ASSESSMENT OF WATER QUALITY OF GAZİBEY DAM LAKE, SİVAS, TURKEY FOR RAINBOW TROUT CULTURE

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Aquaculture is the fastest growing food-producing sector in the world. It is developing, expanding and intensifying in almost all regions of the world. The global population is increasing, thus, the demand for aquatic food products is also increasing. Production from capture fisheries has leveled off and most of the main fishing areas have reached their maximum potential. Sustaining fish supplies from capture fisheries will, therefore, not be able to meet the growing global demand for aquatic food and aquaculture is considered to be an opportunity to bridge the supply and demand gap of aquatic food in most regions of the world (**Subasinghe et al.,** 2009). In recent years, aquaculture production has been rapidly developing in all over the world.

Turkey is a passage-land between the Balkans and the Middle East with three percent of its landmass (Thrace) lying in Europe and 97 percent (Anatolia) in Asia. Turkey is a large peninsula surrounded by three major water-bodies, the Mediterranean Sea, the Aegean Sea and the Black Sea and the smaller sea of Marmara. Turkey has very rich water resource potential in both marine and inland waters with 8333 km of coastline, 175 thousand km of rivers, 1 million hectare of natural lakes, 170 thousand hectares of dams, and 7 hundred small dams used for local needs such as irrigation and the contribution to drinking water. Turkey is also endowed with rich inland waters (200 lakes, 159 dams lakes, 750 small dam lakes) and river systems (33 rivers) with significant capture fishery and aquaculture potential. The climate, water resources and topography along the coasts create many favorable aquaculture sites. The Aegean Sea, more than others, has many sheltered bays that are very suitable for marine cage culture. The inland water resources in Turkey are suitable for culturing different freshwater fishes (**Memiş et al.,** 2002; **Çelikkale et al.,** 2003; **Yıldız,** 2005).

This study was carried out to determine assessment of water quality according to the physico-chemical properties of Gazibey Dam Lake for rainbow trout culture established on the Osugülüç Stream in Şarkışla province of Sivas in Turkey.

MATERIAL AND METHODS

The study area is Gazibey Dam Lake located at Central Anatolian region of 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 meters. 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. The Gazibey Dam was constructed between 1987 and 1992 on Osugülüç Stream. Gazibey Dam Lake is shown in Figure 1. The surface area of Gazibey Dam Lake is 5.74 km^2 . The water of Gazibey Dam Lake is mainly used for irrigation and recreation.

This study was performed by using the information about assessment of water quality of Gazibey Dam Lake from Sivas Provincial Regional Directorate of State Hydraulic Works (DSI) in January 2007. The

Fig. 1. **Gazibey Dam Lake**

Regional Directorate of State Hydraulic Works was developed in the province of Sivas Gazibey Dam Lake is within the scope of the work of the limnological study of existing data, physico-chemical characteristics of this work in 17 October 2001. For this purpose, water samples were taken on surface and bottom from one station selected in Gazibey Dam Lake. In the collected waters, totally 13 physico-chemical parameters were analyzed. According to classifical continental inland water sources of the Water Pollution Control Regulation in Turkey (Anonymous, 1988).

RESULTS AND DISCUSSION

In the collected waters, totally 13 physico-chemical parameters were analyzed. Physico-chemical parameters analyzed in Gazibey Dam Lake are given in Table 1. Water samples were taken on surface and bottom (7 m) from one station selected in Gazibey Dam Lake. Physico-chemical datas were analyzed as following water temperature (13.85 ^{0}C), pH (8.1), conductivity (798 µmhos/cm), dissolved oxygen (9.9 mg/l), oxygen saturation (95.9%), nitrate (0.3 mg/l), nitrite (0.002 mg/l), orto-phosphate (0.014 mg/l), sulfate (172 mg/l), clorid (26.43 mg/l), total hardness (282 mg/l $CaCO_3$), calcium (48.7 mg/l) and magnesium (38.9 mg/l) in surface. Water temperature (13.06 ^{0}C), pH (8.2), conductivity (819 µmhos/cm), dissolved oxygen (5.86 mg/l), oxygen saturation (55.9%), nitrate (0.4 mg/l), nitrite (0.002 mg/l), orto-phosphate (0.052 mg/l), sulfate (172 mg/l), clorid (27.78 mg/l), total hardness (284 mg/l $CaCO_3$), calcium (50.7 mg/l) and magnesium (38.3 mg/l) in bottom (Table 1).

The physico-chemical data were assessment in Gazibey Dam Lake. The water temperature was ranged between 13.85 ^{0}C and 13.06 ^{0}C in Gazibey Dam Lake. There was no very significant difference between in water temperature values in Gazibey Dam Lake. Temperature is basically important for its affects on certain chemical and biological activities in the organism attributing in aquatic life. The water temperature and air temperature were found to go more or less hand in hand (**Singhal et al.,** 1986).

The conductivity was ranged between 798 µmhos/cm and 819 µmhos/cm in Gazibey Dam Lake. Conductivity is the measure of water's ability to conduct an electrical current through dissolved ions. These ions include sodium, calcium, potassium, magnesium, iron, aluminum, chloride, sulfate, carbonate, and bicarbonate. The conductivity increased with the increase in total dissolved solids and water temperature (**Entz,** 1973).

The values of pH was ranged between 8.1 and 8.2 in Gazibey Dam Lake. According to the values of pH was found to be fairly alkaline in Gazibey Dam Lake. The pH is the scale of intensity of acidity and alkalinity of water and measures the concentration of hydrogen ions. Most of the biological processes and biochemical reactions are pH dependent (**Minns,** 1989). According

Table 1. **Physico-chemical parameters of water samples in Gazibey Dam Lake**

Parameters / Sampling Depth	Surface	7 m
Water Temperature (^{0}C)	13.85	13.06
pH	8.1	8.2
Conductivity (µmhos/cm)	798	819
Dissolved Oxygen (mg O_2/l)	9.9	5.86
Oxygen Saturation (%)	95.9	55.9
Nitrate (NO_3 – N mg/l)	0.3	0.4
Nitrite (NO_2 – N mg/l)	0.002	0.002
Orto-Phosphate (PO_4 – P mg/l)	0.014	0.052
Sulfate (SO_4 mg/l)	172	172
Clorid (Cl^- mg/l)	26.43	27.78
Total Hardness (mg/l $CaCO_3$)	282	284
Calcium (mg Ca^{+2} /l)	48.7	50.7
Magnesium (mg Mg^{+2} /l)	38.9	38.3

to the EPA (1980), accepted water quality criteria indicate a pH of less than 6.5 units may be harmful to many species of fish. Therefore, the pH range of 6.5 to 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 Gazibey Dam Lake.

The nitrate values was ranged between 0.3 mg/l and 0.4 mg/l in Gazibey Dam Lake. According to classifical continental inland water sources of the Water Pollution Control Regulation in Turkey, if nitrate is 5 m/l, the water is I. class; if it is 10 mg/l, the water is II. class; if it is 20 mg/l, the water is III. class and if nitrate is >20mg mg/l, the water is IV. class (**Anonymous,** 1988), According to those limits, Gazibey Dam Lake could be categorized as I. class. It is obvious that Gazibey Dam Lake has a high water quality standard or I. class. Thus, it can be said that Gazibey 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.

The nitrite was 0.002 mg/l in Gazibey Dam Lake. According to classifical continental inland water sources of the Water Pollution Control Regulation in Turkey, if nitrite is 0.002 m/l, the water is I. class; if it is 0.01 mg/l, the water is II. class; if it is 0.05 mg/l, the water is III. class and if nitrite is >0.05mg mg/l, the water is IV. class (**Anonymous,** 1988), According to those limits, Gazibey Dam Lake could be categorized as I. class. It is obvious that Gazibey Dam Lake has a high water quality standard or I. class. Thus, it can be said that Gazibey 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.

The values of dissolved oxygen was ranged between 9.9 mg/l and 5.86 mg/l in Gazibey Dam Lake. 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 less than 5.0 mg/l for aquatic (**Egemen and Sunlu,** 1999). The values of dissolved oxygen were normal in Gazibey Dam Lake for aquatic life. According to classifical continental inland water sources of the Water Pollution Control Regulation in Turkey, if dissolved oxygen is 8 m/l, the water is I. class; if it is 6 mg/l, the water is II. class; if it is 3 mg/l, the water is III. class and if dissolved oxygen is <3 mg/l, the water is IV. class (**Anonymous,** 1988), According to those limits, Gazibey Dam Lake could be categorized as I. class. It is obvious that Gazibey Dam Lake has a high water quality standard or I. class. Thus, it can be said that Gazibey 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.

CONCLUSION

Aquaculture is a relatively recent sector in the World and Turkey, enjoying great potential for development. Sivas province is also endowed with rich freshwater ecosystems with aquaculture potential. Sivas is in a lucky situation to have so many water resources. The above is taken into consideration the physico-chemical results, Gazibey Dam Lake water quality was found to be suitable for aquatic life. As a result of this study, Gazibey Dam Lake was not show any significant water pollution problem. According to this study result, by evaluating the physico-chemical datas, it is found that the Gazibey Dam Lake was suitable for rainbow trout culture in cages. This study can be useful contributions to aquaculture of Turkey and be a resource for detailed studies in future in Gazibey Dam Lake.

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SUMMARY

Aquaculture is the fastest growing food-producing sector in the world. It is developing, expanding and intensifying in almost all regions of the world. This study was carried out to determine assessment of water quality according to the physico-chemical properties of Gazibey Dam Lake for rainbow trout culture in Turkey. For this purpose, water samples were taken on surface and bottom from one station selected in Gazibey Dam Lake. In the collected waters, totally 13 physico-chemical parameters were analyzed. By evaluating the physico-chemical datas according to the Water Pollution Control Regulation of Turkey, generally the water quality class of Gazibey Dam Lake were determined class I. as high water quality standard. According to this study result, by evaluating the physico-chemical datas, it is found that the Gazibey Dam Lake was suitable for rainbow trout culture in cages.

Key words*: rainbow trout culture, physico-chemical properties, Gazibey Dam Lake, Sivas, Turkey.*

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