

## Evaluation of Transparency, Temperature, Dissolved Oxygen Content and pH Level of Erzurum Porsuk Puddle Water in Terms of Fish Culture

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**ABSTRACT:** Temperature, dissolved oxygen, pH and limpidity of Erzurum Porsuk Puddle water were investigated on monthly basis. Surface water temperature changed from 4 °C to 25 °C. In terms of limpidity, maximum secchi- disc value was determined as 120 cm in October 1995, and minimum value was recorded as 20 cm in August 1996. Considering all of the data, it was found that the Porsuk puddle's water was very suitable for culture of Cyprinid species, especially for mirror carp.

**Key Words:** Porsuk Puddle, Fish culture, Cyprinidae, Salmonid, Erzurum

### Erzurum Porsuk Göletinin Berraklık, Su Sıcaklığı, Çözünmüş Oksijen Miktarı ve pH Seviyesinin Kültür Balıkçılığı Yönünden Değerlendirilmesi

**ÖZET:** Erzurum Porsuk göleti suyunun sıcaklığı, çözünmüş oksijeni, pH'sı ve berraklığı aylara göre incelendi. Yüzey su sıcaklığı 4 °C -25 °C arasında değişti. Berraklık yönünden yapılan secchi disk ölçümlerinde maksimum değer Ekim 1995'te 120 cm ve minimum değer ise Ağustos 1996'da 20 cm olarak kaydedildi. Elde edilen veriler dikkate alınarak yapılan değerlendirmede, gölette sazan türlerinin özellikle aynalı sazananın başarıyla yetiştirilebileceği sonucuna varıldı.

**Anahtar Kelimeler:** Porsuk Göleti, Balıkçılık, Sazangiller, Alabalık, Erzurum

### INTRODUCTION

Freshwater fish culture is a rapidly improving sector in Turkey (Alpbaz and Hoşsucu, 1996) especially in Eastern Anatolia. There are 30-35 fish farms with approximately 285 tons/year capacity in Erzurum (Anonymous, 1997).

The more population increase, the more nutritional problems will occur, however the size of the available lands for aquaculture will not change (Sarihan and Tekelioğlu, 1990). Therefore, in order to have met nutritional requirements of human and some farmed animals, new water sources should be taken place to produce aquatic products such as fish, plankton etc. (Timur, 1991; Yanık et al., 2001).

Sea fish culture has already reached an important place in economy of Turkey (Alpbaz and Hoşsucu, 1996). To realize the same thing in freshwater fish culture, physical and chemical properties of our existing water sources should be investigated and evaluated for the fish culture. By this way, it will be possible to use water sources economically and get maximum profits (Timur, 1991; Yaramaz, 1992). Lakes, reservoirs, puddles and running waters aimed to use in fish culture should be having some certain properties in order to meet some nutritional and environmental requirements such as temperature and dissolved oxygen of cold water or warm water fishes. It is known that fish culture requires a continuous work for production. Since fishes need different requirements in their growing stages, the properties of production media should be investigated for at least four season in a year (Timur, 1991; Yaramaz, 1992). Some researches were realised in stable water sources by Kolat (1977), Obalı (1978), Gündüz (1981),

Altuner (1982), Hasselrot et al. (1984), Hultberg and Nyström (1988), Kraiem and Pattee (1988), Naslund (1993), Şen and Toprak (1996), and Yanık et al. (1998&2002). There were no data reported from the Porsuk Puddle. Therefore the results of this research will be the first recorded data about Porsuk Puddle in terms of fish culture.

Fish producers have only two choices in producing fish in East anatolia. Available fish species for culture are salmonids, especially rainbow trout and cyprinids, especially mirror carps. However, the nutritional and environmental requirement of these fishes are quite different from each other. Rainbow trout requires high protein level in diets (40-60%) 14-18 °C water temperature, <8 pH, <0.5 NH<sub>4</sub>, > 6 dissolved oxygen and 2 m depth to be raised up in cage culture (Steffens and Menzel, 1976). On the other hand common carp requires 23 °C optimum water temperature, 0.5-7 mg/l dissolved oxygen and 5.5-9 pH (Çelikkale, 1988; Alpbaz and Hoşsucu, 1989; Aras et al., 1995).

The water quality standart for dissolved oxygen tentatively proposed by EIFAC for salmonid waters was an annual median of 9 mg/l (Alabaster, 1982). EIFAC considered that during the warmest seasons 20-21 °C should be accepted as the maximum temperature for salmon and trout waters. The EEC Directive includes a mandatory maximum of 21.5 °C with a maximum of 10 °C during the salmonid spawning season (Anonymous, 1979). Where temperature should not be lower than 5 °C and pH values should not be higher than 8.0.

In order to rear fish under culture, the most important inputs are oxygen, temperature and water supply

(Sarıhan and Tekelioğlu, 1976). One of the potentially damaging aspects of water supply may be extreme pH (Alabaster and Lloyd, 1980).

In this paper findings of this study and standard values for salmonids and cyprinids will be compared to each other and a final suggestion will be made for the fish farmers.

### MATERIAL AND METHODS

The water temperature, limpidness (transparency), dissolved oxygen and pH levels of the Porsuk puddle were investigated monthly basis and evaluated seasonally in 1996. Two sampling points were flagged to collect water samples namely Surface I and surface II. Water samples were collected from 10 cm below water surface (absolute surface) and from 2 m depth from Porsuk puddle surface on monthly basis (Sarıhan, 1976; Boyd, 1980) (Figure 1).

Research duration was one year started in September 1995 and ended in August 1996, in winter months

sampling could not be realized because of the ice cover. Therefore water quality parameters were investigated in only nine months (three seasons). Sampling points were chosen from available places with the consideration of water entering area and highest side of the puddle, based on the data provided by Sarıhan, (1976) and Anonymous, (1995).

Main purpose of the construction of the Porsuk puddle was the irrigation of farmland (Anonymous, 1995). Some properties of the puddle are presented in Table 1. The Porsuk Puddle is located in Porsuk Village, 48.5 km from Erzurum and 8.5 km from Pasinler, a province in Erzurum city (Figure 1). Like in Erzurum city, days are usually very cold in winter and very hot and dry in summer in Porsuk Village. Air temperature were changed from  $-11.5^{\circ}\text{C}$  in December to  $25.6^{\circ}\text{C}$  in August (Anonymous, 1995). There were snow coverage with ice on the puddle in winter months. The average thickness of the snow was approximately 50-60 cm dependent upon years (Anonymous, 1995).

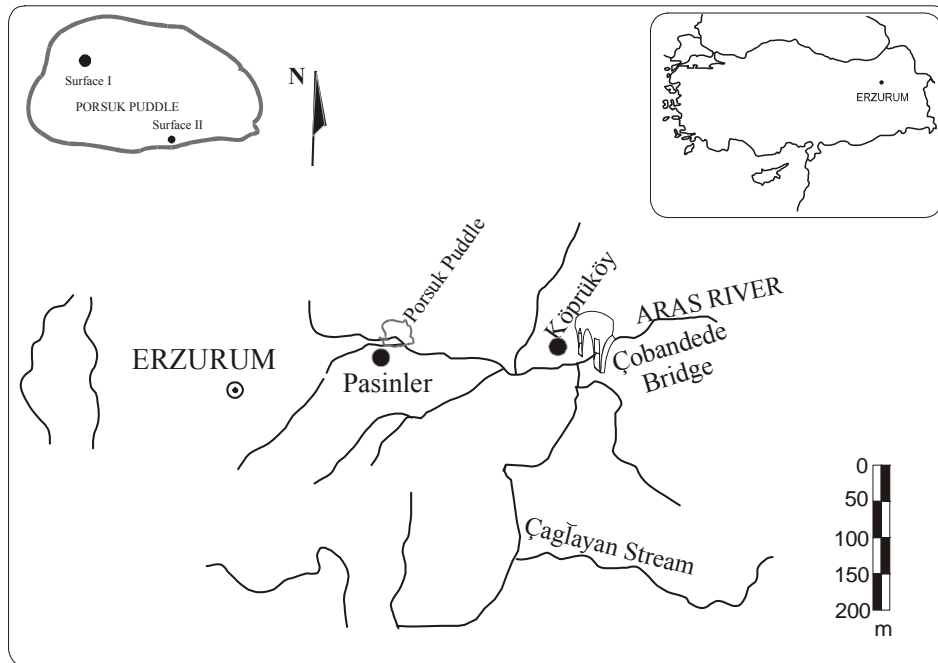


Figure 1. Location of the Porsuk Puddle and sampling points.

Table 1. Some general properties of the Erzurum-Pasinler- Porsuk Puddle (Anonymous, 1982).

Volume	0.765 hm <sup>3</sup>
Dead volume	0.012 hm <sup>3</sup>
Construction purpose	Irrigation
Available water volume	0.753 hm <sup>3</sup>
Maximum aqueduct	13.50 m
Water mirror area	0.14 hm <sup>2</sup>
Construction date	1983

In order to determine water temperatures and limpidity, a mercury thermometer with 1°C sensitivity and a Secchi- disc were used in order (Sarihan, 1976; Yanik et. al., 2002). Dissolved oxygen (DO) and pH values were determined in the field immediately after taking samples using an oxygen meter with 0.01 sensitivity and pH meter in order (Yaramaz, 1992; Yanik and Atamanalp, 2001). SAS program was used for the Statistical Analyzes (Hellwig, 1981).

## RESULTS AND DISCUSSION

Water temperature, pH, Secchi-disc and dissolved oxygen values from Surface I, Surface II are presented in Table 2. Differences between data determined from both Surfaces and 2 m depth were not statistically significant ( $p>0.05$ ). Therefore, only data determined from Surfaces

I and II were discussed to evaluate the puddle water for the suitability of fish culture. Compared to the EIFAC and EEC standards and data presented by Stickney (1991), it can be concluded that the water of the puddle was not completely suitable for salmonid culture because of high temperature ranges in summer months and early autumn (Figure 2). The reasons for that are hot weather and reduction in puddle water level by irrigation of farm lands. Average water temperature changed from 7.5 °C in November - 25.5 °C in August. Critical temperatures were observed in June, July, August and September for salmonid culture but not for cyprinid culture.

The differences between measured values from two sampling points (Surface I and Surface II) were not statistically significant in terms of all data except limpidity ( $p<0.05$ ). Secchi disc value was minimum (20 cm) during the summer (in August), and became maximum (120 cm) in Autumn (in October). Average Secchi - disc value was changed from 22.5 to 111.5 cm (Figure 2). This may refer that suspended solids such as planktons were in high density in Spring and Summer months. Low transparency may come from also turbidity in Spring. As a result, in terms of secchi - disc values, it can be inferred from the determined data that the water was suitable for cyprinid culture in all seasons.

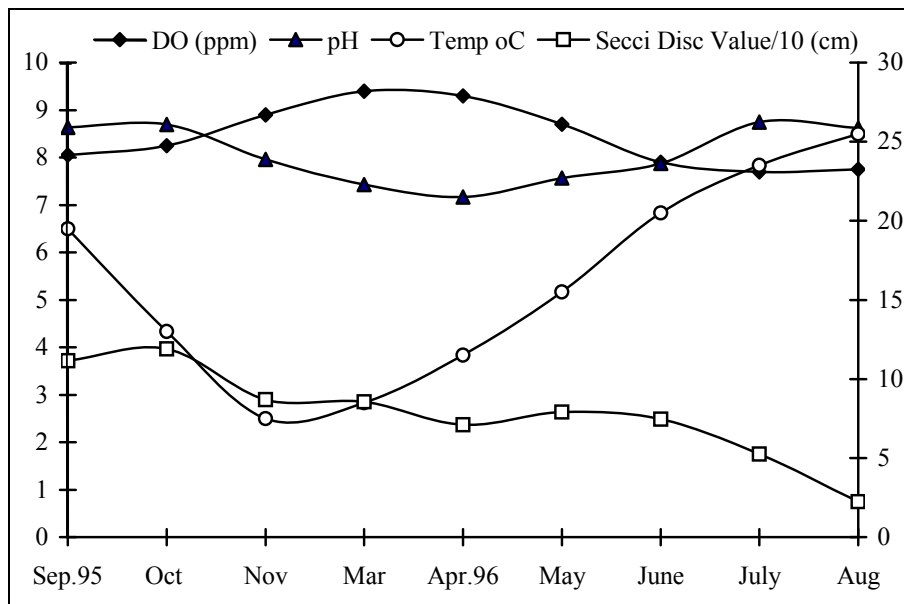


Figure 2. Changes in average water temperature, dissolved oxygen, pH and secchi -disc values of Porsuk Puddle based on months in 1995-1996.

Table 2. Water temperature, dissolved oxygen, pH and transparency of Porsuk Puddle based on months

Months	Dissolved Oxygen (mg/l)	pH	Temperature (°C)	Secchi -Disc/10 (cm)
Sep.95	8.00	8.62	19	11.00
Oct	8.30	8.69	13	11.80
Nov	8.70	7.98	7	8.60
Mar	9.80	7.40	8	8.70
Apr. 96	9.20	7.10	12	7.00
May	8.80	7.68	16	8.00
June	7.90	7.85	20	7.50
July	7.60	8.70	23	5.00
Aug	7.80	8.65	25	2.00
Surface II				
Sep. 95	8.10	8.65	20	11.30
Oct.	8.20	8.70	13	12.00
Nov.	9.10	7.94	8	8.80
Mar.	9.00	7.46	9	8.40
Apr, 96	9.40	7.24	11	7.20
May	8.60	7.46	15	7.80
June	7.90	7.90	21	7.40
July	7.80	8.80	24	5.50
Aug.	7.70	8.60	26	2.50

From the point of dissolved oxygen values view, water was suitable for the fish culture salmonid and cyprinid although average values were above the optimum requirement in the months of June, July and August for salmonid culture when comparing the data to EIFAC's standard values. Dissolved oxygen reduced with the increasing water temperature. Average maximum and minimum dissolved oxygen values were determined as 7.7 ppm in July and 9.4 ppm in March (Figure 2). Although there was no problem in terms of dissolved oxygen, there were ice cover in winter months. Therefore, the Puddle was not suitable for fish culture in that season.

Average pH value changed from 7.17 in April - 8.75 in July. This value was falling in the standards range reported by EIFAC and Stickney, (1991). The differences between pH values from surfaces based on months were not statistically significant ( $p < 0.05$ ). Therefore, it can be suggested that fish culture in this puddle can be realized safely in terms of average pH.

In terms of cyprinid culture, all data determined from the study were compared to the data reported by Albaz and Hoşsucu, (1989) and Aras et al., (1995), it can be said that the water of Porsuk Puddle was not suitable for salmonids but cyprinids especially for mirror carp culture.

The findings of the present study revealed that salmonid culture especially rainbow trout culture in cages can be performed in Porsuk Puddle from Spring to mid Summer (Aras et al., 1995). All of the year (except Winter) cyprinid culture can be managed especially mirror carp can be raised either freely (naturally) or in

cages in the Porsuk Puddle (Albaz and Hoşsucu, 1989; Çelikkale, 1991).

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