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ASSESSING OF TROPHIC STATUS FOR SHATT AL-ARAB ESTUARY AND IRAQI MARINE WATERS

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ABSTRACT

During the months of January to December 2019, the nutritional status of the waters of the Shatt al-Arab estuary and Iraqi marine waters was investigated using the trophic state index (TSI) and an average assessment mesotrophic of the two above-mentioned environments using three factors: total phosphorous, water transparency and chlorophyll-a, were chosen three stations, The third station had the highest value of the directory, 49.9 in February, and the third station had the lowest value, 17.8 in December. with transparency, was the Maximal value in April in the third station reached 212 cm, as well as the minimum value, reached 13 cm in November my first station.

KEY WORDS: TSI, Chlorophyll-a, Transparency, Mesotrophic, Total Phosphor, Ecological characteristics

INTRODUCTION

Estuaries are areas where fresh and marine water meet and mix, indicating that land and sea are in contact, They are considered to be among the most productive environments on the planet due to the nutrients carried by rivers, but they are also among the most impacted by humans due to river pollution and activities (Castro and Huber, 2003). The marine ecosystem is marked by significant fluctuations in the abundance and distribution of many species (Laevastu and Larkins, 1981). On the gulf between Iran and the Arabi peninsula, Iraq has a small coastal region. Given the limited length of the Iraqi coastline of 105 km, the continental shelf of 1034 km2, and the territorial waters of 716 km 2 (Earth Trends, 2003). Inlight of the increasing need to provide the requirements to advance the industrial, agricultural and environmental reality and to ensure the vocabulary of food security, water sources have received increasing attention and focus by specialists, and this has accompanied the interest in the deterioration in water quality due to the continuous pollution that occurs in the sources of water systems (Al-Abadi, 2011). Therefore, in many countries, water quality assessment has become a central and major issue, especially in countries that have taken measures to fill the water shortage that may occur in the future (Voral, *et al.*, 2011).

Carlson's trophic state index primarily uses three variables to calculate the trophic index: Chlorophyll-a (Chl-a), Transparency, and Total phosphate (TP). All trophic classifications are based on the division of the trophic continuum into a series of classes known as trophic states (Carlson, 1977). The Trophic Status Index is a classification system for lakes and coasts based on the level of primary productivity, which describes the biological state of the body of water, which is primarily determined by the availability of phosphorus, nitrogen, and light nutrients (Lech, 2001). Knowing the nutritional levels of an aquatic ecosystem is important in assessing water quality, as it is an important indicator of nutrient excess, which can lead to prosperity (Dodds, 2006). The use of the Index in evaluating lakes and coastal lakes (Martinez and Tavera, 2005; Pace and Prairie, 2005) as well asin this Iraqi study in Al-Hammar marsh (Al-Saboonchi *et al*., 2015; Hussain, *et al*., 1991). The present study aimed to evaluate the nutritional status of Shatt Al-Arab estuary and Iraqi marine water using trophic state index for the first time.

MATERIALS AND METHODS

Study area

The study area is in Iraqi marine waters, which differ from those in other parts of the Arabian Gulf due to sediments transported from the Shatt al-Arab (Hussain *et al*., 1991)

Due to the effect of sediments carried by Shatt al-Arab, the underlying nature varies in different parts of the study area. The results of Shatt Al-Arab increased the clay ratio in the northern parts in comparison to the southern parts towards the sea. Corals were abundant in the open waters of the study area, and they were found in most parts of the Arabian Gulf (Jawad *et al*., 2018). with location (29 ° 54′15.84′N; 48 ° 37′24.24' E), first station (29 ° 46' 48.85 ‘N; 48 ° 43′ 53.16 ‘E) second stationand (29 ° 40′ 04.13 ‘N; 48 ° 43′ 43.39 ‘E) third station, and classified as Oligotrophic (low- productive), Mesotrophic (mod- productive), Eutrophic (high-productive), and Hypertrophic (high- productive) based on CTSI values (very high productive), Carlson’s trophic state index values have a wide range of applications.

From January to December 2019, surface water samples were collected monthly from the chosen study station. A trophic state is a biological response to nutrient additions to water bodies. Carlson’s trophic state index primarily uses three variables to calculate the trophic index: Chlorophyll-a (Chl-a), Transparency, and Total phosphate (TP) (Devi and Siddaraju, 2012). A 20 cm perforated Secchi disc with a diameter of 20 cm, painted in two colors, white and black, was tied to along, graduated rope and lowered into the water to determine light transmittance The procedure outlined in (Lind, 1979). The following equation was used to calculate the amount of chlorophyll present.

Chlorophyll a= 11.4*k*{(E665o – E750o) – (E665a – E750a)} *Ve /L *Vf

L=Measuring cell length (cm)

Ve=Volume of acetone used to extract the chlorophyll dye (ml)

Vf=Filter sample volume (L)

K=A constant equal to 2.43

E=Absorption before and after adding the acid

Total phosphorus was measured in a laboratory according to APHA (2005).

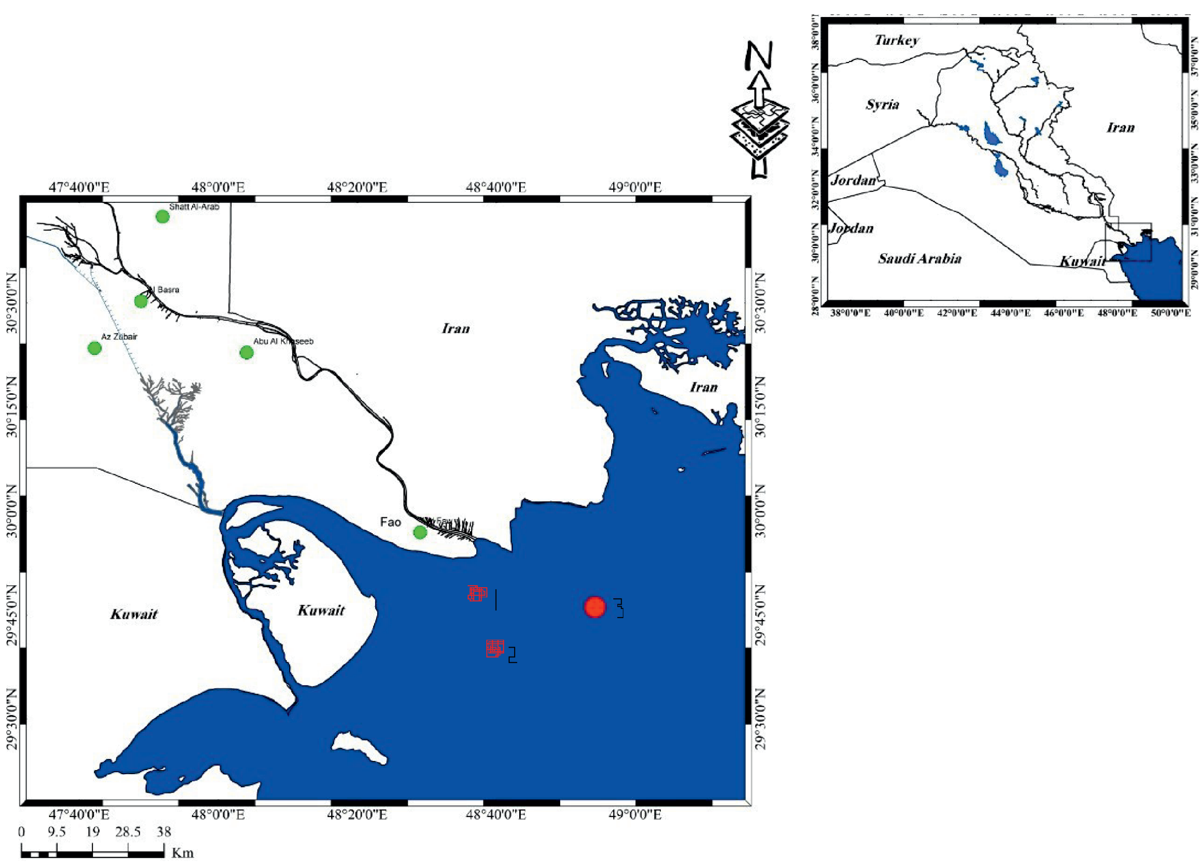

Fig. 1. Northwest Arabian Gulf map showing the location of the studied stations

Trophic state index was calculated according to Carlson (1977) by applying the flowing formula:

TSI (Secchi Disc) = 60 -14.41 Ln (Secchi disc depth (cm)

TSI (Chlorophyll a) = 9.81 Ln (chlorophyll a (µg.l-1) +30.6

TSI (Total Phosphor) = 14.42 Ln (total phosphorus (µg.l-1) + 4.15

Average Trophic State Index= [TSI(TP)+TSI (Chl)+TSI(SD)]/³

RESULTS

Show Fig(2) monthly changes with transparency was the Maximal value in April in the third station was reached 212cm, as well as minimum value, was reached 13cm in November my first station, and for the highest value Total phosphor at in July was reached 0.78 mg/l in the first station and lowest value with total phosphorate in February was reached 0.002 mg/l in the third station (Fig.3). as well as Chlorophyll values are low, as shown in Fig(4), with a maximum of 3.1 mg/m^3 in March and a minimum of 0.01 mg/m^3 in Jon in one station, respectively.

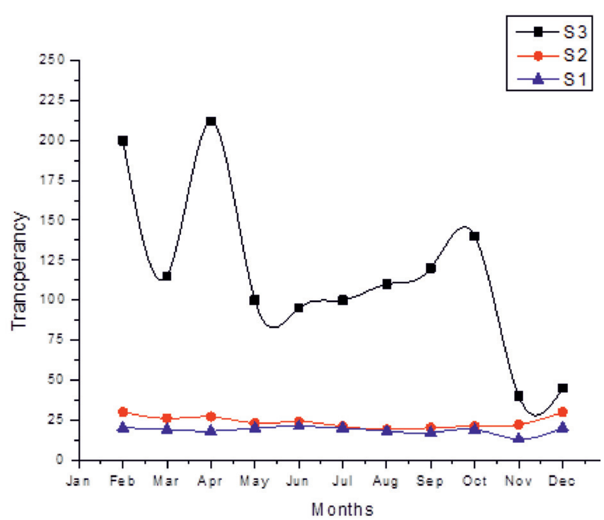

Fig. 2. Illustrate Transparency value During the sample collection period

Table 1. TSI grade and ecological characteristics

Class	Trophic State Index	Ecological characteristics
1	<30	Oligotrophic
2	30-50	Mesotrophic
3	50-70	Eutrophic
4	70-100	Hypertrophic

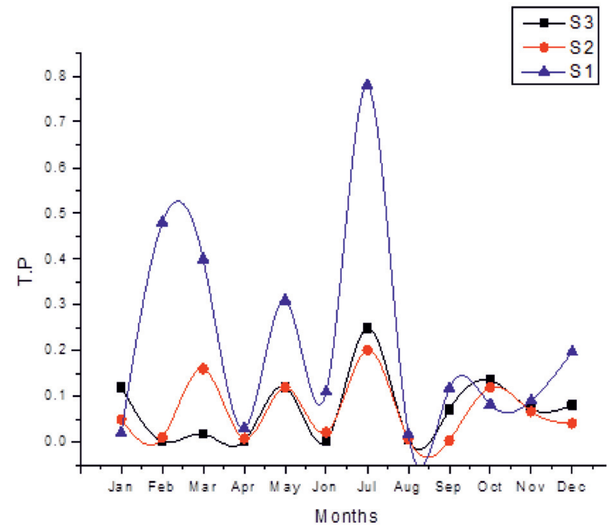

Fig. 3. Illustrate Total phosphor value During the sample collection period

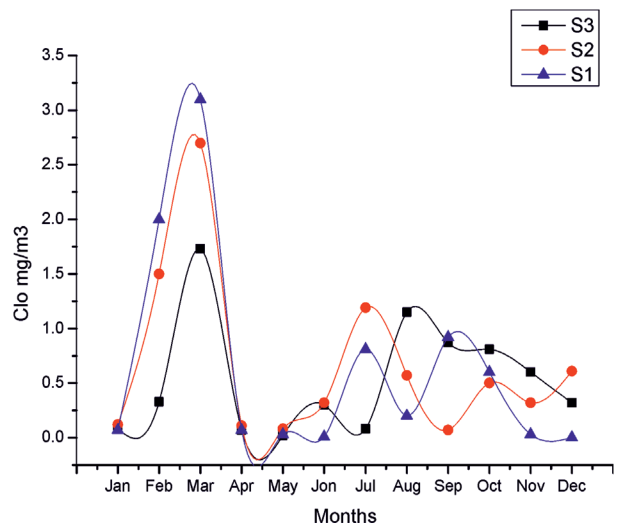

Fig. 4. Illustrate Chlorophyll a value During the sample collection period

Table 1. shows the TSI classification. Depending on how the final value appears to TSI.

In February, the index reached a maximum of 49.9 in the mesotrophic classification and a minimum of 17.8 in the station three classifications in December (Figure 5).

As shown in Fig. 6 The highest average year TSI value was reached 36.2 in two stations, which is classified as mesotrophic, and the lowest with TSI value was reached 34 in station one, which is also classified as mesotrophic

Table (2) explains why the coasts of Limassol, Cyprus, receive a mesotrophic evaluation with a degree of 38.

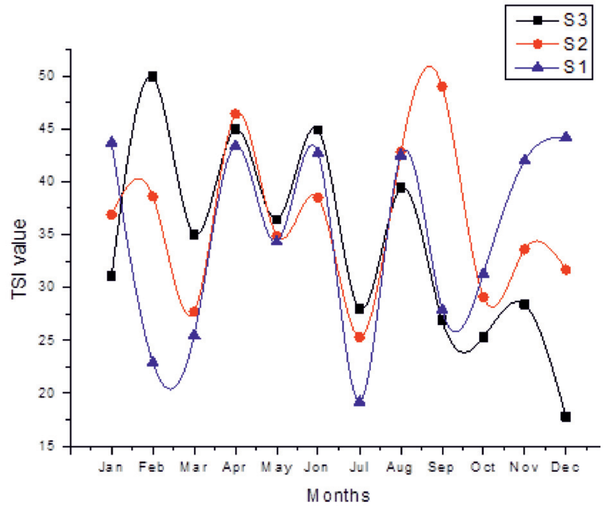

Fig. 5. Illustrate TSI value During the sample collection period

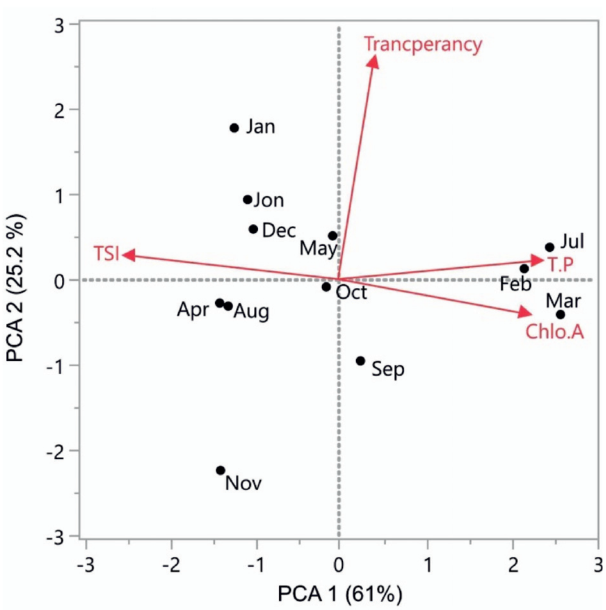

Fig. 7. Illustrate PCA analysis between and three factors in the first station

The Conoco analysis in Figure (7) shows that the Trophic Status Index has a positive correlation with the total.

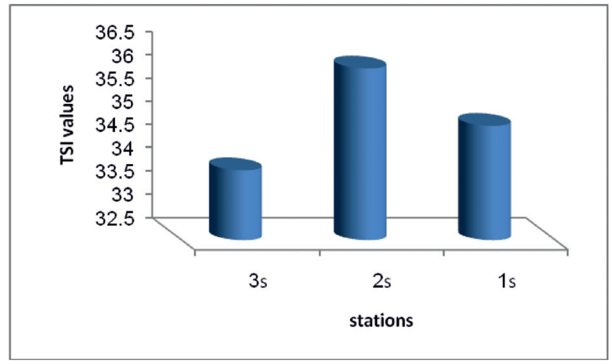

Fig. 6. Illustrate average year TSI value During the sample collection period

phosphorus and transparency factors in the first station, and inversely "with the concentration of chlorophyll due to a lack of primary productivity of algae, as well as the effect of salinity and the increase in silt caused by continuous water mixing. Figure (8) depicts the inverse relationship between the index and total phosphorus as well as the lack of phosphorus in the second station

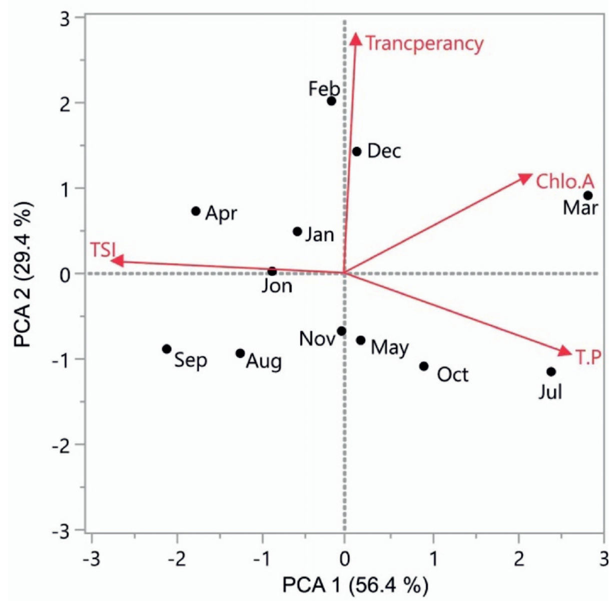

Fig. 8. Illustrate PCA analysis between TSI and three factors in the second station

Table 2. Explain the TSI evaluation in the present study and around the world.

Evaluation (TSI)	Country	Place	Year	Reference
Mesotrophic	Cyprus	Limassol Coastal	2014	Papoutsa and Hadjimitsis, 2014
Oligotrophic	Romania	Adriatic sea	2016	Fiori, *et al.*, 2016
Hypertrophic	Brazil	Patos lagoon estuary	2017	Marrero, *et al.*, 2017
Eutrophic	Egypt	Like timsah	2018	El-Serehy, *et al.*, 2018
Mesotrophic	Iraq	Shatt Al-Arab estuary and Iraqi marine water	2019	Present study

Due to the lack of vegetation cover and the large water depth in the station, the index is little correlated with chlorophyll a. Figure (9) shows the correlation of the index with transparency in the third station, as well as that transparency positively affects the index. The findings of this study also shows that the case's TSI was influenced by the depth of the water and the lack of vegetation.

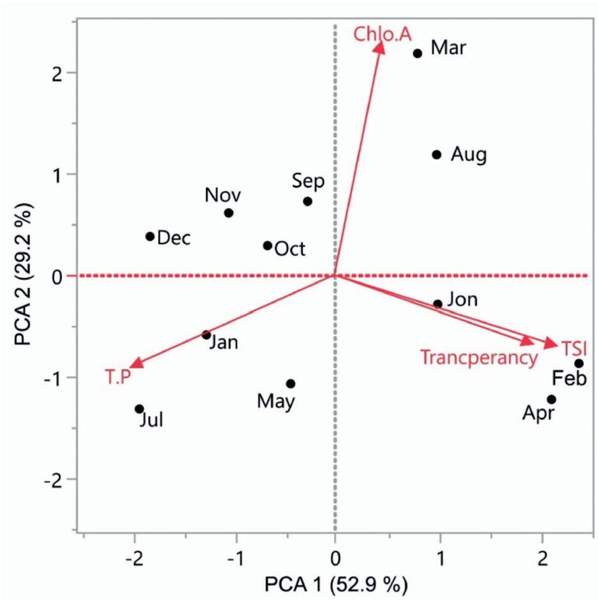

Fig. 9. Illustrate PCA analysis between TSI and three factors in the third station

DISCUSSION

Differences in trophic levels among selected groups of species are a reliable indicator of an ecosystem's health. The marine trophic index measures regional and global changes in the mean trophic level of fish communities. The trophic level of an organism is defined as its position in the food chain, and it ranges from 1 for primary producers to 5 for marine mammals and humans. The trophic level of a consumer is calculated by adding one level to the mean trophic level of its prey (Pavlik and Bij, 2017). As Devi and Siddaraju (2012)emphasized the significance of the TSI as a water quality indicator, which represents the relationship between three variables compiled by Carlson (1980). It's a useful tool for assessing the water environment because it's all in one place, The Shatt al-Arab estuary and Iraqi marine waters were classified as Mesotrophic in this study, which resulted in continuous mixing processes in the downstream area, as well as rains that work to release phosphates from sediments and their low consumption by plankton and other organisms (Devi and Siddaraju, 2012) According to Al-Shamary, *et al.*, (2020). phosphorus is also a determinant element for the growth of algae and thus the lack of algae and aquatic plants in the month of the year (2019). The Shatt Arab Estuary and Iraqi marine waters are being studied. Because the mixing is continuous and clear in the downstream area, and this is in agreement with Fiori *et al.*, (2016) it reached its highest levels in the first station, 3.5 mg/m^3, and because the mixing is continuous and clear in the downstream area (2016). They blamed the lack of nutritional enrichment and chlorophyll a in the Adriatic Sea on the lack of nutritional enrichment and chlorophyll a in the sea. Also, estuaries of coastal rivers and bays show the development of a nutritional status indicator and be a characteristic of nutritional enrichment, and the index can be used as a simple examination tool for the gathering of information within three years dividing individual bodies of water into broad categories based on their nutritional status (Boyle, *et al.*, 2013). The TSI is evaluated at 36 in this study, which is moderately mesotrophic and does not agree with the Fiori *et al.*, (2016) study when it is studied on the Adriatic Sea in Romania, where it is evaluated at 29 and is oligotrophic, which agrees with the study of Papoutsa and Hadjimitsis (2014). Table (2) explains why the coasts of Limassol, Cyprus, receive a mesotrophic evaluation with a degree of 38. The lack of vegetation cover in Iraqi marine waters has resulted in her being classified as mesotrophic, which could be the result of continuous mixing processes caused by tidal processes and the nature of the downstream and sea levels, not to mention the high salinity low levels of total phosphorous, and low levels of high transparency, which according to Al-Shamary *et al.* (2020) during their study of the Shatt al-Arab estuary and Iraqi marine waters, this resulted in a decrease in trophic state index, which had an impact on the communities of aquatic organisms that live there, which affects the aquatic communities and the diet

CONCLUSION

The nutritional status of marine water was revealed in the study to fluctuate in height and decrease during the study period as a result of a decrease in chlorophyll-a concentration in the study stations and a rise in total phosphate in the first station as a result of continuous mixing of water and the movement of working boats, as well as an increase in turbidity levels as well as an increase in transparency in the third station as a result of the third station's high depth, which increased the level of organic matter and nutrients, resulting in an average nutritional status rate of oligotrophic.

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