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Temporal and spatial distribution of physicochemical parameters and water quality indices in an oligotrophic dam lake: A case of Maksutlu Dam Lake, Sivas, Türkiye

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Abstract: This study was conducted at three selected stations in Maksutlu Dam Lake (Şarkışla, Sivas), covering both the dry season (August 2023) and the rainy season (May 2024). Water samples were collected from the lake and a total of 18 physicochemical parameters were analyzed. The eutrophication index (*EI*), organic pollution index (*OPI*) and nutrient pollution index (*NPI*) values were calculated for both seasons based on the physicochemical parameters of the lake water. Additionally, a Geographic Information System (GIS) was used to show the seasonal variation in index values. Bray–Curtis and Pearson correlation analyses were applied to the physicochemical parameters of the water. As a result, it was found that both the physicochemical parameters and water quality indices of the lake exhibited seasonal variation. Phosphate pollution was detected in the lake and it was found that the lake may be oligotrophic in terms of NO_3 and Mg values. Several suggestions were also made for the sustainable management of the dam lake.

Keywords: geographic information system; reservoir; organic pollution index.

INTRODUCTION

Dam lakes are aquatic ecosystems formed by the accumulation of water in large areas behind embankments, created by building a dike across a river valley, typically at its narrowest point. While dam lakes were once the primary sources of drinking water and agricultural irrigation, they now play a significant role in activities such as energy production, transportation, industry and tourism. Dam lakes are also crucial structures for flood protection. Acidification, eutrophication, and various changes in hydrology and geomorphology are the primary pressures affecting the integrity of these lakes.[2]

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The excessive input of plant nutrients, particularly nitrogen and phosphorus, into lakes promotes the growth of organic matter, algae, periphyton and macrophytes, leading to eutrophication. This growth results in changes to aquatic organisms and water quality.[3] As a consequence of eutrophication, decreases in dissolved oxygen levels can lead to hypoxia and toxic algal blooms.[3]

Human activities, including domestic and industrial wastewater discharge and agricultural runoff, contribute to the physical, chemical, and biological pollution of freshwater resources, leading to the deterioration of water quality. This situation also limits the use of freshwater resources for various purposes.[4] Additionally, intensive and excessive use of these resources can harm both the environment and the organisms that depend on them.

Sivas Province is located in the central part of the Anatolian Peninsula, in the Upper Kızılırmak section of the Central Anatolia Region. The province, with an average altitude of over 1,000 m, exhibits continental climate characteristics. Summers are very hot, dry and short, while winters are cold, long and snowy. There are 15 dam lakes in Sivas Province, used for irrigation, energy production and drinking water. In the Şarkışla district, there are three dam lakes: Maksutlu, Yapıaltın and Kanak. Kanak Dam was built to meet the drinking and utility water needs in Şarkışla and to irrigate agricultural lands. Maksutlu and Yapıaltın dams are primarily used for irrigation. Recreation and picnic areas are located around Maksutlu Dam Lake, which is situated close to the Şarkışla district center.[5]

There are few studies on the dam lakes in Şarkışla.[6,7] One study evaluated both the physicochemical data and benthic macroinvertebrates of Kanak Dam Lake by sampling water and benthos monthly for one year.[6] Another study compared the filling rates of Maksutlu Dam Lake between 2010 and 2019.[7] It emphasized that there were decreases in the filling rates of the dam due to drought and that the dam lake should be used rationally. The study also reported that necessary measures should be taken to address the water crisis that may occur during dry periods and that a water management plan should be prepared for Maksutlu Dam Lake.

This study examined certain physicochemical parameters during both the dry and rainy periods of Maksutlu Dam Lake, which has not been studied in detail before. First, water quality values were determined according to various criteria.[8,9] Second, three different water quality indices were applied to the physicochemical parameters. Third, the spatial distribution of the index values across the dam lake was mapped using the IDW interpolation method. Fourth, the relationships between the physicochemical data were investigated using various statistical methods. Finally, several recommendations were made for the sustainable use of the dam lake.

EXPERIMENTAL

Details related to the sampling locations are given in the Supplementary material to this paper.

The research was conducted through both field and laboratory work. During the fieldwork, water temperature was measured using a simple thermometer (°C), electrical conductivity (*EC*) was measured with a conductivity meter (μS cm^{-1}), pH was determined using a pH meter and total dissolved solids (TDS) were measured with a portable device (ppm). For the measurement of other physicochemical parameters (*DO*, BOD_5, *COD*, Cl, salinity, Ca, Mg, total hardness (*TH*), NO_3, NO_2, NH_4-N, SO_4, PO_4), water samples were collected using a Ruttner water sampler and transferred to the laboratory in 2-L dark glass bottles.

The water samples brought to the laboratory were prepared for analysis without delay. Classical titrimetric and spectrophotometric methods were used for this purpose.[10] The quality of the water samples was determined according to specific criteria.[8,9]

All statistical data were analyzed using Microsoft Office Excel 20 (LogBase10) and SPSS 9.0 software to reveal the similarity between stations and physicochemical parameters.[11] The relationship between physicochemical parameters was examined using Pearson correlation analysis conducted in IBM SPSS Statistics, version 27.[12]

Water quality indices

The *EI* is used to evaluate the trophic conditions of the surface water body. *COD*, dissolved inorganic nitrogen (*DIN* / mg L^{-1}), and dissolved inorganic phosphorus (*DIP* / mg L^{-1}) are used to calculate the *EI* values, which are computed using the formula below. An *EI* value less than 1 indicates the absence of eutrophication, while a value of 1 or greater indicates the presence of eutrophication:[3,13]

$$EI = 10^6 \frac{COD \times DIN \times DIP}{4500} \quad (1)$$

OPI is used to assess the organic pollution status of surface water resources. *COD*, *DIN*, *DIP*, *DO* and their standard concentration values are used to calculate the *OPI*. The standard concentration values of COD_S, DIN_S, DIP_S and DO_S were taken from the references in the previous study.[8,13] The value obtained from the formula was evaluated as follows. <0: Excellent water quality, 0–1: good water quality, 1–2: water starting to be polluted, 2–3: lightly polluted water, 3–4: moderately polluted water, >4: heavily polluted water.[13,14] *OPI* values were calculated using the following formula:

$$OPI = \frac{COD}{COD_S} + \frac{DIN}{DIN_S} + \frac{DIP}{DIP_S} + \frac{DO}{DO_S} \quad (2)$$

The *NPI* values of the dam lake were calculated using the NO_3 and PO_4 parameters in surface water sources. These values were calculated using the following formula. The obtained value categorizes the pollution levels as follows. <1: no pollution, 1–3: moderately polluted, 3–6: significantly polluted, >6: very high pollution.[13,15] The NO_3-N maximum limit (mg L^{-1}) is referred to as MAC_N, and the PO_4-P maximum limit (mg L^{-1}) is referred to as MAC_P, with values taken from the criteria:[13]

$$NPI = \frac{C_N}{MAC_N} + \frac{C_P}{MAC_P} \quad (3)$$

The IDW interpolation technique was used to show the spatial distribution of index values on the dam. In IDW interpolation, the distances between the data points are first calculated for estimation. Then, weight values are determined based on the distance of each data point. Finally, the predicted value at a specific location is calculated by taking the weighted average of the points with known locations.[16] In the formula, $Z(x)$ represents the predicted value; $Z(x_i)$ represents the values of known points in the environment; w_i is the weight of each point; and N represents the number of points in the environment:

$$Z(x)=\frac{\sum_{i=1}^{N} w_i Z(x_i)}{\sum_{i=1}^{N} Z w_i} \tag{4}$$

RESULTS AND DISCUSSION

The water quality classes, based on physicochemical data and the average values obtained from sampling in Maksutlu Dam Lake during the dry and rainy seasons, are given in Table I.[8,9]

TABLE I. Water parameters and mean values of Maksutlu Dam Lake in dry and rainy seasons. Min: Minimum; Max; Maximum; Ave: Average; *WT*: water temperature; *EC*: electrical conductivity; *DO*: dissolved oxygen; BOD_5: biological oxygen demand; *COD*: chemical oxygen demand; *TDS*: total dissolved solids; *TSS*: total suspend solid; Cl: chloride; Ca: Calcium; Mg: magnesium; *TH*: total hardness; NO_3: nitrate nitrogen; NO_2: nitrite nitrogen; NH_4-N: ammonium nitrogen; PO_4: phosphate; SO_4: sulfate

Parameter	Unit	Dry season			Rainy season			Min–Max	Ave	Class
		Station								
		1	2	3	1	2	3			
WT	°C	32.5	32.2	34	19.3	18.3	18	18–34	25.7	I
EC		384	268	344	573	495	513	268–573	429.5	I and II
pH		8.23	8.56	7.86	8.01	8.31	7.91	7.86–8.56	8.15	II
DO	mg L^{-1}	4.37	4.76	3.04	7.23	7.80	6.66	3.04–7.80	5.64	III
BOD_5	mg L^{-1}	32.3	25.4	42.3	10.2	15.01	9.78	9.78–42.3	22.5	III
COD	mg L^{-1}	54.8	35.5	55.2	14.5	18	14.2	14.2–55.2	32.03	I and II
TSS	mg L^{-1}	120	360	210	105	318	165	105–360	213	
TDS	ppm	176	268	167	286	247	256	167–286	233.3	I
Cl	mg L^{-1}	38.98	41.98	39.98	29.99	26.99	31.99	26.99–41.98	34.99	I and II
Salinity	‰	0.02	0.01	0.03	0.02	0.03	0.03	0.01–0.03	0.02	
Ca	mg L^{-1}	26.45	24.08	20.04	101	48	70	20.04–101	48.26	
Mg	mg L^{-1}	3.41	2.69	2.38	2.96	1.33	1.99	1.33–3.41	2.46	
TS	FS °	12.4	13	10.6	0.8	1	1.2	1–12.4	6.50	
NO_3	mg L^{-1}	16.50	21.27	16.50	44	47.90	53.51	16.50–53.5	33.28	I and II
NO_2	mg L^{-1}	0	0	0.023	0.02	0.02	0	0–0.023	0.01	I
NH_4-N	mg L^{-1}	0.013	0.019	0.017	0.044	0.012	0.008	0.008–0.04	0.02	I
PO_4	mg L^{-1}	0.19	0.32	1.56	1.245	0.023	1.305	0.023–1.56	0.77	
SO_4	mg L^{-1}	5.57	11.56	5.95	9.89	10.33	10.39	5.57–11.56	8.95	I

Water temperature is a highly effective factor on biotic components in aquatic ecosystems. It plays an important role in reproduction, nutrition, and metabolic activities. Increase in temperature increases the rate of biological activity and decreases oxygen saturation.[17] It was observed that the water temperature values of the dam lake vary seasonally. During the dry season sampling, an increase in both air and water temperatures was noted. The average water temperature placed the lake in class I water quality.

The *EC* value is an indicator of the total amount of dissolved substances in water. *EC* values vary depending on the geological structure and the amount of precipitation. It was found that the *EI* values of the lake water were higher in the rainy season (Table I). The primary reason for this is the significant outflow into the lake during the rainy season. During this period, a large amount of material from outside the lake is transported into it by rain or snowmelt. The average *EI* values were found to range between Class I and Class II water quality.[8] The pH value is an indicator of water acidity.[18] When the average pH value of the dam lake was analyzed, it was determined that the water quality was Class II.[8] It can be concluded that the lake water exhibits basic properties.

The solubility of oxygen in water is inversely proportional to temperature. Additionally, a wavy lake surface and high moisture content increase the solubility of oxygen. As the salt concentration in the water increases, the amount of dissolved oxygen decreases.[19] It was observed that the *DO* values of the lake varied significantly between the dry and rainy periods. During the dry season, the water temperature increased due to heat, and the lake water evaporated. As a result, the *DO* values were found to be quite low in the dry season. However, during the rainy season, the water level of the lake increased due to rainfall, which in turn increased the *DO*. In terms of *DO*, it was determined that the lake water fell under Class III water quality. BOD_5 is defined as the amount of oxygen required by bacteria to break down organic matter under aerobic conditions.[20] Based on the average BOD_5, the dam lake was classified as Class III water quality. *COD* is the amount of oxygen required for the breakdown of chemical compounds. The *COD* value is inversely proportional to the *DO*. *COD* values are generally higher than BOD_5 values because *COD* measures the total organic matter present in a water sample, while BOD_5 only indicates the amount of biodegradable organic matter.[21] In this study, *COD* values were higher than BOD_5 values, supporting the findings in the literature. It was determined that the lake waters were classified as between Class I and Class II water quality based on the average *COD*.

Knowing the total amount of soluble substances or minerals in natural waters is an important parameter for defining the chemical composition of water. It also provides general information about the bottom structure, which contributes to the productivity of the water.[20] The TDS originate from agricultural runoff, industrial wastewater, natural sources, and domestic activities. The main ions that contribute to the *TDS* include bicarbonates, carbonates, sulfates, chlorides, nitrates, magnesium, sodium, potassium, calcium and others. In addition, silt, clay, small organic particles, inorganic substances, soluble organic compounds, plankton and other microscopic organisms also contribute to the *TDS*.

The Cl is an important component of all natural waters and is generally found in low concentrations. High concentrations indicate that salinity and *EC* values are also high.[22] Based on the average Cl values, the lake water was found to fall between Class I and Class II water quality.

The Ca is one of the most abundant elements in natural waters.[23,24] The source of Ca ions in water comes from calcium carbonate and calcium sulfate minerals. Therefore, Ca can be found in waters at varying concentrations. The Ca is the most important ion contributing to water hardness.[25] According to some researchers, water is classified as soft if Ca is less than 10 mg L^{-1}, moderately hard if it ranges from 20–25 mg L^{-1}, and hard if it exceeds 25 mg L^{-1}.[20] In this study, the average value was found to be 48.26 mg L^{-1}. Since the lithological structure of the study area consists of volcanic formations, the concentration of Ca ions may be high. This elevated value indicates that the lake has very hard water.

The Mg is one of the ions that contribute to the hardness of water. Since Mg is present in the composition of chlorophyll, it is vital for chlorophyllous plants. It also regulates phosphorus metabolism in algae, fungi and bacteria. Low Mg levels in lakes significantly affect phytoplankton productivity, resulting in the lake acquiring oligotrophic characteristics.[26] Mg concentrations in natural waters typically range between 10–50 mg L^{-1}.[17] The average Mg value in this study was found to be 2.46 mg L^{-1}.

The nitrates are the most common mineral form of nitrogen in oxygen-rich waters and is an important factor that can either limit or promote algal growth. It is found in trace amounts in surface waters. The amount of nitrogen is low in oligotrophic waters and quite high in eutrophic waters. NO_3-N, an essential element for the intensive development of phytoplankton, is typically found in waters at concentrations between 1–10 mg L^{-1}. It was determined that the lake water falls between Class I and Class II water quality in terms of the average NO_3-N value. The NO_2 is an intermediate product in the biological oxidation of ammonium to nitrate. The concentration of NO_2 is generally low in natural waters but can reach high levels in areas with organic pollution and low oxygen levels.[26] In this study, it was found that the average NO_2-N values of the lake were classified as Class I water quality. In clean and oxygenated waters, NH_4 compounds are found at very low levels. NH_4 is a waste product of aquatic organisms and is reabsorbed by other organisms.[19] Many algae and higher plants can directly take up NH_4. Generally, NH_4 levels should be 1 mg L^{-1} or less. Based on this parameter, the water quality was considered Class I.[12]

It has been reported that productivity is high in waters with PO_4 content between 0.15 and 0.30 mg L^{-1}, but when the PO_4 content exceeds 0.30 mg L^{-1}, the water is considered polluted. When the phosphate level exceeds 0.50 mg L^{-1}, the water shows excessive pollution and causes eutrophication.[23] Waters with a total phosphorus concentration of 20 μg L^{-1} or higher are considered eutrophic.[27]

The SO_4 is an ion that must be present in natural waters to enhance biological efficiency. If its concentration is insufficient, phytoplankton development is inhibited and plant growth slows down. SO_4 values in natural lakes typically range from 3 to 30 mg L^{-1}.[28] An increase in SO_4 concentrations in aquatic environments, caused by various industrial wastes, agricultural runoff, and domestic effluents, is an indicator of pollution. SO_4 levels greater than 250 mg L^{-1} signify serious contamination.[23] It was found that the lake had Class I water quality based on the average SO_4 concentration.

Pearson correlation analysis was applied to the physicochemical parameters of lake water that show a normal distribution. According to the Pearson correlation analysis with *WT*, very strong positive correlations were observed between BOD_5, *COD* and chloride Cl. A positive correlation was found between *TDS* and NO_3 and sulfate SO_4. Since NO_3 and SO_4 are ions that form part of salts, the of *TDS* in water increases as they dissolve. A negative correlation was found between BOD_5 and *TDS* and SO_4 in relation to *WT* and NO_3. Additionally, a general relationship was observed between SO_4, *WT*, BOD_5 and *COD*. The correlation coefficients from the Pearson correlation analysis are presented in Table II.

TABLE II. Pearson correlation analysis and correlation coefficients. *WT*: water temperature; BOD_5: biological oxygen demand; *COD*: chemical oxygen demand; *TDS*: total dissolved solids; Cl: chloride; SO_4: sulphate; NO_3: nitrate; *: correlation is significant at 0.01 level ($p < 0.01$); **: correlation is significant at 0.01 level (2-tailed). –: indicating that no statistically significant correlation was detected

	WT	BOD_5	*COD*	*TDS*	Cl	SO_4	NO_3
WT	1						
BOD_5	**0.923****	1					
COD	**0.941****	**0.962****	1				
TDS	–0.676	**–0.835***	**–0.878***	1			
Cl	**0.943****	0.777	**0.813***	–0.498	1		
SO_4	–0.582	–0.768	–0.808	**0.927****	–0.390	1	
NO_3	**–0.988****	**–0.930****	**–0.948****	0.682	–0.895*	0.627	1

The *EI*, *OPI* and *NPI* index values of the dam lake were calculated (Table III) using the formulas provided above. When evaluating the *EI* values in terms of stations, they were ranked as 1 < 2 < 3 during the dry season and 2 < 1 < 3 during the rainy season. The *OPI* values were also ranked as 1 < 2 < 3 in the dry season and 2 < 1 < 3 in the rainy season. For the *NPI* values, the ranking was 2 < 1 < 3 in both the dry and rainy seasons. The lowest *EI* value was observed at station 2 during the rainy season (326), while the highest *EI* value was recorded at station 3 during the dry season (23122). The lowest *OPI* value was found at station 2 during the rainy season (3.29), while the highest value was observed at station 3 during the dry season (13.16). The lowest *NPI* value was recorded at station 1 during the dry season, while the highest value was found at station 3 during the rainy season. Water quality index values are presented in Table III.

TABLE IV. Water quality index values (*EI*, *OPI* and *NPI*) of stations in the dry and rainy seasons

Station	Dry season			Rainy season		
	EI	*OPI*	*NPI*	*EI*	*OPI*	*NPI*
1	2835	4.05	2.48	1311	3.62	11.42
2	3981	4.41	1.70	326	3.29	3.75
3	23122	13.16	12.63	16307	12.03	12.53

The Bray–Curtis similarity dendrogram for the stations is presented in Fig. 2. This dendrogram summarizes the similarity of physicochemical data between the stations based on Bray–Curtis similarity analysis. The first and third stations showed the highest similarity (91.60 %), while the second station had a lower similarity to the other two stations (82.35 %).

Fig. 2. Bray–Curtis Similarity dendogram of stations.

Remote sensing methods, which have significantly increased in use in recent years, can be employed to determine both water quality and pollution levels.[28,29] In this study, maps showing the distribution of index values across stations were created using a Geographic Information System (GIS). The index values for the stations were generated using GIS, and the corresponding maps are presented in Fig. 3. The spatial distribution of *EI*, *OPI* and *NPI* index values in dry and wet seasons using the IDW method is also presented in Fig. 3.

In the dry season, *EI* values ranged from 2835 (low) to 23122 (high). Lower values were observed in the western and southwestern parts of the map, particularly near the 1st station, while higher values were concentrated around the center and 3rd station. This was due to a significant decrease in the lake's water level caused by evaporation from warming air, which resulted in high eutrophication index values due to increased NO_3 and PO_4 concentrations. These elevated values in the central regions may indicate the accumulation of nutrient loads, which could contribute to eutrophication (Fig. 3a). During the rainy season, *EI* values decreased significantly, ranging from 326 (low) to 16307 (high). Although there was a general decrease in *EI* values, high values were still observed around the 3rd station. This could be due to the dilution of nutrient enrichment caused by increased precipitation (Fig. 3b).

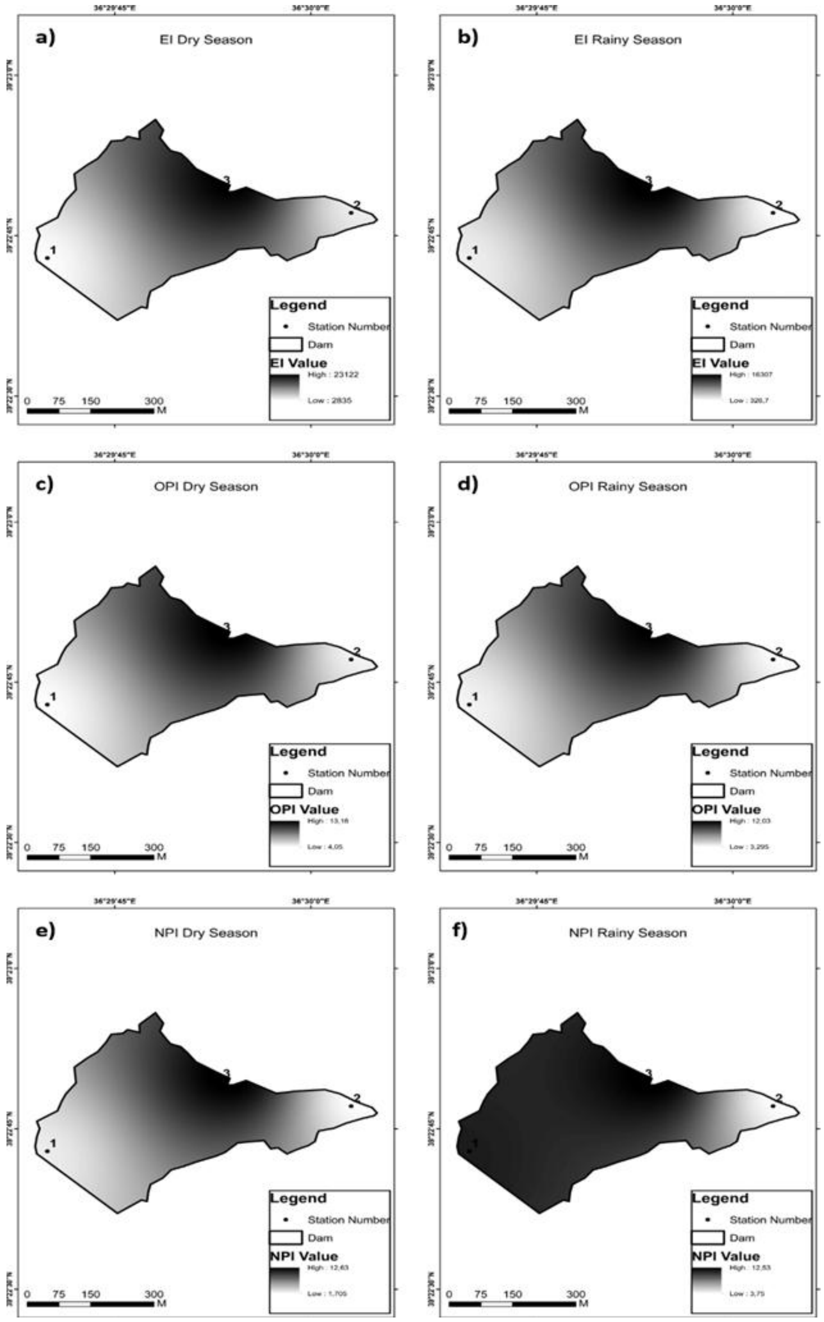

Fig. 3. a) Spatial distribution of *EI* in dry season. b) Spatial distribution of *EI* in rainy season. c) Spatial distribution of *OPI* in dry season. d) Spatial distribution of *OPI* in rainy season. e) Spatial distribution of *NPI* in dry season. f) Spatial distribution of *NPI* in rainy season.

In the dry season, *OPI* values ranged from 4.05 (low) to 13.16 (high). During the rainy season, *OPI* values ranged from 3.29 (low) to 12.03 (high). While *OPI* values generally decreased slightly compared to the dry season, the organic load remained high in the central regions and around the 3rd station (Fig. 3d). This suggests that organic pollution persists even during wetter conditions, particularly near the 3rd station.

In the dry season, *NPI* values ranged from 1.705 (low) to 12.63 (high). High *NPI* values were observed around the 3rd station and some central areas, while the region around the 1st station exhibited low values (Fig. 3e). This indicates moderate to high levels of pollution in the central areas, particularly near the 3rd station. In the rainy season, *NPI* values varied between 3.75 (low) and 12.53 (high). The *NPI* index generally increased across all areas during the rainy season (Fig. 3f), possibly due to the dilution of pollutants and the introduction of additional runoff from surrounding regions.

During the rainy season, *OPI* the values range from 3.29 (low) to 12.03 (high). Although the *OPI* values generally decreased slightly during the rainy season, the organic load remains high in the center and 3rd station (Fig. 3d). In the dry season, the *NPI* index ranges from 1.705 (low) to 12.63 (high). The area around 3rd station and some parts of the center show high *NPI* values in the dry season. The area around 1st station shows low values (Fig. 3e). In the rainy season, the index varies between 3.75 (low) and 12.53 (high). Accordingly, the *NPI* seems to have generally increased in all areas during the rainy season (Fig. 3f). In addition, 3rd station has high values for all three indices, which is an indication that this area is a serious impact zone. In summary, the effect of seasonal variations is evident at all stations.

In this study, seasonal changes in the physicochemical parameters of Maksutlu Dam Lake were analyzed, and the application of pollution indices such as *EI*, *OPI*, and *NPI* revealed varying levels of eutrophication, organic pollution, and nutrient pollution across different seasons. As a result, while our study shows similarities with some studies, it also reveals differences. Anthropogenic activities occurring in water bodies lead to an increase in nutrient levels, reduce water quality and limit its intended uses. Excessive nutrient input causes the overgrowth of aquatic plants, which leads to algal blooms and a decrease in the oxygen content of the water.

CONCLUSION

In the present study, some physicochemical parameters of Maksutlu Dam Lake were evaluated during both dry and rainy periods. According to the results, the average values of *WT*, *TDS*, NO_2-N, NH_4-N, and SO_4 were classified as Class I water quality; the average values of *EC*, *COD*, Cl and NO_3-N were found to fall between Class I and Class II water quality; the average pH value was classified as Class II water quality; and the average values of *DO* and BOD_5 were classified as Class III water quality. The *EI*, *OPI*, and *NPI* index values were also evaluated for both seasons in the study. These index values were analyzed using GIS. In conclusion, the NO_3-N and Mg parameters, along with the water quality index values, indicate that the lake may be oligotrophic. The findings obtained from the study show that the dam lake is suitable for irrigation. It was also found that the lake is under the influence of eutrophication, organic pollution and nutrient pollution. To ensure the sustainability of the dam lake, two suggestions can be made below.

1) These and similar studies should be conducted periodically, and the physicochemical, pesticide and toxicological content of the lake, as well as benthic macroinvertebrates, should be examined and monitored comprehensively.

2) Satellite data and GIS should be utilized for large-scale monitoring of nutrient levels and eutrophication trends in water bodies. Monitoring water quality with satellite data and GIS has been proven to secure the long-term biodiversity and sustainability of water resources, as well as maintain ecosystem health.

SUPPLEMENTARY MATERIAL

Additional data and information are available electronically at the pages of journal website: https://www.shd-pub.org.rs/index.php/JSCS/article/view/13203, or from the corresponding author on request.

ИЗВОД

ВРЕМЕНСКА И ПРОСТОРНА ДИСТРИБУЦИЈА ФИЗИЧКО–ХЕМИЈСКИХ ПАРАМЕТАРА И ИНДЕКСА КВАЛИТЕТА ВОДЕ У ОЛИГОТРОФНОМ ВЕШТАЧКОМ ЈЕЗЕРУ: СЛУЧАЈ ЈЕЗЕРА МАКСУТЛУ, СИВАС, ТУРСКА

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Ова студија је спроведена на три одабране станице у језеру Максутлу Дам (Шаркисла, Сивас), покривајући сушну сезону (август 2023. год.), као и кишну сезону (мај 2024. год.). Из језера су прикупљени узорци воде, а анализирано је укупно 18 физичко–хемијских параметара. Вредности индекса еутрофикације (*EI*), индекса органског загађења (*OPI*) и индекса загађења нутријентима (*NPI*), израчунате су за обе сезоне на основу физичко––хемијских параметара језерске воде. Поред тога, коришћен је Географски информациони систем (GIS) за приказ сезонских варијација у вредностима индекса. На физичко–хемијске параметре воде примењене су Bray–Curtis и Pearson корелационе анализе. Као резултат тога, утврђено је да и физичко–хемијски параметри и индекси квалитета језерске воде показују сезонске варијације. У језеру је детектовано фосфатно загађење и установљено је да језеро може бити олиготрофно у погледу садржаја NO_3 и Mg. Дато је и неколико предлога за одрживо управљање вештачким језером које је настало изградњом бране.

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