MEDWELL PUBLISHING
Journal of Animal and Veterinary Advances 8 (4): 715-719, 2009
ISSN: 1680-5593

Some Physico-Chemical Characteristics and Rotifers of Camligoze Dam Lake, Susehri, Sivas, Turkey

[1]Seher Dirican, [1]Haldun Musul and [2]Süleyman Cilek
[1]Department of Fisheries, Susehri Vocational High School, University of Cumhuriyet, Susehri, 58600 Sivas, Turkey
[2]Department of Animal Breeding, Faculty of Veterinary Medicine, University of Kirikkale, Yahsihan, 71451 Kirikkale, Turkey

Abstract: This study was carried out to determine some physico-chemical characteristics and rotifers of Camligoze Dam Lake located at northeastern part of Turkey. For this aim, water and rotifer samples were taken from 2 station between May 16 and November 16, 2007 in Camligoze Dam Lake. A total of 11 rotifer species; *Brachionus plicatilis*, *Kellicottia longispina*, *Notholca acuminata*, *Notholca squamula*, *Colurella uncinata*, *Lecane luna*, *Lecane lunaris*, *Cephalodella gibba*, *Synchaeta oblonga*, *Synchaeta pectinata* and *Polyarthra dolichoptera* were determined in the Camligoze Dam Lake. In the water samples, totally 5 physico-chemical parameters; water temperature, electrical conductivity, pH, secchi disc depth and dissolved oxygen were analyzed. As a result of this study, Camligoze Dam Lake was found there are no serious a water pollution problem.

Key words: Physico-chemical characteristics, rotifers, Camligoze Dam Lake, Sivas, Turkey

INTRODUCTION

Rotifers constitute an important part of the freshwater zooplankton. Rotifers, which from the 2nd step of the food chain, are important food sources for some invertebrate animals and fishes. Rotifers are one of the basic groups of the zooplankton community providing the energy flux of freshwater ecosystems and they inhabit virtually all aquatic habitats. Rotifers is the dominant group of freshwater ecosystems (Berzins and Pejler, 1987; Barrabin, 2000; Saler, 2004). Rotifers are classified in the phylum Rotifera, one of several phylum of lower invertebrates. Rotifer is the common name of this large group of aquatic invertebrates comprising around 2000 species. Rotifers can be found in many freshwater environments. The majority of which are free-living. They are often found between the high and low water marks of ponds, lakes and other freshwater bodies around the World (Nogrady *et al*., 1993).

Rotifers are microscopic aquatic animals characteristically prevalent in freshwaters. A few rotifers are cosmopolitan while majority of these animals are highly adapted to a wide range of feshwater conditions (Hutchinson, 1967; Brummett, 2000; Fajioye and Omoyinmi, 2006). Rotifers are food for many fish larvae. Rotifers are highly nutritive to planktivorous fish, its protein supports fast growth of fish larvae and juveniles and as such a booster to fish farmers (Lubzens *et al*., 1997; Kitto and Bechara, 2004).

In the last years, technology had progressed along with industrialization. High increasing in human population caused environment and water pollution, which is the most seriously problem of our age. Recently this problem has been increased in the Turkey as in the World.

The natural structure of water pollution is that useful water source is destroyed by harmfully any chemical or physical factor. Pollution effects harmfully many organisms, of which are members of food chain and sensitive to environmental changes. A degree of water pollution is determined by but only physico-chemical parameters not also examining aquatic organisms. One of the most important of these aquatic organisms are rotifers. Rotifers plays significant role in the food chain and biological productions of waters such as water pollution indicators and water quality monitor. Certain species and genera of rotifers are used as indicators of water quality, eutrophic status and productivity of a lake ecosystem (Pontin, 1978; Sladecek, 1983; Saksena, 1987; Haberman, 1998; Marneffe *et al*., 1998).

Corresponding Author: Süleyman Cilek, Department of Animal Breeding, Faculty of Veterinary Medicine, University of Kirikkale, Yahsihan, 71451 Kirikkale, Turkey

The province of Sivas is located at the eastern part of the Central Anatolian region of Turkey. Average height of Sivas province is 1275 m. The majority of Sivas Province shares the climate of terrestrial in which the summer seasons are hot and dry while winter seasons are cold and snowy. However, the northern part of the Sivas province shares the Black Sea climate. Camligoze Dam Lake is situated 140 km north-east of Sivas province centre. The Camligoze Dam was constructed between 1987 and 1998 on the Kelkit stream by the State Hydraulic Works. Camligoze Dam Lake is used for irrigation and produce electrical energy. The surface area and maximum depth of the Camligoze Dam Lake are 5 km^2 and 30 m, respectively. Average capacity of Camligoze Dam Hydroelectric Station is 102 GWh/year (Aydogar, 2004).

The aim of this study was to determine some physico-chemical characteristics and rotifers of Camligoze Dam Lake established on the Kelkit Stream in Sivas province.

MATERIALS AND METHODS

Camligoze Dam Lake is in the inner parts of Black Sea Region on the northeastern part of Turkey. This study was carried out between May 16 and November 16, 2007 in Camligoze Dam Lake. The samples were collected at 2 different stations in the Camligoze Dam Lake. The location of Camligoze Dam Lake and the sampling stations are shown in Fig. 1. Some physico-chemical parameters of Camligoze Dam Lake were determined during the sampling period. Water temperature, electrical conductivity, pH, dissolved oxygen and secchi disc depth parameters were measured in the Camligoze Dam Lake. Water temperature were measured by a thermometer, electrical conductivity by a WTW LF 92 type conductivimeter, pH by a WTW 340-A/SET-1 model pH meter, dissolved oxygen by a YSI 51 B model oxygenmeter and secchi disc depth or light permeability by a Secchi disc 20 cm in diameter.

The rotifer samples were collected by use of a plankton net (25 cm diameter and 55 μ mesh size) with horizontal and vertical hauls from each stations. The rotifers samples were fixed with 4% formaldehyde solution immediately after collection in 300 mL plastic bottles. Rotifer species were identified according to Edmondson (1959), Kolisko (1974), Koste (1978) and Segers (1995).

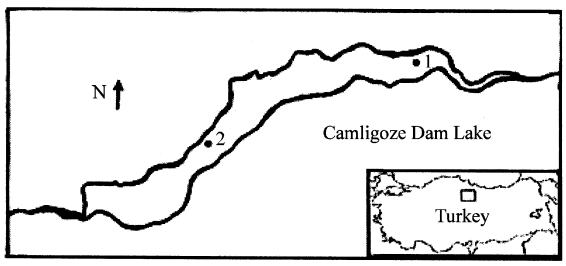

Fig. 1: Camligoze Dam Lake and stations

RESULTS AND DISCUSSION

The some physico-chemical parameters were measured; water temperature, electrical conductivity, pH, dissolved oxygen and secchi disc depth in the Camligoze Dam Lake. Mean values of some physico-chemical parameters of the Camligoze Dam Lake according to stations are given in Table 1.

The mean values of water temperature were ranged between 15.80±3.95 and 14.10±2.40°C during the study. There is no very significant difference between in water temperature mean values between 2 station in Camligoze Dam Lake. The natural temperature regimes in temperate climates tend to follow closely to those of air, being dependent on seasonal variation in the intensity of solar radiation, heat flux and losses through the latent heat of evaporation. The water temperatures however, do not show the extreme of air temperature and may lag slightly behind them in the seasonal cycle (Hellawell, 1986). Rotifers can tolerate temperatures of between 15 and 31°C. Temperature affects a number of physical, chemical and biological processes in naturalaquatic systems. Biologically, one of the most important effects of temperature is the decrease in oxygen solubility as the temperature increases. As a result, the increase in temperature can also increase the oxygendemand of biological organisms such as aquatic plants and fish (Szyper, 2001).

The mean values of electrical conductivity were ranged between 340±2.82 and 332±8.48 μS cm^{-1} im Camligoze Dam Lake. The importance of this factor in the dinamics of the zooplankton (strong negative correlastion) can be explained by the fact that the precence of dissolved electrolysable salts contributes to induce a strong osmotic pressure on the fauna and flora, thus inducing migrations or mortality of some living organisms (Sacchi and Testard, 1971; Ouéda *et al.*, 2007).

In this study period, the mean values of pH were ranged between 8.03±0.04 and 8.30±0.00 during the study. According to the mean values of pH was found to be fairly alkaline at 2 stations in Camligoze Dam Lake. The pH, measures the hydrogen ion concentration of water. The pH of the water indicates whether it is acidic or alkaline. The pH of lake water is an important general water quality indicator because pH is a major factor in most chemical and biological reactions. According to the EPA (1980), accepted water quality criteria indicate a pH

Table 1: Mean values of physico-chemical parameters of the Camligoze Dam Lake

Physico-chemical parameters	1 Station	2 Station
Water temperature (°C)	15.80±3.95	14.10±2.40
Electrical conductivity (μS cm^{-1})	340±2.82	332±8.48
pH	8.03±0.04	8.30±0.00
Dissolved oxygen (mg L^{-1})	8.20±0.14	8.30±0.42
Secchi disc depth (m)	1.70±0.07	2.30±0.14

of <6.5 units may be harmful to many species of fish. Therefore, the pH range of 6.5-9.0 units would be suitable for the protection of aquatic habitats. According to the EPA (1980), the mean values of pH were normal in Camligoze Dam lake.

The mean values of dissolved oxygen were ranged between 8.20±0.14 and 8.30±0.42 mg L^{-1} during this study. Throughout the study period, no important difference was found in dissolved oxygen values between 2 station. Dissolved oxygen is one of the important parameter in water quality assessment and reflects the biological and physical processes prevailing in the water. In freshwater ecosystems, the minimum dissolved oxygen may not be <5.0 mg L^{-1} for aquatic (Egemen and Sunlu, 1999). The mean values of dissolved oxygen were normal in Camligoze Dam lake for aquatic life. Dissolved oxygen concentration of a lake is an important indicator for determining the conditions of a lake. Dissolved Oxygen (DO) is a critical water quality parameter for characterizing the health of an aquatic ecosystem. It is a measurement of oxygen dissolved in water which is available to fish and other aquatic life. The dissolved oxygen content of water results from the photosynthetic and respiratory activities of the flora and fauna in the system and the mixing of atmospheric oxygen with waters through wind and stream current action. A great amount of information can be obtained solely through the analysis of this parameter. Among the information that can be obtained is: the determination of lake productivity through the photosynthetic activity of algae and weeds; an indication of mixing patterns and the effectiveness of mixing processes in a lake through DO gradients and the physical-chemical properties of lakes and the composition of a lake's biota through DO concentrations (McNeely *et al*., 1979). According to classifical continental inland water sources of the Water Pollution Control Regulation in Turkey, if dissolved oxygen is 8 m L^{-1}, the water is I class; if it is 6 mg L^{-1}, the water is II class; if it is 3 mg L^{-1}, the water is III class and if dissolved oxygen is <3 mg L^{-1}, the water is IV class (Anonymous, 1988). According to those limits, Camligoze Dam Lake could be categorized as I. class. It is obvious that Camligoze Dam Lake has a high water quality standard or I class. Thus, it can be said that Camligoze Dam Lake water can be used not only for drinking purpose by disinfecting it, but also for recreational aims, rainbow trout culture, animal production and other aims.

Average secchi disc depth mean values were ranged between 1.70±0.07 and 2.30± 0.14 m in Camligoze Dam Lake. This phenomenon according to Zongo (1991), may account for tendency to the eutrofication of the aquatic environment and whose sign maybe development of zooplankton fauna (Ryding and Rast, 1989; Ouéda *et al*., 2007). According to the level system of OECD for trophic status of lakes, if Secchi disc depth is between 0.8 and 1.5 m, the lake is eutrophic; if it is between 1.4 and 2.4 m, the lake is mesotrophic and if it is between 3.6 and 5.9 m, the lake is oligotrophic (Ryding and Rast, 1989; Altindag and Yigit, 2004). According to those limits, Camligoze Dam Lake could be categorized as mesotrophic.

In this study, 11 rotifer species; *Brachionus plicatilis*, *Kellicottia longispina*, *Notholca acuminata*, *Notholca squamula*, *Colurella uncinata*, *Lecane luna*, *Lecane lunaris*, *Cephalodella gibba*, *Synchaeta oblonga*, *Synchaeta pectinata* and *Polyarthra dolichoptera* were determined in Camligoze Dam Lake. The list of determined rotifers in Camligoze Dam Lake according to stations are given in Table 2.

Rotifers may be of interest in the prediction of long-term changes in lake ecosystem. In freshwater ecosystems, rotifers are more abundant than other zooplankton groups; therefore, they account for a major portion of the food chain. An increase in Rotifers, Cladocerans and Copepods populations may affect fish populations (Emir and Demirsoy, 1996).

In eutrophic lakes, permanent dominant rotifer species have been reported, such as Brachionus and Keratella (Tanyolac, 2006). In Camligoze Dam Lake, 1 *Brachionus* sp. were found during the study. *Keratella* sp. were not found in Camligoze Dam Lake, which may not indicate that Camligoze Dam Lake is eutrophic.

Camligoze Dam Lake some includes distinctive species of oligotrophic and mesotrophic lakes. According to Kolisko (1974), the predominant representatives of oligotrophic lakes in temperate climatic regions are *Synchaeta oblonga*, *Polyarthra vulgaris*, *Polyarthra dolichoptera*, *Keratella cochlearis* and *Asplanchna priodonta*. In this study period, *Synchaeta oblonga* and *Polyarthra dolichoptera* were found at 2 stations in Camligoze Dam Lake (Table 2). Camligoze Dam Lake some includes distinctive species of oligotrophic and mesotrophic lakes.

Table 2: List of determined rotifers in Camligoze Dam Lake

Rotifera sp.	1 Station	2 Station
Brachionus plicatilis (O.F. Müller, 1786)	+	+
Kellicottia longispina (Kellicott, 1879)		+
Notholca acuminata (Ehrenberg, 1832)		+
Notholca squamula (O.F. Müller, 1786)	+	+
Colurella uncinata (O.F. Müller, 1773)	+	
Lecane luna (O.F. Müller, 1776)		+
Lecane lunaris (Ehrenberg, 1832)		+
Cephalodella gibba (Ehrenberg, 1832)	+	
Synchaeta oblonga (Ehrenberg, 1831)	+	+
Synchaeta pectinata (Ehrenberg, 1832)	+	+
Polyarthra dolichoptera (Idelson, 1925)	+	+

CONCLUSION

As a result of this study, Camligoze Dam Lake was found there are no serious a water pollution problem. This study might contribute to Turkey rotifer fauna and be a resource for detailed studies in future on Camligoze Dam Lake. A continuous monitoring programme of the Camligoze Dam Lake will provide rather useful knowledges for environmental management.

REFRENCES

Anonymous, 1988. Water Pollution Control Regulation in Turkey. 1991 Sayili Resmi Gazete, pp: 965-1026 (in Turkish).

Aydogar, S.I., 2004. Studies for districts to become province in Turkey: Susehri. Acar Matbaacilik A.S., Baski 1, Istanbul, pp: 160 (in Turkish).

Altindag, A. and S. Yigit, 2004. The Zooplankton Fauna and Seasonal Distribution Beysehir Lake. Gazi University. J. Gazi Educ. Fac., Cilt 24, Sayi 3: 217-225 (in Turkish).

Barrabin, J.M., 2000. The rotifers of spanish reservoirs: Ecological, systematical and zoogeographical remarks. Limnetica, 19: 91-114.

Berzins, B. and B. Pejler, 1987. Rotifer occurrence in relation to pH. Hydrobiologia, 147: 107-116.

Brummett, R.E., 2000. Food organism availability and resource partitioning in-organically and inorganically fertilized *Tilapia rendalli* ponds. Aquaculture, 183: 51-71.

Edmondson, W.T., 1959. Rotifera, in Freshwater Biology. 2nd Edn. John Wiley and Sons Inc., New York, pp: 420-494.

Egemen, O. and U. Sunlu, 1999. Water Quality. Ege Üniversitesi, Su Ürünleri Fakültesi Yayin No: 14, III. Baski, Bornova, Izmir, pp: 153 (in Turkish). ISBN: 975-483-141-6.

Emir, N. and A. Demirsoy, 1996. Seasonal Variation of the Zooplankyonic Organisms of Karamuk Lake. Turk. J. Zool., 20: 137-144 (in Turkish).

EPA, 1980. Clean Lakes Program Guidance Manual. U.S. Environmental Protection Agency, Washington, D.C., Report No. EPA-440/5-81-003.

Fafioye, O.O. and G.A.K. Omoyinmi, 2006. The Rotifers of Omi River, Ago-Iwoye, Nigeria. Afr. J. Agric. Res., 1 (5): 186-188.

Haberman, J., 1998. Zooplankton of Lake Vortsjarv. Limnologica, 28 (1): 49-65.

Hellawell, J.M., 1986. Biological Indicators of Freshwater Pollution and Environmental Management. Elsevier Applied Science Publishers, London and New York, pp: 546. ISBN: 1-85166-001-1.

Hutchinson, G.E., 1967. A Treatise on Limnology, Introduction to Lake Biology and the Limnoplankton. John Wiley and Sons. Inc. New York, 11: 1115.

Kitto, M.R. and G.P. Bechara, 2004. Business Agriculture in Kuwaitchallenges and Solutions. World Aquacult., 35 (2): 56.

Kolisko, R.A., 1974. Plankton Rotifers Biology and Taxonomy, E. Schweizerbart´sche Verlagsbuchhandlung Die Binnengewasser Stuttgart, 26: 1-146.

Koste, W., 1978. Rotatoria. Die Radertiere Mitteleuropas I, Textband, Berlin, Stuttgart, pp: 670.

Lubzens, E., G. Minkoff, Y. Barr and O. Zmora, 1997. Mariculture in Israel-Past Achievements and Future Directions in Raising Rotifers as Food for Marine Fish Larvae, Hydrobiologia, 358: 13-20.

Marneffe, Y., S. Comblin and J. Thome, 1998. Ecological water quality assesment of the bütgenbach lake (Belgium) and its Impact on the River. Warche Using Rotifers as Bioindicators. Hydrobiologia, 387 (388): 459-467.

McNeely, R.N., V.P. Neimanis and L. Dwyer, 1979. Water Quality Sourcebook: A Guide to Water Quality Parameters. Environmental Canada Publications, Inland Waters Directorate, Water Quality Branch, Ottawa, Canada, pp: 236. ISBN: 0-662-10520-6.

Nogrady, T., R.L. Wallace and T. W. Snell, 1993. Rotifera 1: Biology, Ecology and Systematics. Guides to the Identification of the Microinvertebrates of the Continental Waters of the World, Coordinating. In: Dumont, H.J.F. (Ed.). SPB Academic Publishing, New York, pp: 142. ISNB: 90-5103-080-0.

Ouéda, A., W. Guenda, A.T. Kabré, F. Zongo and G.B. Kabré, 2007. Diversity, Abundance and Seasonal Dynamic of Zooplankton Community in a South-Saharan Reservoir (Burkina Faso). J. Biol. Sci., 7 (1): 1-9.

Pontin, R.M., 1978. A Key to Freshwater Planktonic and Semiplanktonic Rotifera of the British Isles. Freshwater Biological Association Scientific Publication, No: 38, pp: 178. ISBN: 0-900386-33-9.

Ryding, S.O. and W. Rast, 1989. The Control of Eutrophication of Lakes and Reservoirs. UNESCO, Man and The Biosphere Series, Vol. I. The Parthenon Publishing Group, Lancaster, New Jersey, pp: 314. ISBN: 0-929858-13-1.

Sacchi, C.F. and P. Testard, 1971. Ecologie Animale-Organismes et Milieu (Animal's ecology, organisms and environment), Doin Edit., Paris, France, No: 7024.

Saler, S., 2004. Observations on the Seasonal Variation of Rotifera Fauna of Keban Dam Lake (Cemisgezek Region). Sci. Eng. J. Firat Uni., 16 (4): 695-701.

Segers, H., 1995. Rotifera. The Lecanidae (Monogononta), Guides to the Identification of the Microinvertebrates of the Continental Waters of the World 6, Coordinating, In: Dumont, H.J.F. (Ed.). SPB Academic Publishing, Amsterdam, 2: 226. ISBN: 90-5103-091-6.

Sladecek, V., 1983. Rotifers as Indicators of Water Quality. Hydrobiologia, 100: 169-201.

Saksena, N.D., 1987. Rotifers as indicators of water quality. Acta Hydrochimica et Hydrobiologica, 15 (5): 481-485.

Szyper, J., 2001. Freshwater Rotifers. Cooperative Extension Service and the State of Hawaii Aquaculture Development Program. Big Island Aquaculture News, 3 (4): 1-4.

Tanyolac, J., 2006. Limnology. Hatiboglu Basim ve Yayim San., Tic., Ltd., Sti., Ankara, Baski 4, pp: 237 (in Turkish). ISBN: 975-7527-46-7.

Zongo, F., 1991. Pollution Organique des Eaux de Surface au Niveau de Ouagadougou (Organic pollution of the surface waters in Ouagadougou), University Ouagadougou, Thesis, pp: 74.