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Assessment of Water Quality by Physicochemical Parameters for Munzur and Peri River, Turkey

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ABSTRACT

This study is concerned about the relationship of water quality parameters and aquatic life standards in Munzur and Peri River, Turkey. The rivers were classified according to water quality standards and the parameters were revealed the natural living conditions of fish in subjected ecosystems. Water quality parameters such as temperature, pH, DO, BOD_5, COD, total hardness ammonium, nitrate, nitrite, Total Nitrogen, medium-P, chloride, sulphate, potassium, sodium, calcium, magnesium, turbidity, water flow rate and biological parameters such as *E. Coli*, F. Strp., *T. Coli* of Munzur and Peri River were detected once per 3 months during 2008-2009. In terms of physicochemical parameters of Munzur and Peri River, both rivers can be classified as 1st class inland water according to the classification properties. In conclusion we revealed that Munzur and Peri Rivers are in good condition for aquatic life which is unique in this area. The natural of the area should be protected and saved for future generations.

Introduction

Increasing demand for water, higher standards of living, depletion of resources of acceptable quality, and excessive water pollution due to agricultural and industrial expansions have caused intensive social and environmental predicaments all over the world. The previous works related to the water quality management in reservoir–river systems can be classified into three categories: reservoir operation considering the water quality issues, waste load allocation in the river systems and the water quality management in river–reservoir systems (Kerachian and Karamouz, 2007). Fresh water of rivers and lakes, brackish water of marshes and lagoons and salt water of coastal areas are affected from both natural processes and human activities. The environmental problems caused, can be confronted only with the sampling and assessment of water quality and quantity data. The water quality and quantity parameters in lakes, rivers, marshes and lagoons are factors of great importance (Margoni and Psiovikos 2010).

Water quality models are often implemented in order to quantify biological, physical, and chemical transformation of constituents of interest and to investigate the impact of altered boundary conditions on aquatic ecosystems (Wagenschein and Rode, 2008). However, particularly for small rivers, some problems hamper a straightforward model application; specifically calibration data scarcity, lack of major investments in small systems deemed to be of minor importance, and the large number of diverse inputs, especially for rivers that flow through densely populated areas (Marsili-Libelli and Giusti, 2008).

Water is an essential component for life. Water quality can have a major impact on both individuals and communities health. Water an essential component for life which contains minerals extremely important in human nutrition (Versari et. al., 2002). In this research, measurement of some quality parameters of water was aimed for negative effects of using Munzur and Peri Rivers as agricultural and water activities on human health, stream water quality and wild life.

Material and Methods

All laboratory studies were conducted with Directorate of Provincial of Agriculture in Tunceli. Water samples were taken and selected physicochemical parameters were detected by multi meter probes. The physicochemical parameters such as pH, BOD5, COD, DO, water temperature, electrical conductivity, Total hardness Ammonium, Nitrate, Nitric, Total Nitrogen, medium-P, Chloride, Sulphate, Potassium, Sodium, Calcium, Magnesium, Turbidity, water flow rate and biological parameters such as *E. Coli*, F. Strp., *T. Coli* of Munzur and Peri River were detected once per 3 months during 2008-2009.

Results

The water quality parameters of Munzur and Peri River have been observed during 2 years and the results are shown at the tables (Tablo 1and 2).

The temperature was between 0-22 ºC and the highest value was 22 ºC in July 2009 in the Munzur River (Table 1).The lowest value was observed as 0 ºC in February 2008. The highest pH value was 8,4 in February 2009 and the lowest was 7.61 in November 2009.BOD5 was observed as 13mg/L in 2008.Total Dissolved Solid was relatively with electrical conductivity as 431 µΩ/cmin February 2008. The highest Dissolved Oxygen was at the highest value (12 mg/L) in February 2008. Ammonium Nitrogen and Nitric were at the highest value as 0,012-0,008 mg/L respectively in August 2008.Therefore the highest Nitrate value was 2,13mg/L in November. Orthophosphate was at the highest (0,09mg/L) value in February 2008. The other Organic pollution parameter, COD, was at the highest value (32 mg/L) in February. Calcium,

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Magnesium and Total hardness values at the highest in February 2008. Turbidity value was 106.66 NTU in February 2009 as highest. Water flow rate was about 185 m^3/sc. The *E.coli* and *T.coli* values at the maximum in August 2008 and November 2009 as 1480 EMS/100 and 480 EMS/100 respectively (Fig 1). The data of surface water quality parameter were obtained for two years. The average of water temperature was determined and the highest value (21 ° C) was measured in August of 2008 in the Peri River (Table 2). The lowest value is 0 ° C was measured in 2008 February. The highest pH value was measured as 8.8 in February, 2009. The highest Biochemical Oxygen Demands (BOD5) was measured as 8mg / L in 2008. Electrical Conductivity was 438 μΩ / cm, in February 2008. The highest Dissolved Oxygen was in February 2008 (11 mg / L). The maximum value of ammonia (0.56 mg / L) and nitrite nitrogen were measured in November 2009 (0.006 mg / L). Nitrate nitrogen was determined as the highest value (2.48 mg / L) in November 2009. The highest Ortho-phosphate was measured as the (0.08 mg / L) in February 2008. The Chemical Oxygen Demand which is another parameter of organic pollution was the highest in February 2009 as (38 mg / L). The highest Calcium was 62.7 mg / L in February 2008, magnesium (2.88 mg / L) in November 2009, and total hardness (225 mg / L CaCO3), measured in February 2008. The turbidity value was reached the highest value 117.7 NTU in February 2009. The average water flow rate is 47.54 m3/sec. Biological pollution parameters, such as *E. coli* and *T.coli* were at the maximum values in February 2009 and in November 2009 and 24800 EMS/100 320EMS/100 measured respectively (Fig 2).

Discussion and Conclusion

The results of this study showed that the water quality of Munzur and Peri River. The parameters were shown at the Table 1 and Table 2. The water temperature is important for fish life and the fishes are classified as warm water fish (Aras et al. 1995). Optimal conditions for breeding trout water temperature were 7-18 ° C. The reported temperature was 16-26 ° C for growing carp. The Dissolved Oxygen content in water for the trout from 9.20 to 11.50 mg / L and 5.00 to 9.00 for carp mg / L level should be provided (Çelikkale 1994). The average water temperature was 11.88 and 12.88 ° C, for Peri and Munzur waters respectively. The average of dissolved oxygen content was 8.10 mg / L and 8.18 mg / L. Both rivers were shown the optimal environmental conditions for the warm and cold water fish contain. Indeed Munzur River known as the naturally living area for Anatolian trout *Salmo turutta macrostigma*. On the other hand in terms of water temperature and dissolved oxygen Munzur and Peri River showed inland water quality standards, according to the features shown by 1st class water (Table 3 and 4).The pH values should be between 6.5 to 8.5 for endanger aquatic life living for fish farming in order to be available (Goldman and Horn 1983, Çelikkale 1994, Kelly and Çömlekçioğlu 2004). According to measurements Munzur and Peri River (mean pH = 8.10 to 8.35) showed slightly alkaline pH which could be considered a character which could be suitable aquatic living environment. Both rivers were representing the concentration of base and hydroxyl ions, formed by carbonate and bicarbonate salts of alkali, and acidic water holding capacity of acid neutralization (Göksu, 2003). Therefore the total alkalinity of 10 mg / L with a low water level were shown insufficient development of phytoplankton and fish which born with the need for the production of lime (Boyd and Lichtkoppler 1980).

The conductivity values could be changed according to dissolved matter and salinity in Peri River (327.5 and 365 ms / cm). According to results of the concentration results, Munzur and Peri River were ion-rich waters. If the electrical conductivity exceeds the value of 1000 ms at 25 ° C/cm, no fish could survive. The conductivity of water should be about 12.50 to 1800 ms/cm, which reported by Göksu, 2003. The electrical conductivity of water in terms of fish farming for Peri and Munzur could be specified as appropriate.

In general, water hardness occur by Ca^{++} and Mg^{++} ions which express the soap precipitation in the water (Egemen and Sunlu 1999, Göksu, 2003, Yilmaz 2004). Munzur and Peri River were described as slightly hard water with the average of hardness value of 185.31 and 158.69 mg/L. The hardness values were ideal for trout (100-150 mg $CaCO_3$ / L) which expressed as Aras et al. 1995. Although the presence of water hardness usually associated with Ca^{++} and Mg^{++} ions, Mg^{++} ions shows the hardness of the water. In this respect, the Ca^{++} content of the water also should be known. Because calcium plays an important role in the formation of fish skeleton and reduce the effects of toxic substances. In addition ions have physiological roles to the cell wall and cuticle permeability (Egemen and Uslu, 1999). Ideal Ca^{++} concentration was 60-160 mg / L for trout level which was reported (Aras et al. 1995). The Ca^{++} content of Munzur and Peri showed the average of 51.72 and 40.37 mg / L which could be characterized as weak.

Magnesium porphyry of chlorophyll in the composition of the waters is vital for the plants, algae, bacteria, and fungi for phosphorus metabolism (Erençin and Koksal, 1981). Total cations of Ca^{++} is 48% and 14% for Mg^{++} for the amount of dissolved solids of 50 mg/L of soft waters. The average ratio of Mg^{++} ion was 4.8% for inland waters of North America (Tanyolaç1993). The highest concentration of Mg^{++} measured in Munzur and Peri, 18.2 and 19.9 mg / L respectively. The classification of water quality of Munzur River according to inland surface water standards.

Classification of inland surface waters: The classification of inland surface waters according to the quality parameters.

Class I	:	High quality water
Class II	:	Less Polluted water
Class III	:	Polluted water
Class IV	:	Most Polluted water

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Table 1. The average of physicochemical parameters of Munzur River between 2008-2009

Munzur River					
Parameter		February	May	August	November
T	ºC	3,50	15,50	20,00	8,50
pH		8,30	8,25	8,10	7,76
EC	mikroohms/cm	363,50	336,00	379,50	381,00
DO	mg O_2/L	10,05	6,62	6,78	9,28
TDS	mg/L	235,50	215,00	243,00	243,50
SS	mg/L	44,50	30,00	7,50	8,00
NH_4-N	mg/L	0,00	0,00	0,02	0,06
NO_2-N	mg/L	0,00	0,00	0,00	0,00
NO_3-N	mg/L	0,50	0,78	0,61	1,14
o-PO_4	mg/L	0,05	0,04	0,05	0,02
ΣP	mg/L	0,02	0,06	0,02	0,02
BOD_5	mg/L	7,50	1,50	4,50	2,00
COD	mg/L	31,00	12,00	14,50	14,50
TKN	mg/L	1,75	1,26	1,57	1,23
pV	mg O_2/L	2,11	1,65	1,57	2,83
P-AI	mg/L	8,00	5,00	0,00	0,00
M-AI	mg/L	153,50	142,75	158,25	164,25
Cl	mg/L	6,90	6,17	9,24	6,05
SO_4	mg/L	41,70	15,50	34,49	34,35
Na	mg/L	3,71	4,67	7,20	7,26
K	mg/L	0,51	1,71	1,07	2,28
Ca	mg/L	59,35	44,36	53,41	49,75
Mg	mg/L	14,10	12,52	12,16	16,05
TH	mg/L $CaCO_3$	206,00	162,00	183,25	190,00
Turb	NTU	58,65	38,50	10,50	11,50
CoI	Pt-Co	7,50	5,00	5,00	5,00
ΣN	mg/L	2,25	2,04	2,19	2,37
E.coli	EMS/100ml	131,00	680,00	1190,00	190,00
F.strp	EMS/100ml	310,00	909,00	815,00	415,00
T.coli	EMS/100ml	9670,00	19100,00	57000,00	257500,00
Q	m^3/s	75,40	205,50	43,50	31,40

Table 2. The average of physicochemical parameters of Peri River between 2008-2009

Peri River					
Parameter		February	May	August	November
T	ºC	3,5	14,5	21	12,5
pH	mikroohms/cm	8,4	8,4	8,35	8,25
EC	mg O_2/L	349,5	300	306,5	353
DO	mg/L	9,6	7	7,215	8,565
TDS	mg/L	225	191,5	196	224,5
SS	mg/L	52,5	14,5	10	11,5
NH_4-N	mg/L	0,005	0,003	0,0185	0,2835
NO_2-N	mg/L	0,003	0,004	0,0035	0,001
NO_3-N	mg/L	0,7865	0,39	0,445	1,25
o-PO_4	mg/L	0,06	0,025	0,035	0,035
ΣP	mg/L	0,03	0,025	0,02	0,025
BOD_5	mg/L	6,5	1	3	1
COD	mg/L	29	13,5	18,5	19,5
TKN	mg/L	2,383	1,285	1,675	1,355
pV	mg O_2/L	3,065	1,465	1,55	1,785
P-AI	mg/L	7	13	9	6,5
M-AI	mg/L	158	124,75	137,75	143,5
Cl	mg/L	7,6	5,81	7,25	8,85
SO_4	mg/L	24,7	14,44	17,76	37,75
Na	mg/L	13,74	9,385	13,55	13,46
K	mg/L	1,335	1,19	1,54	1,86
Ca	mg/L	49,2	38,17	31,17	42,93
Mg	mg/L	12,95	10,91	16,19	16,4
TH	mg/L $CaCO_3$	175,75	140,25	144,25	174,5
Turb	NTU	66,65	20	13	16
CoI	Pt-Co	7,5	5	5	5
ΣN	mg/L	2,6295	1,682	2,1325	2,6995
E-Coli	EMS/100ml	202,5	65,5	163	65
F-Strp	EMS/100ml	140	1915	2415	5210
T- Coli	EMS/100ml	18000	1508,65	8256,75	12406,25
Q	m^3/s	48,4	146		

Table 3.The classification of water quality of Munzur River according to inland surface water standards

		Classification of Water Quality				
Water Quality Parameter	Average	Class □I	□I	□II	□III	□IV
Temperature (°C)	11,88	I	25	25	30	> 30
pH	8,10	I	6.5-8.5	6.5-8.5	6.0-9.0	6.0-9.0 Except
Dissolved Oxygen (mg O_2/L)[a]	8,18	II	8	6	3	< 3
Chloride ion (mg Cl^-/L)	7,09	I	25	200	400[b]	> 400
Sulfat ion (mg $SO_4^=$/L)	31,51	I	200	200	400	> 400
Ammonium Nitrogen (mg NH_4^+-N/L)	0,02	I	0.2[c]	1[c]	2[c]	> 2
Nitrit Nitrogen (mg NO_2^--N/L)	0	I	0.002	0.01	0.05	> 0.05
Nitrat Nitrogen (mg NO_3^--N/L)	0,76	I	5	10	20	> 20
Total Phosphorus (mg P/L)	0,03	II	0.02	0.16	0.65	> 0.65
Total Dissolved Matter (mg/L)	234,5	I	500	1500	5000	> 5000
Color (Pt-Co)	5,63	II	5	50	300	> 300
Sodium (mg Na^+/L)	5,71	I	125	125	250	> 250
(COD) (mg/L)	18	I	25	50	70	> 70
(BOD) (mg/L)	3,88	I	4	8	20	> 20
Fecal coliform(EMS/100 mL)	399	III	10	200	2000	> 2000
Total coliform (EMS/100 mL)	72533	II	100	20000	10000	> 100000

Table 4. The classification of water quality of Peri River according to inland surface water standards

	Average	Class of water Quality				
Water Quality Parameters		Class	I	II	III	IV
Temperature(°C)	12,88	I	25	25	30	> 30
pH	8,35	I	6.5-8.5	6.5-8.5	6.0-9.0	6.0-9.0 except
Dissolved Oxygen (mg O_2/L)[a]	8,10	II	8	6	3	< 3
Clorur ion (mg Cl^-/L)	7,38	I	25	200	400[b]	> 400
Sulfat ion (mg $SO_4^=$/L)	23,66	I	200	200	400	> 400
Ammonium Nitrogen (mg NH_4^+-N/L)	0,08	I	0.2[c]	1[c]	2[c]	> 2
Nitrit Nitrogen (mg NO_2^--N/L)	0,003	I	0.002	0.01	0.05	> 0.05
Nitrat Nitrogen (mg NO_3^--N/L)	0,72	I	5	10	20	> 20
Total Phosphorus (mg P/L)	0,025	I	0.02	0.16	0.65	> 0.65
Total Dissolved Matter (mg/L)	327,25	I	500	1500	5000	> 5000
Color (Pt-Co)	5,63	II	5	50	300	> 300
Sodium (mg Na^+/L)	12,54	I	125	125	250	> 250
(COD) (mg/L)	20,13	I	25	50	70	> 70
(BOD) (mg/L)	2,88	I	4	8	20	> 20
Fecal coliform(EMS/100 mL)	146,88	II	10	200	2000	> 2000
Total coliform (EMS/100 mL)	10110	II	100	20000	100000	> 100000

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