African Journal of Agricultural Research Vol. 7(45), pp. 6022-6026, 27 November,2012
Available online at http://www.academicjournals.org/AJAR
DOI: 10.5897/AJAR12.1188
ISSN 1991-637X ©2012 Academic Journals

Full Length Research Paper

Identification of fish species of Çamlıgöze Dam Lake, Sivas, Turkey

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Accepted 6 November 2012

This study was carried out to determine fish species in Çamlıgöze Dam Lake located at Central Anatolian region of Turkey. Fish samples were caught seasonally with nets of various mesh sizes between April 2010 and January 2011 in Çamlıgöze Dam Lake. As a result of evaluated fish samples *Oncorhynchus mykiss* belonging to Salmonidae, *Cyprinus carpio*, *Barbus plebejus*, *Capoeta sieboldii*, *Capoeta tinca*, *Chalcalburnus chalcoides*, *Chondrostoma nasus*, *Leuciscus cephalus* belonging to Cyprinidae and *Silurus glanis* belonging to Siluridae were identified in this study area. All fish species were native except the *Oncorhynchus mykiss* and *Cyprinus carpio* in Çamlıgöze Dam Lake. Some morphometric and meristic characteristics of the fish samples were examined in Çamlıgöze Dam Lake.

Key words: Fish species, Çamlıgöze dam lake, Sivas, Turkey.

INTRODUCTION

Freshwater fish represent an important component of the aquatic ecosystem and are highly valued for their economic, social and aesthetic importance. Fish are vital to the health of freshwater ecosystems. Fish are an important element because of their biological and socioeconomic status. Fish are already involved in environmental policies as biodiversity and ecological quality indicators and they have been used successfully in biogeographical studies, conservation evaluations and assessments of ecologically acceptable water regime management (Moyle and Randall, 1998; Kestemont et al., 2000; Economou et al., 2007; Schmutz et al., 2007). Freshwater ecosystems have frequently been cited as among those that are most altered and threatened by human activities (Saunders et al., 2002; Clavero et al., 2005; Ferreira et al., 2007). Growth of the human population, rising consumption, and rapid globalization have caused widespread degradation and disruption of natural systems, especially in the freshwater realm. Freshwater ecosystems have lost a greater proportion of their species and habitat than ecosystems on land or in the oceans, and they face increasing threats from dams, water withdrawals, pollution, invasive species, and overharvesting. Freshwater ecosystems and the diverse communities of species found in lakes, rivers, and wetlands may be the most endangered of all (Abell et al., 2008). Turkey is located at the crossroads of Europe, Asia and Africa, and is surrounded by sea from three sides with different ecological characters. Turkey is a very rich country in terms of its aquatic ecosystems and water sources owing to its geomorphological structure. As a result of these features, Turkey becomes one of the important countries being in geography on account of biodiversity. It is necessary to find out the biological richness, especially with regards fish fauna, to increase the utilisation of products obtained from inland water sources (Kuru, 2004; Torcu-Koç et al., 2008). To date, the fish fauna of Çamlıgöze Dam Lake has not been directly studied. The aim of this study was to determine fish species in Çamlıgöze Dam Lake located at Central Anatolian region of Turkey.

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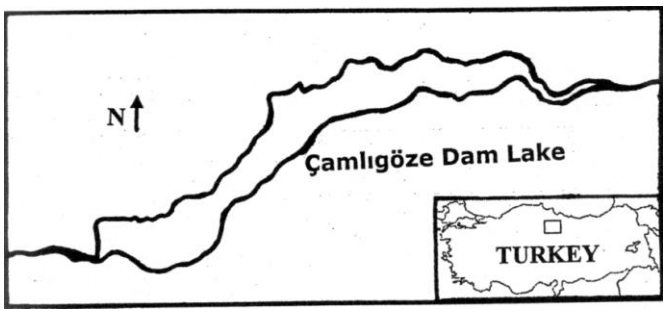

Figure 1. Çamlıgöze Dam Lake.

MATERIALS AND METHODS

The province of Sivas is located at the eastern part of the Central Anatolian region of Turkey. Çamlıgöze Dam Lake is situated on the east of Sivas province and geographical cordinates are 40° 13' 45" N, 38° 04' 36" E. The location of Çamlıgöze Dam Lake is shown in Figure 1. The Çamlıgöze Dam was constructed between 1987 and 1998 on the Kelkit Stream, a tributary of Yeşilırmak River. Çamlıgöze Dam is a 37 m high rockfill a power plant. The water of Çamlıgöze Dam Lake is mainly used for produce electrical energy, commercial fishing, aquaculture, irrigation and recreation. The surface area and maximum depth of the Çamlıgöze Dam Lake are 5 km^2 and 30 m, respectively. Average capacity of Çamlıgöze Dam Hydroelectric Station is 102 GWh/year (Dirican et al., 2009). This study was carried out between April 2010 and January 2011 in Çamlıgöze Dam Lake. Fish samples were caught seasonally with nets of various mesh sizes (20, 30, 40 and 60 mm) in Çamlıgöze Dam Lake. The samples were fixed in 4 % formaldehyde solution and preserved in 70 % ethyl alcohol solution.

Colour features of fish were examined in fresh specimens. A milimetric ruler was used to measure the metric characteristics of the fish samples. Meristic characteristics, such as number of gill rakers, lateral line scales, pharyngeal teeth, dorsal, anal, pectoral and ventral fin rays were determined under a stereo microscope.

RESULTS

In total, 142 fish specimens were caught from the Çamlıgöze Dam Lake. A total of 9 fish species belonging 3 families; Salmonidae, Cyprinidae and Siluridae were determined in research area. Some morphometric and meristic characteristics of fish species are given as follows according to findings.

Family: Salmonidae

Oncorhynchus mykiss (Walbaum, 1792)

According to the diagnostic characteristics of the 14 specimens; the formula of fin rays is D: III 10-12, A: III 10-11, P: I 11-12, V: I 9-10. Adipose fin is present, usually with black edge. Lateral line scales are between 119 and 132. Coloration blue to olive green above a pink band along the lateral line and silver below. Back, sides, head and fins covered with small black spots. The total lenght ranged between 19.3 and 46.2 cm. The weights ranged between 120.7 and 1058 g.

Family: Cyprinidae

Cyprinus carpio Linnaeus, 1758

According to the diagnostic characteristics of the 27 (19 Common carp and 8 Miror carp) specimens; the formula of fin rays is D: III 18-20, A: III 5-6, P: I 14-16, V: II 7-8. Lateral line scales are between 34 and 38. Transversal scales are 6-7/5-6. Scales are large and thick. Pharyngeal teeth are in triserial 1.1.3-3.1.1. There are 2 pairs of barbels on the upper jaw. The number of gill rakers on the first arch is between 24 and 27. There are many varieties of common carp found throughout the world. Carp that are partially scaled along their sides are called Mirror carp. Mirror carp is identified by irregular scales dotted haphazardly over its body. The total length is ranged between 16.6 and 52.4 cm. The weights ranged between 108.3 and 2280 g.

Barbus plebejus Bonaparte, 1832

According to the diagnostic characteristics of the 13 specimens; the formula of fin rays is D: III 8-9, A: III 5-6, P: I 13-14, V: I-II 7-8. Lateral line scales are between 58 and 62. Transversal scales are 11-13/7-9. Dorsal, anal, caudal fins and body are untidy dark spots. Pharyngeal teeth are in triserial 2.3.4-5.3.2. The number of gill rakers on the first arch is between 8 and 10. Mouth is inferior, with 2 pairs of barbels. The total length is ranged between 11.0 and 27.5 cm. The weights ranged between 17.6 and 184.9 g.

Capoeta sieboldii (Steindachner, 1864)

According to the diagnostic characteristics of the 7 specimens; the formula of fin rays is D: III 8-9, A: III 5, P: I 16-18, V: II 8-9. Lateral line scales are between 57 and 59. Transversal scales are 10-9/10. Pharyngeal teeth are in triserial 2.3.4-4.3.2. There is 1 pairs of barbels. The number of gill rakers on the first arch is between 22 and 27. Body is yellowish brown. The total length is ranged between 22.7 and 42.1 cm. The weights ranged between between 107.1 and 682.5 g.

Capoeta tinca (Heckel, 1843)

According to the diagnostic characteristics of the 52 specimens; the formula of fin rays is D: III 8-9, A: III 5-6, P: I 15-18, V: I 8-9. Lateral line scales are between 70 and 78. Transversal scales are 11-15/8-12. Pharyngeal teeth are in triserial 2.3.4-4.3.2. There are 2 pairs of

Table 1. Fish species and their percentage ratio in total number.

Fish Species	N	%
Oncorhynchus mykiss (Walbaum, 1792)	14	9.86
Cyprinus carpio Linnaeus, 1758	27	19.01
Barbus plebejus Bonaparte, 1832	13	9.15
Capoeta sieboldii (Steindachner, 1864)	7	4.93
Capoeta tinca (Heckel, 1843)	52	36.62
Chalcalburnus chalcoides (Güldenstädt, 1772)	5	3.52
Chondrostoma nasus Linnaeus, 1758	4	2.82
Leuciscus cephalus (Linnaeus, 1758)	18	12.68
Silurus glanis Linnaeus, 1758	2	1.41

barbells.

The number of gill rakers on the first arch is between 14 and 18. Body is yellowish brown. The total length ranged between 10.5 and 34.7 cm. The weights ranged between 19.1 and 427.5 g.

Chalcalburnus chalcoides (Güldenstädt, 1772)

According to the diagnostic characteristics of the 5 specimens; the formula of fin rays is D: III 8-9, A: III 14-16, P: I 13-16, V: I 7-8. Lateral line scales are between 57 and 61. Transversal scales are 11-12/4-5. Pharyngeal teeth are in biserial 2.5-5.2. The number of gill rakers on the first arch is between 21 and 23. Body is bright silvery white. The total length ranged between 13.8 and 17.4 cm. The weights ranged between 32.7 and 51.2 g.

Chondrostoma nasus Linnaeus, 1758

According to the diagnostic characteristics of the 4 specimens; the formula of fin rays is D: III 8-9, A: III 9-11, P: I 11-12, V: I 8-9. Anal and ventral fins are orange or red. Lateral line scales are between 59 and 62. Transversal scales are 9-10/5-6. Pharyngeal teeth are in uniserial 6-6. The number of gill rakers on the first arch is between 21 and 25. The total length ranged between 21.7 and 25.6 cm. The weights ranged between 105 and 139.2 g.

Leuciscus cephalus (Linnaeus, 1758)

According to the diagnostic characteristics of the 18 specimens; the formula of fin rays is D: III 8, A: III 8-9, P: I 14-16, V: I 7-9. Anal and ventral fins are orange. Lateral line scales are between 42 and 45. Transversal scales are 7-8/3-4. Pharyngeal teeth are in biserial 2.5-5.2. The number of gill rakers on the first arch is between 8 and 10. The total length ranged between 11.4 and 28.3 cm. The weights ranged between 16.2 and 174.2 g.

Family: Siluridae

Silurus glanis Linnaeus, 1758

According to the diagnostic characteristics of the 2 specimens; the formula of fin rays is D: I 3-4, A: I 80-89, P: I 13-15, V: I 11-13, C:16-17. Body naked and there is no scale. Dorsal fin is very small. Anal fin is very long, confluent with the caudal fin. There are 3 pairs of barbels around the mouth. One pair on the upper jaw, two pairs on the lower. The body is black on the back. The body is white in the abdomen. The total length ranged between 48.6 cm and 55.3 cm. The weights ranged between 682.6 and 924.1 g.

During this study, a total of 142 specimen belonging 3 families were caught in research area. The contribution of each family was Cyprinidae (88.73%), Salmonidae (9.86%) and Siluridae (1.41%). The Cyprinidae family is dominant in Çamlıgöze Dam Lake. Fish species and their percentage ratio in total number in Çamlıgöze Dam Lake are given in Table 1. *C. tinca* (36.62%) was the dominant species of fish caught in research area. Also, *C. carpio* (19.01%) is second the most abundant species of Çamlıgöze Dam Lake. *S. glanis* (1.41%) was the most rarely encountered species in Çamlıgöze Dam Lake.

DISCUSSION

Ichthyofauna studies are important in relation to the determination of biodiversity, protection, and continuity of gene sources (Uğurlu et al., 2009). As a result of this study; *O. mykiss* belonging to Salmonidae, *C. carpio*, *Ba. plebejus*, *C. sieboldii*, *C, tinca*, *C.chalcoides*, *C. nasus*, *L. cephalus* belonging to Cyprinidae and *S. glanis* belonging to Siluridae were identified in Çamlıgöze Dam Lake during the research period. This present study reported that the metric and meristic features of concerning *O. mykiss*, *C. carpio*, *B. plebejus*, *C. sieboldii*, *C. tinca*, *C. chalcoides*, *C. nasus*, *L.cephalus* and *S. glanis* were similar to previous studies of Kuru (1980), Balık (1995), Geldiay and Balık (1996), Elvira (1997), Küçük and İkiz (2004), Uğurlu and Polat (2007), Uğurlu et al. (2008), Ünver et al. (2008), Ergüden and Göksu (2012). Turkey has important water resourches diversity, and occurs between important biogeographic regions, thus it has a considerably rich fish fauna. This richness is being influenced by habitat deterioration, managing the water resourches by human kind, introducing and stocking native and exotic fishes to the waters for culture, commercial and sport fishing and biological control, causes rapid changes in fish fauna. The changes may be useful in some cases but the activities have negative effects also and may be detrimental on natural populations, native endemic species and aquatic ecosystems (Çetinkaya, 2006). All fish species were native except the *O. mykiss* and *C. carpio* in Çamlıgöze Dam Lake. Ichthyofaunal composition seven of these are

native fish species; *B. plebejus*, *C. sieboldii*, *C. tinca*, *C. chalcoides*, *C. nasus*, *L. cephalus* and *S. glanis*. *C.carpio* and *O. mykiss* are introduced fish species in Çamlıgöze Dam Lake. By fish introducing studies performed occasionally or periodically in lakes, ponds and reservoirs of Turkey, it is aimed to increase fish stocks of aquatic environments. In order to improve fisheries activities, as economical species, mirror carp (*C. carpio*) and rainbow trout (*O. mykiss*) are generally introduced by the relevant units of DSI (General Directorate of State Hydraulic Works) and Ministry of Agriculture (Balık and Ustaoğlu, 2006; Kişisel, 2006). Within stocking programme, 100000 fry of *C. carpio* have been introduced to Çamlıgöze Dam Lake by DSI (Anonymous, 2008). *C. carpio* (Common Carp and Miror Carp) belongs to the family Cyprinidae which is considered the largest freshwater fish family. The carp is established as one of the oldest domesticated fish species of freshwater fish and it is among the most important cultured fishes worldwide. In China, carp farming began in the 5th century B.C., whereas the culture of carp in Europe dates back to the Roman Empire. The wild ancestor of domesticated carp probably lived in the Caspian and Aral Sea basins, from where it was dispersed both to Western Europe and to East Asia. The current natural distribution of common carp ranges from Europe throughout the continent of Eurasia to China, Japan and South East Asia (Balon, 1995, 2006; Imsiridou et al., 2009; Chistiakov and Voronova, 2009). *C. carpio* is omnivore species that entered the Çamlıgöze Dam Lake with introducing studies.

O. mykiss (Rainbow Trout) is one of the most widely introduced fish species in the world. *O. mykiss* is an anadromous fish. Also, *O. mykiss* commonly known by its former scientific name *Salmo gairdnerii*. Since 1874, it has been introduced to waters on all continents except Antarctica, for recreational angling and aquaculture purposes. Production greatly expanding in the 1950s as pelleted feeds was developed. The native range is the Eastern Pacific Ocean and the freshwater, mainly west of the Rocky mountains, from northwest Mexico, to the Kuskokwim River, Alaska. It is probably native in the drainages of the Peace and Athabasca rivers east of the Rocky Mountains. *O. mykiss* are native to western North America with both resident and anadromous life-history forms found throughout their range (Narum et al., 2004; Thibault et al., 2010). *O. mykiss* (9.86%) is the fourth abundant species of Çamlıgöze Dam Lake (Table 1). Only one rainbow trout farm are present in net cage since 2008 in Çamlıgöze Dam Lake and its total production capacity is about 2000 tons/years in project base. *O. mykiss* is a carnivore species that entered the Çamlıgöze Dam Lake escaping from rainbow trout farm. At the same time; *O. myksis* from cage culture is distributed to lake by catch and dominated by their carnivore characteristics in Çamlıgöze Dam Lake can cause the increase of negative predation pressure on the native fish species.

This study is significant due to inventories of freshwater fish in Turkey, that constitutes a ring of chain, as well. The Çamlıgöze Dam Lake area is quite rich as a regard to fish species in spite of being small dam lake. It can be said that protection of this richness is important at least as much as determination. Fish are vital to the health of freshwater ecosystems. All fish species were native except the *O. mykiss* and *C. carpio* in Çamlıgöze Dam Lake. *O. mykiss* and *C. carpio* are introduced fish species in Çamlıgöze Dam Lake. Most fish introductions are for aquaculture in Turkey. The goal of aquaculture is to grow in a manner that does no harm to aquatic ecosystems. Clearly, further introductions should not be contemplated without serious research and risk assessment. Stating that there are no ecological consequences of introductions when these have seldom been sought and never been considered prior to introductions is problematic at best. The future of native fish species is threatened due to the lacks of lake management plan and fisheries management plan (fisheries, stocking, aquaculture) and wrong applications in terms of fisheries. Therefore, monitoring of environmental impacts of non-native fish species is very important for aquatic ecosystems conservation in Çamlıgöze Dam Lake. Besides, native fish protection policy should be developed in Çamlıgöze Dam Lake.

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