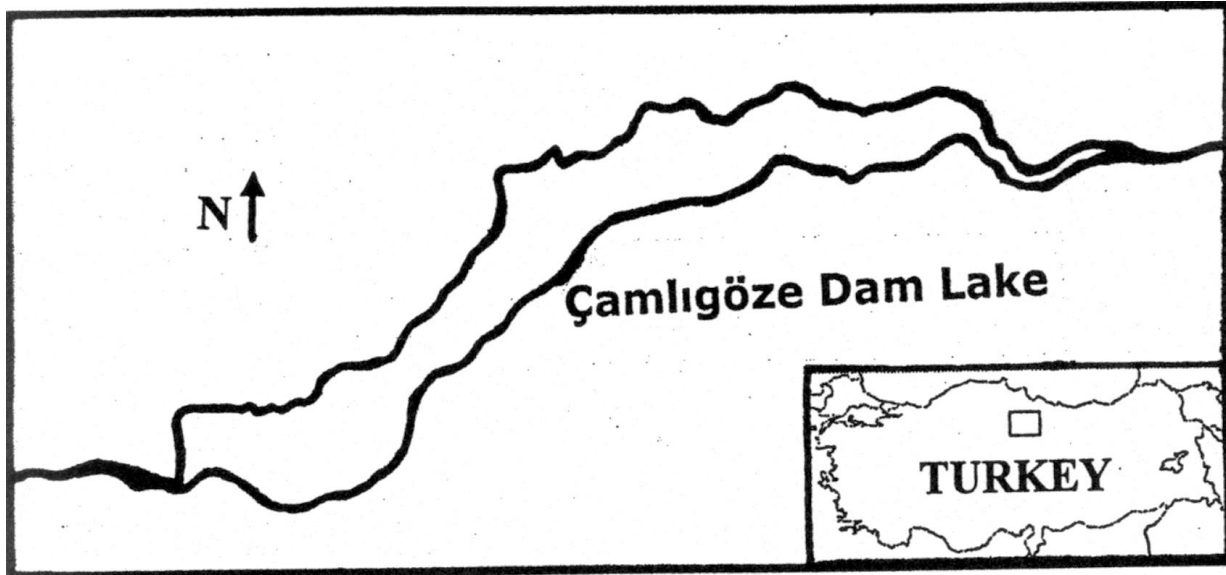---

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Figure 1. Çamligöze dam lake.

Table 1. Length, weigth and condition factors for seven *Cyprinid* fish species.

Fish species	N	%	Length	Weigth	Condition factor		
			Min-Max	Min-Max	Min-Max	Mean	±SD
Barbus plebejus	13	10.3	11.0–27.5	17.6–184.9	0.8184–1.5298	1.1142	0.1973
Capoeta sieboldii	7	5.5	22.7–42.1	107.1–682.5	0.9147–1.3582	1.0214	0.1547
Capoeta tinca	52	41.3	10.5–34.7	19.1–427.5	1.0232–1.8015	1.3126	0.1927
Chalcalburnus chalcoides	5	4.0	13.8–17.4	32.7–51.2	0.9719–1.2443	1.1138	0.1251
Chondrostoma nasus	4	3.2	21.7–25.6	105–139.2	0.7683–1.2919	0.9894	0.2281
Cyprinus carpio	27	21.4	16.6–52.4	108.3–2280	1.2328–2.3676	1.6362*	0.2785
Leuciscus cephalus	18	14.3	11.4–28.3	16.2–174.2	0.7686–1.9507	1.2915	0.3021
Total	126	100	10.5–52.4	17.6–2280	0.7683–2.3676	1.3241	0.2944

"*"means (p = 0.000) significance level of the one-way ANOVA.

situated approximately 140 km North-east of Sivas province centre. The Çamligöze dam was constructed between 1987 and 1998 on the Kelkit stream, a tributary of Yeşilirmak river. Çamligöze dam is a 37 m high rockfill power plant. The water of Çamligöze dam lake is mainly used for produce of electrical energy, commercial fishing, aquaculture, irrigation and recreation. The surface area and maximum depth of the Çamligöze dam lake are 5 km^2 and 30 m respectively. Average capacity of Çamligöze dam hydroelectric station is 102 GWh/year (Dirican et al., 2009). Fish samples were collected seasonally with nets of various mesh sizes (20, 30, 40 and 60 mm) from April 2010 to January 2011. The samples were preserved in 4% formaldehyde solution and preserved in 70% ethyl alcohol solution. During the course of the study, 126 individuals of seven species representing the family Cyprinidae were collected from Çamligöze dam lake. Fish samples were identified in the laboratory to the species level. All individuals were measured to the nearest ±1 mm in total length (TL) and weighed to the nearest ± 0.1 g in total body weight (W). The condition factor was calculated by the formula (Pauly, 1983):

Condition factor = (W/L^3) ×100

Biostatistical analysis of this study, the variables mean, standard deviation, minimum and maximum values are defined. One-way ANOVA was used to compare differences, the Scheffe post-hoc test was employed for the comparison of means (p<0.05). Data analysis was performed using Statistical Package for the Social Sciences (SPSS) software version 17.5 for Windows.

RESULTS AND DISCUSSION

The following seven *Cyprinid* fish species were analyzed: *Barbus plebejus*, *Capoeta sieboldii*, *Capoeta tinca*, *Chalcalburnus chalcoides*, *Chondrostoma nasus*, *Cyprinus carpio* and *Leuciscus cephalus* in Çamligöze dam lake. For each *Cyprinid* fish species total length, weigth and condition factor are given in Table 1. These *Cyprinid* species were barbel (*B. plebejus*), colchic khramulya (*C. sieboldii*), Anatolian khramulya (*C. tinca*), bleak (*C. chalcoides*), common nase (*C. nasus*), carp (*C.*

carpio) and chub (*L. cephalus*). Seven *Cyprinid* fish species belonging to 126 speciemens were captured from Çamligöze dam lake. In numerical terms, the most abundant species were *C. tinca* with 52 individuals, followed by *C. carpio* (27), *L. cephalus* (18), *B. plebelejus* (13), *C. sieboldii* (7), *C. chalcoides* (5) and *C. nasus* (4) in study area (Table 1). *C. tinca* (41.3%) had the greatest population size followed by *C. carpio* (21.4%), *L. cephalus* (14.3%), *B. plebejus* (10.3%), *C. sieboldii* (5.5%), *C. chalcoides* (4.0%) and *C. nasus* (3.2%) in Çamligöze dam lake. Condition factor of the barbel population in Çamligöze dam lake ranged from 0.8184 to 1.5298. The mean condition factor of all barbel samples was determined as 1.1142 ± 0.1973 in Çamligöze dam lake (Table 1). The mean condition factor for *B. plebejus* from different habitat in Turkey was reported as 1.405 in Çildir lake (Çalişkan et al., 1999) and our results are lower than before.

Condition factor of the Colchic khramulya population in Çamligöze dam lake ranged from 0.9147 to 1.3582. The mean condition factor of all Colchic khramulya samples was determined as 1.0214 ± 0.1547 in Çamligöze dam lake (Table 1). The mean condition factors for *C. sieboldii* from different habitats in Turkey were reported as 1.5929 in Delice stream (Gül et al., 2005) and 1.31 in Hirfanli dam lake (Yilmaz et al., 2010). Our results are lower than what was formerly observed. Condition factor of the Anatolian khramulya population in study area ranged from 1.0232 to 1.8015. The mean condition factor of all Anatolian khramulya samples was determined as 1.3126 ± 0.1927 in Çamligöze dam lake (Table 1). The mean condition factors for *C. tinca* from different habitats in Turkey were reported as 1.355 in Kizilirmak river (Akgül, 1987), 1.300 in Sariyar dam lake (Ekmekçi, 1989) and 1.375 in Sakarya River-Kirmir Stream (Yilmaz et al., 1996). Our results are in accordance with the previous ones. Condition factor of the bleak population in Çamligöze dam lake ranged from 0.9719 to 1.2443. The mean condition factor of all bleak samples was determined as 1.1138 ± 0.1251 in Çamligöze dam lake (Table 1). The mean condition factors for *C. chalcoides* from different habitats in Turkey were reported as 1.086 in Tozanli stream (Akyurt and Sari, 1991) and 1.2695 in Kuş lake (Balik et al., 1996). Our results are in accordance with the previous ones. Condition factor of the common nase population in Çamligöze dam lake ranged from 0.7683 to 1.2919. The mean condition factor of all common nase samples was determined as 0.9894 ± 0.2281 in Çamligöze dam lake (Table 1). The mean condition factor for *C. nasus* from different habitat in Turkey can be calculated as 1.6143 in Kunduzlar dam lake (Topuzoğlu, 2006). Our results are lower than before. Condition factor of the carp population in Çamligöze dam lake ranged from 1.2328 to 2.3676. The mean condition factor of all carp samples was determined as 1.6362 ± 0.2785 in the study area (Table 1). The mean condition factors for *C. carpio* from different

habitats in Turkey were reported as 1.836 in Tödürge lake (Erdem, 1988); 2.286 in Mamasin dam lake (İkiz, 1988); 2.022 in Karamik lake (Balik et al., 2006); 1.881 in Beyşehir lake (Çetinkaya et al., 2006); 1.870 in Liman lake (Demirkalp, 2007) and 1.970 in İznik lake (Yağci et al., 2008). Our results are lower than before. Condition factor of the chub population in Çamligöze dam lake ranged from 0.7686 to 1.9507. The mean condition factor of all chub samples was determined as 1.2915 ± 0.3021 in Çamligöze dam lake (Table 1). The mean condition factors for *Leuciscus cephalus* from different habitats in Turkey were reported as 1.5758 in Akşehir lake (Altindağ, 1996); 1.6082 in Sariyar dam lake (Ekmekçi, 1996); 1.8174 in Işikli lake (Balik et al., 2004); 1.667 in İkizcetepeler dam lake (Koç et al., 2007) and 1.41 in Hafik lake (Ünver and Kekilli, 2010). Our results are lower than before.

The condition factor reflects through its variations, information on the physiological state of the fish in relation to its welfare. From a nutritional point of view, there is the accumulation of fat and gonad development. From a reproductive point of view, the highest condition factor values are reached in some species. Condition factor also gives information when comparing two populations living in certain feeding, density, climate, and other conditions when determining the period of gonad maturation, and when following up the degree of feeding activity of a species to verify whether it is making good use of its feeding source (Le Cren, 1951; Angelescu et al., 1958; Weatherley, 1972; Kumolu-Johnson and Ndimele, 2010). A total of 126 individuals belonging to Cyprinidae family and seven species were analysed in this study. The mean condition factor of all seven species *Cyprinid* samples was determined as 1.3241 ± 0.2944 in Çamligöze dam lake. The mean condition factors of seven species *Cyprinid* fish were ranged from 0.9894 to 1.6362. *C. carpio* (1.6362 ± 0.2785) was determined to have the greatest mean condition factor followed by *C. tinca* (1.3126 ± 0.1927), *L. cephalus* (1.2915±0.3021), *B. plebejus* (1.1142±0.1973), *C. chalcoides* (1.1138 ± 0.1251), *C. sieboldii* (1.0214 ± 0.1547) and *C. nasus* (0.9894 ± 0.2281) in Çamligöze dam lake. The significant difference was found as a result of analysis of variance. After that, the differences between species in order to determine the post-hoc comparisons made with Sheffe test average *Cyprinus carpio* other types of exercise were significantly higher in very high averages. Outside the observed differences between species *C. carpio,* it was concluded that there is no statistically significant difference in Çamligöze dam lake (Table 1). Condition factors of seven *Cyprinid* fish species around "1" showed a good level of nutrition of fish and nutritional capacity in Çamligöze dam lake. Condition factor compares the well-being of a fish and is based on the hypothesis that heavier fish of a given length are in better condition. Condition factor has been used as an index of growth and feeding intensity. Condition factor decrease

with increase in length and also influences the reproductive cycle in fish (Bagenal and Tesch, 1978; Fagade, 1979; Welcome, 1979; Abowei, 2010).

Weight-length relationships are used for estimating the weight corresponding to a given length, and condition factors are used for comparing the condition, fatness, or well-being of fish, based on the assumption that heavier fish of a given length are in better condition. It is known that condition factors parameters depend on factors including biological and environmental, as well as geographical and temporal, such as the age and condition of the fish or the season of year when samples are collected (Lagler et al., 1962; Froese, 2006; Ferreira et al., 2008; Vaslet et al., 2008; Nowak et al., 2009). The condition of fish is influenced by the age, sex, season, stage of maturation, fullness of the gut, type of food consumed, degree of muscular development, amount of fat reserved, and may also be influenced by water qualities, water temperature, stress and disease, and stocking densities (Barnham and Baxter, 1998; Williams, 2000). When using the results presented in this study, it should be borne in mind that the samples were taken seasonally, total length measured and the number of fish examined was limited.

Conclusion

In conclusion, the condition factor presented here will provide useful information for fisheries studies, sustainable fishery management and fish population dynamics modeling in Çamligöze dam lake. To the best of our knowledge, the condition factors for most of these fishes were presented in Çamligöze dam lake for the first time. These results can therefore serve as baseline data for these species and for comparisons with future studies.

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