The influence of organic pollution resulting from the connection of some polluted small rivers to the Shatt al-Arab on the fish assemblage

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Abstract

Due to the lack of studies dealing with the influence of organic pollutants on fish assemblages in the Shatt Al-Arab River, the present study was done to explain the impact of these pollutants on the composition, abundance, and diversity of fish in the river near the points of discharge of these rivers in the Shatt Al-Arab River. The samples were collected monthly from January to December 2024. Some ecological parameters were measured in the study region As water temperature, salinity, hydrogen ion concentration, dissolved oxygen, biological oxygen demand, total nitrate, and total phosphate. Out of the total of 26 fish species that were caught, five were native, eight were exotic, and 13 were marine fish species belonging to 20 genera, 15 families, and nine orders, all of them affiliated with the bony fish Osteichthyes class. Four species recorded the highest values of numerical relative abundance and formed 68.64% of the overall number of species. The present study concluded that the region has high organic pollutants and total nitrate and phosphate concentrations, with a clear impact on the composition, abundance, and diversity of fish assemblages near these rivers, particularly those meeting the Shatt Al-Arab River.

Keywords: Organic pollutants, Fish assemblage, Al-Ribat River, Al-Ashar River, Al-Saraji River.

Introduction

The Shatt Al-Arab River is a significant waterway in southwestern Asia (Olson and Speidel, 2024). The river ecosystem supports many small rivers and regional ecosystems in the area, which contain diverse organisms, including fish populations (Abdullah and Aldoghachi, 2024). Neuromas factors can affect healthy and reduce survival rates of fish assemblages in the river, such as thermal stress, salinity, oil pollution, industrial effluents, and agricultural runoff. All these factors can cause habitat degradation (Lateef *et al.*,

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2020). Organic pollution reduces biodiversity via the departure of sensitive species and the survival of resistant fish species, resulting in changes in species composition that may change the ecological functions and interactions within the ecosystem (Chakraborty and Chakraborty, 2021). Oxygen depletion is one of the results of organic pollution by excessive growth of algae, which causes the phenomenon of eutrophication. When these algae die and decompose consume the oxygen levels in the water and cause hypoxia for fish and other organisms (Akinnawo, 2023; Mishra, 2023). Organic pollution can shift the chemical and physical features of the aquatic environments, reduce the availability of habitats for feeding and spawning, increase sedimentation, alter vegetation, and vary the water chemistry. These consequences may alter habitats and then the composition of fish assemblages (O'Mara and Wong, 2016). The present type of pollution can impact the food web by affecting the primary reproductive communities of invertebrate species, and it can result in enormous effects on diversity, abundance, and spawning, with a reduction in the structure of fish communities (Fremlin *et al.*, 2020). Pesticides, heavy metals, and pharmaceuticals are perhaps one of the components of organic pollutants that may cause fish to become toxic. Exposure for a long time can cause a chronic effect that changes behavior, physiological, and reproductive processes, increases mortality, decreases diversity, and affects fish assemblages (Krause *et al.*, 2019).

Organic pollution usually contains household pollutants that include large amounts of nitrate and phosphate, which may cause the eutrophication phenomenon that happens via increased nitrate and phosphorus concentrations that harm fish populations (Akinnawo, 2023). However, fish assemblage is affected by biotic and abiotic factors; the biotic factors are represented by competition of other organisms in habitats and replacements of Iraqi native fish by tilapia species from Cichlidae that have many features that cause these species dominance (Fernando and Suarez, 2021). Abiotic parameter also influences the composition of fish communities, such as water temperature and salinity, which play an important role in the spread and distribution of fish species, and hydrogen ions and oxygen concentrations, along with other factors (Gebrekiros, 2016). Fish assemblages that are subjected to anthropogenic activities or effects, especially pollutants, exhibit an important ecological change, including reduced biodiversity, and a shift composition of species and conversion of functional features (Zhang *et al.*, 2024). The character of fish populations in highly degraded environments prefers resisting species such as Carassius gibelio, Oreochromis niloticus, O. aureus, and Coptodon zillii that can live in polluted habitats, whereas the absence or decline of sensitive species is noted (Yongo *et al.*, 2021). Polluted rivers show a reduction in species richness and diversity, and a change in functional and structural characteristics, with bioaccumulation of contaminants (Aldoghachi and Abdullah; Lee *et al.*, 2023).

There is no paper dealing with the effect of organic pollutants on the structure of fish communities in the Shatt Al-Arab River, except for Hussain *et al.* (1995), who dealt with the influence of low salinity, temperature, and domestic sewage on the distribution of fish assemblage in the Shatt Al-Arab River. There are many studies focused on fish population composition and the conditions factors that affect distribution, abundance, and widespread. Mohamed and Abood (2017) studied compositional change in fish assemblage structure in the Shatt Al-Arab River. Mohamed and Hameed (2019) investigated the impacts of saltwater intrusion on the fish assemblage in the middle part of the Shatt Al-Arab River, Abdullah *et al*. (2023) studied the influence of some ecological factors on fish diversity and abundance in the Al-Huwyzah marsh south of Iraq.

The present study focused on the impact of organic pollutants from the branching river of the Shatt Al-Arab River on the composition, richness, abundance, and occurrence of certain species of fish assemblage.

Materials And Methods

Description of study area

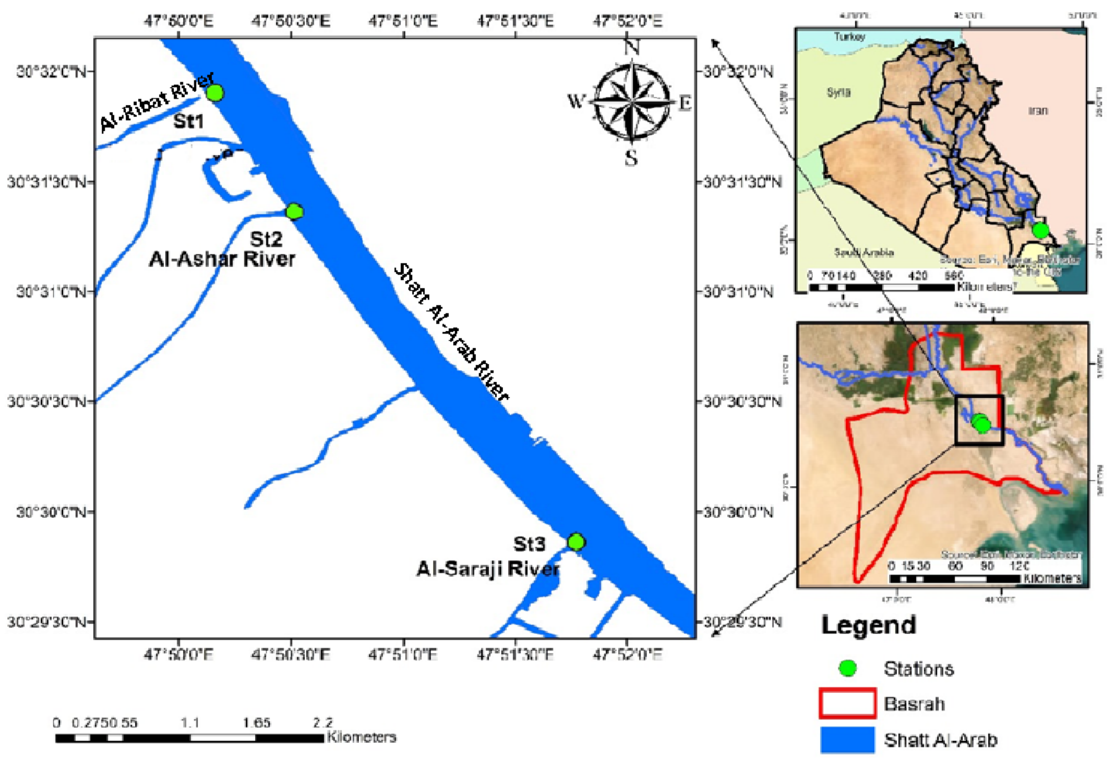
The present study discussed the organic pollutants in some rivers branching from the Shatt Al-Arab River, including the Al-Ribat River, Al-Ashar River, and Al-Saraji River (Figure 1). The Ribat River is a small tributary of the Shatt Al-Arab River in Basrah. It flows through the city's urban areas. It is 5.5 km long and 8 to 15 meters wide. It is currently polluted with household waste. The Al-Ashar River is 4.5 km long and has a width of 7 to 10 m, and it extends into urban areas. The Al-Saragi River extends to 5.3 km and has a width of 6 to 10 m (Mawat and Hamdan, 2024).

The current rivers are subjected to large quantities of organic pollutants from household use. Rivers have varying widths and lengths between 6 to 12 meters with depths between one meter to four meters. The samples were obtained monthly from the Shatt Al-Arab River in the period from January to December 2024. For data collection, three stations were chosen: Station 1 was at the meeting point of Al-Ribat River with the Shatt Al-Arab River (N 30°31' 53″, E 47° 49' 59″); station 2 at the confluence of Al-Ashar River with Shatt Al-Arab River (N 30°31' 30″, E 47°50' 42″); station 3 at the joining of Al-Saraji River with the Shatt Al-Arab River (N 30°29' 44″, E 47° 51' 54″) (Figure 1). Some ecological factors were measured at the same time as the sampling: water temperature (-10 to100°C) was measured with a mercury thermometer. Salinity and hydrogen ions were measured using a Lovibond-Sensor Direct 150, made in Germany.

Dissolved oxygen (DO) and biological oxygen demand were measured according to Welch (1964). Total nitrate was estimated according to Parsons *et al*. (1984), and total phosphate was determined according to Murphy and Riley (1962). Fish samples were collected monthly from the three stations using fixed and draft gillnets, cast nets, and electro-fishing with an electric generator (400–500 volts, 10 amps). Fricke *et al*. (2022) and Froese and Pauly (2024) were used to classify the fish species. The ecological indices used to evaluate the fish assemblage in the present study region. Relative abundance was estimated in the equation % = (ni / N) 100, where ni= number of individuals of a species in the sample and N= the total number of individuals of all collected species. According to Walag *et al*. (2016). Occurrence Common species (> 50), rare species (6-50), and very rare species (< 6). by Tyler (1971). Fish diversity was measured as follows: $H=-\sum pi \ln pi$, where

H= diversity index and P_i = the proportion of individuals in the (i) the species by Huang *et al.* (2019), and richness in the equation $D= S-1/\ln N$ where D= richness index N= number of all individuals in samples, and evenness in $J= H/\ln s$ where J= evenness index and S= number of species, followed by Nyitrai *et al.* (2012).

Figuer1: A map illustrating of study area, the three rivers branching from the Shatt Al-



Arab River.

Statistical analysis

The analysis of statistics was conducted using the Statistical Package for the Social Sciences, Version 20 (SPSS), to examine the correlation among the stations. Excel 2016 was used to create the diagrams and analyze the ecological factors and their relationships. The same program, One-Way ANOVA (Analysis of Variance) used to compare the means of the three stations of abiotic factors, total nitrate, phosphate, the number of species, and individuals to notice statistically significant differences among them.

Results

Ecological parameters

Water temperature rates fluctuated from 13°C in January to 34°C in August, with the mean ± SD 24.83 ± 7.541, while the salinity varied from 1.91 psu in March to 3.91 psu in September, with the mean ± SD 2.69 ± 0.72. These values included all the study areas extending on the Shatt Al-Arab River near the three rivers meeting points (Figure 2). A weak positive relationship was shown ($r= 0.374$) between temperature and the species number. A weak negative correlation ($r= -0.098$) was found between the species number and salinity. The relationship between water temperature and the number of individuals (r= 0.468) appeared to be a weak positive relationship. In contrast, the relationship between salinity and the number of individuals revealed (r= -0.022) a negative correlation. The monthly changes in the temperature mean and salinity mean show no significant differences (P> 0.05) among the three stations.

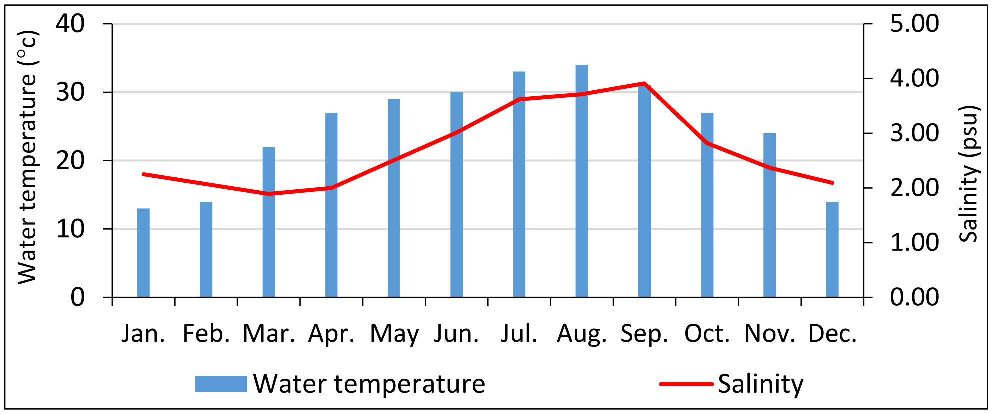


Figure 2: Monthly variations in the water temperature and salinity in the study region.

The concentration of hydrogen ion values varied from 7.49 in November to 8.63 in January, with a mean ± SD of 7.86 ± 0.268. A negative correlation was noticed (r= -0.032) between hydrogen ions and the number of species. The values of dissolved oxygen shifted from 6.61 mg/l in August to 9.87 mg/l in December, with a mean ± SD 8.666 ± 1.084. Biological oxygen demand (BOD5) ranged from 0.58 mg/l in January to 4.08 mg/l in August, with a mean ± SD of 2.30 ± 1.26 (Figure 3). No significant differences were found in the monthly means of hydrogen ion, dissolved oxygen, and biological oxygen demand (P> 0.05) among the stations.

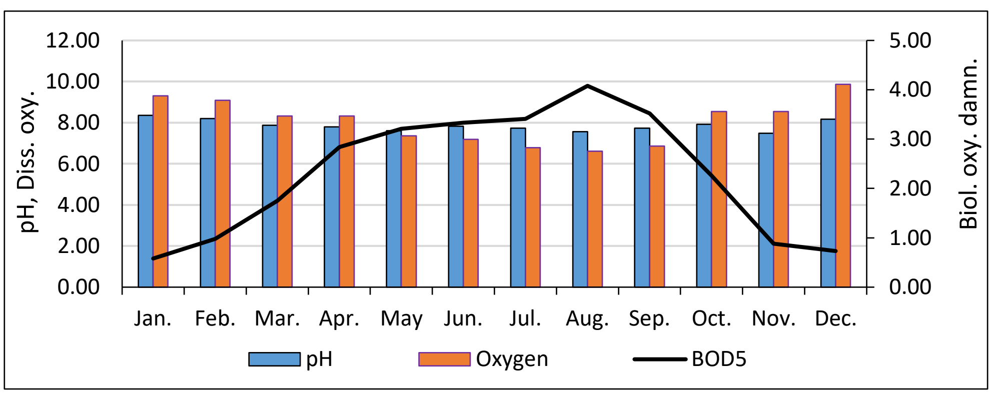


Figure 3: Monthly changes in hydrogen ion, dissolved oxygen, and biological oxygen demand in the present study region.

There is a slight variation in values of total nutrients in the study region among the study months (Fig. 4). The lowest value of total nitrate ranged from 0.63 mg/l in May to 3.88 mg/l in December (mean ± SD 1.59 ± 1.191), but the concentrations of total phosphate ranged from 0.42 mg/l in April to 1.07 mg/l in January (mean ± SD 0.74± 0.219). All these values included the study areas near the point of meeting the three rivers, with the Shatt Al-Arab River. A positive relationship was detected between total nitrate and the number of species (r= 0.464) in the study area. A weak relationship (r= 0.232) was detected between total phosphate and the number of species. The monthly fluctuations in the means of nitrate and phosphate concentrations in the present study region showed no significant differences (P > 0.05) among the present three stations (Fig. 4).

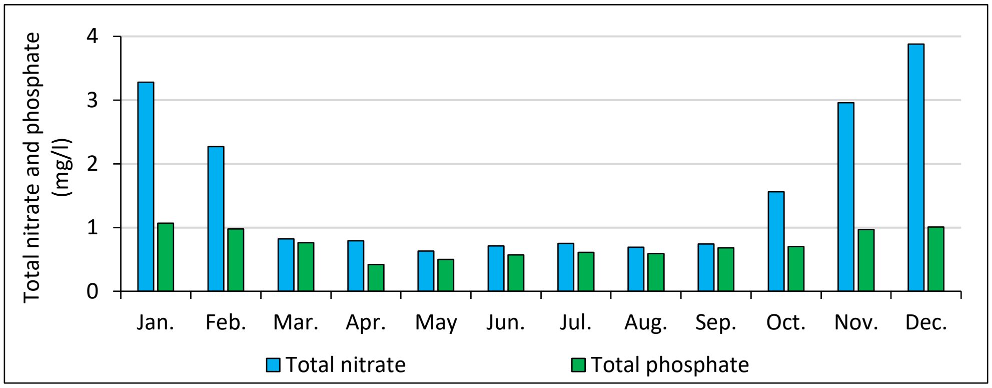


Figure 4: Monthly variations in the values of total nitrate and phosphate in the present study area from January to December 2024.

Organic Pollutants

The current results showed a high percentage of nitrate (NO3-) and phosphate (PO4-) in the Shatt Al-Arab River near the point where the rivers release their discharges. The study recorded a high ratio of organic pollutants like bicarbonate (HCO3), which measured 192 µg/l, and sulfate concentrations in the Shatt Al-Arab pathway attained 192 µg/l (Fig. 5).

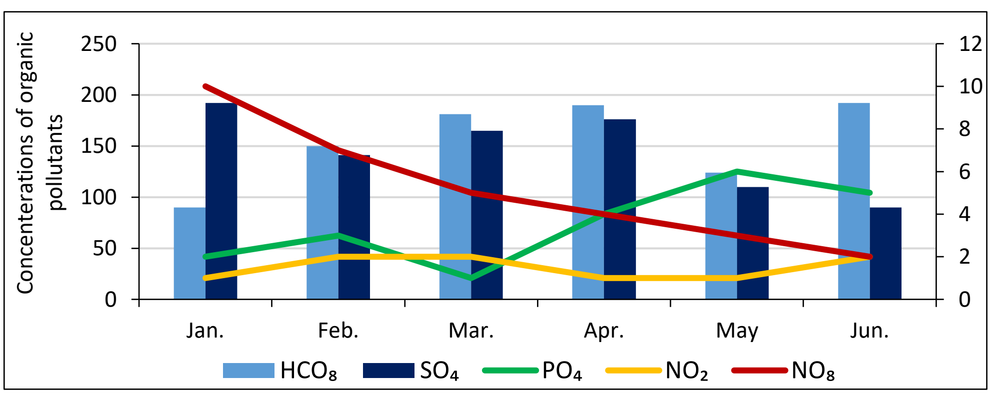


Figure 5: Concentration of organic pollutant materials (HCO3, PO4, SO4, NO2, and NO3) in the Shatt Al-Arb River.

fish assemblage composition

A total of 26 fish species were caught in the present study area; five were native, eight were exotic fish species, and marine species. Overall, species are affiliated with 20 genera, 15 families, and nine orders, all of them affiliated with the Osteichthyes class. Four families share three species each: Cichlidae, Mugilidae, Dorosomatadae, and Engraulidae. The families Sparidae, Cyprinidae, and Poeciliidae consisted of two species each. Eight families contain one species each (Table 1).

Table 1: Fish species, families, and orders in the present study area with refer to native and exotic fish species

Order	Family	Species	Habitat
Cichliformes	Cichlidae	*Oreochromis niloticus*[E]	F
		Coptodon zillii[E]	F
		Oreochromis aureus[E]	F
Mugiliformes	Mugilidae	*Planiliza abu*[N]	F
		Planiliza subviridis[M]	M
		Planiliza klunzingeri[M]	M
Clupeiformes	Dorosomatadae	*Tenualosa ilisha*[M]	M
		Nematalosa nasus[M]	M
		Sardinella albella[M]	M
	Engraulidae	*Thryssa whiteheadi*[M]	M
		Thryssa vitrirostris[M]	M
		Thryssa hamiltonii[M]	M
Siluriformes	Siluridae	*Silurus triostegus*[N]	F
Percifomes	Sillaginidae	*Sillago sihama*[M]	M
	Sparidae	*Sillago arbicus*[M]	M
		Acanthopagrus arabicus[M]	M
Synbranchiformes	Mastacembelidae	*Mastacembelus mastacembelus*[N]	F
Acanthuriformes	Scatophagidae	*Scatophagus argus*[M]	M
Eupercaria	Gerreidae	*Gerres limbatus*[M]	M
Cypriniformes	Cyprinidae	*Carassius gibelio*[E]	F
		Cyprinus carpio[E]	F
	Poeciliidae	*Gambuzia holbrooki*[E]	F
		Poecilia latipinna[E]	F
	Cyprinodontidae	*Aphanius dispar*[N]	F
	Leuciscidae	*Alburnus mossulensis*[N]	F
	Xenocyprididae	*Hemiculter leucisculus*[E]	F

*N= Native species, E=Exotic species, M= Marine species

Number of species and individuals

The diagram addressed evident variations in the number of species among the sampled months in the study region in the study areas near the point of meeting the three rivers, with the Shatt Al-Arab River. The number of species varied from 12 species in November and December to 21 species in March and April, with the mean ± SD 15.42 ± 3.09. The number of individuals in the present study region, 2222 individuals, differed from 100 individuals in December to 289 individuals in May, with a mean ± SD of 1185.17 ± 60.83 (Figure 6.). The analysis of the data detected a significant positive correlation (r= 0.713*) between the number of species and individuals. The analysis of the data showed no significant differences (P > 0.05) in the number of species and individuals among the three stations.

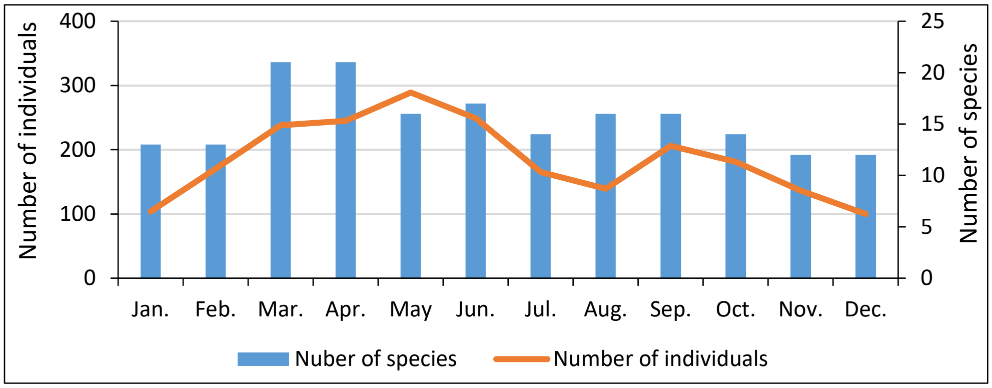


Figure 6: Monthly changes in the number of species and individuals in the current study area from January to December 2024.

Diversity of fish fauna

Fish fauna in the freshwater is divided into three parts: Native fish species included five species, forming 19.49% of the overall catch, ranging from two species in June and December, and five species in March and April, with a mean ± SD of 3.5 ± 1.09. Exotic species count eight fish species, constituting 65.03% of the total catch. Varied from five species in May and September to eight species in April, with a mean ± SD of 6.08 ± 0.79. Marine species accounting for 15.48% of the overall catch differ from two species in November to 10 species in March, with a mean ± SD of 5.67 ± 2.53 (Figure 7).

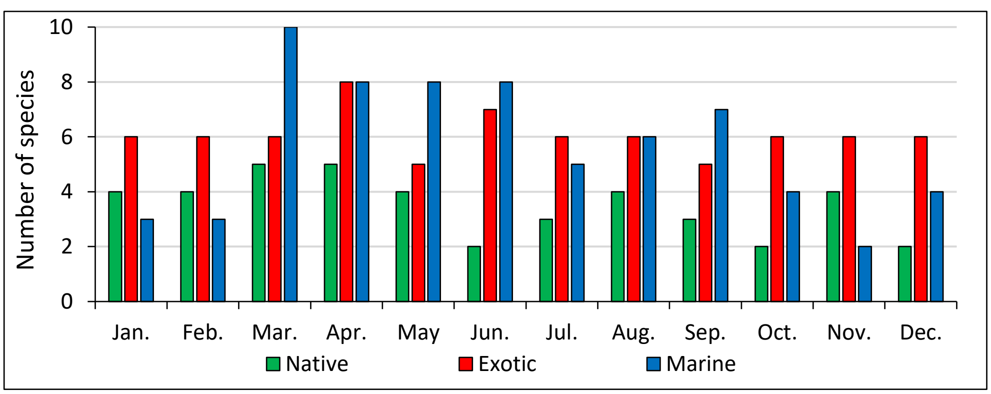


Figure 7: Monthly variations in the native, exotic, and marine fish species in the Shatt Al-Arab River.

Relative abundance

Four species recorded the highest values of relative abundance in the present study region, forming 68.64% of the overall number of species in the current work. The species C. gibelio is the most abundant, accounting for 23.36% of the total number of species. The species *O. niloticus* constituted 18.23% of the overall catch. Species *O. aureus* harvested 14.22%. The species *P. abu* formed 12.83% of the overall catch (Table 2).

Table 2: Monthly changes in the relative abundance in the present study area from January to December 2024.

Species	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
C. gibelio	22.12	11.76	34.03	16.33	15.22	28.51	24.85	25.18	31.55	20.44	29.41	22	23.36
O. niloticus	17.31	23.53	9.24	13.47	30.10	15.66	12.12	13.67	16.99	24.86	22.79	16	18.23
O. aureus	13.46	16.47	10.92	14.29	10.03	16.06	13.94	14.39	14.56	11.60	18.38	25	14.22
P. abu	11.54	10.59	10.50	15.51	14.53	13.25	16.97	11.51	10.68	11.05	8.82	19	12.83
T. whitehaedi		2.94	7.14	7.76	7.61	6.02	7.88	6.47	8.25	10.50			6.12
C. zilli			4.62	4.08	4.50	3.21	3.03	1.44	3.88	6.63	6.62		3.51
T. ilisha		11.76	5.04	4.49	2.77	0.40	1.21	2.16		0.55			2.61
A. mossulensis	8.65	8.24	2.94	1.63	1.38			1.44		2.76	4.41	5	2.52
S. triostegus	4.81	3.53	1.68	3.67		0.80	3.64		0.97	1.66	0.74		1.71
P. latipinna	1.92	1.76		1.63		3.21	3.64		1.46	3.31		1	1.49
G. holbrooki	0.96		1.26	2.86	1.73	2.41		6.47			0.74	1	1.49
Cyprinus carpio	9.62	2.35	0.84	1.22			1.82			2.21	2.94	2	1.44
Aphanius dispar	2.88	2.35	1.26	2.04	2.08			1.44	2.91		1.47		1.40
A. arabicus			1.68	2.86	1.73	0.80		4.32					1.08
H. leucisculus		3.53		0.82		4.42		4.32		2.21			1.31
P. subviridis			1.26	0.41	2.08	1.61	4.85		1.94	1.10			1.26
M. mastacembelus			1.26	0.82	1.38		3.64	3.60	1.46				1.04
P. klunzingeri	1.92			1.63	0.00	2.01			0.97			2	0.68
S. sihama			1.68		1.73			1.44			2.21		0.63
S. argus	2.88	1.18	0.42				1.82					3	0.54
G. limbatus	1.92		1.26			0.40			1.94			2	0.54
T. hamiltonii			0.84	2.45	1.04				0.49	1.10			0.63
N. nasus			1.68		2.08	0.40			0.49			2	0.63
T. vitrirostris				1.22				0.72			1.47		0.27
S. albella			0.42			0.80			1.46				0.27
S. arbicus				0.82			0.61	1.44					0.23

Discussion

Fish have an ectothermic nature; therefore, temperature has a significant influence on fish activity, especially their body temperature and metabolism, which are heavily influenced by the ambient environment (Alfonso and Sadoul, 2021). An increase in metabolic rate with a temperature up to certain limits led biochemical reactions and rise enzyme activity to speed up in the body of fish and resulting in increased metabolic rate, which required more oxygen and energy (food) to maintain the vital activities which represented by reproduction, respiration, swimming, and digestion (Prabu *et al*., 2023). The rates of metabolism slow in the cool water and result in a reduction in the fish activity, including consumption of food, slow growth, oxygen demand, and decline in movement (Reeve and Speers-Roesch, 2022). When the optimal temperature range is exceeded, the metabolic rate becomes too high, leading to hypoxia (because warmer water contains less dissolved oxygen), thermal stress, and mortality, reduction in immune function, and decreased reproductive functions (Bulbul Ali and Mishra, 2022). The response to temperature is specific to species, each species has an optimal temperature, e. g. salmon fish, which has a lower optimal temperature range than e. g. common carp (Volkoff and Ronnestad, 2020). Temperature varies according to daytime, season, pollution, climate change, and geographical location, and can control survival, growth rate, and distribution of fish, leading fish to migrate horizontally or vertically due to their temperature preferences, when the temperature rises, as in the present results (33°C in July and 34°C in August it may cause thermal stress (Alfonso and Sadoul, 2021: Cooke *et al.*, 2022).

Salinity means salt concentrations in the water, which impact fish osmoregulation. Dugan (2024) refers that high salinity indicates the availability of sat ions in the water (e.g. Na^+, Mg^{2+}, Cl^-, Ca^{2+}). Salinity is some significant environmental parameters that have a critical effect on fish physiology, biodiversity, and distribution (Agarwal *et al.*, 2024). Fish have osmoregulators that maintain internal balance by specialized organs such as kidneys, intestines, and gills (Natochin, 2019). Salinity gradient marine transition habitats, freshwater, estuaries, and lagoons, can form the structure of fish assemblage, which is clear through examining the structure of the estuary rivers where fish composition varies with prolonged the river section toward the sea (Abdullah and Aldoghachi, 2024).

Generally, elevated salinity can work in an antagonistic manner to reduce the bioavailability of pollutants and toxicity in the aquatic environment and convert them to less bioavailable or toxic forms by complexation and ion competition, like (Cd+2 or Pb+2, Zn) in pollutant areas of aquatic environments (Waqas *et al.*, 2024). Salinity range in the present study is within the range of the Basrah rivers, with a slight increase in the concentrations.

Presence of bicarbonate and carbonate in the soil of river bottoms makes hydrogen ion values heading towards the alkaline direction, this consequent is consistent with the pH results of most studies in the south of Iraq (Abdullah and Aldoghachi, 2024).

Dissolved oxygen (DO) and biological oxygen demand (BOD) have a negative relationship. The results detected that there is a moderate range with the lower and upper limit values (6.61- 9.87mg/l), which may be due to the presence of pollutants in the study region, which reduce oxygen concentrations in the aquatic environment (Abdullah and Aldoghachi, 2021: Lv *et al.*, 2024).

There is a noticeable decrease in total nitrate values from March to October, with a clear increase in concentration during the remaining months. Household waste is a major nitrate source in the work region, in addition to the presence of other sources that caused an increase in nitrate concentrations during some months. The plant flowering period, due to the high temperature during March to October, led to a decrease in nitrate concentrations, while they increased during the cold months (Ye, *et al.*, 2021; Cao *et al.*, 2022).

Total phosphate concentrations differ significantly due to many agents, including both natural and anthropogenic factors, especially in the polluted regions. Human sources, which include household discharge, agriculture runoff, and urban runoff, whereas the natural sources that can influence phosphate levels are organic matter decomposition, geological weathering, and soil erosion; therefore, the present study recorded high concentrations of phosphate (Bi *et al.*, 2022).

In the context of organic pollutants, the chemistry of water influences the structure of fish assemblages by altering the toxicity, suitability, and food web dynamics of habitats (Lee *et al.*, 2023). The availability of various compounds and materials such as HCO3, PO4, SO4, NO2, and NO3 in the fish habitats significantly affects fish communities via influencing water chemistry, toxicity, productivity, and the ecosystem. For instance, moderate levels of HCO3 support stable hydrogen ions, maintain fish health, livelihood, and fish biodiversity (Abdullah and Aldoghachi, 2024).

Pollutants in the Shatt Al-Arab River have significantly influenced fish assemblage structure. Contamination comes from many sources, including household effluents, agricultural fertilization, and industrial. These substances can impact on structure of the fish assemblage (Piria *et al.*, 2019).

Hussain *et al.* (1995) pointed out that untreated domestic sewage has significant variations in fish assemblage abundance and composition, resulting in a large reduction in the number of some species at polluted stations. There is a negative correlation between fish occurrence and habitat degradation. This study is compatible with the present results. Increased pollutants caused habitat degradation, the release of sewage to the rivers increased the load of organic materials and resulting in hypoxia for fish and eutrophication in the aquatic environments, which leads to suffocation due to depletion of oxygen in the water (Tiwari and Pal, 2022). Affandi and Ishak (2019) reported that chemical pollutants and sedimentation can change the grounds of spawning, and decline the recruitment of an important commercial species.

A decline in species diversity, as observed in the present study, was recorded, with only pollution-tolerant species (26 fish species) present, and the absence of sensitive indigenous fish species that represent the nucleus of the local fish population (Malik *et al.*, 2020). Pollutants alter trophic composition by destroying the food web, leading to declines in benthic invertebrates and plankton, which in turn affect fish that feed on them and contribute to the bioaccumulation of toxins in carnivorous species (González *et al.*, 2021; Oros, 2025).

Pollutants have a significant impact on the abundance of species, fish diversity, richness of species, and ecosystem health. Pollutants can reduce the number of species and individuals in polluted areas and increase the mortality of many individuals of fish and the loss of biodiversity (Lee *et al.*, 2023). The effects differ depending on pollutant types (organic effluents, heavy materials, industrial metals, pesticides, plastic) and exposure levels. Notably, we notice the dominance of resistant species (*Oreochromis niloticus*, *O. aureus*, *Coptodon zillii*, and *Carassius gibelio*) in the study area and the absence of sensitive native species like (*Mesopotamichthys sharpeyi*, *Arabibarbus grypus*, *Luciobarbus kersin*, and *Luciobarbus xanthopterus*) (Abdullah and Aldoghachi, 2024).

The study area is heavily polluted with organic effluents, which can cause eutrophication by increasing concentrations of nutrients and phosphorus, leading to algal blooms, reducing the oxygen levels, causing fish suffocation, and further deteriorating water quality (Lan *et al.*, 2024).

Eutrophication phenomenon can effect on fish assemblage as direct mortality from depletion of oxygen concentrations when algal bloom dies and decomposition, disruption of food web which affecting on availability of preys, loss of habitats due to water become more turbid and prevent sun light to reach vegetated bottoms, toxic impact from algal, Changed water chemistry and disturbed reproductive (Wurtsbaugh *et al.*, 2019; Lan *et al.*, 2024).

Conclusions

Because the three study stations are opposite the connection of three polluted rivers in the Shatt Al-Arab, it is natural that the rivers environment near them will be affected by the waste water of those three polluted rivers, which leads to an increase in the abundance of tolerant- fish species of the three species of Cichlidae (*O. niloticus*, *C. zillii*, and *O. aureus*), *P. abu*, and *C. gibelio* and a decrease or absence of oxygen-sensitive species. The results showed a decline in the abundance of species and individuals near the point of connection between these rivers and the Shatt Al-Arab River. The study confirmed a decrease in oxygen levels, an increase in biological oxygen demand values, and a decline in biodiversity.

Recommendations

The current study recommends diverting polluted river streams to the Main Outfall Drain after being treated in various ways to ensure they are free of various pollutants and are not dumped in the Shatt Al-Arab River, as well as raising environmental awareness among the general public, particularly regarding water issues.

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تأثير التلوث العضوي الناتج عن ارتباط بعض الأنهار الصغيرة الملوثة بشط العرب على التجمع السمكي

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المستخلص

بسبب نقص الدراسات التي تناولت تأثير التلوث العضوي على التجمعات السمكية في شط العرب، عملت الدراسة الحالية لتوضيح تأثير هذه الملوثات على تركيبة ووفرة وتنوع الاسماك في النهر قرب نقطة تصريف هذه الانهار في شط العرب. جمعت العينات شهرياً من كانون الثاني الى كانون الاول 2024. اجريت بعض القياسات للمتغيرات البيئية لمنطقة الدراسة كدرجة حرارة الماء والملوحة وتركيز الاس الهيدروجيني والاوكسجين المذاب والمتطلب الحيوي للأوكسجين وقيست النترات والفوسفات الكلية. صيد ما مجموعة 26 نوعاً كانت منها خمسة اصيلة وثمانية دخيلة و13 نوعا من الاسماك البحرية، تنتمي الى 20 جنساً و15 عائلة وتسعة رتب، جميعها تعود الى صنف الاسماك العظمية Osteichthyes سجلت أربعة أنواع أعلى قيم للوفرة النسبية العددية، وشكلت 68.64% من إجمالي عدد الأنواع. وخلصت الدراسة الحالية إلى أن المنطقة تتميز بتركيزات عالية من الملوثات العضوية والنترات والفوسفات، مما يؤثر بشكل واضح على تركيبة ووفرة وتنوع التجمعات السمكية قرب هذه الأنهار، وخاصة قرب نقاط التقائها بشط العرب.

الكلمات المفتاحية: تلوث عضوي، تجمعات الأسماك، نهر الرباط، نهر العشار، نهر السراجي.