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Colored Microplastic Particles Ingested by Fishes From Shatt al-Arab River Basrah, Iraq

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ABSTRACT

Microplastic fragments were collected from fish stomachs collected from selected stations at the middle part of the Shatt al-Arab River, including Al-Najibiyah, Al-Dakir, Al-Ashar, and Al-Baradhiyah, from November 2021 to August 2022. Three types of plastic forms were extracted from the guts of fish: 1-fibers, 2- fragments, and 3- films. Nine colors of plastic were extracted from the guts of the studied fishs: transparent, brown, green, white, red, black, blue, yellow, and purple. The highest occurrence was red plastic pieces, which were the most abundant, forming 20 pieces in autumn, whereas green and black plastic were not recorded in summer. Moreover, purple was the most abundant in spring and winter, and yellow in autumn, winter, and spring. The benefit of colors was added for the diagnosis of microplastics. Red fibers were the most abundant type of plastic, and were recorded in autumn. The lowest type was yellow fragments, and only one fragment was recorded.

INTRODUCTION

The impact of a contaminant on the base of the food web can have far-reaching implications for the trophic structure and ecosystem performance. The effects of microplastic exposure on young planktivorous fish were investigated (*Acanthochromis polyacanthus*) (**Critchell & Hoogenboom, 2018**). The amount of plastic contamination was also determined by analyzing the gastrointestinal contents of the resident fish assemblages (**Mertinez *et al.*, 2021**). The color distribution of the fibers was mainly black (40%), blue (19%), red and white (14%). SEMimages represented the surface morphology, while the elemental composition of the fibers was studied using EDX spectra **(Widianarko & Inneke, 2018)**. Internal abrasions and obstructions, behavioral abnormalities, decreased food assimilation, reproductive failure, and even death are common outcomes of fish exposure to microplastics **(Alice *et al.*, 2018)**. Microplastics (5 mm) have been detected in various fish species in most marine settings. However, they are essential for figuring out how microplastics move through food webs **(Hamed,2020)**. The removal of this plastic is detrimental to ecology. Only 16 percent of plastics are recycled; while the rest are burned or dumped in landfills **(Chaudhary & Garg, 2023**). Thus, between 1950 and 2018, the use of plastics increased by approximately 180 times. An estimated 400.3 million tons of plastic were produced globally by 2022. Therefore, it is anticipated that the plastic output will rise rapidly in the future **(Rafey & Siddiqui, 2021)**. The microplastics in fish guts ranged in length from 0.04 to 1.25mm on average, which is the same length that was discovered by **Kadhum *et al*. (2020)**. The red color of the plastic predominated in the rest of the colors; the largest amount of plastic waste was at the Dakir and Al-Ashar stations, accounting for 43.40% of the total number of plastics **(Al-Zawar *et al.*, 2023)**. Plastic pollution has emerged as a significant environmental crisis, that poses profound threats to ecosystems, human health, and biodiversity. Since the mid-20th century, the widespread use of plastic has resulted in a dramatic rise in plastic waste, and biodiversity. Since the mid-20th century, the widespread use of plastic has resulted in a dramatic Increase in plastic waste, especially in marine settings. Accumulation of plastic garbage poses a serious threat to marine life, ecosystems, and communities worldwide. Convenience and consumerism have fueled the increasing use of single-use plastics, which has resulted in excessive production and disposal, raising pollution levels worldwide **(Al-Fares & Al-Zaidan, 2025)**. Among the studies that addressed plastic in the waters of the Shatt al-Arab are the following: **Hussein *et al.* (2022)**, **Al-Zawar *et al.* (2023)**, **Al-Fares and Al-Zaidan (2025)**, **Al-Shamary *et al.* (2025)**, **Hussein (2025)** and **Sadiq and Al-Hejuje (2025)**.

The studies aimed to identify the colors of plastic materials that fish eat while feeding in the Shatt al-Arab water.

MATERIALS AND METHODS

From January 2022 to December 2022, quarterly missions were conducted to collect water and fish samples from four stations in the middle section of the Shatt al-Arab River. According to the map in Fig. (1), Al-Najebia (Station 1) is located within coordinates of E 047 45.930 N 30 34. 766; Al-Dakier (Station 2), coordinates E 047 50.223 N 30 32.105l Al-Ashar (Station 3) E 047 50.830 N 30 30.923, and Al-Bradieyha (Station 4) coordinates E 047 51.693 N 30 30.142. Fish samples were collected using two methods: cast nets with mesh sizes of 2ˣ2 and 3ˣ3. cm, and electrofishing. Fish were classified according to **Fischer and Bianchi (1984)** and **Kuronuma and Abe (1986)** and positions of the field stations were determined using GPS type V.10.1 (Fig. 1).

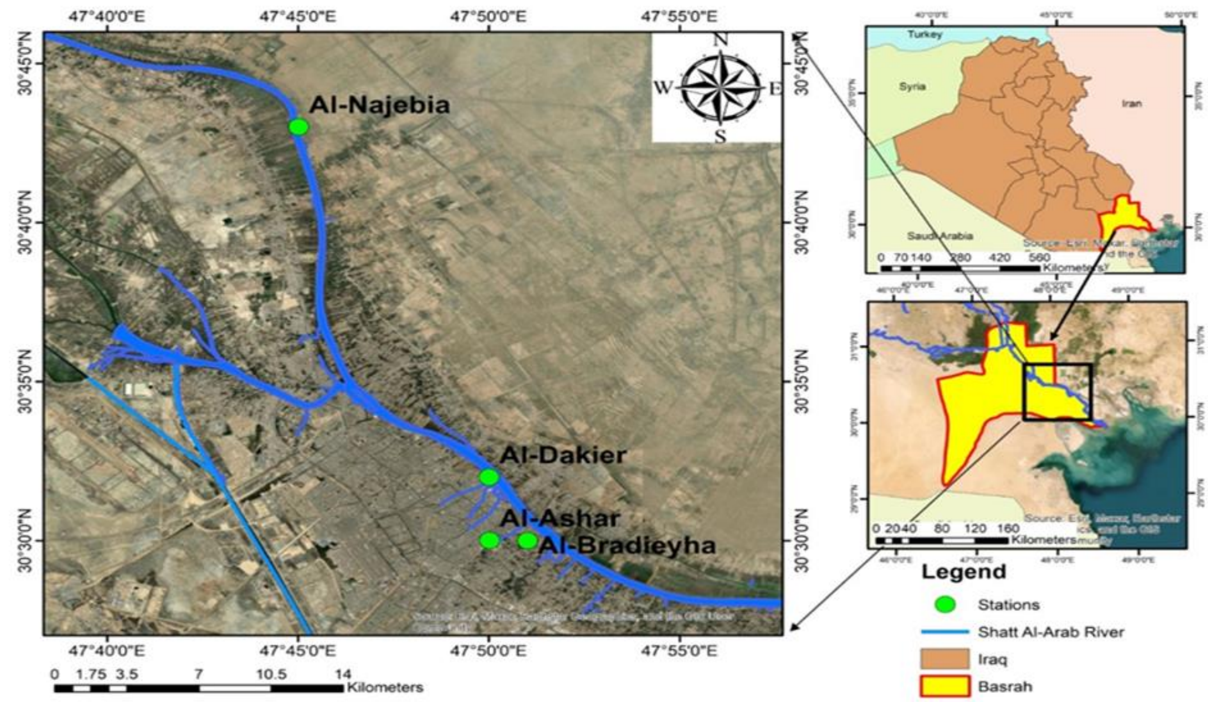


Fig. 1. The Four Sampling Stations in the Middle Section of the Shatt al-Arab River

1. Examination and Measurements of Plastic Particles

Ninety-five percent of plastic produced worldwide are composed of common microplastics, such as poly ethylene terephthalate (PET), polyvinyl chloride, nylon, polyethylene, polypropylene, and polystyrene. By getting into the food chain and serving as carriers of various pollutants that prefer plastic surfaces. these microplastics have detrimental effects on ecosystems **(Lagarde *et al.*, 2016)**.

Microplastic Identification and Detection of Microplastics

The samples were visually screened for microplastics using a binocular stereoscope (Stemi 2000 Zeiss, maximum magnification PI 10×23). Fourier-Transform Infrared Ray (FTIR) polymer identification spectroscopy is a fingerprinting technique commonly used to identify polymeric particles. The distinctive spectrum that differentiates plastic particles from other organic and inorganic particles makes it easy to characterize carbon-based polymers with various bond compositions **(Loder *et al.*, 2015)**. The apparatus was used at the University of Basra's /Department of Chemistry, College of Science. The plastic materials consumed were assessed using a Swiss-made Projectina microscope (CH-9435 Heerburg) (Plot 1). Statistical analysis was conducted using the F-test program past3.

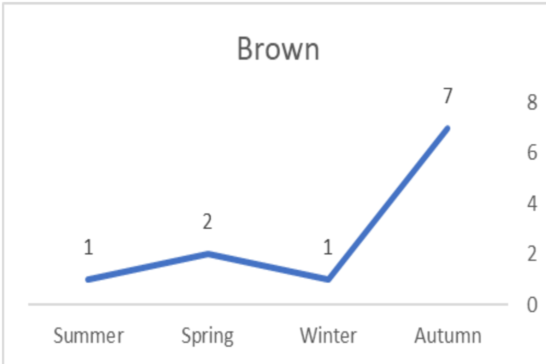
2. Approval Statement

The study was conducted in cooperation with the laboratories of Basrah University and approved under Ethical Approval No. 2.VET.2021.2.

Plot. 1. Device Projectina to Examine and Enlarge Plastic Particles

RESULTS AND DISCUSSION

The colors of plastic are the only thing that attracts fish to eat, especially the bright colors that are high in the river, since they consider them edible things that satisfy their hunger (**Pegado *et al.*, 2018**). In the present study, nine colors of plastic materials were detected that were swallowed by fish while eating. While green color was present in five plastic pieces in both autumn and winter, no plastic pieces appeared in summer. The largest number of plastic bits was observed in autumn, reaching 15, 7, 7, 20, 10 and 2 in transparent, gray, white, red, blue, and purple colors, respectively. The highest number of black plastic pieces was also recorded in the fall, reaching six pieces, and one piece in the summer season, which was yellow (Fig. 3). In the present study, the red color of the plastic was recorded in 20 pieces, followed by the transparent color in 15 pieces at the four stations. This may be because transparent color was the most abundant in the rivers. These colors are derived from plastic packaging materials of all kinds, paints, fishing lines, and clothes, especially at the Al-Dakir station, which is densely populated and an anchorage of repaired boats. As for the red color, it tends to be due to the abundance of dyes, plastic bottles, nylon packaging materials, and household utensils that lines, and clothes, especially at the Al-Dakir station, which is densely populated and anchorage of repaired boats. The red color, tends to be due to the abundance of dyes, plastic bottles, nylon packaging materials, and household utensils that are attractive to the fish, so the fish devours and swallow them as if they were food (**Anderson *et al.*, 2018; Andrade *et al.*, 2019**). Piranha fish and other serrasalmids with various eating patterns consume plastic debris. The first study documented the presence of plastic pollutants on freshwater fish in the Amazon. The majority of the plastic particles were black, blue, red, white, and transparent particles were also observed. The color of the plastic varies during this season, with red being the most preferred. This may be because fish swallow red threads since they resemble their prey, which is consistent with the finding of **Smith (2018)**. In his study on plastic ingestion by the fish species *Scyliorhinus canicula*, which was captured in the North Sea, the percentage of red color was 33.3% of the total number of plastics consumed. Autumn is also the most common time for the spread of brightly colored plastics because of the abundance of organic and mineral materials exposed to environmental conditions such as solar radiation, physical erosion, and biological processes **(He *et al*., 2018; Fahrenfeld *et al*., 2019)**. Mechanical holes were also found in the surface of industrial organic materials, as many sewage materials were found at all stations during the fall, accompanied by solid plastic materials, which are sometimes attributed to harsh conditions and the increase in the human activities, which lead to their decomposition in the long term, and they remain polymeric materials until their constituents were identified through analysis. Significant differences ($P<0.05$) between the plastic hues during the study period between the stations were revealed by the statistical test (F-test) results, and are illustrated in Fig. (2). Plastic paints ingested by fish during study seasonal consist of nine colors. It is noted that the red color of the plastic is the most common, with 45 pieces of plastic used, and this color may attract fish as bait. This is the same conclusion that **Bahri *et al.* (2020)** reached during his study on identifying plastic particles in fish *Oreochromis mossambicus* in the Talo River, Indonesia.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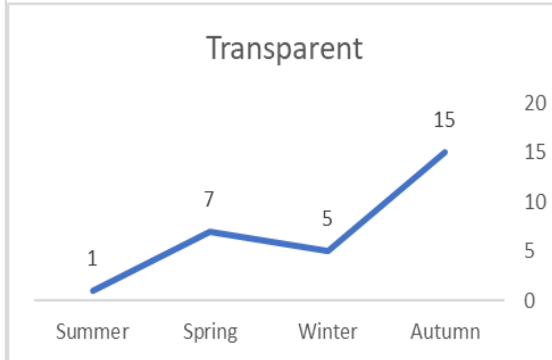
Autumn

A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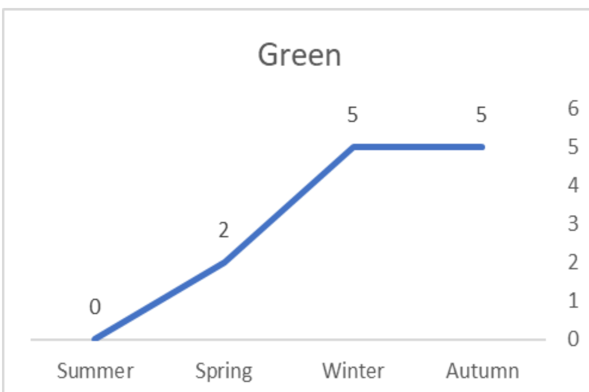
B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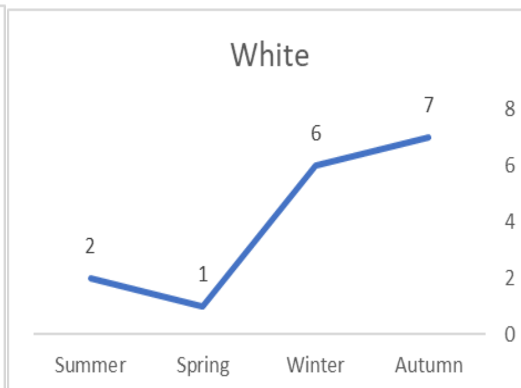
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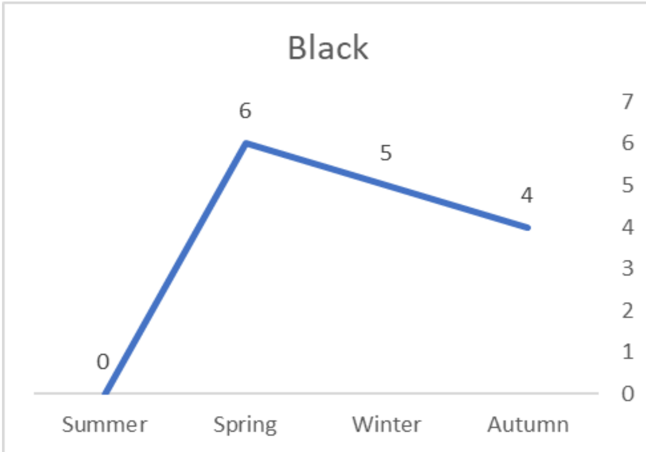

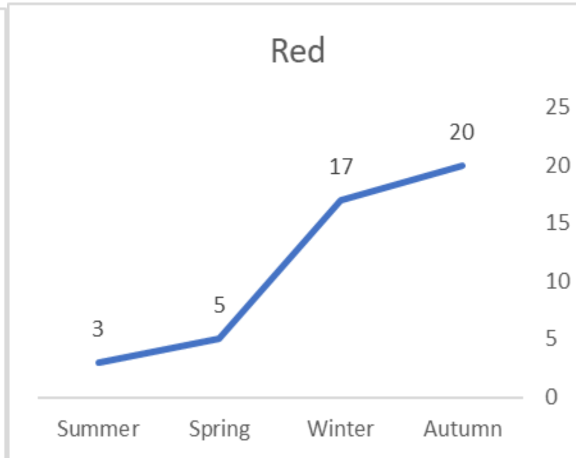

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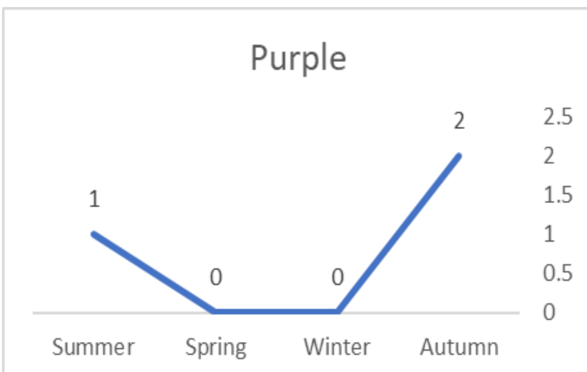

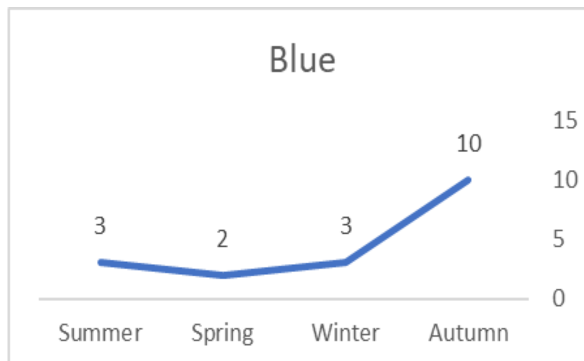

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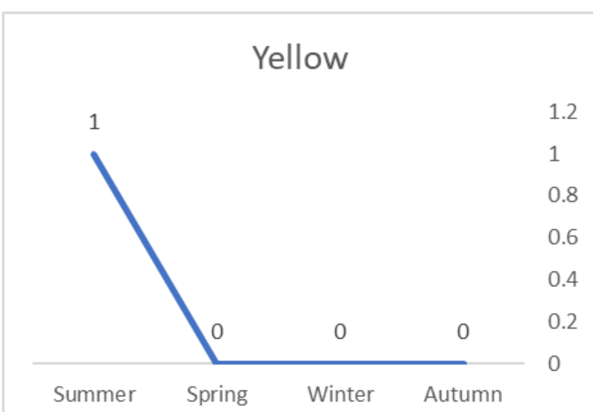

I

Fig. 2. Distribution of Plastic Colors over the seasons in the Shatt al- Arab River

Red was the most frequent color, accounting for 30.20% of the total plastic consumed during the study period, with a total of 45 samples (Fig. 3). This may be due to the frequent use of red-colored fishing nets and lines, as all red plastic pieces were fibers. This result is consistent with the findings of **Martinez *et al.* (2021**). They investigated metal pollution and microplastics in freshwater tilapia *(Oreochromis niloticus)* from a central Mexican reservoir. Black was the predominant color, accounting for 42% of the total plastic. They attributed this to the preference of fish for ingesting it because of its similarity to food or prey. The results of the F-test showed significant differences (P<0.05) between the colors of plastic during the study season. Table (1) shows the types of plastic that were diagnosed during the present study, along with the types of fish that consumed plastic. *Captodon zillii* is a fish species that eats more types of plastic than any other fish. In the present study, plastic fibers predominated over other types of plastic at all study stations. This is probably due to the increased dumping of plastic waste into the river, including fishing lines, clothing threads, and dyes, fishing nets. The results of the study showed a clear dominance of plastic fibers, representing 56% of the total number of plastics, amounting to 83 samples, followed by plastic fragments, representing 37% of the total number of plastics, amounting to 55 samples, and plastic films, representing 7% of the total number of plastics, amounting to 11 samples. This result is consistent with that of **Forrest and Hindell (2018)**. In their study on the ingestion of plastics by fish intended for human consumption in remote South Pacific islands, plastic fragments were dominant, representing 60%. They attributed this to the exclusion of the methods used for some smaller and more difficult to identify elements, such as fibers and transparent films.

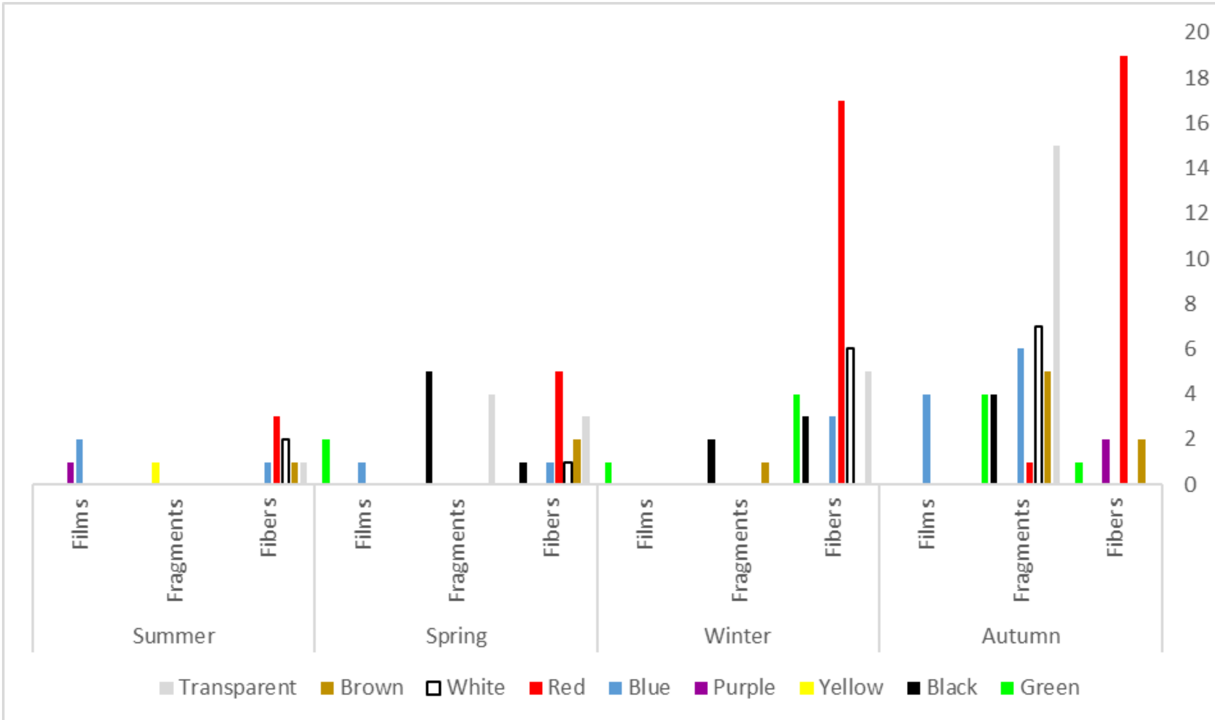

Fig. 3. Distribution of Plastic Materials Colors Ingested by Fish Across the Four Seasons in the Shatt al-Arab River

Table 1. The Types of Fish and the Number of Pieces of Plastic they Ingested During the Present Study

Coptodon zillii	55	47	8
Oreochromis niloticus	12	3	2
Cyprinus carpio	16	4	
Planiliza abu		1	0
Thryssa whiteheadi		0	1

Additionally, the widespread occurrence of microplastics in the environment and subsequent penetration of aquatic food webs may pose a serious threat to organisms. This study provides baseline data and a framework for further investigation of microplastic contamination in estuaries. The variation between seasons is due to the distribution of plastic in rivers and may sometimes be attributed to recent climate changes, which may be attributed to the primary productivity in autumn and winter, as **Muhammad *et al.* (2021)** highlighted in their study on the primary productivity of plankton in the northern part of the Shatt al-Arab. They stated that the highest value of primary productivity was recorded in April and the lowest value was recorded in July, which led to the availability of nutritional elements in the environment and the availability of nutrients in large quantities during autumn and the flourishing of phytoplankton, which led to fish consuming plastic during this season and the following seasons. It was also found that the largest amount of plastic waste was at the Al-Dakir and Al-Ashar stations owing to their high population density and industrial activity, which confirms the pollution of the tributaries near the selected stations with plastic waste that ends up in Shatt al-Arab. This was confirmed by **Kyork (2016)** in her study on plastic particles in the Shatt al-Arab and also shown in Table (2). The present study illustrates the distribution of plastic types and colors across the study seasons of the caught fish. It is also noted that *C. zillii* fish are the fish that eat the most plastic of all kinds during the seasonals study, and that red is the dominant color of plastic. This is consistent with the study of **Rizki *et al.* (2020**) from his studies, it can be inferred that the Tallo River tilapia fish contained 37 microplastic particles. The microplastic structures discovered were pieces and lines. Microplastics were identified as purple, black, blue, red, and brown. The microplastic diameters ranged from less than 1mm to 1.00- 4.75mm. It is important determine that plastic colors, especially red, brown, and transparent, attract fish as food which is consistent with **Moyle *et al.* (2023**) in his study in the Shatt al-Arab River. The author noticed widespread plastic waste, especially the bright colors in the waste, and the attraction of some fish to it as food. The plastic pieces are distributed according to their colors, and it is noted that the red color is the most abundant among the plastics (Fig. 4). This is the same thing that researchers found during their study of plastic in Shatt Al-Arab.

Table 2. Fish Species that Ingested Colored Plastics; Their Colors, and the Seasons

Fish species	Plastic number			Plastic color									seasons	Number of species
	fibers	films	fragments	Tra	Bro	Whi	Red	Blu	Pur	Yel	Bla	Gre		
C.zillii	4	2	1		1	1	2	2		1			summer	7
C.carpio	2			1			1							2

O.niloticus	2					1		1						2
T.whiteheadi		1							1					1
C.zillii	12	3	8	5	2	1	5	2			6	2	Spring	23
O.niloticus	1			1										1
P.abu			1	1										1
C.zillii	19	1	3	3	1	3	6	2			5	3	Winter	23
C.carpio	10			2			6	1				1		10
O.niloticus	9			2		3	3					1		9
C.zillii	20	2	35	13	4	7	16	7	2		4	3	Autumn	57
O.niloticus		2	3		2			2				1		5
O.niloticus	4		4	2	1		4					1		8

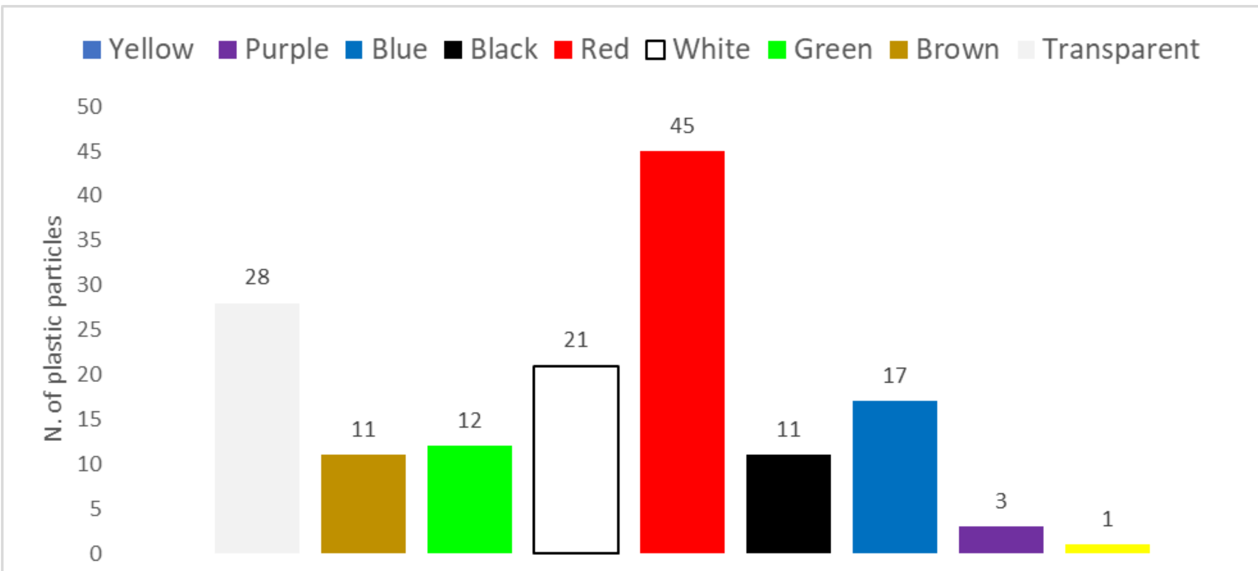

Fig. 4. Colors of Plastic Materials Consumed By Fish During the Period from November 2021 to August 2022 in the Shatt Al Arab River

Distribution of plastic materials in the Shatt al-Arab over the last few years has been a major environmental issue. This can be attributed to the fact that they are present in the water where they sometimes float on the surface. Besides, the decreased release of the Shatt al-Arab and other climate related factors like high rate of salinity, high rate of evaporation and high temperature that are not within the normal ranges of the climatic conditions have also contributed to the degradation and dispersion of the plastic materials. These circumstances promote the disintegration of plastics into smaller fragments and the expansion of the same within the water body. Plastic particles of color tend to attract fish, which confuses them as a food item and this could be very dangerous when consumed by fish. This is also a possible hazard to the human beings by consuming contaminated fish. **Mohamed *et al.* (2021)** made similar observations when researching on the estuary of the Kaling River in Malaysia. FTIR analysis was used to identify several plastic polymers such as thermoplastics, polyvinyl chloride, polyethylene terephthalate, polyethylene, nylon, and silica (Fig. 5).

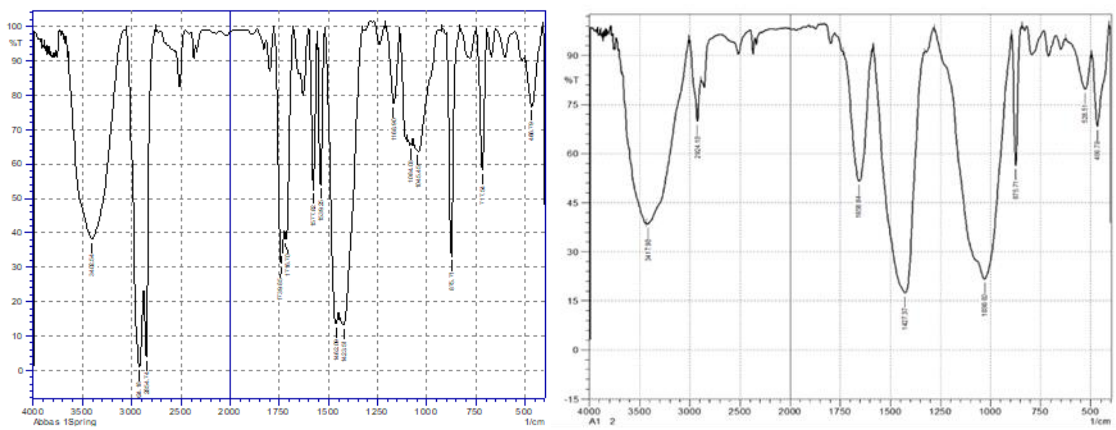

Fig. 5. The Examination of Plastic Polymers Using FTIR Technology

CONCLUSION

We infer that the existence of these colors reveals that there are microplastics in fish food, which gives evidence to the presence of plastic contamination in the Shatt al-Arab River. These colored particles can serve as fish bait because they look like some food found in nature. We thus advise that fish must be comprehensively cleaned upon capture and subjected to a thorough inspection in order to eliminate any form of plastic contamination since the contaminants could be hazardous to the human health.

REFERENCES

Alice, K.; Forrest, H. and Mark, H. (2018). Ingestion of plastic by fish destined for human consumption in remote South Pacific Islands, Australian Journal of Maritime & Ocean Affairs, 10(2): 81–98.

Anderson, Z. T.; Cundy, A. B.; Croudace, I. W.; Warwick, P. E.; Celis-Hernandez, O. and Stead, J. L. (2018). A rapid method for assessing the accumulation of microplastics in the sea surface microlayer (SML) of estuarine systems, Scientific Reports, 8(1): 1–11.

Andrade, M. C.; Winemiller, K. O.; Barbosa, P. S.; Fortunati, A.; Chelazzi, D.; Cincinelli, A. and Giarrizzo, T. (2019). First account of plastic pollution impacting freshwater fishes in the Amazon: ingestion of plastic debris by piranhas and other serrasalmids with diverse feeding habits, Environmental Pollution, 244: 766–773.

Al-Fares, E. A. and Al-Zaidan, A. S. Y. (2025). Occurrence of macro- and microplastics in sediment and mudskippers from Ashish Al-Doha, Kuwait, Kuwait Journal of Science, 52: 100423.

Al-Shamary, A. Ch.; Hussien, N. A. and Al-Zwar, A. M. (2025). The effect of water discharge rates on the spread of plastic particles in the Shatt al-Arab River, Journal of Water Resources and Geosciences, 4(1): 70–87.

Al-Zawar, A. M.; Al-Shamary, A. Ch. and Hussain, N. A. (2023). Assessment of ingested plastic particles in the guts of seventeen fish species from Shatt Al-Arab River, IOP Conference Series: Earth and Environmental Science, 1215(1): 012015.

Bahri, A. R. S.; Muhammad, I.; Alfina, B. and Hasriwiani, H. A. (2020). Identification of microplastic in tilapia fish (Oreochromis mossambicus) at Tallo River in Makassar, International Journal of Science and Healthcare Research, 5(3): 406–411.

Chaudhary, R. and Garg, A. P. (2023). Global impact of plastic pollution and its management for sustainable development, In: Quality of life and climate change, IGI Global, 1: 125–145.

Critchell, K. and Hoogenboom, M. O. (2018). Effects of microplastic exposure on the body condition and behavior of planktivorous reef fish (Acanthochromis polyacanthus), PLoS ONE, 13(3): e0193309.

Fahrenfeld, N. L.; Arbuckle-Keil, G.; Beni, N. N. and Bartelt-Hunt, S. L. (2019). Source tracking microplastics in the freshwater environment, TrAC Trends in Analytical Chemistry, 112: 248–254.

Fischer, W. and Bianchi, G. (1984). FAO species identification for fishery purposes, western Indian Ocean (Fishing Area 51), FAO, 3: 1–594.

Forrest, A. K. and Hindell, M. (2018). Ingestion of plastic by fish destined for human consumption in remote South Pacific Islands, Australian Journal of Maritime & Ocean Affairs, 10(2): 81–97.

Hamed, M.; Soliman, H. A. M.; Osman, A. G. M. and Sayed, A. E. D. (2020). Antioxidants and molecular damage in Nile tilapia (Oreochromis niloticus) after exposure to microplastics, Environmental Science and Pollution Research, 27: 14581–14588.

He, D.; Luo, Y.; Lu, S.; Liu, M.; Song, Y. and Lei, L. (2018). Microplastics in soils: analytical methods, pollution characteristics and ecological risks, TrAC Trends in Analytical Chemistry, 109: 163–172.

Hussein, D. A.; Al-Hejuje, M. M. and Mahdi, M. A. (2022). Determination of water quality and pollution by micro and nano plastics in water treatment plants, Egyptian Journal of Aquatic Biology and Fisheries, 26(4): 47–58.

Hussein, K. M. (2025). Study of the accumulation of micro plastic in sediments and samples of the shrimp Metapenaeus affinis (H. Milne Edwards, 1837) in Iraqi inland and marine waters, Master's Thesis, University of Basrah, 1: 1–110. (in Arabic)

Kadhum, S. A.; Salwan, A. A.; Salam, H. E.; Nadhir, A. and Abolfazl, N. (2020). Microplastic contamination of surface sediment of Euphrates River, Iraq: a preliminary study, Journal of Physics: Conference Series, 1664(1): 012139.

Kuronuma, K. and Abe, Y. (1986). Fishes of the Arabian Gulf, Kuwait Institute for Scientific Research, International Academic Printing Co. Ltd, 1: 1–356.

Kyork, S. A. (2016). Classification of litter pollutants in the main branches of Shatt Al-Arab River and the management, Misan Research Journal of Science, 12(24): 71–86.

Lagarde, F.; Olivier, O.; Zanella, M.; Daniel, P.; Hiard, S. and Caruso, A. (2016). Microplastic interactions with freshwater microalgae: hetero-aggregation and changes in plastic density appear strongly dependent on polymer type, Environmental Pollution, 215: 331–339.

Loder, M. G. J.; Kuczera, M.; Mintenig, S.; Lorenz, C. and Gerdts, G. (2015). Focal plane array detector-based micro-Fourier-transform infrared imaging for the analysis of microplastics in environmental samples, Environmental Pollution, 277: 113–122.

Martinez-Tavera, E.; Duarte-Moro, A. M.; Sujitha, S. B.; Rodriguez-Espinosa, P. F.; Rosano-Ortega, G. and Exposito, N. (2021). Microplastics and metal burdens in freshwater tilapia (Oreochromis niloticus) of a metropolitan reservoir in Central Mexico: potential threats for human health, Chemosphere, 266: 128968.

Mohamed, R. M.; Zaki, P. X. Y.; Azim, H. Z.; Muhammad, R. R. and Ahmad, Z. A. (2021). Occurrence, abundance, and distribution of microplastics pollution: an evidence in surface tropical water of Klang River estuary, Malaysia, Environmental Geochemistry and Health, 44: 727–741.

Moyle, M. S.; Akbar, M. M. and Hussain, N. A. (2023). Evaluation of spatio-temporal changes in water quality in the middle section of the Shatt Al-Arab River, Southern Iraq, Journal of Ecological Engineering, 24(4): 297–311.

Pegado, T. S. E. S.; Schmid, K.; Winemiller, K. O.; Chelazzi, D.; Cincinelli, A.; Dei, L. and Giarrizzo, T. (2018). First evidence of microplastic ingestion by fishes from the Amazon River estuary, Marine Pollution Bulletin, 133: 814–821.

Rafey, A. and Siddiqui, F. Z. (2021). A review of plastic waste management in India – challenges and opportunities, International Journal of Environmental Analytical Chemistry, 103(16): 3971–3987.

Rizki, S. B.; Muhammad, I.; Alfina, B. and Hasriwiani, H. A. (2020). Identification of microplastics in tilapia fish (Oreochromis mossambicus) at Tallo River in Makassar, International Journal of Science and Healthcare Research, 5(3): 406–411.

Sadiq, D. M. A. and Al-Hejuje, M. M. (2025). Evaluation of microplastic pollution in water of Shatt Al-Arab River southern of Iraq, Egyptian Journal of Aquatic Biology & Fisheries, 29(3): 1349–1361.

Smith, L. E. (2018). Plastic ingestion by Scyliorhinus canicula trawl captured in the North Sea, Marine Pollution Bulletin, 130: 6–7.

Widianarko, B. and Inneke, H. (2018). Microplastics in seafood from the north coast of Java, Soegijapranata Catholic University, 1: 1–55.