A STUDY ABOUT THE EFFECTS OF IRRIGATION SCHEMES OF BUYUK MENDERES BASIN ON RIVER WATER QUALITY AND ENVIRONMENT

Ebru Yılmaz[1], Cengiz Koç[2]

[1]*Adnan Menderes University, Turkey*
[2]*Bilecik Şeyh Edebali University, Turkey*

Abstract

In this study, it was researched the effects of irrigation schemes that placed in Buyuk Menderes River basin on river water quality and environment. About 220,000 hectares in Buyuk Menderes basin are irrigated with irrigation scheme built sequentially. The main water source of the basin is the Buyuk Menderes river. The water, stored in dams built in the basin is given to irrigation schemes in terms of basin irrigation scheduling. The quality of water in the storage facilities is used in the irrigation scheme built along the river and after that it returns to the river again. The water returning from an irrigation scheme in river basin irrigation system becomes the source of irrigation water for other scheme. Therefore, the quality of the water released from storage facilities (dams) shows considerable differences in both irrigation schemes and along the river. On the river and at the entry points of irrigation schemes, stations were determined and water samples were taken these stations in order to research water quality along the river and to determine negative effects of irrigation areas on water quality and environment. After that these water samples were analyzed in the laboratory and changes were examined. In the water samples, changes on EC, pH, Na, K, Ca, Mg, Cl, NO_2-N, NO_3-N parameters were examined, the effects of the water samples on river water quality and environment were researched and some recommendations were presented about the study.

Key words: Menderes River, water quality, irrigation schemes, environment, Turkey

INTRODUCTION

Rivers are important resources because they are directly used for drinking, domestic, agriculture, transportation, power generation, recreation, and other human activities including waste disposal. However, discharge of untreated or partially treated industrial effluent, municipal wastewater, as well as washing clothes and cattle bathing adversely affect river water. Human settlements and industries have long been concentrated along rivers, estuaries, and coastal zones owing to predominance of water borne trade. A river's water quality is the composite of several interrelated compounds, which are subjected to local and temporal variations and also affected by the volume of water flow [1].

Irrigation means that giving the part which can not be met by natural ways of plant water consumption into ground by natural ways in order to increase plant production and sustain productivity. Irrigation system means that a system which distribute irrigation water into irrigation area. A good irrigation system should move water to usage point with minimal loss. According to topographical features of the area, the degree of efficiency and the amount of irrigation water, irrigation systems are built in different ways [2].

MATERIAL AND METHOD

Buyuk Menderes Basin is one of the most populous basins of Turkey with 2.5. Million population (Fig. 1) [3]. The climate in the basin varies from the Mediterranean climate in the coastal regions and downstream to the continental climate upstream. The average annual temperature is 17.68°C and the average annual precipitation is about 635

mm. The BM river, a typical meandering river, is the dominant water body of the basin. The total length is approximately 530 km. Its average annual flow volume is about 3.020 billion m^3. The average annual discharge is 110 m^3/s. The surface area of the river is 200 km^2. Its sea level height changes between 50 and 70 m. The names of the main branches of the river are Banaz, Cürüksu, Çine, and Akçay creeks. The basin consists one of the most agriculturally fertile soil of the country and is heavily dependent on agricultural production. The total irrigable area in the basin is 235 000 ha. Cotton, wheat, corn, alfalfa, sunflower, and citrus are the traditional yields of these lands by irrigation tradition [4]. Bafa Lake which is the last stop of Menderes River before it reaches Aegean Sea is the place where the highest amount of ammonia nitrogen measured. Water quality is at good level in Kufi brook. Here, pollution originates from trout farms. Waste water from textile factories mixes into river and reduces dissolved oxygen. Usage of excessive water and polluted water threats Işıklı Lake. Water quality which is 2nd quality in Çürüksu brook decrease to the level of 4. class water quality in the point links up to Buyuk Menderes. Adıgüzel and Cindere dams involves in the middle of basin. There is agricultural pollution here. *Leuciscus cephalus, Siluris glanis*, *Barbus barbus*, *Alburnoides bipunctatus, Gobio gobio* and *Capoeta pestai* are faced with extinction [3].
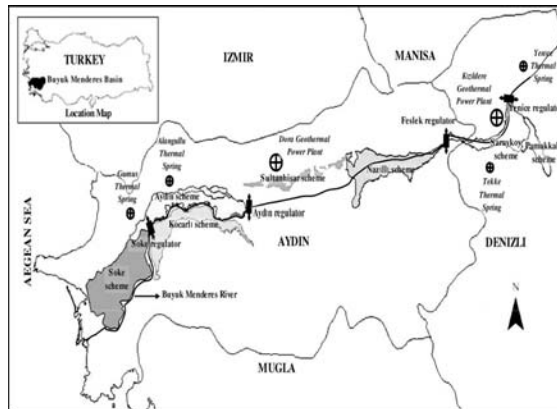

Figure 1 Lower Buyuk Menderes basin and irrigation schemes, Turkey

Physical and chemical analysis of the river and entry points of irrigation schemes samples were performed at the Technical Research and Quality Control Laboratory of the Department of Regional Hydraulic State Works XXI. Water quality parameters measured in the research area were electrical conductivity ($EC*10^6$), pH, cations (Na^{+1}, Ca^{+2}, Mg^{+2}), anions (Cl^{-1},), and NO_2-N, NO_3-N. Electrical conductivity was measured with a YSI model 3200 EC meter. The pH of raw water samples was measured using a Radiometer type TTT lc auto-titrator with glass pH electrode, calomel reference electrode and temperature compensator electrode. Cations were determined by Varian Spectr AA220; colorimetric analysis using the mercury (III) thiocyanate method for Cl^{-1} was calculated from analytical values. NO_2-N and NO_3-N was measured calorimetric method. Parameters were calculated using SPSS (Statistical Package for Social Science) 13 for Windows Software Program.

RESULTS AND DISCUSSIONS

There are 6 irrigation systems in Buyuk Menderes basin. In the article, water quality criteria taken from some points of Menderes and water systems were given. The samples were taken in June and August of 2013 (Table 1, 2).

Table 1 Chemical analysis results of water samples taken from regulators and bridges in the basin (2013)

Reference stations	pH	25×10^6 EC	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)
Sarayköy bridge									
June	8.2	1152	77.83	3.7	67.18	44.6	73.19	0.036	1.4
August	8.2	931	68.17	5.12	73.37	33.8	64.37	0.003	1.2
Nazilli bridge									
June	8	1474	117.2	6.27	97.41	83.5	79.43	0.026	1.6
August	8.1	1292	93.03	7.38	88.24	53.4	77.01	0.017	1.4
Aydın bridge									
June	8.1	1072	63.9	4.62	56.81	64.8	48.58	0.022	0.9
August	8	1121	69.21	5.12	75.96	55.5	54.05	0.003	0.9
Koçarlı bridge									
June	8.1	606	28.79	3.13	61.23	28	24.03	0.019	1.2
August	8.1	595	27.91	3.29	59.3	24.4	23.29	0.002	0.6
Söke Regulator									
June	8.1	809	51.23	5.22	67.93	44.4	41.93	0.009	1.1
August	8.1	635	27.34	3.29	60.33	23.2	22.67	0.001	0.7
Yenice Regulator									
June	8.3	778	57.69	8.56	44.53	31.7	39.52	0.033	0.9
August	8.2	715	47.74	4.42	64.62	22.4	44.21	0.003	1.1
Akçay Regulator									
June	8.4	596	11.88	1.35	35.41	49.6	10.73	0.004	0.5
August	8.1	527	5.68	0.76	27.96	27.1	4.63	0.001	0.3

Table 2 Chemical analysis results of water samples taken from irrigation scheme (2013)

Reference stations	pH	25×10^6 EC	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)
Sarayköy irrigation scheme									
June	8.3	1200	80.93	5.7	78.08	54.67	90.29	0.066	1.9
August	8.7	1120	78.11	8.19	89.11	45.89	84.07	0.007	1.7
Nazilli irrigation scheme									
June	8	1680	179.2	8.27	111.21	90.5	97.23	0.026	1.8
August	8.2	1389	102.23	9.98	99.27	78.9	85.09	0.019	1.7
Akçay irrigation scheme									
June	8.0	1198	85.9	5.62	78.81	84.8	68.78	0.029	1.9
August	8.1	1178	93.29	6.12	97.96	75.5	64.07	0.005	1.9
Aydın irrigation scheme									
June	8.1	816	58.59	5.83	78.03	27	43.09	0.026	1.9
August	8.0	765	67.99	4.29	62.34	22.4	56.86	0.005	0.9
Bozdoğan irrigation scheme									
June	8.1	909	67.03	8.22	79.99	52.4	54.03	0.014	1.9
August	8.1	735	56.94	7.12	70.36	37.9	29.07	0.003	0.9
Söke irrigation scheme									
June	8.3	898	73.70	9.20	56.93	39.9	45.02	0.020	1.8
August	8.2	765	67.94	7.50	70.40	29.7	56.91	0.007	1.6

CONCLUSIONS

The water returning from irrigation is less quality than irrigation water. Water given to the land takes nutrients, sediment and pesticides while passing from earth stratum. That's why, mains water creates pollution in the river.

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