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SOME QUALITY PARAMETERS OF SURFACE WATER OF KARASU RIVER IN UPPER PART OF EUPHRATES BASIN, TURKEY

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Abstract: Research in Euphrates basin in Turkey showed the following values: temperature, dissolved oxygen, pH, nitrite, nitrate, chlorine, sulfate, iron, copper, calcium, magnesium and silica in surface waters were monitored. Significant relationships among these parameters were observed at seasonal term. Some significant ($p<0.05$) differences were determined among the parameters (temperature, dissolved oxygen demand, nitrite, chlorine, sulfate, iron and copper) according to seasons. pH was not determined a significant ($p>0.05$) differences in all seasons. However, it was also significant ($p<0.05$) differences the results of nitrate at summer, calcium and magnesium at spring, silica at winter as other seasons. The data of chlorine, iron, and copper in Karasu River were measured high levels according to water quality standards of EPA.

Key Words: Water quality, surface water, Karasu River, Euphrates basin, Turkey.

1. INTRODUCTION

A catchment approach is increasingly being adopted as a most useful framework in which to consider the interplay between human activity and the characteristics of natural land and water resources. Rivers in a catchment are the natural veins that collect and transport water and its associated constituents, which are the essential lifeblood of river ecosystems (Rose, 2004).

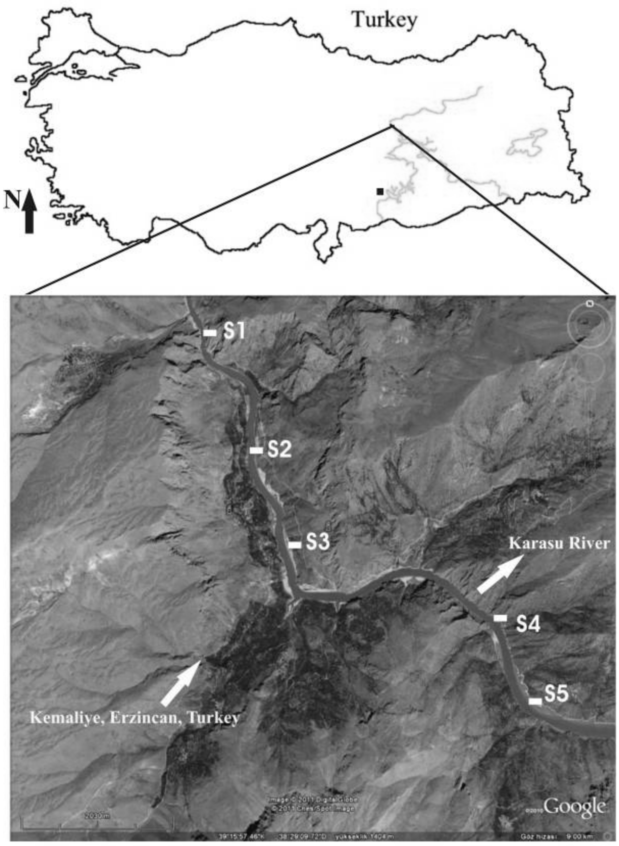
A river is a large natural waterway. The source of a river may be a lake, a spring, or a collection of small streams, know as headwaters. From their source, all rivers flow downhill, typically terminating in the ocean. The mouth, or lower end, of a river is known as its base level (Manivanan, 2008). Water Framework Directive (EC, 2000), which was implemented in European Union in 2000, calls for a holistic river basin-wide approach to the water protection in both chemical and ecological sense. WFD places the achievement of “good ecological” and “good chemical” status of surface and ground waters as a primary goal, which is to be accomplished by 2015.

The Euphrates river, with a catchment area of 444.000 km^2, consists of two main tributaries, the Karasu and Murat rivers, both originating in Eastern Turkey and contribute 89.2% of water, and only 10.8% from rainfall in Syria. During its passage through Syria (657 km), and Iraq (around 1200 km), the Euphrates receives only negligible amount of water. Euphrates has only one third the volume of the Nile River with an average flow of 33.4 bcm^2, but it is the longest river in East Asia (2700 km). Also the Euphrates is smaller than the Tigris in volume (Bolz & Rohrmeier, 2002). It exists in Southeastern and Eastern regions of Turkey and it is the main river in the basin. Determining sediment yields carried by Euphrates is highly important because of the dams existing in the basin. Euphrates River rises in Erzurum Mountains and collects water from the mountainous area accounting for upper part of the river basin during its flowing toward Southwest. Average annual flow rate of Euphrates River is 31.6 x 10^9 m^3 (Akçakoca, 1997). Euphrates Basin covering 127304 km^2 with an average height of 1009.87 m is the largest water basin in Turkey. Average precipitation taken by Euphrates Basin is 540.1 mm/year and average annual flow is 31.61 km^3 (EİE, 2000). Euphrates Basin is divided into three; lower, middle and upper Euphrates.

In this study, some water quality parameters of surface waters in upper part of Euphrates River Basin were researched. With these purposes, in 5 stations, Karasu River of upper of Euphrates River Basin was monitored by a sampling period of winter, spring and summer seasons during 2008 and 2009.

2. REGIONAL SETTING

In this study, Karasu River of upper part of Euphrates Basin was investigated (Fig. 1). Euphrates River originated from the mountainous Eastern Anatolia in Turkey, is one of the major rivers within Middle Eastern countries including Turkey, Syria and Iraq. Geographical location of Karasu River is longitudes from 38° 58’013’’E to 41°38’28’’ E and latitudes from 39°23’18’’ N to 40° 24’26’’ N. Kemaliye district of Erzincan province in Turkey (39°15’57.46’’N and 38°29’00.72’’E), basin location of Karasu River and study area are shown in figure 1.



S: Samples

Figure 1. Karasu River of upper part of Euphrates Basin and Stations in Kemaliye, Turkey

3. MATERIALS AND METHODS

3.1. Water Analyses

The study was carried out between 2008 and 2009 by collecting water samples of 5 stations as seasonal (Fig. 1). Sampling bottles were washed 1-2% HCl solution to a day before sampling time and sampling bottles, which then were rinsed through distilled water, were dried in the drying oven. Water samples were taken from the surface and immediately transferred to the laboratory for analyses. Oxygen, temperature and pH were measured directly by digital instrument which is Hatch HQD model. Other water quality parameters such as dissolved oxygen (DO), nitrite, nitrate, sulphate, chlorine, magnesium, calcium, iron, copper and silica analyses were done on the same day in Aquaculture and Fisheries Laboratory of Kemaliye Hacı Ali Akın Vocational High School of Erzincan University. All measurements, which require photometric measurements, were done according to the standard procedures by using Hatch brand DR 2800 model spectrophotometer (Table 1) (APHA, 1998). Water analyses were done according to procedures described by EPA (2001) (Table 2).

3.2. Statistical Analyses

Statistical analyses were performed with SPSS 11 version for Windows at 95% confidence Interval. Seasonal difference of each parameter was compared by using one-way ANOVA, and Duncan test (Sümbüloğlu & Sümbüloğlu, 1998).

4. RESULTS AND DISCUSSION

We determined 12 water quality parameters of surface water of Karasu River of the upper part of Euphrates River in this study (Table 3, Fig. 3).

4.1. Temperature

The temperature is one of the most important physical characteristics of the river water. It influences other properties of rivers like oxygen concentration and suspended solid content as well as has significant effect on chemical and biochemical reactions occurring in the river waters (Walling & Webb, 1992).

According to Allan (1995), the temperature of running waters usually varies due to season and the time of the day, and among locations dependent on climate, elevation, presence of vegetation on the riversides and the relative importance of ground water inputs. Seasonal changes in the river temperature are closely related to seasonal trends in mean monthly air temperature. Daily fluctuations occur more often in small streams, especially unshadowed, due to day-night changes in the air temperature and absorption of the solar radiation during the day.

Table 1. Measurement methods for DR2800 model spectrophotometer

	Method	Reactive Number	Reading Range *(mg/L)*	Wave length *(nm)*
Nitrite (NO_2^--N) (mg/L)	Diazotization Method NitriVer 3 Nitrite Reactive Powder Pillows	21071-69	0.002-0.3	507
Nitrate (NO_3^--N) (mg/L)	Cadmium Reduction Method NitraVer 5 Nitrate Reactive Powder Pillows	21061-69	0.1-10.00	400
Chlorine (Cl_2) (mg/L)	DPD (N, N-dietil-p-fenilendiamin) Method DPD Total Chlorine Reactive Powder Pillows	21056-69	0.02-2.00	530
Sulfate (SO_4^{2-}) (mg/L)	SulfaVer 4 Method SulfaVer 4 Reactive Powder Pillows	21067-69	2.00-70.00	450
Iron (Fe^{2+}) (mg/L)	FerroVer Method FerroVer Iron Reactive Powder Pillows	21057-69	0.02-3.00	510
Copper (Cu) (mg/L)	Bicinchoninate Method CuVer 1 Copper Reactive Powder Pillows	21058-69	0.04-5.00	560
Calcium (Ca) (mg/L) Magnesium (Mg) (mg/L)	Calmagite Colorimetric Method Alkali Solution for Ca and Mg Ca and Mg Indicator Solution EDTA Solution, 1M EGTA Solution	22417-32 22418-32 22419-26 22297-26	0.05-4.00	522
Silica (SiO_2) (mg/L)	Silicomolybdate Method Acid Reagent Powder Pillows Citric Acid Powder Pillows Molybdate Reagent Powder Pillows	21074-69 21062-69 21073-69	1.00-100.00	452

Table 2. Some water quality parameters for EPA (2001)

Parameters	**EPA**	
Dissolved Oxygen (DO)	Surface Water Regulations (1989)	A1 waters: >60% A2 waters:>50% A3 waters: >30%
	Freshwater Fish Directive	50%≥9, 100%≥7 for Salmonids 50%≥8-7, 100%≥5 for Cyprinid
pH	Surface Water Regulations (1989)	A1 waters: 5.5-8.5 A2 waters: 5.5-9.0 A3 waters: 5.5-9.0
	Freshwater Fish Directive	≥6.0 and ≤9.0 for Salmonids and Cyprinids
Nitrite (mg/L)	Freshwater Fish Directive	≤0.01 for Salmonids ≤0.03 for Cyprinids
Nitrate (mg/L)	Surface Water Regulations (1989)	A1 waters: 50 A2 waters: 50 A3 waters: 50
	Freshwater Fish Directive	<50 (Hazard to infants)
Chlorine (mg/L)	Freshwater Fish Directive	≤ 0.005 for Salmonids and Cyprinids
Sulphate (mg/L)	Surface Water Regulations (1989)	A1, A2, A3 waters: 200
Iron (mg/L)	Surface Water Regulations (1989)	A1 waters: 0.2 A2 waters: 2.0 A3 waters: 2.0
Copper (mg/L)	Surface Water Regulations (1989)	A1 waters: 0.05 A2 waters: 0.1 A3 waters: 1.0
	Freshwater Fish Directive	≤0.04 for Salmonids and Cyprinids

However, Walling & Webb (1992) said that these variations are particularly important during low flows in the summer, because unshaded streams can become too warm for many invertebrates and fish to survive. Besides riverbank (riparian) vegetation, temperature may vary locally in response to factors such as groundwater seepage, channel depth, shape and orientation and substrate condition.

In this study, the average water temperature ranged from 8.2ºC in winter (January, February and March), 16.17 ºC in spring (April, May) and 19.3ºC in summer (June, July) over the year. In contrast with seasons, water temperature did not change as much by stations. The differences of water temperature were changed by seasonal and it was significant as statistical difference ($p<0.05$) (Fig. 3). Temperatures of this study were determined lower than results of other studies. According to Najah et al., (2009), at Al-Hammar Marsh which is situated south of the Euphrates River, water temperature changed from 12.5°C in February to 29°C in July. However, Fikrat et al., (2008), at The Euphrates River, a tributary river of Shatt Al-Hilla, temperature of water was determined 10.3-32°C. These vary about temperature has been caused by climate of different in regions.

4.2. Dissolved Oxygen

When organic matter is discharged into a watercourse it serves as a food source for the bacteria present there. These will sooner or later commence the breakdown of this matter to less complex organic substances and ultimately to simple compounds such as carbon dioxide and water. If previously unpolluted, the receiving water will be saturated with dissolved oxygen (DO), or nearly so, and the bacteria present in the water will be aerobic types. Thus the bacterial breakdown of the organic matter added will be an aerobic process; the bacteria will multiply, degrading the waste and utilizing the DO as they do so. If the quantity of waste present is sufficiently large, the rate of bacterial uptake of oxygen will outstrip that at which the DO is replenished from the atmosphere and from photosynthesis, and ultimately the receiving water will become anaerobic. Bacterial degradation of the waste will continue but now the products will be offensive in nature; for example, hydrogen sulphide. Even if the uptake of oxygen is not sufficient to result in anaerobic conditions there will be other undesirable effects as the DO level falls, notably damage to fisheries and, ultimately, fish deaths. Where levels are around 50 per cent saturation for significant periods there may be adverse, though non-lethal, effects on game fish. Coarse fish will be likewise affected if levels are regularly around 30 % saturation (EPA, 2001).

In this study, dissolved oxygen (DO) was determined to 11.08 mg/L in winter, 9.2 mg/L in spring and 8.11 mg/L in summer. There was different at seasons and the changing of average of DO was significant ($p<0.05$) as statistical difference. The changing of dissolved oxygen at stations was not significant as statically.

According to Fikrat et al., (2008), the most values of dissolved oxygen is <7 mg/L, and the most lowest values recorded at site 3, which is represented the site of discharge point of most civilian activities of Hilla city. However, Alp et al., (2010), was determined 6.7-10.1 mg/L of dissolved oxygen. Our results were found higher than other investigator's results. We can say that the clean river is characteristics by high concentration of dissolved oxygen. These varies can be why rivers have different temperature and organic materials expressed by the EPA (2001).

4.3. pH

The pH of water is a measure of the acid and base equilibrium and, in most natural waters, is controlled by the carbon dioxide, bicarbonate and carbonate equilibrium system. An increased carbon dioxide concentration will therefore lower pH, whereas a decrease will cause it to rise. Temperature will also affect the equilibrium and the pH. In pure water, a decrease in pH of about 0.45 occurs as the temperature is raised by 25°C. In water with a buffering capacity imparted by ions of bicarbonate, carbonate and hydroxyl, this temperature effect is modified (APHA, 1998). The pH is of importance in determining the corrosivity of water, but the relationship with a number of other parameters is complex. Natural waters contain gases, colloidal matter and a variety of electrolyte and non-electrolyte material, and these, together with pH, determine the extent of corrosion in a system. However, in general, the lower of pH is the higher of potential level of corrosion (WHO, 2009).

In this research, the average pH of water was determined about 8.20 in winter and spring and 8.35 in summer and it was character of alkaline. The pH did not change as much by stations. The difference of pH at seasonal was not significant as statistical difference ($p>0.05$) (Fig. 3).

According to some authors found that are Işçen et al., (2009); 7.87-8.26 and Alp et al., (2010); 7.4-8.4. Our results were higher than data of these investigators. We think that the reason of this difference was geological rockers, because area of this study is a valley in the mountains with calcareous. Other hands, our results of pH can describe as A1 character of water by surface water regulations of EPA (2001). So in this study, data of pH can not hazard for cyprinid and salmonid fish by Freshwater Fish Directive.

4.4. Nitrate and Nitrite

Nitrate and nitrite are naturally occurring ions that are part of the nitrogen cycle. The nitrate ion (NO_3^-) is the stable form of combined nitrogen for oxygenated systems. Although chemically unreactive, it can be reduced by microbial action. The nitrite ion (NO_2^-) contains nitrogen in a relatively unstable oxidation state. Chemical and biological processes can further reduce nitrite to various compounds or oxidize it to nitrate (ICAIR, 1987). The nitrate concentration in surface water is normally low (0–18 mg/L) but can reach high levels as a result of agricultural runoff, refuse dump runoff, or contamination with human or animal wastes. The concentration often fluctuates with the season and may increase when the river is fed by nitrate-rich aquifers. Nitrate concentrations have gradually increased in many European countries in the last few decades and have sometimes doubled over the past 20 years. In the United Kingdom, for example, an average annual increase of 0.7 mg/L has been observed in some rivers (Young & Morgan-Jones, 1980).

The average nitrite of water was obtained to 0.007 mg/L in winter, 0.012 mg/L in spring and 0.004 mg/L in summer. Alterations of nitrite at seasonal were significant ($P<0.05$) as statistical difference. The average nitrate of water was determined to 0.47 mg/L in winter, 0.53 mg/L in spring and 0.23 mg/L in summer. The changes of nitrate as statistical difference was not significant ($P>0.05$) between winter and spring, but was significant ($P<0.05$) in summer as other seasons. They did not change as much at stations.

Alp et al., (2010) found 1.6-5.6 mg/L of nitrate value at Euphrates River and their results was bigger than our results. In this study, results of nitrate and nitrite can describe as A1 character of water by surface water regulations of EPA (2001) and so data cannot hazard for fish.

4.5. Chlorine

Chloramination may give rise to the formation of nitrite within the distribution system, and the concentration of nitrite may increase as the water moves towards the extremities of the system. Nitrification in distribution systems can increase nitrite levels, usually by 0.2–1.5 mg of nitrite per liter, but potentially by more than 3 mg of nitrite per liter (AWWARF, 1995). A colorimetric method can be used to determine free chlorine in water at concentrations of 0.1-10 mg/L. Other methods allow for the determination of free chlorine, chloramines, other chlorine species, and total available chlorine, and are suitable for total chlorine concentrations up to 5 mg/L (APHA, 1998).

In this study, alterations of average of chlorine at seasonal were obtained 0.10 mg/L in winter, 0.18 mg/L in spring and 0.01 mg/L in summer. These changes of chlorine by seasonal were significant ($P<0.05$) as statistical difference. At stations, chlorine did not change as much. Our results were found less than İşçen et al., (2009); 0.10-1.89 mg/L and Alp et al., (2010); 14.9-29.8 mg/L. In this study, results of chlorine were obtained bigger than Freshwater Fish Directive of EPA (2001) (for salmonids and cyprinids fish ≤ 0.005 mg/L).

4.6. Sulfate

Levels of sulfate in rainwater and surface water correlate with emissions of sulfur dioxide from anthropogenic sources (Keller & Pitblade, 1986). Sulphates exist in nearly all natural waters, the concentrations varying according to the nature of the terrain through which they flow. They are often derived from the sulphides of heavy metals (iron, nickel, copper and lead). Iron sulphides are present in sedimentary rocks from which they can be oxidized to sulphate in humid climates; the latter may then leach into watercourses so that ground waters are often excessively high in sulphates. As magnesium and sodium are present in many waters their combination with sulphate will have an enhanced laxative effect of greater or lesser magnitude depending on concentration. The utility of a water for domestic purposes will therefore be severely limited by high sulphate concentrations, hence the limit of 250 mg/L SO_4 (EPA, 2001).

The average sulphate of water was determined to 77.33 mg/L in winter, 44.00 mg/L in spring and 62.33 mg/L in summer. Differences of sulphate at seasons were significant ($P<0.05$) as statistical difference. Sulphate did not change as much at stations.

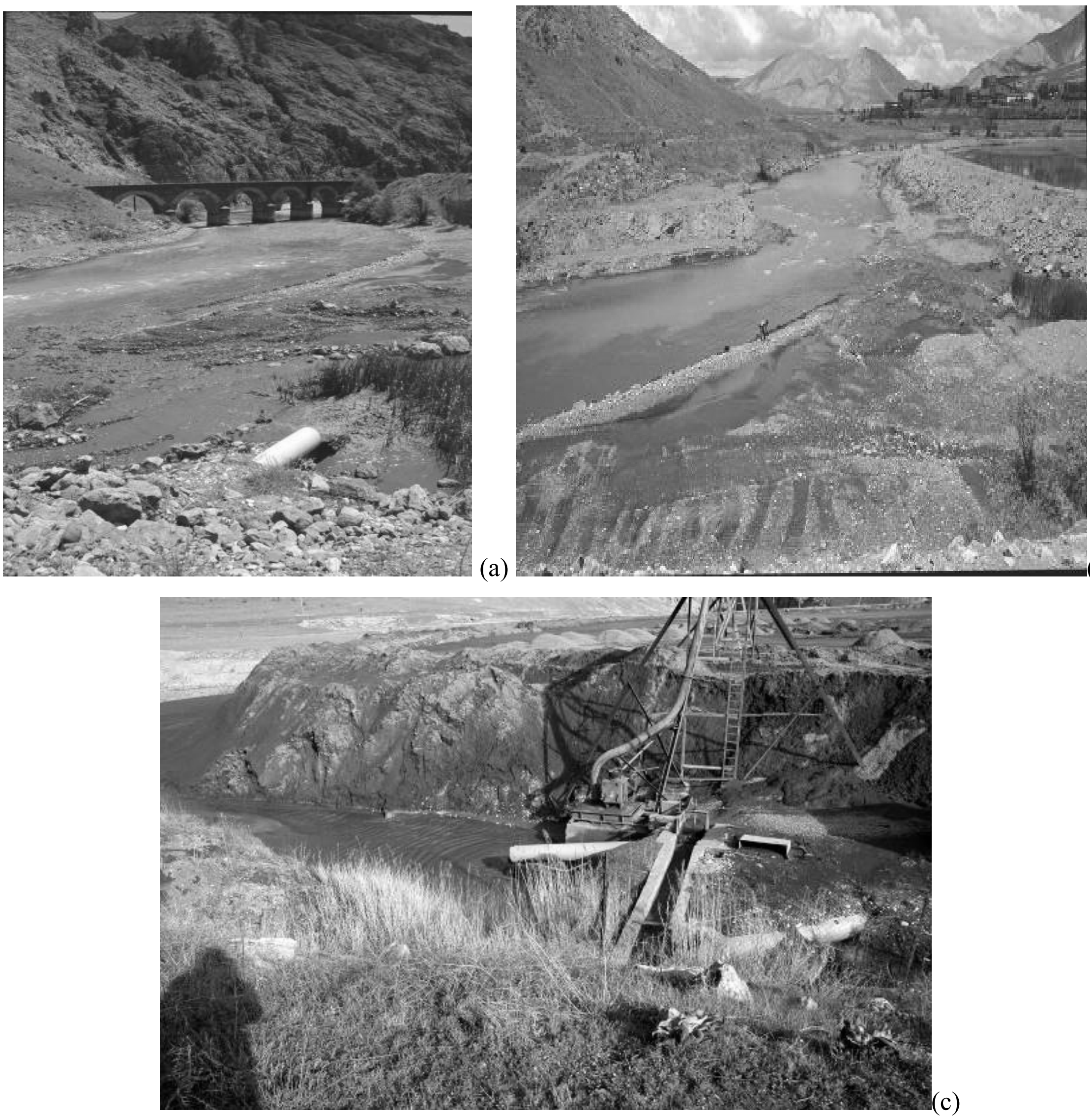
While our results were found less than Fikrat et al., (2008); 46.6-1660 mg/L. However our data of sulpate was bigger than İşçen et al., (2009); 0.08-1.11 mg/L and Alp et al., (2010); 26.4-38.7 mg/L. In this study, results of sulphate can describe A1 for Surface

Water Regulations of EPA (2001) (A1 waters: 200) and doesn't hazard for fishes.

4.7. Iron and Copper

Iron is the second most abundant metal in the earth's crust, of which it accounts for about 5%. Elemental iron is rarely found in nature, as the iron ions Fe^{2+} and Fe^{3+} readily combine with oxygen- and sulfur-containing compounds to form oxides, hydroxides, carbonates, and sulfides. Iron is most commonly found in nature in the form of its oxides. Aeration of iron-containing layers in the soil can affect the quality of both groundwater and surface water if the groundwater table is lowered or nitrate leaching takes place. Dissolution of iron can occur as a result of oxidation and decrease in pH (Elinder, 1986; Knepper, 1981). The median iron concentration in rivers has been reported to be 0.7 mg/L. In anaerobic groundwater where iron is in the form of iron (II), concentrations will usually be 0.5–10 mg/L, but concentrations up to 50 mg/L can sometimes be found (NRC, 1979).

Copper is found in surface water, groundwater, seawater and drinking-water, but it is primarily present in complexes or as particulate matter. Copper concentrations in surface waters ranged from 0.0005 to 1 mg/L in several studies in the USA; the median value was 0.01 mg/L (ATSDR, 2002). In the United Kingdom, the mean copper concentration in the River Stour was 0.006 mg/L (range 0.003–0.019 mg/L). Background levels derived from an upper catchment control site were 0.001 mg/L. Four-fold increases in copper concentrations were apparent downstream of a sewage treatment plant. In an unpolluted zone of the River Periyar in India, copper concentrations ranged from 0.0008 to 0.010 mg/L (IPCS, 1998).



(a) (b) (c)

Figure 2 (a, b, c). Drainage of iron-steel mines of Divriği town of Sivas Province (from Prof. Dr. Ali Demirsoy, 2001).

Table 3. The results of some water quality parameters of Karasu River of Upper Part of Euphrates River

N=5		Mean ± SE	95% Confidence Interval for Mean		Min.	Max.
			Lower Bound	Upper Bound		
Temperature *(^0C)*	**Winter**	8.2000±0.06^a	7.95	8.45	8.10	8.30
	Spring	16.1667±0.17^b	15.45	16.88	16.00	16.50
	Summer	19.3000±0.49^c	17.18	21.42	18.50	20.20
DO (Dissolved Oxygen) *(mg/L)*	**Winter**	11.0833±0.06^c	10.81	11.36	11.01	11.21
	Spring	9.2200±0.02^b	9.13	9.31	9.19	9.26
	Summer	8.0967±0.14^a	7.50	8.70	7.83	8.30
pH	**Winter**	8.2000±0.02^a	9.13	9.27	9.18	9.23
	Spring	8.1933±0.02^a	9.10	9.29	9.15	9.22
	Summer	8.3533±0.22^a	8.41	10.29	9.13	9.79
Nitrite (NO_2^--N) *(mg/L)*	**Winter**	0.0073±0.00^b	0.00	0.01	0.01	0.01
	Spring	0.0120±0.00^c	0.01	0.02	0.01	0.01
	Summer	0.0040±0.00^a	0.00	0.01	0.00	0.01
Nitrate (NO_3^--N) *(mg/L)*	**Winter**	0.4667±0.07^b	0.18	0.75	0.40	0.60
	Spring	0.5333±0.03^b	0.39	0.68	0.50	0.60
	Summer	0.2333±0.03^a	0.09	0.38	0.20	0.30
Chlorine (Cl_2) *(mg/L)*	**Winter**	0.1033±0.01^b	0.05	0.16	0.09	0.13
	Spring	0.1833±0.02^c	0.11	0.26	0.15	0.20
	Summer	0.0133±0.00^a	0.00	0.03	0.01	0.02
Sulfate (SO_4^{2-}) *(mg/L)*	**Winter**	77.3333±1.76^c	69.74	84.92	74.00	80.00
	Spring	44.0000±1.53^a	37.43	50.57	42.00	47.00
	Summer	62.3333±5.33^b	39.39	85.28	57.00	73.00
Iron (Dissolved Ferrous, Fe^{2+}) *(mg/L)*	**Winter**	0.1567±0.01^b	0.13	0.19	0.15	0.17
	Spring	0.2567±0.02^c	0.18	0.34	0.22	0.28
	Summer	0.0290±0.01^a	-0.02	0.07	0.02	0.05
Copper (Cu) *(mg/L)*	**Winter**	0.1933±0.00^b	0.18	0.21	0.19	0.20
	Spring	0.3300±0.02^c	0.26	0.40	0.30	0.35
	Summer	0.0533±0.01^a	0.00	0.11	0.04	0.08
Calcium (Ca) *(mg/L)*	**Winter**	0.6900±0.16^a	-0.01	1.39	0.48	1.01
	Spring	3.5000±0.00^b	3.50	3.50	3.50	3.50
	Summer	0.6000±0.06^a	0.35	0.85	0.50	0.70
Magnesium (Mg) *(mg/L)*	**Winter**	0.2333±0.06^a	-0.02	0.49	0.12	0.32
	Spring	3.5000±0.00^b	3.50	3.50	3.50	3.50
	Summer	0.4100±0.11^a	-0.05	0.87	0.23	0.60
Silica *(mg/L, SiO_2)*	**Winter**	8.9000±1.86^a	0.89	16.91	6.70	12.60
	Spring	11.4000±2.04^a	2.61	20.19	8.40	15.30
	Summer	20.3000±0.75^b	17.07	23.53	18.80	21.10

**Different letters at the same row is a statistically significant difference between the means ($P < 0.05$, Duncan test)*

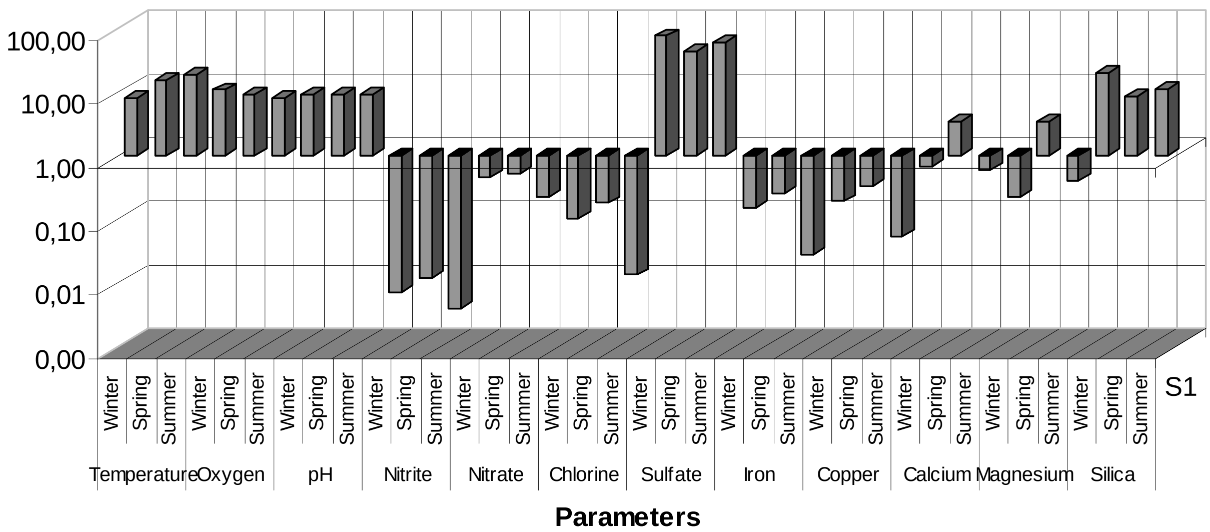


Figure 3. Some water quality parameters of surface water of Karasu River of upper part of Euphrates Basin

The changes of average of iron of water were investigated to 0.16 mg/L in winter, 0.26 mg/L in spring and 0.03 mg/L in summer. The changes of average of iron at seasons were significant (P<0.05) as statistical difference. The averages of copper of water were determined to 0.19 mg/L in winter, 0.33 mg/L in spring and 0.05 mg/L in summer. All measurements of copper at seasons were significant as statistical difference (P<0.05). The data of copper did not change as much at stations. And these copper data can be hazard for fish as freshwater fish directive by EPA (2001).

4.8. Calcium and Magnesium

Concentrations of up to 100 mg of calcium per liter are fairly common in natural sources of water; sources containing over 200 mg of calcium per liter are rare. Magnesium salts are soluble, natural water sources typically containing concentrations of up to 10 mg/L. Such sources rarely contain more than 100 mg of magnesium per liter, and it is usually calcium hardness that predominates (WHO, 2009).

The averages of calcium of water were investigated to 0.69 mg/L in winter, 3.50 mg/L in spring and 0.60 mg/L in summer. These difference were not significant (P>0.05) as statistical difference between winter and summer but were significant (P<0.05) at spring for other seasons.

The averages of magnesium of water were determined to 0.23 mg/L in winter, 3.50 mg/L in spring and 0.41 mg/L in summer. These alterations of magnesium were not significant (P>0.05) as statistical difference between winter and summer. It was significant (P<0.05) as statistical difference at spring for other seasons.

Our results of Ca and Mg were less than Fikrat et al., (2008); Ca: 48.09–224.4 mg/L and Mg: 2.06-180.8 mg/L, Fikrat et al., (2010) Ca: 56.10-260.50 mg/L and Mg:1.3-120 mg/L, Alp et al., (2010), Ca: 36.1-86.2 mg/L and Mg: 8.5-20.7 mg/L.

4.9. Silica

Silicon (as silica) is the most abundant element found in rocks and it will always be present in natural waters. The element is a major component of the structure of diatoms (*Bacillariophyta*), one of the main divisions of the algae, and when algal growth takes place in water there will be a dramatic drop in the silica levels as the diatom population rises. The subsequent replenishment of silica is principally from run-off. It is in connection with the diatom population that silica is determined as there are no apparent connotations for the purity of the water or its suitability for consumption (EPA, 2001).

In this study, the averages of silica of water were obtained to 8.90 mg/L in winter, 11.40 mg/L in spring and 20.30 mg/L in summer. These changes of silica were not significant (P>0.05) as statistical difference between winter and spring. It was significant (P<0.05) as statistical difference at summer for other seasons. Fikrat et al., (2010) reported that silica was ranged 0.0365-0.467 mg/L. The present study showed high values of silicate than Fikrat et al., (2010). It may be because of more the decay and product of diatoms in Karasu River.

In Kemaliye District, Karasu River has been pressured under wastewater of iron-steel mines in Divriği town of Sivas province (Fig. 2). By the continuously drainage of this mines ore, iron contents of

Karasu River was grow up. Especially, water color of this river has been turned into red at period of drainage and surface water of river has been determined high iron content (June 2007, iron: 0.48 mg/L, copper: 3.23 mg/L). Finally, we have known that all of these iron wastewaters have dissolved and deposited at sediment. All this iron demands will effect on biological organisms by toxic. However, while Fikrat et al., (2010) reported that iron and copper were 0.1056 mg/L and 0.0025 mg/L. Our results of iron and copper were higher than their results. Finally, our results of iron and copper can be hazard for fish species by EPA (2001) (iron: 0.2 mg/L; copper: 0.05 mg/L).

5. CONCLUSIONS

Finally our results were aimed to determine some quality parameters of surface water of Karasu River of upper part of Euphrates River in Kemaliye district of Erzincan province in Turkey. However we tried to determine reasons of the changing of these parameters. Especially the data of chlorine, iron, and copper has been problems for water quality parameters of EPA (2001). Also it determined that Kemaliye district doesn't any negative effect on Karasu River. However, Karasu River has been more economic fish species which are *Barbus esocinus, Barbus xanthopterus, Barbus rajanorum mystacus, Leuciscus cephalus, Cyprinus carpio*, *Oncorrhynchus mykiss* and important species which are *Mastacembelus simack*, *Glyphtothorax sp., Garra rufa*, *Barbatula euphraticus, Barbus plebejus lacerta* and etc. (Özgür et al., 2007). Especially pollution of Karasu River will effect on these fish species and all system of water sources in Euphrates River.

The changing of all parameters has been supported to Benavides (1996). This author said that human practices such as farming, deforestation, industrial and domestic waste discharges lead to the degradation of water quality, bringing about changes in runoff characteristics, increasing suspended solid loads and nutrient levels in surface water. The climate and geology of the river catchment determine the water quality in the natural environment where as human induced changes to water quality in populated areas override this natural variability in surface sources. People should be aware of the possible threats on water pollution in the river.

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REFERENCES

Akçakoca, H., 1997. *Water sources of Southern Anatolia project, the prime minister's office, GAP regional development chairmanship*, Turkey, 3-37.

Allan, J.D., 1995. *Stream ecology: Structure and function of running waters*, Chapman & Hall, New York, 388p.

Alp, M.T., Kocer, M.A.T., Sen, B. & Ozbay, O., 2010. *Water quality of surface waters in lower Euphrates basin (Southeastern Anatolia, Turkey)*, Medwell Journals, Journal of Animal and Veterinary Advances, 9 (18), 2412-2421.

APHA, 1998. *Standard methods for the examination of water and wastewaters*, 20th Edition. American Public Health Association, Washington, DC.

ATSDR, 2002. *Toxicological profile for copper (draft for public comment)*. Atlanta, GA, US, Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry.

AWWARF, 1995. *Nitrification occurrence and control in chloraminated water systems*. Denver, CO, American Water Works Association Research Foundation.

Benavides, A.M.S., 1996. *The use of water chemistry and benthic diatom communities for qualification of a polluted tropical river in Costa Rica*. Revista de Biologia Tropical 44, 395–416.

Bolz, V. & Rohrmeier, M., 2002. *Euphrates and Tigris, ETH seminar: Science and politics of international freshwater management*, Swiss Federal Institute for Environmental and Technology (EAWAG), Zurich. 18 p.

EC (European Commission), 2000. *Directive 2000/60/ec of the European Parliament and of the Council of 23 October 2000 establishing a framework for community action in the field of water policy.*

EİE., 2000. *General Directorate of Electrical Power Resources Survey and Development Administration.* Web page: http://www.eie.gov.tr\turkce\hidroloji\havzalar html.

Elinder, C.G., 1986. *Iron. In: Friberg L, Nordberg GF, Vouk VB, eds. Handbook on the toxicology of metals*, Vol. II. Amsterdam, Elsevier. 276-297.

EPA (Environmental Protection Agency), 2001. *Parameters of water quality*, Interpretation and Standards, Published in Ireland.

Fikrat, M.H., Nuha, F.K. & Falah, H.H., 2008. *Effect of chemical and physical properties of river water in Shatt Al-Hilla on phytoplankton communities,* CODEN ECJHAO E-Journal of Chemistry, April, 5(2), 323-330.

Fikrat, M.H., Maysoon, M.S. & Jasim, M.S., 2010. *A study of physicochemical parameters and nine heavy* *metals in the Euphrates River, Iraq*. CODEN ECJHAO, E-Journal of Chemistry, 7(3), 685-692.

ICAIR Life Systems, Inc., 1987. *Drinking water criteria document on nitrate/nitrite*. Washington, DC, United States Environmental Protection Agency, Office of Drinking Water.

IPCS, 1998. *Copper*. Geneva, World Health Organization, International Programme on Chemical Safety (Environmental Health Criteria 200).

İşçen, C.F., Altın, A., Şenoğlu, B. & Yavuz, H.S., 2009. *Evaluation of surface water quality characteristics by using multivariate statistical techniques: a case study of the Euphrates river basin*, Turkey, Environment Monitoring Assess., 151. 259-264.

Keller, W. & Pitblade, J.R., 1986. *Water quality changes in Sudbury area lakes: a comparison of synoptic surveys in 1974–1976 and in 1981–1983*. Water, Air and Soil Pollution, 29, 285.

Knepper, W.A., 1981. *Iron.* In: Kirk-Othmer encyclopedia of chemical technology, Vol. (13). New York, NY, Wiley Interscience, 735-753.

Manivanan, R., 2008. *Water quality modeling: rivers, streams and estuaries*, New India Publishing Agency, India, 287.

Najah, A.H., Abdul-Razak, M.M., Sajed, S., Falah, M.M., Ibrahim, M.A. & Brian, W.C., 2009. *Structure and ecological indices of fish assemblages in the recently restored Al-Hammar Marsh*, Southern Iraq, BioRisk 3, 173-186.

NRC (National Research Council), 1979. *Iron*. Baltimore, MD, University Park Press.

Özgür, M.E., Demirsoy, A. & Akbulut, A. 2007. *Fish Fauna of Karasu River at Euphrates Basin*, IX. National Ecology Congress, September, Malatya, Turkey, 45 p.

Rose, C., 2004. *An introduction to the environmental physics of soil, water and watersheds*, Cambridge University Press, UK, 397 p.

Sümbüloğlu, K. & Sümbüloğlu, V., 1998. *Bio-statistics*, Hatiboğlu Publisher, Ankara, Turkey, 269.

Walling, D.E. & Webb, B.W., 1992. *Chapter 3: Water Quality. I. Physical Characteristics*. In The Rivers Handbook volume I (ed. P. Calow & G.E. Petts), Oxford: Blackwell. 48-72.

WHO, 2009. *Policies and procedures used in updating the WHO guidelines for drinking-water quality*, Public Health and the Environment Water, Sanitation, Hygiene and Health, Printed by the WHO Document Production Services, Geneva, Switzerland.

Young, C.P. & Morgan, J.M., 1980. *A hydro geochemical survey of the chalk groundwater of the Banstead area, Surrey, with particular reference to nitrate*. Journal of the Institute of Water Engineers and Scientists, 34, 213–236.

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