Journal of Agricultural Science and Technology B 8 (2018) 466-471
doi: 10.17265/2161-6264/2018.07.006

Some Biological Features of *Tinca tinca* Population in Asartepe Reservoir (Ankara)

Ömer Saylar[1], Göktuğ Gül[2], Mehmet Yilmaz[3] and Ali Gül[3]

1. Division of Science Education, Gazi Faculty of Education, Gazi University, 06500 Teknikokullar, Ankara, Turkey

2. Gazi University Health Services Vocational School, Gölbaşı, 06500 Teknikokullar, Ankara, Turkey

3. Division of Biology Education, Gazi Faculty of Education, Gazi University, 06500 Teknikokullar, Ankara, Turkey

Abstract: *Tinca tinca* (L., 1758) grafted into Turkish inland waters in 1970 has shown constantly widening distribution since then. It is a locally consumed species with limited economic value. The elucidation of length-weigh relation, condition factor and biological features are of great importance in the determination of the effects of different habitats on particular species. *T. tinca* is regarded as an important species to be monitored among the fish taxa. This study was intended to study some biological aspects of *T. tinca* population in Asartepe Reservoir and to compare the results with the available information. The study has been carried out on 131 *T. tinca* species caught in Asartepe Reservoir between the periods of March 2015-February 2016. The morphometric and meristic properties and the ratio of some diagnostic features to the standard length were elucidated. The highest and the lowest variations observed among the morphometric features were in body length with 21.35% and eye diameter with 8.31%. The corresponding values for the meristic features were pectoral fin unbranched rays with 30.09% and number of vertebrae with 2.68%. The highest percentage relative to the standard length was found in predorsal distance with 56.95%. The age distribution of *T. tinca* population was between the ranges of 1-9 years of age. The average weight and length were found to be 520.58 ± 207.84 g (103-1,302 g) and 308.68 ± 41.38 mm (190-429 mm). The parameters of a and b of length and weight relation and the correlation coefficient were found to be 0.9692, 3.0522 and 1.6807 ± 0.1264 (1.4199-2.0368), respectively. The results indicate that the growth level of *T. tinca* population is satisfactory.

Key words: Asartepe Reservoir, *Tinca tinca*, length-weight, condition factor, meristic, morphometric.

1. Introduction

The fish species introduced into inland waters have been inserting increasingly more adverse effects upon other domestic and economic species living in the same habitat. It was reported that grafting of *Sander lucioperca* in 1955, *Carassius gibelio* 1996 and *Atherina boyeri* in 2003 had a great impact upon the ichthyofauna of Beyşehir Lake, which resulted in the extinction of the endemic species *Pseudophoxinus handlirschi* and *Hemigrammocapoeta kemali*. Also the populations of other endemic species of *P. egridiri* and *Capoeta pestai* were at critical levels [1]. Therefore, it becomes necessary to carry out periodic monitoring of the biological characteristics of the same species in different habitats. The species with different feeding regimes are known to cause the change of the biological features of some species living in the same habitat. Some species has a rapid breeding rate and compete for the food and region in the lake with the domestic species [2]. That is why the determination of the length-weight, condition factor and morphological features of same species in different aquatic ecosystems is of great importance for ichthyofauna [3]. The determination of the morphometric and meristic features of the fish species is necessary to elucidate whether there is any morphological differentiation in fish populations.

The water parameters of Asartepe Reservoir are reported as: pH 8.5-9.16, dissolved oxygen 7.04-8.2 mg/L, electrical conductivity 306-450 µS/cm, temperature 10.45-23.5 °C and Secchi disc 85-178 cm.

Corresponding author: Ali Gül, professor, research field: hydrobiology.

It is also reported that there were 43 taxa of Rotifera, three taxa of Cladocera and two taxa of Copepoda zooplanktons in the lake [4]. Also there were 93 taxa of diatoms determined in the lake [5]. A total of 14 fish species living in Asartepe Reservoir, which included *Alburnus escherichii*, *Alburnoides kosswigi*, *Capoeta baliki*, *Chondrostoma angorense*, *Squalius pursakensis*, *Vimba vimba*, *Cobitis simplicispina*, *Oxynoemacheilus angorae*, as the domestic species, introduced and economically valuable species such as *Cyprinus carpio*, *Perca fluviatilis*, *Esox lucius*, *Tinca tinca*, and invasive species such as *C. gibelio*, *Pseudorasbora parva* [6].

Tench, *T. tinca* (L., 1758) has a very large distribution in Europe, Western Asia and Caspian Sea. It came to Turkey from the north and is distributed all over the country after being introduced in reservoirs and natural lakes starting from 1970s [7, 8]. Its growth rate is comparatively slower than the ones reported in the literature. Although it is not of great economic importance it is locally consumed in different parts of the country. In mid Europe it is bred in pools [9]. It feeds on sediment. It digs the sediments and plays an important role in the mineralization of the waterbodies. It is also reported that these species are used for the cleaning of the carp breading pools [9, 10]. Due to its relations with the other species in the ecosystem, effects in mineralization, capacity to adapt to the different water systems and the role in the purification of the environment, *T. tinca* is regarded as a species to be constantly investigated and monitored to have important information about the conditions of aqueous regions as a habitat of fish species.

There is a huge literature upon the biological features of *T. tinca* in different aqueous ecosystems of Turkey, including Mogan Lake [11], Seyhan Reservoir [12], İznik Lake [13], Bafra Fish Lakes, Karaboğaz, Liman and Simenit-Akgöl Lagoons [14], Eğirdir, Gölcük and Beyşehir Lakes [15], freshwaters of Western Black Sea region [16]. The purpose of the present study was to elucidate some of the biological features of the *T. tinca* population in Asartepe Reservoir.

2. Materials and Methods

The study was conducted on 131 *T. tinca* specimens captured from Asartepe Reservoir between March 2015 and February 2016. The reservoir constructed upon the İlhan Stream has a depth of 36 m and an area of 1.7 km^2 (Fig. 1). The samples were collected from three different stations representing the whole lake. The samples were collected from three different stations representing the whole lake. The fish was caught with trammel nets with various mesh sizes, hoops and with a 12 volt DC 5 Amper Samus brand 725 MP and PWM2 model electro-shocker at the entrance of the rivers feeding the lake. The age of the fish was determined from the scale preparations by the use of Kyowa SDZ-PL model binocular microscope [17]. The morphological measurements were made by a ruler with an accuracy of ±1 mm and the weight were determined with a scale with an accuracy of ±0.01 g



Fig. 1 Map of Asartepe Reservoir.

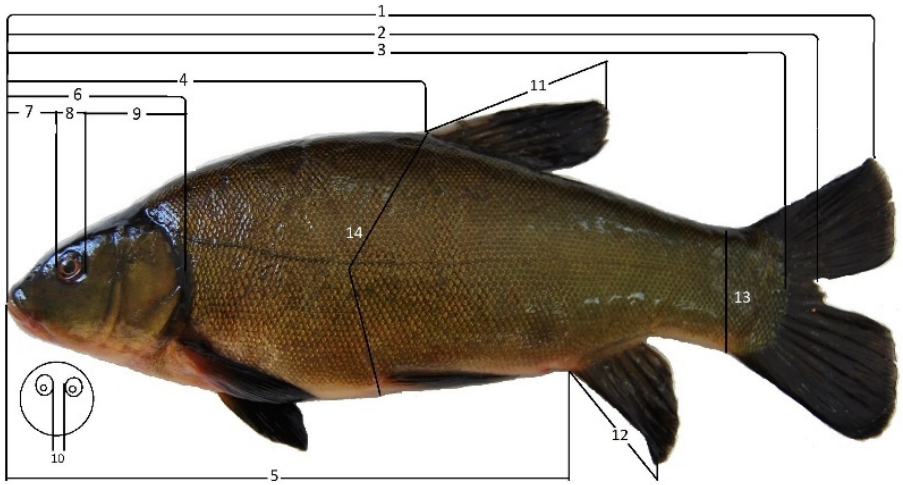


Fig. 2 Morphometric landmarks on the specimen of *Tinca tinca.*

1: total length; 2: fork length; 3: standard length; 4: predorsal length; 5: preanal length; 6: head length; 7: snout length; 8: eye diameter; 9: postorbital length; 10: interorbital distance; 11: dorsal fin height; 12: anal fin height; 13: caudal peduncle height; 14: body height.

(Fig. 2). The meristic properties were elucidated by the use of a lens mounted on the table and a stereomicroscope.

The relation between the length (L) of and weight (W) and the condition factor (C) of the fish were determined by the formula, $W = a \times L^b$ and $C = W/L^3 \times 100$ given in Ref. [18]. The basic statistical data of the morphometric (mm) and meristic characters, variation coefficient (VC = SD/mean × 100) and the percentage values of morphometric features in the standard length (SL%) were determined [19].

3. Results and Discussion

The mean total length and weight of *T. tinca* species living in the lake were found to be 520.58 ± 207.84 g (103-1,302 g) and 308.68 ± 41.38 mm (190-429 mm), respectively. The length-weight relation was $W = 1E\text{-}05L^{3.0522}$ (Fig. 3). The b value of length-weight relation gives information on the biotic and abiotic information about the somatic growth pattern of the fish. The age distribution of *T. tinca* population was between the ranges of 1-9 years of age. Since the b value obtained in this study (3.0522) was greater than three (3), it could be understood that *T. tinca* population living in the lake follows an allometric growth pattern. The condition factor was found to be 1.6807 ± 0.1264 (1.4199-2.0368). The result indicates that the growth level of *T. tinca* population in Asartepe Reservoir is satisfactory. The b value of length-weight relation was calculated as 2.7619 in Mogan Lake [20], 3.174 in Kesikköprü Reservoir [21], 3.174 in Bayındır Reservoir [22], 3.015 in Beyşehir Lake [23], 3.152 in Hirfanlı Reservoir [24] and 3.010 in Çivril Lake [25]. The b value obtained in this study was lower than the ones in Bayındır, Kesikköprü and Hirfanlı Reservoir, similar to Çivril Reservoir and higher than Mogan Lake. The b value, a parameter of length-weight relation, is the measure of the success of the population to adapt the habitat they live.

The condition factor was calculated to be 1.950 in Kesikköprü Reservoir [21], 1.550 in Bayındır Reservoir [22], 1.504 in Beyşehir Lake [23] and 1.647 in Hirfanlı Reservoir [24]. The value condition factor determined in this study was found to be lower than Kesikköprü Reservoir, higher than Bayındır Reservoir and Beyşehir Lake and similar to Hirfanlı Reservoir. Condition coefficient indicates the feeding condition and the relation between height and length of the fish. This factor varies according to the sexual maturity of the fish and the food available in the habitat [26]. The value of condition factor in this study indicates that Asartepe Reservoir has a rich food reserves for the *T. tinca* population living there.

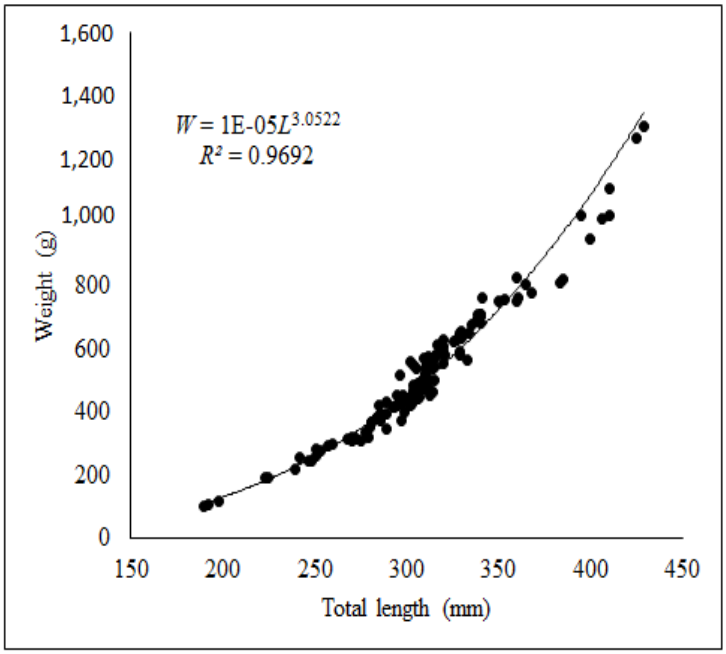


Fig. 3 Length-weight relationship of *T. tinca*.

Table 1 Morphometric characters of *Tinca tinca* (mm) in Asartepe Reservoir.

Morphometric characters	Min-max (mm)	Mean (mm)	Standard deviation	Variation coefficient (%)	The percentage ratio of morphometric characters to standard length (%)
Total length	190-429	308.68	41.37	13.40	-
Fork length	188-414	300.33	40.15	13.37	-
Standard length	155-381	264.72	38.34	14.48	-
Predorsal distance	85-191	150.76	18.02	11.95	56.95
Preanal distance	103-265	189.18	27.46	14.52	71.46
Head length	42-79	67.76	6.80	10.04	25.60
Snout length	15-28	24.39	2.62	10.74	9.21
Eye diameter	7-15	11.92	0.99	8.31	4.50
Postorbital length	20-36	31.44	3.37	10.72	11.88
Interorbital distance	18-45	24.88	5.07	20.38	9.40
Dorsal fin height	38-64	48.98	4.87	9.94	18.88
Anal fin height	23-62	46.64	5.65	12.11	17.62
Caudal peduncle height	28-72	47.18	9.18	19.46	17.82
Body height	50-124	64.63	13.80	21.35	24.41

The highest and lowest variations in morphometric features were observed in body length with 21.35% and in eye diameter with 8.31% (Table 1). The corresponding values in meristic features are found to be in the number of unbranched rays in pectoral fin with 30.09% and in number of vertebrae with 2.68% (Table 2). The highest predorsal distance compared the standard length was found to be 56.95%.

The meristic characteristics of *T. tinca* living in different habitats are listed in Table 3. The results obtained for *T. tinca* population in Asartepe Reservoir were generally similar with other habitats.

This study revealed that the meristic characters of *T. tinca* living in different habitats do not show significant changes. The small changes are attributed to effect of the different physicochemical parameters of

Table 2 Meristic characters of *T. tinca* in Asartepe Reservoir.

Meristic characters	Min-max	Mean	Standard deviation	Variation coefficient (%)
Lateral line scales	97-110	103.74	3.36	3.24
Transverse rows of scales between dorsal fin and lateral line	22-32	27.63	3.06	11.07
Linea transversal lower scale number	19-30	23.30	2.69	11.55
Dorsal fin unbranched rays number	2-3	2.60	0.49	3.55
Dorsal fin branched rays number	8-11	9.32	0.78	8.37
Anal fin unbranched rays number	1-3	2.12	0.77	36.32
Anal fin branched rays number	7-10	7.89	0.83	10.52
Pectoral fin unbranched rays number	1-2	1.13	0.34	30.09
Pectoral fin branched rays number	13-18	16.18	0.92	5.69
Pelvic fin unbranched rays number	1-2	1.57	0.50	31.85
Pelvic fin branched rays number	8-11	9.00	0.78	8.67
Number of vertebrae	38-41	39.25	1.05	2.68

Table 3 The meristic characters of *T. tinca* living in different habitats.

Habitats	Dorsal fin unbranched/branched rays number	Anal fin unbranched/branched rays number	Pectoral fin unbranched/branched rays number	Pelvic fin unbranched/branched rays number	lateral line scales	Number of vertebrae
Mogan Lake [11]	III-IV/8-10	III/7-9	I/15-18	I-II/8-10	91-109	39-41
Seyhan Dam Lake [12]	III/8	III/6-7	I/11-15	II/9	95-98	-
İznik Lake [13]	III-IV/8-9	III-IV/6-7	-	-	101-111	-
Bafra Fish Lakes, Karaboğaz Lagoon, Liman Lagoon and Simenit-Akgöl Lagoon [14]	IV/9	III-IV/7-8	I/17-18	II/9	98-102	-
Eğirdir, Gölcük and Beyşehir Lakes [15]	III-IV/8-9	III/6-8	I/15-16	I/8-9	88-99	-
West Black Sea Region [16]	III/8	III/7	I/15	I/9	97	-

different habitats. The results related to the biological variations are quite useful in the determination of the effect of different environments upon the same species.

4. Conclusions

Asartepe Reservoir is a habitat of 14 fish species in spite of its small water volume. Among these species are the ones which were latter introduced to the reservoir through grafting, domestic or unknown ways. The predators such as *E. lucius* and *P. fluviatilis* and invasive omnivore fish such as *P. parva* and *C. gibelio* are thought to be much more successful in the struggle of life than the domestic species. The facts that the age distribution of the fish was between 1-9 years of age, the parameter of b is bigger than three (3) and condition factor is satisfactory show that Asartepe Reservoir is a highly suitable habitat for the breeding of *T. tinca*.

The morphologic and meristic characteristics *T. tinca* populations living in different habitats show very small differences which are of no ecological significance. There is not a serious threat for the *T. tinca* population for a foreseeable future

References

[1] Küçük, F., Sari, H. M., Demir, O., and Gülle, İ. 2009. "Review of the Ichthyofaunal Changes in Lake Eğirdir between 1915 and 2007." *Turkish Journal of Zoology* 33 (3): 277-86.

[2] Polat, N., Zengin, M., and Gümüş, A. 2011. "Invasive Fish Species and Life Strategies." *The Black Sea Journal of Sciences* 1 (4): 63-86.

[3] Çoban, M. Z., Gündüz, F., Yüksel, F., Demirol, F., Yıldırım, T., and Kurtoğlu, M. 2013. "Fish Fauna of Uzunçayır Reservoir (Tunceli)." *Yunus Research Bulletin* 2: 35-44.

[4] Buyurgan, Ö., Altındağ, A., and Kaya, M. 2010. "Zooplankton Community Structure of Asartepe Reservoir (Ankara, Turkey)." *Turkish Journal of Fisheries and Aquatic Sciences* 10 (1): 135-8.

[5] Atıcı, T., and Obalı, E. O. 2010. "The Diatoms of Asartepe Reservoir (Ankara), with Environmental and Some Physicochemical Properties." *Turkish Journal of Botany* 34 (6): 541-8.

[6] Saylar, Ö., Gül, G., Yılmaz, M., and Gül, A. 2018. "Fish Fauna in Asartepe Reservoir (Ankara)." *Limno Fish—Journal of Limnology and Freshwater Fisheries Research* 4 (2): 90-7.

[7] Karabatak, M. 1994. "The Length-Weight Relationship of Tench (*Tinca tinca* L., 1758) in Mogan Lake (Ankara), Condition and Seasonal Changes in Gonad Development." *Istanbul University Journal of Fisheries & Aquatic Sciences* 8: 15-30. (in Turkish)

[8] Geldiay, R., and Balık, S. 2009. "Freshwater Fish of Turkey." Ege University Faculty of Fisheries Publications 46, 355, İzmir. (in Turkish)

[9] Michaels, V. K. 1988. *Carp Farming.* Great Britain: Henry Ling Ltd., the Dorset Press, Dorchester, 200.

[10] Demirsoy, A. 1998. "The Basic Rules of Life III/Part I." Hacettepe University Publications A/55, 399, Ankara. (in Turkish)

[11] Gül, A., Benzer, S., Saylar, Ö., Gül, G., and Yılmaz, M. 2017. "Fish Fauna in Mogan Lake." *J. BAUN Inst. Sci. Technol*. 19 (1): 91-103.

[12] Ergüden, S. A., and Göksu, M. Z. L. 2012. "The Fish Fauna of the Seyhan Reservoir (Adana)." *Journal of Fisheries Sciences* 6 (1): 39-52.

[13] Özuluğ, M., Altun, Ö., and Meriç, N. 2005. "On the Fish Fauna of Lake İznik (Turkey)." *Turkish Journal of Zoology* 29 (4): 371-5.

[14] Uğurlu, S., Polat, N., and Kandemir, Ş. 2008. "Fish Fauna of Lagoons within the Kızılırmak and Yeşilırmak Deltas (Samsun-Turkey)." *Journal of Fisheries Sciences* 2 (3): 475-83.

[15] Yeğen, V., Balık, S., Bostan, H., Uysal, R., and Bilçen, E. 2006. "Recent Status of Fish Faunas in Some Lakes and Dams in Lakes." In *Proceedings of the National Fishing and Reservoir Management Symposium*, February 7-9, Antalya, 129-39.

[16] İlhan, A. 2006. "Investigation of Taxonomic and Ecological Features of Freshwater Fishes of Western Blacksea Region." Ph.D. thesis, Ege University Institute of Sciences, 186.

[17] Lagler, K. F. 1956. *Freshwater Fishery Biology*. Dubuque, Iowa: Wm. C. Brown Company Publishers, 421.

[18] Ricker, W. A. 1975. "Computation and Interpretation of Biological Statistics of Fish Populations." *Bulletin of the Fisheries Research Board of Canada* 191: 382.

[19] Avşar, D. 1998. *Fisheries Biology and Population Dynamic,* Lesson Book No. 5. Baki Book and Publisher, Adana, 303.

[20] Gül, G., Yılmaz, M., Saylar, Ö., Benzer, S., and Gül, A. 2017. "Morphometric and Meristic Characteristics and Length-Weight Relations of *Cyprinus carpio* in the Mogan Lake Population." *Süleyman Demirel University Journal of Eğirdir Fisheries Faculty* 13 (2): 163-72.

[21] Altındağ, A., Yiğit, S., and Ahıska, S. 1998. "The Growth Features of Tench (*Tinca tinca* L., 1758) in the Kesikköprü Reservoir." *Turkish Journal of Zoology* 22: 311-8.

[22] Altındağ, A., Shah, S. L., and Yiğit, S. 2002. "The Growth Features of Tench (*Tinca tinca* L., 1758) in Bayındır Reservoir, Ankara, Turkey." *Turkish Journal of Zoology* 26: 385-91.

[23] Erol, K. G., Çetinkaya, S., Tümgelir, L., and Çubuk, H. 2006. "Growth Features of Tench (*Tinca tinca* L., 1758) Population in Beyşehir Lake." In *Proceedings of the International Beyşehir and Region Symposium,* May11-13, Konya, 315-21.

[24] Yılmaz, S., Yazıcıoğlu, O., Yılmaz, M., and Polat, N. 2010. "Length-Weight and Length-Length Relationships, and Seasonal Condition Factors of *Cyprinus carpio* (L., 1758) and *Tinca tinca* (L., 1758) Inhabiting Hirfanlı Reservoir." *SDU Journal of Science (E-Journal)* 5 (2): 154-62.

[25] Balık, S., Sarı, H. M., Ustaoğlu, M. R., and İlhan, A. 2004. "The Structure, Mortality and Growth of the Tench (*Tinca tinca* (L., 1758)) Population in Çivril Lake, Denizli, Turkey." *Turkish Journal of Veterinary and Animal Sciences* 28: 973-9.

[26] Le Cren, E. D. 1951. "The Length-Weight Relationship and Seasonal Cycle in Gonad Weight and Condition in the Perc (*Perca fluviatilis*)." *Animal Ecology* 20 (2): 201-19.