

AN ASSESSMENT OF WATER QUALITY OF THE NORTH AND SOUTH PART OF THE SHATT AL-ARAB USING ORGANIC POLLUTION INDEX (OPI)

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Abstract

Water quality indicates to the physical, chemical and biological properties of water based on the standards of it utilize. The current study aims to assess some quality of surface water in some areas of the Shatt Al-Arab using the Organic Pollution index. During the period from October 2018 to September 2019, water samples were assembled from three stations, The stations identify by the presence of aquatic plants and unpopulated, The third station characterized by the A near proximity to residential settlements that deposit hazardous wastes into surface waters and agricultural activity both contribute to this problem. Monthly changes in the organic pollution index show that there is little variation between stations, If the minimum value of the index (6) is recorded in the second station and thus classified as None, and the highest value of (10) in the third station and is classified under the category Weak, The general classification of the Shatt Al-Arab (8) is classified within the category None, The results showed that there are no significant differences between the first and second stations and the presence of significant differences with the third station.

Keywords: Water Quality, Organic Pollution Index (OPI), Shatt Al-Arab, BOD₅.

1. Introduction

Rivers are intricate ecosystems that have been severely harmed, or even devastated, by overuse and expanding the population. rivers and human societies have a close interaction that goes beyond socioeconomic River ecosystems have undergone significant alterations and degradation as a result of industrialization. essential products and services, such as organic compounds, potable water, and water treatment [1]. Aquatic ecosystems typically have a complicated structure that must be appropriately exploited in order to maintain the water system's sustainability and continuity. Additionally, managing aquatic ecosystems demands an awareness of how ecosystem aspects relate to human activity and how to achieve it all without affecting the physical and chemical structure of the aquatic system [2]. Due to climate change and poor water resource management, the Middle East has experienced a severe water shortage in recent years [3] . River estuaries are significant areas for fast economic growth, yet the expansion of human activity and the rising use of water supplies. Therefore, Many rivers' freshwater discharges into the sea have been decreasing [4]. The majority of Basrah's civic, agricultural, and industrial uses rely on surface water. The Shatt Al-Arab River, which runs from north of Basrah to south where it discharges into the Gulf, is the important source of surface water in this region of Iraq [5]. When water is polluted, it spoils the qualities of its fundamental component, which is water, causing significant harm and grave

threats to living things as well as disrupting human balance. Natural waters are exposed to the danger of the occurrence of foreign materials such as pesticides or an increase in the concentration of one of the natural components, such as salts, beyond their natural limits, which leads to harmful effects on people or aquatic organisms. These effects can take one of two different forms, one natural and the other that result from various human activities [6]. In the aquatic environment, nutrients, particularly nitrates and phosphates, have a significant role in the primary productivity and development of plankton, which sit at the base of the food chain's pyramid [7]. The Shatt Al-Arab River's water quality reflects the combined influences of natural and Human-caused factors [8]. While one of the main causes of the organic pollution of the Shatt Al-Arab waters by the discharge of some residential wastewater into the river branches, particularly in the Basrah urban area where the majority of the population is located [9]. The Organic Pollution Index (OPI) is one of the most key considerations that has previously been presented to quantify spatial and season pollution with organic pollutants. [10]. The purpose of this study is to describe the levels of organic pollution in the north and south parts of the Shatt Al-Arab using the Organic Pollution Index (OPI) in order to provide a clear and expressive view of the organic pollution of water and to evaluate the effective variables by assessing the organic pollution index.

2. Materials and methods

2.1 Description of the Study Area

The Shatt Al-Arab is an important river in Iraq, originating at the confluence of the Tigris and Euphrates rivers near the city of Qurna, north of the city of Basrah, and flowing southeast for around 195 kilometers to overflow into the Arabian Gulf south of the city of Faw. The river's width fluctuates from 400 m to around 1500 m, and its depth ranges from 8-15 m, with depths reaching more than that in some locations. [11].

In this study, three stations were selected from the Shatt Al-Arab to collect samples and apply the evidence of organic pollution, the first station (Qurna) .It is located in the district of Qurna, about 2.5 km south of the confluence of the Tigris and Euphrates rivers, within longitude and latitude E: 47° 27 22.74, N: 31° 00 02.7. As for the second station (Al-Deir), it is about (40 km) away from the first station, within coordinates 47°96'37'20'81"E 30.23'18'89'51"N. The third station (Abi al-Khasib) is located at the district of Abu al-Khasib within coordinates 47°96'37'20'81"E 30°23'18'89'51"N (Figure 1).



Figure 1- A map showing sampling stations.

2.2 Organic Pollution index Application

During the study, the organic pollution index, which was modified to suit the Shatt Al-Arab, was applied based on [12]; [13]; [14] to assess the organic pollution in the Shatt Al-Arab waters. In order to give more acceptable results, the time period must first be determined, as the data were collected monthly and over a full year, starting from October 2018 until September 2019. Three main variables were chosen to calculate the index (BOD_5 , PO_4 , NO_3). The Shatt Al-Arab standards were also selected based on the standards contained in the Regulation of Conservation of Rivers from Pollution No. 25 of 1967 to assess the water quality of the Shatt Al-Arab and the American standards of the Environmental Protection Agency [15];[16] (Table 1).

2.3 determination of the organic pollution index

The index was calculated by relying on the following equation and the modified to suit the Shatt Al-Arab by [13].

$$OPI = (\sum C_i / C_{mi}) / n \times 10$$

Where:

C_i are the monitored pollution concentrations in different segments

C_{mi} are the guidelines that stand for the maximal amount of permitted pollution content (Table 1).

N is the Number of variables

Table 1- Maximum allowable limits for organic pollution index variables

Unite	Allowable limits				Index
	The propo	EPA (2001)	EPA (2000)	Iraqi Standards and	

	l for Shatt Al Arab			Metrology Organization 1967	
Mg/L	4	-	-	< 5	BOD₅
Mg/L	0.15	*0.13	*0.04	0.04	PO₄
Mg/L	2	**0.76	**0.9	15	NO₃

* Total Phosphore

** Total Nitrogen

A measure of the organic pollution index (Table 2) divided into seven categories, in which it shows the levels of organic pollution, as the value of the index is compared with this scale to assess the organic pollution in water.

Table 2- Grid evaluation of organic pollution types [13].

Limits	Organic pollution level
9≥	None
10-29	Weak
30 – 39	Moderate (Medium)
40 – 49	Strong
50 – 59	Very Strong (Deteriorated)
60 – 69	Bad
≥ 70	Very Bad

2.4 Statistical analysis

The statistical program Statistical Package for Social Science (SPSS) (V. 20) used to conduct the statistical analysis of some of the study results under the significance level of (0.05).

3. Results and discussion

3.1 Monthly changes in index values

The monthly Changes in the organic pollution index values were observed. a slight variation during the study period (Figure 2, Table 3). The lowest values (1) were recorded in St.2 (Al-Deir) during the month of January, which is classified under the category None, Thus, it is considered Al-Dair station Not polluted as a result of the density of vegetation cover in the area and the lack of population centers.

Lower OPI readings in the spring may be due to increased nitrogen intake by microalgae and macrophytes. [17];[18]. As for the highest values of the organic pollution index (21) it was recorded in the third station (Abi al-Khasib) during the month of November, and thus it is classified within the category Weak, This may be due to the impact of the water of this area on household waste due to its close to the population centers, The area is also exposed to also to the agricultural waste, which has a significant impact on surface water quality [19].

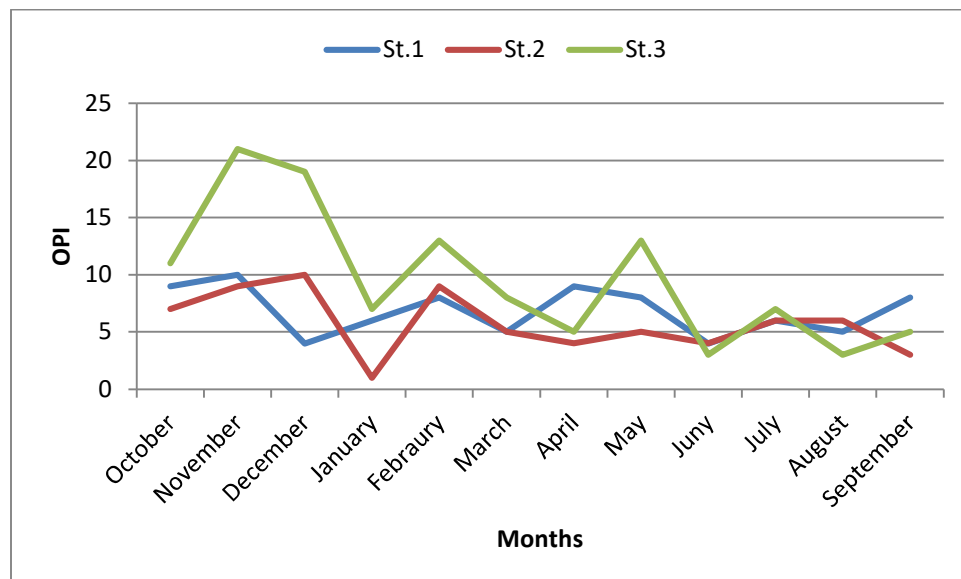


Figure 2- values of the organic pollution index for the three stations during the months of the year.

Table 3- values of the organic pollution index for the three stations during the months of the year.

Months	St.1	St.2	St.3
October	9	7	11
November	10	9	21
December	4	10	19
January	6	1	7
February	8	9	13
March	5	5	8
April	9	4	5
May	8	5	13
June	4	4	3
July	6	6	7
August	5	6	3
September	8	3	5

3.2 Annual averages in index values

There was a slight variance in the annual averages of the index of organic pollution in the study stations, as the first and second station was classified in the None category. While the third stations were classified in the category Weak (Table 4) As for the general average of the Shatt Al-Arab, it is classified under the category None. It might be related to an increase in water flow into the Shatt Al-Arab during the flood season, which has the potential to distribute harmful contaminants in water [20]. The results of the statistical analysis showed that there were no significant differences between the first and second stations While there are significant differences between the first and third stations, as well as differences between the second and third stations.

Table 4- values of the annual averages of the organic pollution index for study stations.

station	Index value	category
St.1	7	None
St.2	6	None
St.3	10	Weak
The general average of Shatt Al Arab	8	Weak

4. Conclusion

The Organic Pollution Index is used for quantitative and descriptive assessment of Shatt Al-Arab water. The results showed that the water quality of the Shatt Al-Arab is generally affected by agricultural activity and population density. according to OPI values the northern part of the Shatt Al-Arab can be classified as uncontaminated (None), As for the southern part of the Shatt Al-Arab, it is classified as low pollution (Weak), The general assessment of the water of the Shatt Al-Arab is classified within the category of weak and this is the result of the abundance of fresh water in the Shatt Al-Arab during the study period and the density of aquatic plants.

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