

# The recent trends of the inland fishery of Basrah government, Iraq

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**Abstract:** The fish species caught in the inland fishery of Basrah were recorded from seven landing sites between January and December 2022. A total of 14 types of fish from four families were identified in this fishery. The most commonly caught fish were exotic species such as *Cyprinus carpio* and tilapia species. In contrast, the landings of significant native freshwater fish that are characteristic of Mesopotamian aquatic environments, such as *Carasobarbus luteus*, *Mesopotamichthys sharpeyi*, *Luciobarbus xanthopterus*, and *Arabibarbus grypus*, dropped considerably. The total fish landing has been steadily increasing since 2009, indicating a positive trend in the overall landing. This growth may be attributed to the expansion of fishing activities and the prevalence of exotic species due to the degradation of the water ecosystem in Southern Iraq. From a fisheries management viewpoint, it is essential to maintain native stocks in the aquatic ecosystems in southern Iraq involving regional cooperation between Iraq, Turkey and Iran to secure the appropriate quantities of water for Iraq from the upper Tigris and Euphrates Rivers, strengthening the stocks of economically native fish by artificially propagating them and then releasing juvenile species into natural waters, and restrict the reproduction of carps and confining them to fish farms, and finally minimizing the impacts of tilapia species by intensifying the fishing activities.

**Key-Words:-** Inland fisheries, Landing trends, Exotic species, Basrah, Iraq.

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## 1 Introduction

For centuries, inland waters such as lakes, rivers, streams, inland canals, reservoirs, and marshlands have been a fundamental source of nutrition for humans. Particularly in developing countries, inland fisheries play a significant role in ensuring food security and providing nutrition to many people around the globe [1]. In 2020, the worldwide inland fisheries production was 11.5 million tons, which means around 12.7% of the total capture fishery production. The top three countries in global production were India, China and Bangladesh with 1.80, 1.46 and 1.25 million tons respectively [2].

Iraq has very rich freshwater resources, among the most abundant in the Middle East, due to the Tigris and Euphrates Rivers and their tributaries. According to a study conducted by Çiçek et al. [3], these waters support a wide variety of fish species, with 98 different species

identified and the majority of these species (57) belonging to the Cyprinid.

In 1990, the southern region of Iraq was responsible for more than 60% of the inland fish catch, which made it a potentially productive source of fish [4]. However, towards the end of the century, due to the construction of hydropower projects in the headwaters of the Tigris and Euphrates Rivers and their tributaries, the water quality and quantity in Basrah province suffered a decline. Additionally, the runs of the Karun and Karkha Rivers were diverted into Iranian territory [5], which led to the extension of the saltwater up to about 100 km into the Shatt Al-Arab River during dry years, resulting in high levels of salinity in the water lands of the province [6; 7].

Some studies have been conducted on the inland fisheries of Basrah. For example, Mohamed et al. [8] provided a detailed description of the species, catch rates, fishing efforts, and total landing of artisanal fisheries in the landing sites at Al-Qurna, Al-Midaina,

and Swab, located north of Basrah province in 2005. Nasir and Khalid [9] defined the annual landings of species in Basrah inland fishery from 2005 to 2016. Abood and Mohamed [10] and Mohamed and Abood [11] also examined the species composition, total catch, fishing effort, and landing trends of the Basrah inland fishery of Basrah during 2017-2019 and 2020-2021, respectively.

To adequately manage the fisheries in Basrah province, it is necessary to keep track of the landings of various species and analyze the statistics of inland fisheries. To achieve this, a study will be conducted to evaluate the trends in landings of different inland fish species in Basrah during 2022 and compared with the relevant literature on the state of this fishery in Basrah since 1975. This study will help ensure responsible resource techniques to evaluate the fisheries and the environment.

## 2 Materials and Methods

Basrah province is located in southern Iraq between latitudes 29°50' and 31°20' in the North and longitudes 47°40' and 48°30' in the East. The province is characterized by a diverse range of inland water resources, including rivers, channels, and marshes. It is surrounded by the Tigris and Euphrates rivers, as well as marshlands such as Al-Hammar and Al-Hawizah in the north, and the Arabian Gulf in the south. The Shatt Al-Arab River flows through the Basrah governorate to the Gulf, along with the Shatt Al-Basrah Canal leading to the Gulf through Khor Al-Zubair and Khor Abdullah (Fig. 1).

This work focuses on the landing sites of fish within the Basrah province, including Al-Qurna, Al-Midaina, Al-Dair, Al-Hartha, Abu-Al-Kaseeb, and Al-Seeba (as shown in Fig. 1). These sites have been selected due to their proximity to water bodies in the province and their suitability for fishing activity and landing. The research will cover the period from January to December 2022.



Fig. 1: Location of the landing sites of data collection in the Basrah inland fisheries.

The official prime data included the monthly total catch of each species, the number of fishermen and the specifications of fishing gear obtained by the competent staff of the Directorate of Basrah Agriculture of the Iraqi Ministry of Agriculture from the landing sites as documented in the Directorate. These prime data were computerized, analyzed through descriptive statistics and included in each species' numerical and graphic results.

The relative abundance (%R) of each species was calculated according to the formula of Krebs [12]:

$$\%R = C_i / TC * 100$$

where  $C_i$  is the landing of  $i^{\text{th}}$  species and TC is the total landings.

The monthly variations between monthly landings were tested using one-way analysis of variance (ANOVA) and the least significant differences were used to analyse the difference between months and years using SPSS software (version 16, 2007) statistical package.

A trend line (technical analysis) was used to show the general direction and designate patterns of fish species' landings by the TREND function in Microsoft Excel. The biomass diversity index (Hb) was calculated for each month by Morisita's index [13]:

$$H_b = - \sum P_i \log_e P_i$$

where  $P_i$  is the proportion of  $i^{\text{th}}$  species as the weight of each species for each month. All

computations and analyses were carried out using Microsoft Excel 2010 program.

### 3 Results

#### 3.1 Catch Composition

In 2022, the Basrah inland fishery landed fourteen fish species from four families. Other species that are not commercially desirable are often sold as mixed fish. The Cyprinidae included Common carp (*Cyprinus carpio*), Tigris asp (*Leuciscus vorax*), Himri barble (*Carasobarbus luteus*), Binni (*Mesopotamichthys sharpeyi*), Yellowfin barbell (*Luciobarbus xanthopterus*), Shabout (*Arabibarbus grypus*), Mosul bleak (*Alburnus mossulensis*). The Mugilidae included Abu mullet (*Planiliza abu*), Greenback mullet (*Planiliza subviridis*), Klunzinger's mullet (*Planiliza klunzengeri*), the Cichlidae had Nile tilapia (*Oreochromis niloticus*), Blue tilapia (*Oreochromis aureus*), Redbelly tilapia (*Coptodon zillii*) and the Sparidae included Arabian yellowfin seabream (*Acanthopagrus arabicus*).

According to Figure 2, the total landing and relative abundance of each species caught during 2022 is explained below. A total of 2,339.1 t from different species were landed, and the three most commonly landed species were *C. carpio* with about 709.5 t, tilapias at

380.8 t, and *P. abu* at 303.7 t. The other caught species ranged from 9 t for *A. mossulensis* to 222.9 t for *L. vorax*, while mixed fish landing was 267.9 t.

The landing data for 2022 shows the relative abundance of different species, which is illustrated in Figure 2. Among all the landings, *C. carpio* was the most dominant species, constituting 30.3% of the total landings. Tilapias were the second most abundant species, accounting for 16.3% of the landings, followed by *P. abu* at 13.0%. The mixed fish contributed to 11.5% of the total landings. In addition, some historical species such as *L. vorax*, *C. luteus*, *M. sharpeyi*, and *A. grypus* also made up parts of the landings, with 9.5%, 5.1%, 5.1%, 1.6%, and 1.2% of the total landings, respectively.

#### 3.2 Monthly landings

Monthly fluctuations were observed in the contribution of species that constituted 5.0% or more of the total landing, as depicted in Figures 3-4. The lowest landing was recorded in April, which was 105 t, while the highest was 263 t in January (Fig. 3). The analysis of variance conducted to compare the landings of different species throughout the year revealed a significant difference between the months ( $F=98.220, P>0.05$ ).

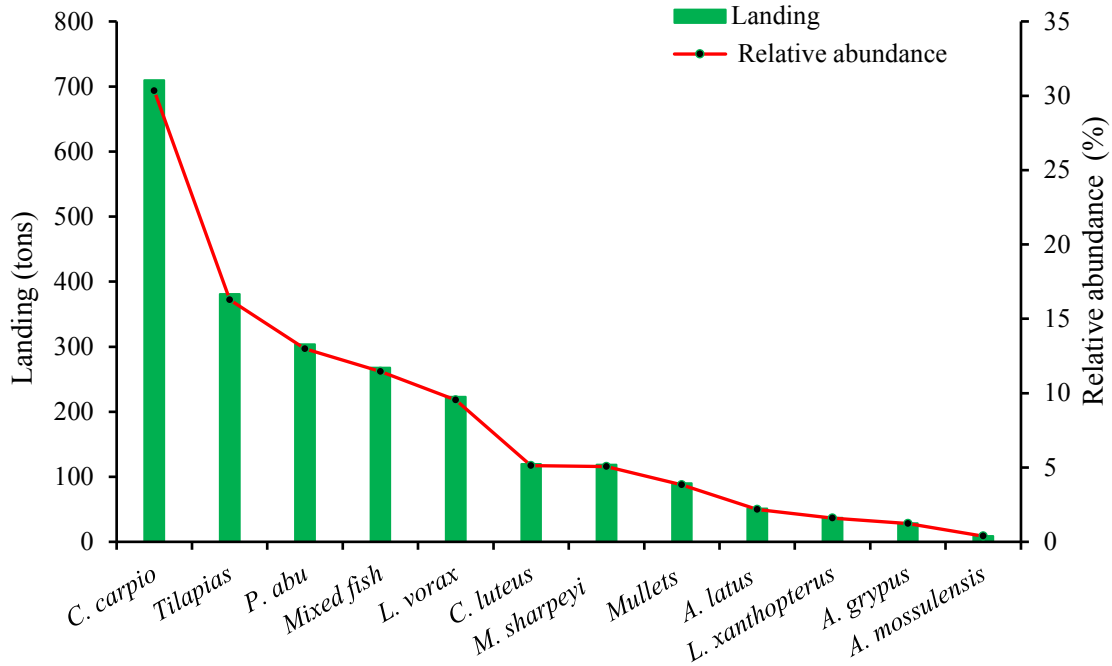


Fig. 2: The total landing and relative abundance of fish species in inland fisheries in 2022.

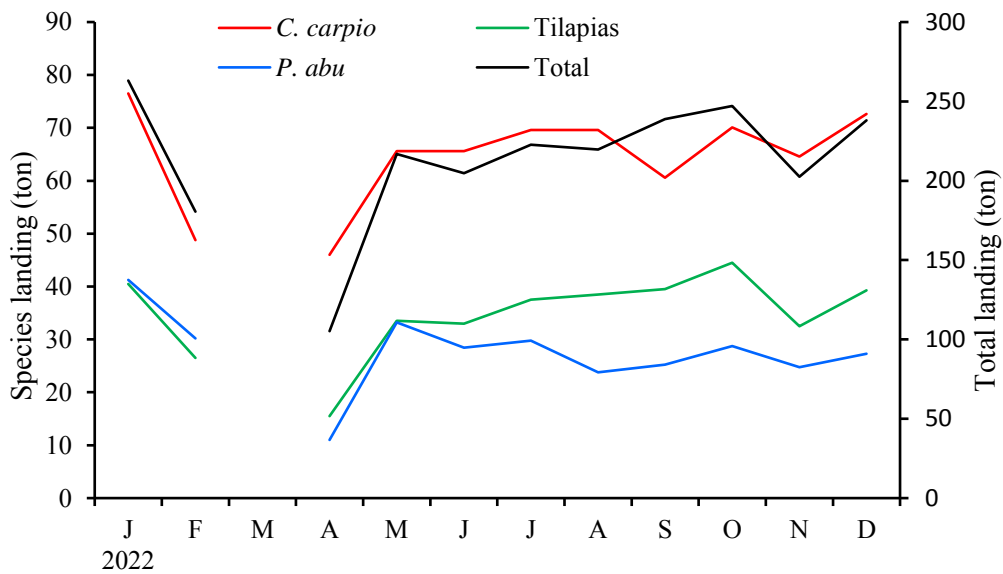


Fig. 3: The monthly fluctuations in the landings of the total, *C. carpio*, *P. abu* and tilapias.

*C. carpio* was the main species that landed during the study period when the landing extended from 46.0 t in April to 76.5 t during January (Fig. 3). The second most landed species was the tilapias, their landings fluctuated from 15.5 t in April to 44.5 t in October. The landing of *P. abu* fluctuated from 11 t in April to 41.3 t in January (Fig. 4).

Figure 4 explains the monthly differences in the catches of the *L. vorax*, *C. luteus*, *M.*

*sharpeyi* and mixed fish during 2022. The landing of the *L. vorax* varied from 4.0 t in April to 47.2 t in September, while the *C. luteus* from 2.8 t in April to 15.9 t in December. The landing of *M. sharpeyi* changed from 3.6 t in June to 16.9 t in January, and the mixed fish landing varied from 14.5 t in April to 31.4 t in July.

The monthly variation in the biomass diversity "Hb" for all species during 2022 is demonstrated in Figure 5. The diversity ranged from 1.79 in April to 2.89 in January, and the overall value was 2.52.

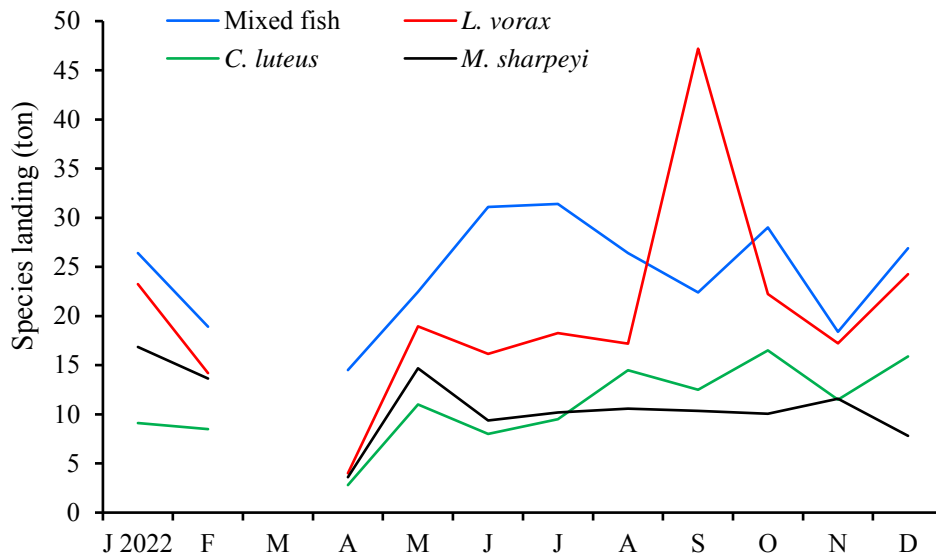


Fig. 4: The monthly fluctuations in the landings of the *L. vorax*, *M. sharpeyi*, *C. luteus* and mixed fish.

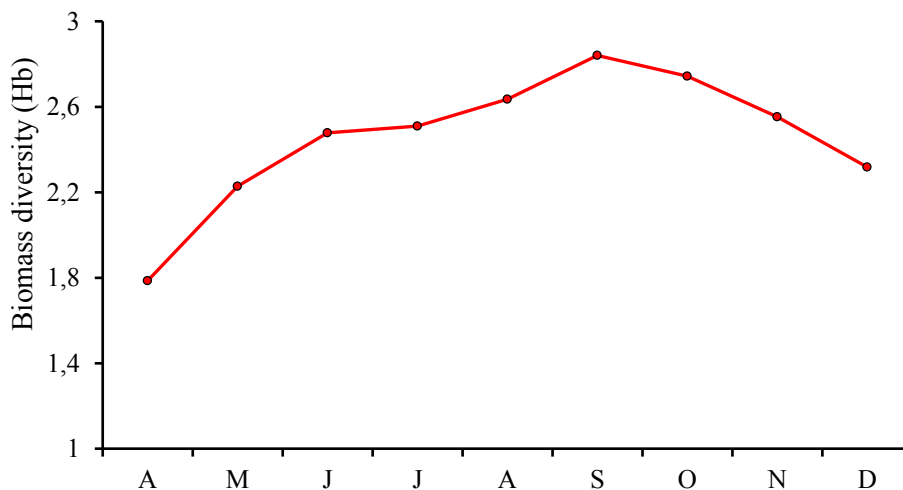


Fig. 5: Biomass diversity ( $H_b$ ) values of the monthly inland fish catch during 2022.

#### 4 Discussion

In Basrah province, the banning of freshwater fishing activities started from the middle of February to the middle of April when fishing was suspended coinciding with the breeding season for most freshwater fish according to the Act of Regulating Fishing and Aquatic Exploitation and Protection No. 48 for 1976.

In this study, we compare the characteristics of the inland fishery with the

relevant literature on the state of this fishery in Basrah since 1975, specifically for species landings, and from 2009 for the total landings. The sources used for comparison include Sharma [4], Mohamed et al. [8], Nasir and Khalid [9], Abood and Mohamed [10], and Mohamed and Abood [11]. This comparison aims to estimate the landing trends of the total and the main species landings in this fishery to provide a comprehensive overview of the development fishery and to facilitate appropriate management.

According to Figure 6, the total fish landing has consistently increased over the years. In 2009, the total landing was approximately 256.0 t, and it reached its highest point at 2,537.8 t in 2020. This indicates a positive trend in the total landing, with a slope of 187.8. The

increase in the overall landing of fish may be attributed to the expansion of fishing activities and the prevalence of exotic species due to the degradation of the water ecosystem in southern Iraq.

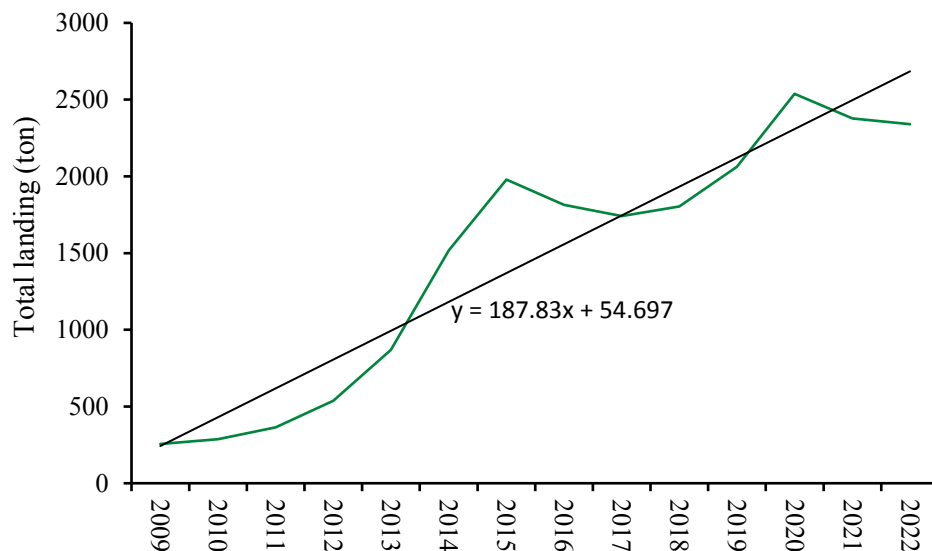


Fig. 6: The trends of the total landings of Basrah inland fishery (2009-2022).

A study conducted by Mohamed and Abood [11] found that there has been a significant increase in the fishing effort used by fishermen in the Basrah Inland fishery in recent years, which included 2140 non-motorized boats ranging from 3.5-5.0 m in length, each employing one to three fishermen, and 1160 motorized boats powered by outboards of 2 to 55 hp ranging from 5.5-10.5 m in size, using two to three fishermen to operate each. In contrast, about 1283 boats operated in this fishery from 2005 to 2016, most of which were less than 10 m long and had small outboard motors. The estimated number of fishermen working in this fishery during that period was 1490, according to a study by Nasir and Khalid [9]. Generally, the main fishing gears and techniques used by fishermen in the Basrah inland fisheries during the investigated period included gill nets of various mesh sizes, seine and cast nets, and electro-fishing, which did not differ from those previously described by other authors [15; 16; 8].

The two most common fish species caught during landing were *C. carpio* and tilapias, which concurrently made up 46.6% of the catch. However, several native freshwater fish that are indicative of the Mesopotamian aquatic environment, such as *C. luteus*, *M. sharpeyi*, *L. xanthopterus*, and *A. grypus*, saw a significant decline in their landing numbers, accounting for only 13.0% of the total catch. These species are classified as threatened by the International Union for the Conservation of Nature and are included in the Red List [17; 18; 19]. Interestingly, an earlier report by Sharma [14] stated that the total landing in the central fish market in Basrah from October 1975 to June 1977 was 3,118.9 t, of which 2,172.8 t was landed during 1976. During that period, the native species *M. sharpeyi*, *L. xanthopterus*, and *C. luteus* constituted 24.8%, 24.1%, and 12.6% of the total landings, respectively, from 1975-1977.

Figures 7 and 8 show the trend lines of the landing of major fish species in the Basrah inland fishery from 1975 to 2022. Over this period, several species showed a significant

increase in their percentages (Fig. 7). *C. carpio* exhibited the highest increase, rising from 0.0% during 1975-1977 to 29.8% during 2021-2022, with a trend slope of 6.896. Tilapia also showed an increase from 0.0% during 1975-1977 to 16.5% during 2021-2022 ( $b= 3.854$ ). Furthermore, *L. vorax* increased from 2.2% during 1975-1977 to 14.4% during 2019-2020 ( $b= 1.895$ ), and *P. abu* increased from 5.7% during 1975-1977 to 17.2% during 2017-2018 ( $b= 1.895$ ), and *P. abu* increased from 5.7% during 1975-1977 to 17.2% during 2017-2018 ( $b= 1.376$ ). Despite measures to prevent the catching of *A. grypus* in the marshes for

breeding and to promote fish growth during the 1970s [14], the landing trend of *A. grypus* slightly increased from 0.2% during 1975-1977 to 1.8% during 2019-2020 ( $b= 0.39$ ).

In contrast, other species showed clear decreasing trends in their percentages during this period (Fig. 8), including *L. xanthopterus* was dropped from 24.1% during 1975-1977 to 1.0% during 2005-2016 with a trend slope ( $b$ ) - 4.43, followed by *M. sharpeyi* from 24.8% during

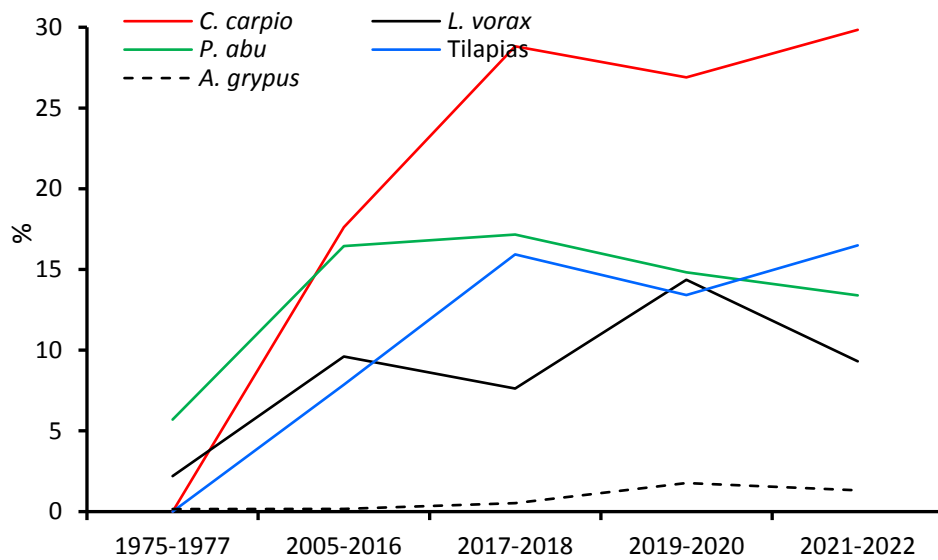


Fig. 7: The landing trends of *C. carpio*, tilapias, *P. abu*, *L. vorax* and *A. grypus* in Basrah inland fishery (1975-2022).

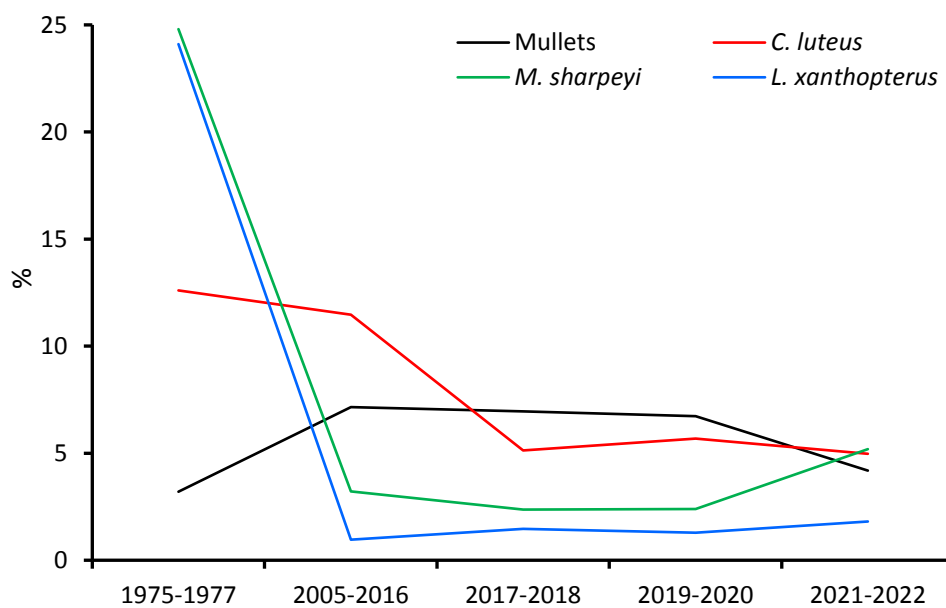


Fig. 8: The landing trends of *C. luteus*, *M. sharpeyi*, *L. xanthopterus*, and mullets in Basrah inland fishery (1975-2022).



1975-1977 to 2.4% during 2017-2018 ( $b = -4.00$ ), and *C. luteus* from 12.6% during 1975-1977 to 5.0% during 2021-2022 ( $b = -2.10$ ), whereas the landing trend for mullet showed small increasing from 3.2% during 1975-1977 to 7.2% during 2005-20016 ( $b = 0.16$ ).

The decline in the landings of native freshwater fish and their contributions over the last few decades can be attributed to significant changes in the aquatic environment in south Iraq as a result of the deterioration in water quality and quantity caused by the construction of numerous irrigation projects, dams, and reservoirs in the headwaters of the Tigris and Euphrates Rivers and their tributaries. Additionally, the conversion of the Karkheh and Karun Rivers into Iranian territory has exacerbated the situation [20; 21 ; 5; 22; 23; 24]. Previously, the southern marshlands of Iraq received consistent flood pulse during the spring season from the Tigris and Euphrates basins, which corresponds with the primary breeding season for most endemic fish species in these environments that depend on water level and temperature for stimulation spawning and migration, and support better juvenile fish survival and improve growth [25; 26]. The recent various upstream activities (damming and diversion) have caused a substantial reduction in water flow patterns and cut this flood pulse, resulting in less water supply downstream and severely threatening the marshlands [20]. Several studies referred to the impacts of alteration of the annual flood-pulse in stretches of floodplain as a result of dams upstream construction can affect the structure of the fish assemblages, fish production, reproductive processes, support better juvenile fish survival and improved growth [27; 28; 29; 30; 31].

Furthermore, the exotic species *C. carpio* and tilapia thrive in the different aquatic ecosystems of Basrah province [32; 33; 34; 35]. Since *C. carpio* was introduced into the aquaculture industry more than 60 years ago [36], the species has been established very well in different inland systems of Iraq in the mid-

1980s [32]. Moreover, recently, *C. carpio* was reproduced in the shrimp hatchery in the marshes of Basrah province by the Ministry of Agriculture and released fingerlings into the waters of the region (Personal communication). On the other hand, tilapia species were recorded firstly in the middle of Iraq in 2007 [37] and later successfully established and spread widely in the aquatic environments in the south of Iraq [38; 33]. However, several studies referred that *C. carpio* and tilapias were considered a problem in several countries because of their perceived impacts on water quality, aquatic plants and the population sizes of native freshwater fish populations through competition and lowering habitat quality [39; 40; 41; 42; 43; 34; 44; 45; 46].

(Koehn *et al.*, 2000; Canonico *et al.*, 2005; Simoes Vitule *et al.*, 2009; Badiou *et al.*, 2011; Gu *et al.*, 2015; Jawad *et al.*, 2021; Stauffer *et al.*, 2022; Abd Hamid *et al.*, 2023; Piczak *et al.*, 2023).

## 5 Conclusion

According to the study, the overall fish catch has been on the rise in recent years. This has been attributed to the dominance of exotic species such as *C. carpio* and tilapia. Conversely, economically valuable native fish such as *M. sharpeyi*, *L. xanthopterus* and *C. luteus* have contributed less than their historical levels. Subsequently, the following management actions should be required to maintain sustainable native stocks in the aquatic ecosystems in southern Iraq involve regional cooperation between Iraq, Turkey and Iran to secure the appropriate quantities of water from the upper Tigris and Euphrates Rivers and their tributaries for Iraq, following the historical principles in this regard; protect water bodies from various pollutants and the deterioration of their quality, as many rivers and canals pass through cities and agricultural fields that transport large quantities of untreated domestic and agricultural sewage waste directly to these bodies; strengthening the stocks of economically valuable native fish by artificially propagating them and then releasing juvenile species into natural water bodies, and restrict the reproduction of carps and confining them to fish farms. Finally minimizing the impacts of tilapia species by



intensifying the fishing activities, such as increasing the number of fishing boats and decreasing the mesh size for extensive harvest for use as animal forage or for export as less desired as food by Iraqi people compared with the exotic cyprinids.

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The authors have no conflicts of interest to declare that are relevant to the content of this article.

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