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Fish Diversity as a Biological Indicator of Organic Pollution in the Shatt Al- Basrah canal

Mayada H. Ahmed , Nada M. Al-Baghdadi , Haider S. Majeed

[1]Department of Marine Vertebrates, Marine Sciences Centre, University of Basrah, Basrah, Iraq
[2]Marine Biology Department, Marine Science Center, University of Basrah, Basrah, Iraq
[3]Basrah Agriculture Directorate, Basrah, Iraq

E-mail: mayada.ahmed@uobasrah.edu.iq

Abstract

In addition to being a sewage channel for the entire Basrah Governorate, the Shatt Al-Basrah Canal's environment is polluted by Several things, including spoiled medications, dirt, construction debris, and butchery waste that are dumped into the river and its banks, which results in a low density of organisms and a lack of biodiversity in the area. Two sampling stations were selected, the first station near Al-Zubair Bridge and the second station after the regulator. A total of 1664 fish were captured from Shatt Al-Basrah Canal, which included 14 species belonging to 11 families. The *Coptodon zillii* fish ranked first in terms of numerical abundance during all the study seasons. Environmental variables (Water temperature, dissolved oxygen, pH, salinity and Biological Oxygen Demand) were measured, Water temperatures ranged from 12 ºC in winter in the second station to 37 ºC in summer in the first station, dissolved oxygen values ranged from 4 mg/L in the summer in the first station to 9 mg/L in winter in the second station, pH values ranged between 7.2 in the spring and 8.3 in the autumn in the first station. Salinity values ranged between 22 g/L in winter and 49.1g/L in summer in the first stations. Biological Oxygen Demand values ranged from 3 mg/L in winter to 5.9 mg/L in summer in the first stations. Both stations recorded a significant increase in the level of organic pollution. The first station is more affected.

***Keywords:* Qualitative composition, Organic pollution, Fishes, Shatt Al-Basrah canal, Iraq.**

I. INTRODUCTION

Pollution has become a threat to the natural environment in general to the extent that it has affected the course and development of life as a result of the intersection of many factors, most notably the increase in population numbers and the accompanying industrial and agricultural development to meet the growing needs of millions of people, in addition to the depletion of natural resources and the dumping of industrial and domestic wastes directly into the water without treatment (Gatea *et al.*, 2018).

Inland waters including rivers, streams, etc. are now the primary recipient of organic matter in amounts greater than the aquatic environment's capacity for self-purification and mitigation mechanisms due to industrialization, population increase, and other factors. Urban wastewater, industrial discharges, and agricultural runoff are the main sources of organic pollutants that enter aquatic environments and release toxic compounds (Tiwari *et al*., 2017; Hader, 2021; Ahmed *et al*., 2022a). Crude oil spills and plastic pollution also significantly degrade fish habitats, further threatening fish diversity (Hader, 2021). The decline in fish variety indicates that organic pollution poses a threat to aquatic ecosystems and human health, particularly for people whose primary food source is fish (Jordan-Ward *et al*., 2023; Vagi *et al*., 2021). Because contaminated fish can cause long-term health problems in people, polluted environments

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need immediate rehabilitation (Jordan-Ward *et al*., 2023). On the other hand, some research suggests that certain fish species may be resistant to specific pollutants, indicating the potential for environmental adaptation. This resilience, differs greatly between species and habitats and is not universal. Estuarine and marine fish enter the Shatt Al-Basrah canal for spawning or feeding, and after completing a portion of their life cycle, they return to the sea (Ahmed *et al*., 2022b; Okash, 2024; Hassan, 2018). The goal of the current study was to evaluate how organic pollution affected the fish diversity structure of the Shatt al-Basrah canal.

II. MATERIAL AND METHOD

Shatt Al-Basrah canal is located southern part of the Main Drain, which was created in 1992. The length of Shatt Al-Basrah Canal is 37 km, and the study area is located between longitude "49.47 '50 ° 47 east" 30.27 '28 ° 30 north (Fig. 1).

The Shatt al-Basrah canal is characterized by being an industrial channel branching in its northern part into two eastern branches, which connect to the Karma River and from it connects to the Shatt al-Arab. While the western branch is connected to the eastern donkey marsh, However, due to the lack of drainage water from the Euphrates River in recent years and to prevent the rise of salty marine water from Khor Al-Zubair to the Shatt al-Arab, the earthen dam was built at the end of the Abdul Allah canal that connects the Shatt al-Basrah canal with the Karma River.

Two sampling stations were chosen, the first station near Zubair Bridge and the second station after the regulator, which is about 22 km from the beginning of the canal and is controlled through gates that close during the tide and open during the islands.

Seasonal fish samples were taken from the Shatt Al-Basrah canal using a gill net drift that was 80 meters long and 8 meters high, with a mesh size of 10 x 10 mm. The fish was kept in a chilly icebox until it was transported to the lab and placed in a deep freezer. Some environmental factors were measured in the field such as water temperature using thermometer mercurial (0.1-100) ºC, Water salinity was measured directly in the field by using Multi-meter model (Multi 350i meterIn contrast, 300 ml transparent Winkler bottles were filled with water to measure the amount of dissolved oxygen. One milliliter of manganese sulfate solution, one milliliter of alkaline iodide azid solution, and one milliliter of concentrated sulfuric acid were added to each container in the field to fix the oxygen.

Another 300 ml dark Winkler bottles were filled with water to measure the BOD_5 levels; they were not fixed and kept in an ice box until they arrived at the lab (APHA, 2005 ; 2012). As quickly as possible, the samples were taken to the lab and stored in an icebox.

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).

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Figure (1) A map showing the two sampling stations

III. RESULTS AND DISCUSSION

Table (1) shows the quarterly and location changes in the values of some environmental variables (Water temperature, dissolved oxygen, pH, salinity and Biological Oxygen Demand) during the study period.

Table (1). Seasonal differences in environmental factors of the Shatt Al-Basrah canal.

Environmental factors	St1				St2			
	spring	summer	autumn	winter	spring	summer	autumn	winter
Water temperature (°C)	14	37	18	12.4	13	33	20	12
DO (mg/L)	6	4	7.5	8	6.5	4.5	7	9
pH	7.2	7.6	8.3	8.1	7,5	7.4	8.1	7.9
BOD_5 (mg/L)	4	5.9	5.5	3	4.6	5.8	4	3.7
Salinty (g/L)	33	49.1	44	22	32	48.6	46	25.2

Water temperature is a major factor in controlling the distribution and abundance of living organisms and their activities, and it also affectes the biological processes of aquatic organisms (especially fish) such as growth, feeding,

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sexual maturity and reproduction, as well as water temperature affects the physical characteristics of water such as density, viscosity and gases melting (Bishop *et al.*,2001).
Lower values of water temperature in this study were recorded during winter and higher value during summer, hence the rate of fishing was high during spring and summer Seasons and low during winter season.
Salinity plays an important role in determining the biological population and its composition, It is among of the most important factors that affect the presence and survival of aquatic organisms. (Ahmed *et al*., 2024). The results of the current study showed high salinity concentrations in the two study stations, as the highest values were recorded in the summer and amounted to 49.1 mg/ L in the first station, and this may be due to changes in environmental conditions, also to the large fluctuation in freshwater quantities crossing into marine water.

Dissolved oxygen is an important environmental factor that affects the abundance and activity of aquatic organisms (Ahmed and Majeed, 2022). The results of the current study showed a decrease in dissolved oxygen concentrations in the two study stations. Lower values of DO may be caused by higher input of sewage waters of Shatt Al-Basrah canal.
One crucial element is pH for assessing the quality of water and its suitability for living, feeding, growing and reproducing fish naturally, as it is sensitive to any change in the pH value, as any sharp rise or decrease in its value indicates that the aquatic environment is not normal (Avvannavar and Shrihari, 2007). The pH of natural waters is usually because of certain geological elements and biological activity. Table 1, show the values of pH, which varies from 7.2 to 8.3 hence, almost all water samples, are alkaline.
The Biological Oxygen Demand is an important measure of organic pollution in the aquatic environment and a guide to express its suitability for various uses (Liu *et al*., 2010; Radwan, 2007). The release of organic matter in large quantities with sewage and agricultural water into the water body can cause an imbalance in the ecological balance through excessive growth of microorganisms and thus the amount of dissolved oxygen consumed that may adversely affect the ecosystem's integrity (UNEP and GEMS, 2006).
The current study's findings demonstrated a very significant increase in the biological oxygen demand values, as the higher values were recorded 5.9 mg/L in the summer in the first station, and this is clear evidence of the extent of contamination of the area with organic materials as a result of the discharge of sewage directly without treatment (Table 2).

Table (2). BOD_5 Level in water according to international standards.

BOD_5 Level (In mg/L)	**Water Quality**
1-2	**very good**
2-3	**good**
3-5	**fair**
6-9	**poor**
10 <	**very Poor**

Knowing the fish community's composition is important in the management of water bodies and the development of fish wealth, especially after human intervention and changing the environment of natural rivers through the construction of dams and canals, as well as the remnants of modern civilization that reduce the number of species in the composition of the fish community (Allan, 2004).

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Between March 2022 and February 2023, 1664 fish, including 14 species from 11 families, were caught from the Shatt Al-Basrah Canal. Some of them are freshwater fish and others are marine fish. The (*Coptodon zillii*) ranked first in numerical abundance during all the study seasons. This is probably due to the ability and capacity of this type of fish to confront changes in environmental conditions, especially high levels of water salinity and tolerating pollution by organic materials resulting from the discharge of sewage water without treatment.

While fish **(***Planiliza subviridis***)** ranked second in numerical abundance, their presence in the Shatt Al-Basrah canal is not random but rather linked to specific environmental characteristics some of these fish are adapted to tolerance to salinity, availability of food, and, most importantly, tolerance to organic pollution. In addition, most species use the estuaries as nursery grounds for their juveniles (Ortiz-zarragoitia *et al*., 2014).

While fish (*Oreochromis niloticus*) ranked third in numerical abundance, their plentiful presence in the Shatt Al-Basrah canal is a result of their tolerance to unfavorable environmental conditions such as high salinity, pollution, and low oxygen levels, in addition to their rapid reproduction rate.

were recorded, Resen *et al*. (2014). recorded 33 species, This difference between number of fish species catched during current study and the previous one may be due to high level of pollution as a result of the dumping of sewage directly into the water without treatment and the decline in water levels has a significant impact on the decline of fish species.

Table (3) Fish species catch from Shatt Al-Basrah Canal and their families.

Families	**Fish species**
Cichlidae	*Coptodon zillii*
	Oreochromis aureus
	Oreochromis niloticus
Mugilidae	*Planiliza subviridis*
	Planiliza abu
Clupeidae	*Tenualosa ilisha*
Sparidae	*Acanthopagrus arabicus*
Soleidae	*Brachirus orientalis*
Gobiidae	*Bathygobius fuscus*
Leiognathidae	*Photopectoralis bindus*
Engraulidae	*Thryssa whiteheadi*
Hemiramphidae	*Hyporhamphus limbatus*
Mullidae	*Upeneus sundaicus*
Poeciliidae	*Poecilia latipinna*

Table (4) Seasonal changes in the number of fish species during the time spent studying.

Fish species	**St.1**				**St.2**			
	spring	**summer**	**autumn**	**winter**	**spring**	**summer**	**autumn**	**winter**
Coptodon zillii	173	80	206	42	133	60	199	22
Oreochromis aureus			27				18	
Oreochromis niloticuss	13	20	32		53	52	15	
Planiliza subviridis	62	42	15	33	88	45	16	22

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Planiliza abu	2	3	4					
Tenualosa ilisha	1				6	7	18	
Acanthopagrus arabicus	9							
Brachirus orientalis	1							
Bathygobius fuscus	18	22	15	4	18	22	8	
Photopectoralis bindus	1	1				1		
Thryssa whiteheadi	2				9	12	2	
Hyporhamphus limbatus	1	1				1		
Upeneus sundaicus	1	1				1		
Poecilia latipinna	1	1					2	

The results of the statistical analysis showed no significant differences between the two study stations. However, the results of the correlation analysis Principal Component Analysis (PCA) between environmental factors and the number of species and individuals showed a direct correlation between increased dissolved oxygen and increased number of species and individuals, as well as a direct correlation with pH values. The effect of temperature on the number of species and individuals was twofold: moderately high temperatures support diversity, while high temperatures reduce dissolved oxygen and limit diversity. Salinity showed an inverse correlation; high salinity reduces the ability of organisms to survive, as illustrated in Figures 2 and 3.

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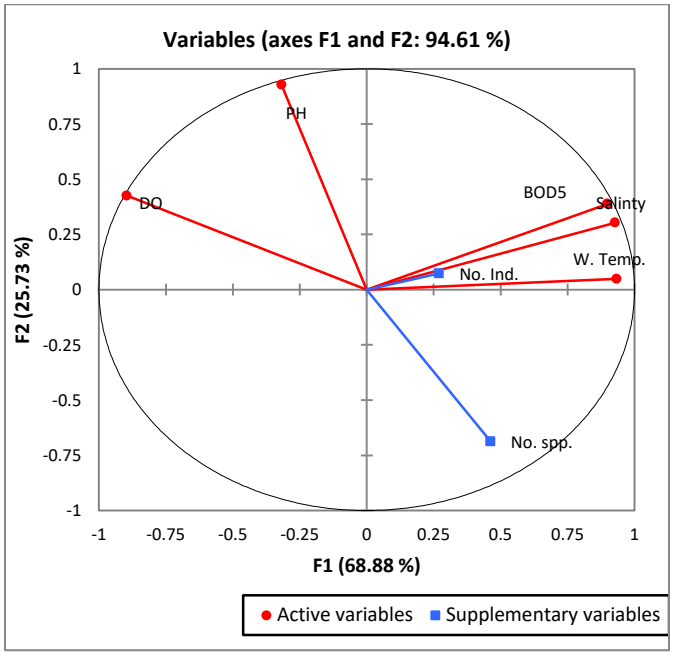

Figure(2) illustrates the correlation between environmental factors and the number of species and individuals at the .first station during the study period

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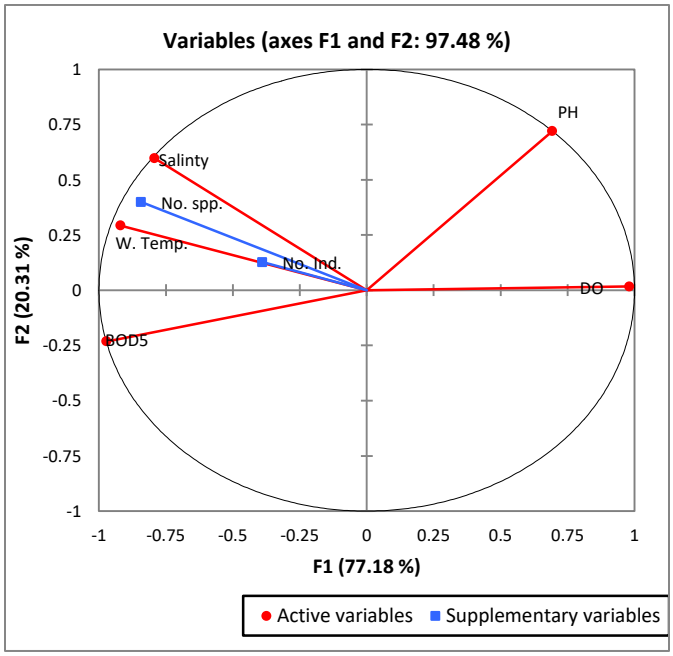

Figure(3) illustrates the correlation between environmental factors and the number of species and individuals at the .second station during the study period

IV. REFERENCES

Ahmed, M. H. and Majeed, H. S. (2022). AN Assessment of water quality of the north and south part of the Shatt AL-Arab using organic pollution index (OPI). Annals of forest research, 65(1): 4939-4945. https://www.e-afr.org/

Ahmed, M. H.; Resen, A. K. and Al-Niaeem, K. S. (2022a). Detection of Antibacterial Residues in Nile Tilapia Oreochromis niloticus (L.) in the Shatt Al-Arab river, Southern Iraq. Basrah J. Agric. Sci. 35(2), 49-59. https://doi.org/10.37077/25200860.2022.35.2.04

Ahmed, M. H.; Resen, A. K. and Al-Niaeem, K. S. (2022b). Effects of antibiotic residues on some health parameters of *Planiliza abu* H. in Shatt Al-Arab, Southern Iraq. Caspian Journal of Environmental sciences, ISSN: 1735-3866. https://cjes.guilan.ac.ir/article_6080.html#:~:text=10.22124/CJES.2022.6080

Ahmed, M. H.; Al-Baghdadi, N. M. and Aufy, L. A. (2024). An Assessment of the Water Quality of Some Areas of Shatt al-Arab and the East Hammar Marsh Using the Water Quality Index WQI. Egyptian Journal of Aquatic Biology & Fisheries, 28(6): 2413 – 2424. http://www.ejabf.journals.ekb.eg/

Allan, J. D. (2004). Landscapes and rivers capes: the influence of use on stream ecosystems. Annual Review of Ecology, Evolution, and Systematics, 35: 357–384. https://doi.org/10.1146/annurev.ecolsys.35.120202.110122

University of Thi-Qar Journal of agricultural research

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https://jam.utq.edu.iq/index.php/main *https://doi.org/10.4174/utagr.v13i1.323*

APHA, AWWA and WEF. (2012). Standard Methods for The Examination of Water And Wastewater. 22st edition. Washington, DC: American Public Health Association, American Water Works Association, Water Environment Federation.

APHA. American Public Health Association (2005). Standard Method for the Examination of Water and Wastewater. 21st. ed. American Public Health Association.

Avvannavar, S. M. and Shrihari, S. (2007). Determination of water quality deterioration at Pilgrimage centre along River Netravathi, Manga-lore using WQI Approach. Environ. Eng. and Manage. J., 6(2): 123-131. https://doi.org/10.30638/eemj.2007.017

Bishop, K. A., Allen, S. A., Pollard, D. A. and Cook, M.G. (2001). Ecological studies on the freshwater fishes of the Alligator rivers Region, Northern Territory: Autecology. Supervising Scientist Report 145, Supervising Scientist, Darwin.

Gatea, M. H., Dakhil, A. J., and Dawood, A. S.(2018). Evaluation of Water Quality Parameters for Shatt Al-Basrah Canal in Basrah Authorities, Science Journal of University of Zakho 6(4), 177-181, December-2018 DOI: https://doi.org/10.25271/sjuoz.2018.6.4.547

Hader D. P. (2021). Effects of Pollution on Fish. 39-60. doi: 10.1007/978-3-030-75602-4_3 DOI: https://doi.org/10.1007/978-3-030-75602-4_3

Hassan, A. A. Dawood, A. S. and AL-Mansori, N. J. (2018). Assessment of Water Quality of Shatt Al-Basrah Canal using Water Pollution Index. International journal of engineering and technology, 7:757-. https://doi.org/10.14419/ijet.v7i4.19.27994

Jordan-Ward R, von Hippel F. A, Wilson CA, Rodriguez Maldonado Z, Dillon D, Contreras E, Gardell A, Minicozzi MR, Titus T, Ungwiluk B, Miller P, Carpenter D, Postlethwait JH, Byrne S, Buck CL. (2023). Differential gene expression and developmental pathologies associated with persistent organic pollutants in sentinel fish in Troutman Lake, Sivuqaq, Alaska. Environmental Pollution, 122765-122765. https://doi.org/10.1016/j.envpol.2023.122765

Liu, X., Li, G., Liu, Z., Guo, W. and Gao, N. (2010). Water pollution characteristics and Assessment of lower Reaches in Haihe River Basin. Procedia Environmental Sciences, 2: 199-206. https://doi.org/10.1016/j.proenv.2010.10.024

Ortiz-Zarragoitia, M.; Bizarro, C.; Rojo-Bartolomé, I.; De Cerio, O.D.; Cajaraville, M.P.; Cancio, I. Mugilid Fish Are Sentinels of Exposure to Endocrine Disrupting Compounds in Coastal and Estuarine Environments. Mar. Drugs 2014, 12, 4756-4782. https://doi.org/10.3390/md12094756

Okash A. N. (2024). Study on the presence and density of three types of Brachyuran crabs in Shatt Al-Basrah Canal, Basrah, Iraq. https://doi.org/10.48550/arXiv.2410.04233

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https://jam.utq.edu.iq/index.php/main *https://doi.org/10.4174/utagr.v13i1.323*

Resen, A. k.; Hasan, S. S.; Taher, M. M. and Sadiq J. M. (2014). The qualitative composition and environmental indexes of fishes assembly from Shatt Al-Basrah Canal, Southern Iraq, Global Journal of Fisheries and Aquaculture Res., Vol.1, (2): pp. 152 -163 . https://doi.org/10.13140/RG.2.1.1620.0729

Radwan, M. (2007). Evaluation of different water quality parameters for the Nile River and the different drains. Ninth International Water Technology Conference, IWTC9, Sharm El-Sheikh, Egypt, 1293-1303.

Tiwari.P. K., Bulai, I. M., Misra, A. and Venturino, E,. (2017). Modeling the direct and indirect effects of pollutants on the survival of fish in water bodies. Journal of Biological Systems, 25(03):521-543. https://doi.org/10.1142/S0218339017500243?urlappend=%3Futm_source%3Dresearchgate.net%26medium%3Darticle

UNEP and GEMS (United Nations Environment Programme and Global Environment Monitoring System) (2006). Water quality for ecosystem and Human health. UN GEMS/ Water Program Office c/o National Water Research Institute, Burlington, Ontario, Canada. 132 pp.

Vagi, M. C., Petsas, A. S., and Kostopoulou, M. N. (2021). Potential Effects of Persistent Organic Contaminants on Marine Biota: A Review on Recent Research. *Water*, (18), 2488. https://doi.org/10.3390/w13182488.