2014

ISSN: 2147-3781

JOURNAL OF SELÇUK UNIVERSITY NATURAL & APPLIED SCIENCE

SPECIAL ISSUE (2nd INTERNATIONAL CONFERENCE on ENVIRONMENTAL SCIENCE and TECHNOLOGY — ICOEST 2014 May 14-17, Side, Turkey)



Selçuk University Institute of Natural & Applied Science

Digital Proceeding Of The ICOEST'2014 - , SIDE
Side, Turkey, May 14 – 17, 2014

Journal of Selçuk University Natural and Applied Science

Online ISSN: 2147-3781
www.josunas.org

The Evaluation of Water Quality Parameters of BeydilliRiver(Hafik-Sivas)

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ABSTRACT

In this study, it has been aimed to determine and record the monthly and seasonal changes in water quality parameters of Beydilli River rising from foots of Karakis Mountain constituting the border of Gülpınar Village located in Hafik district of Sivas and Kızılalan Village being affiliated with central district of Sivas city, passing through Karabalçık, Beydilli, Bayıraltı and Düzyayla villages, mixing with Horohon Brook, and satisfying the drinking and usage water needs of Karabalçık and Beydilli villages, also being used in watering agricultural lands. It has also been aimed to create a database to be used in further studies on Beydilli River on which there has never been carried out any study.

The study has been started in March 2011. Among the water quality parameters, the dissolved oxygen (DO), pH, temperature, saltiness, electrical conductivity (EC), suspended solid matter (SSM), chemical oxygen demand (COD), biological oxygen demand (BOD), total ammonic azote, nitrite, nitrate, total alkalinity, total hardness, phosphate, sulfate, sulfite, sodium, magnesium, calcium, ferrous, lead, copper and cadmium analyses have been carried out monthly for 12 months through sampling from 7 sampling stations. As a result of this study, it has been determined in which quality category Beydilli River's water belongs to according to SWQMR, and it has been discussed whether or not the actual situation of water quality is suitable for aquacultural activities.

Keywords:Water pollution, Water quality, BeydilliRiver, Sivas

INTRODUCTION

Being the essential element in sustaining the life, the water is also one of the most important natural resources. The degradation of water quality and the balance in its environment is accepted to be water pollution(TOROĞLU et al., 2006). Nowadays, the factors such as industrialization, increasing population and urbanization, global climate changes, the wrong watering methods, unconsciously and illegal water usage, and excessive agricultural activities increase the pressure on water resource protection. The water deficiency becoming threatening in both world and Turkey arises due to lack of amount and quality of the water(GEYİKÇİ and BÜYÜKGÜNGÖR, 2010).
Especially in recent years, only the procurement of water is not enough because of increasing pollution in water resources in our country, and the necessity of water to be in certain quality and the continuous monitoring the quality of water became very important (ŞEN and GÖLBAŞI, 2008).
The pollution threat on fresh water resources having great important in these days, together with increasing water requirement, has led studies on water pollution and water quality to increase. In order to determine the pollution in rivers, the physical, chemical and biological factors are utilized. The most important aim of monitoring water quality via physical and chemical factors is to determine the factors determining water quality by determining the changes in pollution sources and consequently in pollution levels(ÖZBAY et al., 2011).
Beydilli River, where the study has been carried out, from Karakis Mount where it originates to the point where it mixes with Kızılırmak by joining Horohon Brook, passes through residential areas near to agricultural lands, and it is in position of the receiver of drainage waters of agricultural lands in most of locations. Beydilli River is very important for Beydillivillage and its neighbors. As well as it provides drinking and usage water for Beydilli and Karabalçık villages, it also provides water for watering fruit gardens and other fertile lands around the villages.

Between March 2011 and February 2012, 7 points have been determined as representatives of the Beydilli River for monthly investigations during 1 year. The aim of this study is to monitor the water quality of the river through analyses of water samples via physico-chemical methods, and to determine and record the monthly and seasonal changes in water quality data. Also it has been aimed to reveal the pollution problems, to determine the compliance with lives of creatures, and to classify the river's water according to Surface Water Quality Management Regulation's (SWQMR) Inland Surface Water Classification criteria.

MATERIAL and METHOD

Research Field:

The river originates from the foots of Karakis Mountain constituting the border of Gülpınar Village located in Hafik district of Sivas (Central Anatolia region, Upper Kızılırmak Plateau, Tozanlı Valley) and Kızılalan Village being affiliated with central district of Sivas city, and it is 72 km-long. It passes through the Karabalçık, Beydilli, Bayıraltı and Düzyayla villages, and pours into Kızılırmak by joining Horohon Brook.

The source of Beydilli River is Karakis Mountain. By passing through valleys and through lands and meadows with steep slopes, Beydilli River arrives at southeastern part of Düzyayla Village where it joins Horohon Brook.
In this study, 7 (seven) stations have been chosen to represent the whole of the river. 1st station: Karakis Mountain (water resource), 2nd station: Karabalçık Village's exit, 3rd station: entrance of Beydilli Village, 4th station: exit of Beydilli Village, 5th station: border of Bayıraltı Village, 6th station: exit of the border of Bayıraltı Village, and 7th station: the point of mixing with HorohonBrook



Figure 1.The location of Beydilli River (Hafik-Sivas)

Water Analysis

In this study started in March 2011, samples used in analyses of some chemical and physical parameters constituting the water quality has been collected monthly from 7 sampling stations during 12 months. Sampling process continued until February 2012. The cleaning and maintenance of all of the equipment, land-type measurement tools, and glass sampling containers to be used in sampling have been executed 1 day before the sampling. Sampling tubes have been immersed into acidic solution, and then dried in drying oven after being washed wit pure water. The sampling tubes to be used in water sampling have been flushed and immersed into 15 cm below water surface for taking water sample.

The obtained water samples have been taken to the laboratory within max. 2 hours for analysis. Temperature, pH, dissolved oxygen, saltiness and electrical conductivity parameters have been measured in-place via land-type measurement devices. Dissolves oxygen and temperature were measured via YSI brand 52 model oxygen meter, pH measurement was conducted with Orion brand 420A model pH-meter, the electrical conductance (µs/cm) and salinity (ppt) were measured by using YSI brand 30/50 FT model conductance-meter.

Among other parameters determining water quality; total alkalinity, total hardness, ammoniac, nitrite, nitrate, ammonium azote, phosphate, sulfite, sulfate chloride, sodium, potassium, suspended solid matter (SSM), chemical oxygen demand (COD), calcium, magnesium, ferrous, lead, copper and cadmium analyses of water samples were conducted in Cumhuriyet University Hafik Kamer Örnek Vocational High School Laboratory in same day.

Titration with sulfuric acid (for total alkalinity) and titration with EDTA (for total hardness) were executed. The results were presented in mg/L $CaCO_3$ unit.

Chemical oxygen level was calculated through titration with ferrous ammonium sulfate based on determination of amount of oxygen being used while lysing the natural and organic pollutant load by using powerful chemical oxidants. The analyses of ammoniac, nitrite (NO_2), nitrate (NO_3), ammonium nitrogen (NH_4^+), phosphate, sulfate, sulfite, chloride, sodium, potassium, calcium, and magnesium were conducted with CECİL CE4003 brand spectrophotometer by using Merk photometric test kits according to standard procedures. The analyses of lead copper, ferrous and cadmium water samples were conducted with PERKIN ELMER brand ELMER ANALIST 800 Atomic Absorption Spectrometer in laboratory. The analysis of Suspended Solid Matter (SSM) was conducted by filtering the water through Whatman brand 42 Nr0.45 NM membrane filters, and then keeping filter papers at 103°C for 24 hours and calculating the weight difference.

Monthly mean values, standard deviations and graphics of each of parameters were calculated by using Office Excel 2007 which is a part of Microsoft Office Professional Edition 2007.

FINDINGS

Water temperatures varied between seasons, months and measurement stations. The lowest temperature in the river has been determined in 7th station as 6.1^{0}C, while the highest value has been observed in September 2011 in 7th station as 26.4^{0}C. The annual mean temperature of the river among all the stations is 9.75^{0}C.In 1st station at the source of the river, the temperature difference between highest and lowest values has been observed to be 3.8^{0}C. While the lowest temperature in 1st station has been determined in February 2012 as 8.6^{0}C, the highest temperature has been observed in September 2011 as 12.4^{0}C.

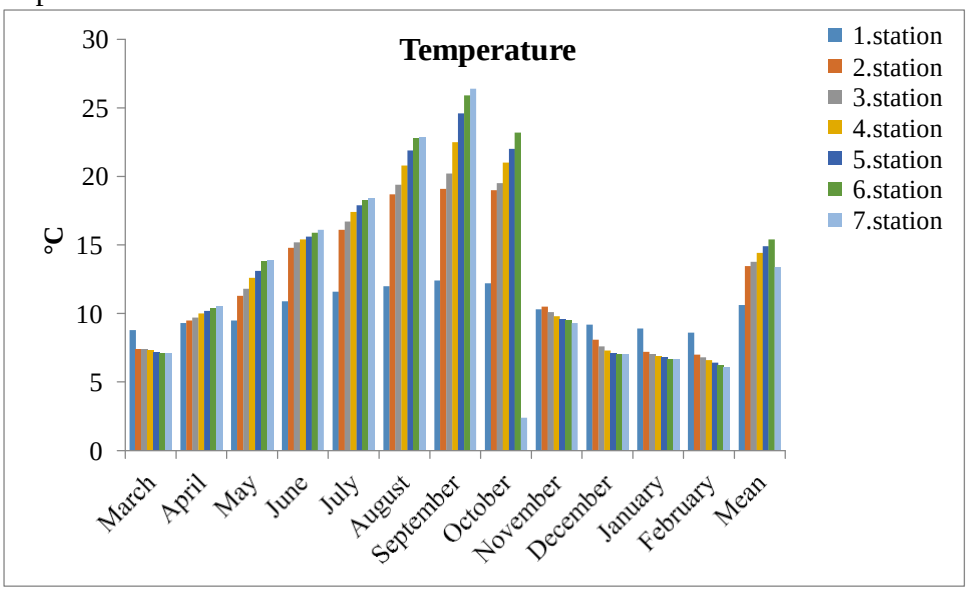


Figure 3.1 Mean temperature values (^{0}C) of the stations

Showing the acidic and basic situation of the waters, pH values measured in 7 points of the river indicated that Beydilli River is mildly basic. The mean pH value of 7 stations where the measurements have been carried out monthly on the river is 7.49. While the highest pH value of the river has been determined in September 2011 in 7th station as 7.82, the lowest value has been obtained in February 2012 in 1st station

as7.26. The seasonal mean pH values of the lake are 7.40 for spring, 7.60 for summer, 7.61 for autumn and 7.35 for winter.

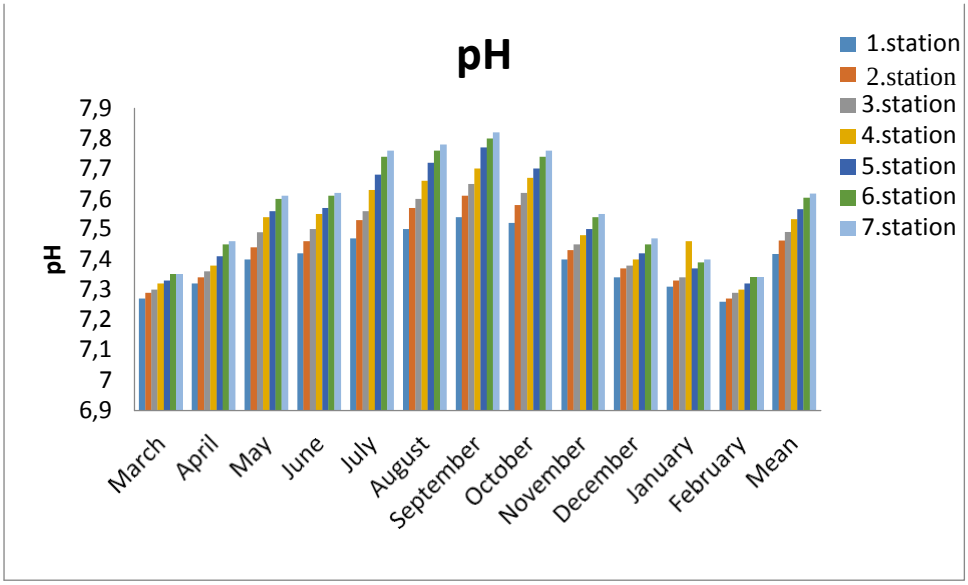


Figure 3.2.Monthly mean pH values of the stations

During the study, the amount of Dissolved Oxygen in Beydilli River showed variance between seasons, months and stations. The mean dissolved oxygen amounts of the stations on the river is 10.29 mg/L, while the lowest value has been determined in September 2011 in 7th station as 10.76 mg/L and the highest value has been determined in February 2012 in 2nd station as 14.90 mg/L. The mean seasonal dissolved oxygen amounts in the river are 13.82 mg/L for spring, 12.67 mg/L for summer, 12.29 mg/L for autumn and 14.15 mg/L for winter.

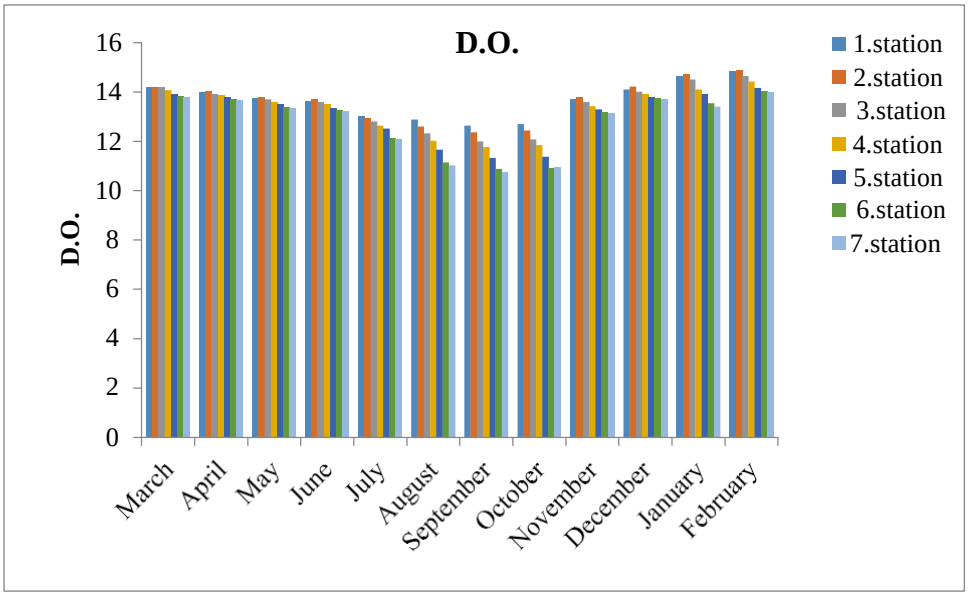


Figure 3.3.Monthly mean dissolved oxygen demands in stations (mg/L)

The mean chemical oxygen demand (COD) of Beydilli River has been determined to be 2.07 mg/L as a result of 1 year-long measurements in 7 stations. The lowest COD value has been determined in February 2012 in 1st and 2nd stations as 0.2 mg/L, while the highest value has been observed in September 2011 in 7th station as 9.6 mg/L.

The biological oxygen demand (BOD) of the river showed variance between seasons, months and stations. The mean BOD value of 1 year-long measurements in 7 stations

is 1.2 mg/L. The highest BOD value has been observed in September 2011 in 7th station as 7.1 mg/L, while the lowest value has been observed in February 2012 in 1st and 2nd stations as 0.1mg/L.

The lowest suspended solid matter (SSM) level in Beydili River has been determined in February 2012 in 1st and 2nd stations as 0.1 mg/L, while the highest level has been detected in September 2011 in 7th station as 4.9 mg/L. The mean SSM value among 7 stations during 1 year-long measurements has been found to be 1.21 mg/L.

The saltiness values of Beydilli River have shown variance between seasons, except the 1st station (in front of the source). The saltiness has decreased in winter months, while it has increased in hot months when the water temperature is high. The lowest saltiness in the river has been determined to be 0.01 ppt in February 2012 in all stations, the highest value has been determined in September 2011 in 6th and 7th stations as 0.08 ppt. The mean saltiness value of 7 stations where the measurements have been carried out for 1 year has been found to be 0.02 ppt.

The electrical conductivity (EC) value of Beydilli River has shown variance between seasons, months and stations. The mean EC value of 7 stations where the measurements have been carried out for 1 year has been found to be 100.36 µs/cm. the highest EC value in the river has been found to be 184.10 µs/cm in September 2011 in 7th station, while the minimum value has been observed in 1st station in February 2012 as 100.42 µs/cm.

It has been determined in Beydilli River that the amounts of nitrite (NO_2), nitrate (NO_3) and ammonium azote (NH_4) were below the measurable levels in winter months. While the lowest nitrite and ammonium azote values have been observed in February 2012 in 6th and 7th stations as 0.0001 mg/L, the highest nitrite (NO_2)has been observed in September 2011 in 7th station as 0.013 mg/L, and the highest ammonium azote (NH_4) level has been observed in 6th and 7th stations as 0.0013 mg/L.

The nitrate (NO_3) level in Beydilli River has been determined to be at minimum in winter months in all of the stations and at maximum in summer months in all the stations. The amount of nitrate in the river has been observed to be lower than measurable limit in 7th station in September 2011 when the water temperature was at maximum and the amount of dissolved oxygen was at minimum. As a result of monthly analyses of water samples taken from 7 stations on Beydilli River, the mean nitrate value has been found to be 0.95 mg/L.

As expected, the total alkalinity and total hardness values of Beydilli River have been found to increase and decrease together, and to be very close to each other. In all of the stations on the river, they have been found to be at minimum in February 2012, while they have been found to be at maximum in June 2011 when the amount and flow rate of the river have been very high. The minimum hardness value has been observed in February 2012 in 1st station as 99.42mg/L $CaCO_3$, while the maximum value has been determined in June 2011 in 7th station as 155.26 mg/L $CaCO_3$. The mean total alkalinity value in 7 stations as a result of monthly measurements during the year has been found to be 116.63 mg/L $CaCO_3$.

Being one of the important nutritive minerals affecting the productivity of aquatic life, phosphate (PO_4) has been found to be below the measurable limits in February 2012 in all of the stations. The highest amount of phosphate in the river has been found to be 0.062 mg/L in 7th station in November 2011. The seasonal phosphate averages of all of

the stations on Beydilli River are 0.0050 mg/L for spring, 0.0072 mg/L for summer, 0.0201 mg/L for autumn and 0.0024 mg/L for winter.

It has been seen in year-long monthly measurements in Beydilli River that the sulfate (SO_4) values have been below the levels potentially harmful for aquatic life. The sulfate (SO_4) level in the river has shown decrease in winter months, while it has increased in all of the stations from February to September. While the highest sulfate value in the river has been determined in September 2011 in 7th station as 95.22 mg/L, the lowest value has been determined in February 2012 in 1st station as 1.70 mg/L.

In all of sampling stations on Beydilli River, the level of sulfite (SO_3) has shown decrease in winter months, while it has increased in summer months. The highest sulfite concentration has been observer in September 2011 in 7th station as 4.4 mg/L, while the annual average of 7 stations was 1.58 mg/L.

In Beydilli River, the calcium (Ca) and magnesium (Mg) values have shown parallelism during the year, and they have varied between seasons, months and stations. While the highest calcium and magnesium amounts have been observed in June 2011 in 7th station as 7.26 mg/L and 6.82 mg/L, respectively, the minimum levels have been observed in February 2012 in 1st station as 5.2 mg/L and 5.28 mg/L.

The chloride in BeydilliRiver has shown variance among seasons, months and stations. The mean value of 7 stations as a result of monthly measurements during the year was 7.54 mg/L.While the highest chloride value has been observed in February 2012 in 2nd station as 8.46 mg/L, the minimum value has been determined in September 2011 in 7th station as 5.38 mg/L.

The increases and decreases of levels of sodium (Na) and potassium (K) in Beydilli River showed parallelism. While sodium and potassium values in 7th statin have been at their maximum levels as 46.12 mg/L and 3.06 mg/L, their minimum levels have been observed in September 2011 in 1st station as 12.4 mg/L and 1.27 mg/L.

In Beydilli River, while the levels of lead (Pb) and cadmium (Cd) have been determined to be lower than measurable limits in winter months, the maximum levels of them have been observed in 7th station in September 2011 as 0.009 mg/L.

In Beydilli River, while it has been determined in all of 7 stations that the levels of ferrous (Fe) have been lower than measurable limits in February 2012, they have shown significant increases in May and June, and its highest concentration has been found to be 0.184 mg/L in 7th station in June.

Similar with ferrous concentration, the copper (Cu) concentration in BeydilliRiver has been found to be lower than measurable limits in February 2012 in all of 7 sampling stations. It has shown a rapid increase in April and Mau, and its highest concentration has been observed in April 2012 in 7th station as 0.025 mg/L.

RESULTS and DISCUSSION

7 stations have been determined on Beydilli River rising from Tozanlı Valley of Sivas City, joining the Horahan Brook in border between Düzyayla Village of Hafik district, and pouring into Kızılırmak. Water samples have been taken from those stations between 08:00 and 10:30 during March 2011- February 2012 period for 8 times a month. The seasonal mean values of investigated water quality parameters are given in Table 1.

Table 1: Seasonal Mean Values of Some of Water Quality Parameters Belonging to Beydilli River

Water Quality Parameters	Spring	Summer	Autumn	Winter
Dissolved Oxygen(mg/L)	14.1567	13.8286	12.6733	12.2943
Salinity (‰)	0.0143	0.0286	0.0433	0.0429
pH	7.3595	7.4081	7.6043	7.6110
Temperature	7.2000	9.9000	17.0857	16.1667
Electrical Conductivity	106.7233	118.3667	146.8590	144.2067
Suspended Solids (mg/L)	0.6000	1.1952	2.2524	2.2267
Chemical Oxygen Demand(mg/L)	0.7476	1.3810	4.0381	4.4857
Biological Oxygen Demand (mg/L)	0.4714	0.9143	2.0714	2.8048
Chloride (Cl)(mg/L)	8.1752	8.0590	7.1695	6.7914
Phosphate (PO_4)(mg/L)	0.0024	0.0050	0.0073	0.0202
Sulfate (SO_4)(mg/L)	5.6038	28.8862	47.1886	39.6086
Sulfite (mg/L)	0.6000	1.0238	2.0476	2.0952
Sodium (Na)(mg/L)	21.2448	28.7486	25.4338	19.6714
Potassium (K)(mg/L)	1.8752	2.3286	2.1571	1.6990
Total Hardness ($CaCO_3$)(mg)	102.9386	120.7952	123.9586	117.0648
Total Alkalinity($CaCO_3$)(mg/L)	103.2586	121.3829	124.5533	117.3514
Magnesium (mg) (mg/L)	5.3071	5.5871	5.6886	5.4348
Calcium (Ca)(mg/L)	5.4110	5.8300	5.9562	5.6005
Nitrite (NO_2)(mg/L)	0.0001	0.0005	0.0013	0.0014
Nitrate (NO_3)(mg/L)	0.3810	0.7429	1.9333	1.8762
Ammonium (NH_4)(mg/L)	0.0007	0.0007	0.0015	0.0008
Ferrous (Fe)(mg/L)	0.0005	0.0261	0.0474	0.0267
Lead (Pb) (mg/L)	0.0007	0.0024	0.0041	0.0063

Copper (Cu)(mg/L)	0.0007	0.0078	0.0061	0.4805
Cadmium (mg/L)	0.0007	0.0016	0.0036	0.0044

The temperature has important effects on various physical and chemical water quality characteristics. Some events such as solubility, saturation, concentration and diffusion are affected by temperature. Fish and many aquatic creatures are cold-blooded animals. Hence, while metabolic activities increase with increasing temperature, they decrease as temperature decreases (MUTLU et al.; 2013).

In our study, the seasonal changes in water temperature of Beydilli River have occurred within normal limits. The seasonal difference of water temperature monthly measured during the year and the differences among the stations have not been harmful for aquatic life, and it has been understood that the water of the river is 1st quality according to SWQMR in terms of temperature.

In order for a pH value of any aquatic medium to not jeopardize the aquatic life and in order for a water resource to be suitable for aquaculture, it should not pass the limit of 6.5 – 8.5 (KARA and ÇÖYLEKÇİOĞLU, 2004).

In our study, it has been seen that the pH values of 7 stations are within acceptable limits, and the mean pH value has been found to be 7.49. According to SWQMR, the water of the river is 1st quality in terms of pH.

The level of dissolved oxygen (DO) in rivers is an important factor limiting the lives of aquatic animals(MUTLU,2013).At least 5 mg/L dissolved oxygen is required for aquatic life in fresh waters (ATAY and PÜLATSU, 2000).

The dissolved oxygen in Beydilli River has shown increase in all of the stations during winter months, while it has decreased in all of stations during summer months. The water of Beydilli River is 1st quality according to SWQMR in terms of dissolved oxygen amount.

Chemical Oxygen Demand (COD) indicates the oxygen required for oxidation of all of the matters in water (ATAY and PULATSU, 2000). According to Güler (1997), the concentration of COD in waters higher than 25 mg/L is a pollution indicator, and its concentration higher than 50 mg/L indicated that water is severely polluted and it may have toxic effect.

The highest level of COD in our study has been determined to be 9.6 mg/L in 7th station in September 2011, and it has been determined that it is much lower than acceptable limits. From the aspect of COD, the river's water is 1st quality according to SWQMR.

Biological oxygen demand (BOD) is the amount of oxygen required by bacteria for digesting the organic materials under oxygenic conditions (ATAY and PULATSU, 2000). From the aspect of water characteristic, BOD measurement is an indicator of water pollution(EGEMEN and SUNLU 1999). BOD value in clean waters may be 2mg/L at highest level, but it may exceed the level of 10mg/L(ÇİÇEK and ERTEN 2012).

In measurements in all the stations on Beydilli River, it has shown increase from February to September, and it has reached at its maximum level in September 2011 in 7th station with the

value of 7.1 mg/L. The reason of BOD increase in the river is the possibility of leakage of domestic or animal wastes which may result in organic pollution from agricultural lands around or villages where the river passes from into the river. The river's water is 1st quality according to SWQMR.

Suspended solid matters (SSM) can occur in waters as a result of erosion, pollution, phytoplankton population increase, and the rocks mixing into water by being eroded (MUTLU, 2013). The concentration of SSM in water more than 2mg/L leads the physical water pollution (MUTLU et al.; 2013). The mean SSM amount in the river has been found to be 1.21mg/L, and it has been determined that the SSM concentration of the river is suitable.

The saltiness levels of Beydilli River have shown variation seasonally. It has been determined that the saltiness has decreased in all the stations on the river during winter months,while it has increased in all of the stations (except 1st station) during hot summer months. In general, it has been seen that the river is in good condition in terms of saltiness.

In water quality studies, electrical conductivity (EC) is very important, and EC exceeds the level of 1000 µs/cm as the pollution increases(POLAT, 19997). The mean EC value in Beydilli River has been found to be 129.03Ns/cm, while the maximum EC value has been observed in September 2011 in 7th station as 184.40 µs/cm. It has been concluded that the river is in good condition in terms of EC value according to SWQMR.

The azote resources mixing into surficial waters are generally domestic, natural and agricultural originated(MUTLU et al.; 2013). Nitrogenous compounds nitrite (NO_2), nitrate (NO_3) and ammonium azote (HN_4) may have toxic effect on aquatic animals when existing at high levels. In this situation, the toxic effects of nitrogenous compounds increase in parallel with increasing pH and water temperature (MUTLU et al., 2013).

In our study, it has been observed that nitrite, nitrate, and ammonium azote have been found to be at very low level. It has also been determined that the river's water is 1st quality in terms of nitrite, nitrate, and ammonium azote levels according to SWQMR, even at their highest levels.

In fish farming, the total alkalinity and total hardness values are desired to be within 20-300 mg/L $CaCO_3$ range, and to be similar with or close to each other (PULATSU and TOPÇU, 2012).In this study on Beydilli River, the total alkalinity and total hardness values have been found to be close to each other. The highest levels of total hardness and total alkalinity have been detected in June 2011 in 4th station as 155.26mg/L $CaCO_3$ and 156.38 mg/L $CaCO_3$. Under the light of these results, it has been concluded that the river is mildly hard, and it has suitable characteristics for aquacultural activities.

Being one of the most important nutritive minerals affecting aquatic life, phosphate (PO_4) has been determined to be at its highest level in November 2011 in 7th station as 0.062mg/L. The reason of increase in phosphate level in Beydilli River between October and November is that this time period overlaps with the second fertilizer implementation period which is very important for wheat planted densely around the river. Because the fertilizers used in second fertilization period contain phosphate, it is thought that the phosphate-containing fertilizers may have mixed into river through rain waters and surficial water flows. According to SWQMR, the river's water shows 3rd class characteristic in terms of phosphate content.

In natural waters, the value of sulfate (SO_4) varies between 5 and 100, but the sulfate level required for aquaculture has been determined as 90 mg/L (KÜÇÜK, 2007). The amount of sulfate in Beydilli River has reached its maximum value in September 2011 in 7th station as 95.22 mg/L. This value is higher than the maximum sulfate level required for aquaculture. The reason of that the phosphate content is higher than required maximum level in September is thought to be the mix of phosphate-containing fertilizers into river through domestic and agricultural activities. Beydilli River, according to SWQMR, shows 1st class water characteristic in terms of phosphate content.

The highest sulfite (SO_3) level in Beydilli River has been determined in September 2011 in 7th station as 4.4 mg/L. Even this highest level is lower than the half of the level acceptable for aquaculture. The river is suitable for aquaculture in terms of sulfite concentration.

In normal waters, the levels of calcium (Ca) and magnesium (Mg) between 5 and 60 mg/L are accepted as normal. In our study, the levels of calcium and magnesium have been found to be within these limits, and it has been concluded that Beydilli River is suitable for aquaculture in terms of calcium and magnesium content.

Being an indicator of healthy life, the chloride ions may exist in natural waters up to 30 mg/L concentration(TAŞ, 2011). The highest concentration of chloride in Beydilli River has been found to be 8.46 mg/L in February 2012 in 2nd station. It has been concluded that the river is suitable for aquaculture in terms of chloride content.

Sodium salt varies between 2 and 100 mg/L in natural waters, while potassium varies between 1 and 100mg/L (TEPE et al.; 2006).In Beydilli River, sodium (Na) and potassium (K) values have reached their highest levels in May 2011 in 7th station as 46.12mg/L and 3.06mg/L, respectively. Even those values are much lower than acceptable limits. It has been concluded that the river is suitable for aquaculture in terms of sodium and potassium content, and the river shows 1st quality water characteristic in terms of sodium and potassium.

In Beydilli River, the concentrations of lead (Pb) and cadmium (Cd) have found to be either lower than measurable limits or much lower than acceptable limits in all of sampling station. It has been observed that the river shows 1st quality water characteristic in terms of lead and cadmium content according to SWQMR. The river has been determined to be suitable for aquaculture in terms of those values.

The level of ferrous (Fe) in Beydilli River has shown rapid increase in May and June. The reason of that, as it has been mentioned in (MUTLU, 2013), has been thought that dense wheat farming is performed in region, and that the fertilizers implemented in May and June for wheat plants to produce more grain via spraying method may mix into river via rain waters and surficial flows. In our study, the ferrous content has been determined to be at its highest level in June 2011 in 7th station as 0.184mg/L. It has been found that this value has decreased to much lower values several months later.

The concentration of copper (Cu) in the river has shown rapid increase in April and May, and it has reached its maximum level in April 2011 in 7th station as 0.025mg/L. The reason of that is the utilization of copper-containing agricultural pesticides in fruit garden care periods, and it is thought that those pesticides may mix into river through rain waters and surficial flows. According to SWQMR, the river shows 2nd quality water characteristic in terms of copper content.

According to the results of our study, it has been concluded that Beydilli River is under pressure of pollution, and immediate measures should be taken in order to prevent domestic, agricultural and organic wastes from Beydilli, Bayıraltı and Düzyayla villages to mix into the river. The legislations about the protection of river should be rigorously, and the degradation in ecological balance should be prevented. When the actual situation of the river is compared with drinking and usage water standards and SWQMR, according to the rule that the value of the lowest parameter determines the class, the actual class of the river's water is 3rd quality. In order to prevent further pollution in Beydilli River, to improve the water quality, to protect the fish stocks, and to ensure the sustainability of natural ecologic balance, the river should be monitored periodically. Also, from the aspect of investigated parameters, it has been concluded that the river is suitable for aquaculture, except a couple of months.

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