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Evaluation of the Commercial Fish Catch at the Al-Fao Landing Site, Southern Iraq During January to December 2022

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ABSTRACT

Due to the lack of published information on the commercial fish caught at the Al-Fao landing site, this study was conducted from January to December 2022 to fill this gap in the literature. The collected data were obtained from the Fao Agriculture Division and provided by the Al-Nasr Fish Society in Al-Fao City, southern Iraq. The total weight of the catch fluctuated between 825 tons in February, representing 6.7% of the total marketing fish, and 1418 tons in August, equivalent to 10.44% of the overall fish collected at the Al-Fao landing site. In total, the catch weighed 13585 tons. The present results showed that five families of fish in addition to small fish constituted 70.73% of the total quantities of fish at the landing site. Specifically, Nemipteridae accounted for 14.46%, small fish for 14.32%, Mugilidae for 12.04%, Sparidae for 11.74%, Lethrinidae for 10.12%, and Carangidae for 7.69% of the total weight of fish.

INTRODUCTION

Fish represent an essential food source with high nutritional value. Fish are easy to digest, and they contain protein, fats, minerals, and vitamins that maintain human health **(Balami *et al*., 2019)**. As the world's population continues to increase, fish serve as a valuable protein-rich food for hundreds of millions of poor people worldwide **(Pradeepkiran, 2019)**.

Global fisheries and aquaculture production have reached high levels in the last few years of the current decade; they play an important role in providing food to a wide segment of the world's population **(Mekouar, 2020)**. Global production of fisheries and aquaculture reached a significant milestone in 2020, reaching a capacity of 214 million tons. This included 178 million tons of aquatic animals and 36 million tons of algae, with the majority originating from Asia. Approximately, 157 million tons of aquatic animals were designated for human consumption, accounting for around 89% of the total production of aquatic animals. The remaining 20 tons were allocated for non-food usage, such as the production of fish powder and oil **(FAO, 2022)**.

Iraqi marine water located northwest of the Arabian Gulf, represents estuarine waters which are directly affected by the Shatt al-Arab River water **(Mohamed, 2018)**. Its high primary productivity characterizes it as a breeding, feeding, refuge, and nursery environment for countless marines and estuarine organisms. This is attributed to the large amount of nutrients released by the Shatt al-Arab River **(Ben-Hasan *et al*., 2018; Mohamed, 2018)**. The Arabian Gulf is characterized by being semi-closed region and exposed to high temperatures during the long summer season, which increased salinity concentrations, especially after the lack of drainage of the Tigris and Euphrates rivers. Therefore, the freshwater dilutes the salinity of seawater adding to dilution in the Iraqi marine waters making it distinguishable as a breeding area, a nursery, and a shelter for many young marine fish species **(Al-Yamani *et al*., 2021)**.

The anthropogenic activities have caused deterioration in environmental characteristics and overfishing resulting in a decline in the stock of commercial fish in the northern Arabian Gulf **(Nichols *et al*., 2019)**. The impact of constructing dams on the Tigris and Euphrates rivers and reducing the discharge of freshwater into the Arabian Gulf had a major impact on fish **(Ben-Hasan *et al*., 2018)**, especially inshore fish, in addition to other factors that formed a stress on the Arabian Gulf ecosystem, such as the discharge of untreated sewage water, development factors near the coast, and desalination plants that release large amounts of salt water **(Hosseini *et al*., 2021)**.

Several studies were performed on marine fish composition and catch quantity in Iraqi marine waters. During these studies, a varying number of species from bony and cartilaginous fish were recorded, including both commercial and noncommercial fish. According to **Younis *et al*. (2014)**, the description of the commercial fish catch in Iraqi marine waters revealed that the amount of fish caught reached 3098 tons, representing 16 families. **Mohamed (2018)** recorded 31 commercial fish affiliated with 15 families. **Al-Faisal and Mutlak (2018)** surveyed 214 species belonging to 75 families, representing commercial and noncommercial fish, including 198 bony fish and 16 cartilaginous species. While, **Mohamed and Abood (2020)** harvested 35 taxa belonging to 18 families from the Iraqi marine water. In addition, **Al-Shamary *et al*. (2021)** caught 91 species affiliated with 71 genera, representing 47 families. Furthermore, **Al-Shamary and Younis (2022)** collected 37 commercial fish from 27 genera and 19 families.

The current study aimed to study the composition, diversity, and abundance of commercial fish off the Iraqi marine waters from January to December 2022.

MATERIALS AND METHODS

Iraqi marine water is distinguished by high nutrient and sediment levels from the waters of the Shatt al-Arab River, with the majority of the bottom components being muddy, sandy clay, rocky, or containing coral reefs **(Al-Humaidan *et al*., 2021)**. Because of the low salinity, it serves as a breeding and nursery habitat for a variety of marine fish.

Fishing operations take place throughout the year as stated by **Mohamed and Abood (2020)**.

Collection of data

The raw data on commercial fishing were daily collected through the commercial marketing process at the landing site. This information was obtained from the FAO Agriculture Division, which, in turn, received data from the Al-Nasr Fish Society in the Fao City covering the period from January to December 2022. Monthly field visits were organized to the location where the fish are landed in Al-Fao. The fish were identified according to **Fricke and Van der Laan (2023)** and **Froese and Pauly (2024)**. Through field visits to the port of Al-Fao, many interviews were conducted with fishermen, wholesalers, and retailers. The fish were weighed and classified according to their families.

Canonical correspondences analyses program (CCA) PAST 4.11 Software was used to analyze the results (Fig. 1).

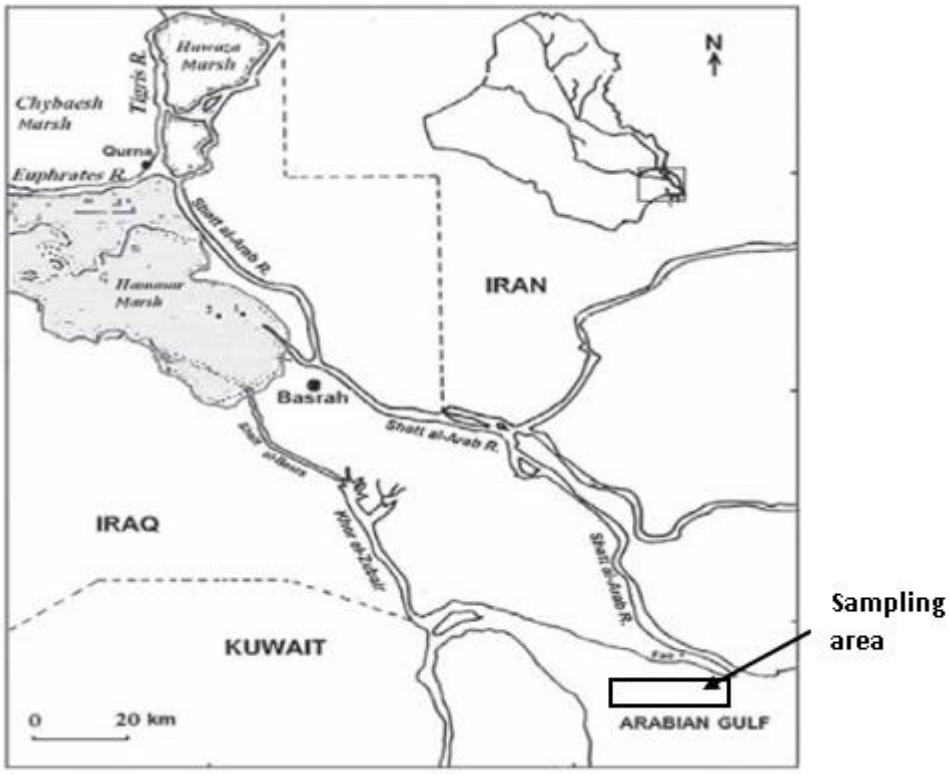

Fig. 1. Map of sampling site at Al-Fao City, south of Iraq

RESULTS

Species and families

A total of 41 commercial fish species belonging to 29 genera, 14 families, were recorded from the landing site. These families include Dorosomatidae, Epinephelidae, Carangidae, Chirocentridae, Haemulidae, Lethrinidae, Mugilidae, Nemipteridae, Platycephalidae, Sciaenidae, Scombridae, Soleidae, Stromateidae, and Sparidae, spanning six orders. These species are affiliated with bony fish. These commercial species vary in their economic value (Table 1).

Table 1. Fish species, genera, families, and their orders collected from Al-Fao landing site from January to December 2022

Order	Family	Species
Pleuronectiformes	**Soleidae**	***Brachirus orientalis***
Scombriformes	**Scombridae**	***Scomberomorus commerson***
		Scomberomorus guttatus
	Stromateidae	***Pampus argenteus***
Mugiliformes	**Mugilidae**	***Planiliza klunzingeri***
		Planiliza carinata
		Mugil cephalus
Clupeiformes	**Dorosomatidae**	***Tenualosa ilisha***
		Nematalosa nasus
	Chirocentridae	***Chirocentrus dorab***
Carangiformes	**Carangidae**	***Carangoides chrysophrys***
		Parastromateus niger
		Scomberoides commersonnianus
		Uraspis helvola
		Alectis indica
		Alepes djedaba
		Atropus atropos
		Alepes melanoptera
		Alepes djedaba
		Carangoides bajad
Perciformes	**Nemipteridae**	***Nemipterus japonicus***
		Nemipterus bipunctatus
	Sparidae	***Acanthopagrus arabicus***
		Acanthopagrus berda
		Acanthopagrus bifasciatus
		Sparidentex hasta

		Pagellus affinis
	Sciaenidae	***Otolithes ruber***
		Argyrosomus hololepidotus
		Johnius dussumieri
		Johnius belangerii
	Haemulidae	***Pomadasys argenteus***
	Lethrinidae	***Lethrinus nebulosus***
		Lethrinus borbonicus
		Lethrinus microdon
	Serranidae	***Epinephelus areolatus***
		Cephalopholis hemistiktos
		Epinephelus bleekeri
		Epinephelus coioides
		Epinephelus polylepis
	Platycephalidae	***Platycephalus indicus***

Relative weight abundance of families and small fish

In the present study, the landing site yielded 13585 tons of fish from January to December 2022. The Nemipteridae family had the highest weight abundance (14.46%), with 1965 tons of fish recorded from the landing sites. Small fish constituted the second largest portion, accounting for 14.32% of the total catch with 1945 tons, followed by Mugilidae, which accounted for 12.04% of the total catch with 1635 tons. The family Sparidae formed 11.74% of the overall catch, totaling 1595 tons. The families Soleidae, Scombridae, and Platycephalidae ranked the last in terms of catch amounts for the current year, accounting for 0.67%, 0.35%, and 0.34% of the total catch, respectively. The mean ± SD of quantities for all families was 905.67± 677.12 (Table 2).

Table 2. Quantities of marketed fish from the Al-Fao landing site from January to December 2022

Family	Quantity of marketed fish (ton)	Percentage (%)
Nemipteridae	**1965**	**14.46**
Small fish	**1945**	**14.32**
Mugilidae	**1635**	**12.04**
Sparidae	**1595**	**11.74**
Lethrinidae	**1375**	**10.12**
Carangidae	**1045**	**7.69**
Dorosomatidae	**997**	**7.34**
Sciaenidae	**815**	**6.00**
Epinephelidae	**800**	**5.89**

Chirocentridae	**585**	**4.31**
Stromateidae	**417**	**3.07**
Haemulidae	**226**	**1.66**
Soleidae	**91**	**0.67**
Scombridae	**48**	**0.35**
Platycephalidae	**46**	**0.34**
Total caught	**13585**	
Mean ± SD	**905.67 ± 677.12**	

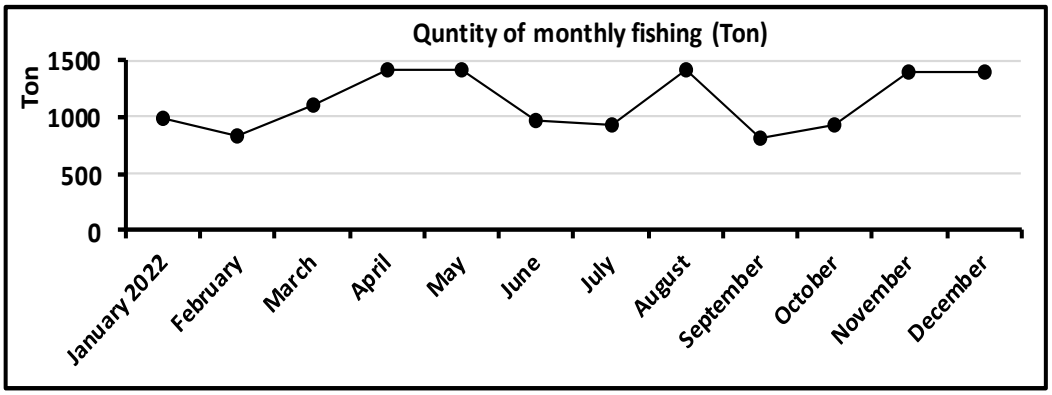

Fig. 2. Monthly variations in the total catch at the Al-Fao landing site from January to December 2022

Monthly variations in total catch at the landing site were significant, ranging from 825 tons in February, representing 6.07% of the total catch, to 1418 tons in August, which equals 10.44% of the overall catch, with a mean ± SD equals to 1132 ± 251.09 (Fig. 2).

Six families topped the marketing of fish quantities during the months of 2022. The family Nemipteridae, represented by two species, led the catch with 250 tons in January, 200 tons in October, and 250 tons in November. Sparidae had the highest catch quantities in February (260 tons) and March (250 tons), while Dorosomatidae led the catch in April (250 tons), May (400 tons), and June (200 tons). Mugilidae recorded high quantities in July (150 tons) and September (150 tons), while Carangidae topped the catch in August (310 tons) and December (227 tons). Additionally, Lethrinidae led the overall catch with 150 tons in September. The mean ± SD of families that monthly topped the fish quantities was 241.42 ± 67.99 (Fig. 3).

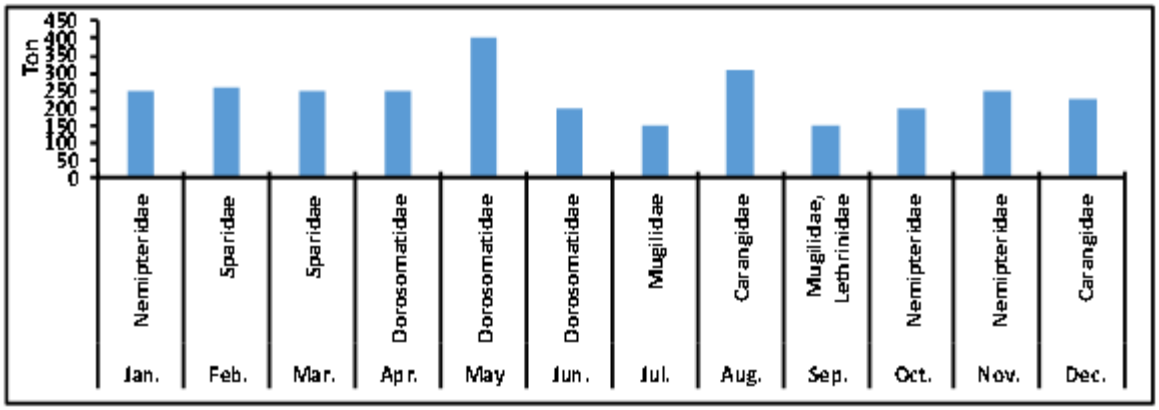

Fig. 3. Monthly topped quantities (ton) of families marketed from January to December 2022

The quantity of marketed fish from the Nemipteridae family was 1965 tons, which is equivalent to 14.46% of the total weight of the fish in the year. The two species, *Nemipterus japonicus* and *Nemipterus bipunctatus*, formed the largest percentage of the family caught. The lowest quantity of catch collected by the present family was 20 tons in September, which is equivalent to 2.45% of the total weight of catch in this month. The highest weight of catch was in January and November, 250 tons each, which equals 24.13% of the total weight of catch in January and 17.95% of the overall catch in November. The mean ± SD was 167.92 ± 60.73 (Fig. 4).

The mass production of marketed fish for Sparidae was 1595 tons, representing 11.74% of the total weight caught in the present investigated year. The present amount of fish mass is dominated by five species: *Acanthopagrus arabicus*, *Acanthopagrus berda*, *Acanthopagrus bifasciatus*, *Sparidentex hasta*, and *Pagellus affinis*. The minimum amount of catch in May was 15 tons, forming 1.07% of the total mass caught in this month, whereas the maximum catch was 260 tons in February, equivalent to 31.52% of the total caught in the present month. The mean ± SD was 130.83± 92.07 (Fig. 4).

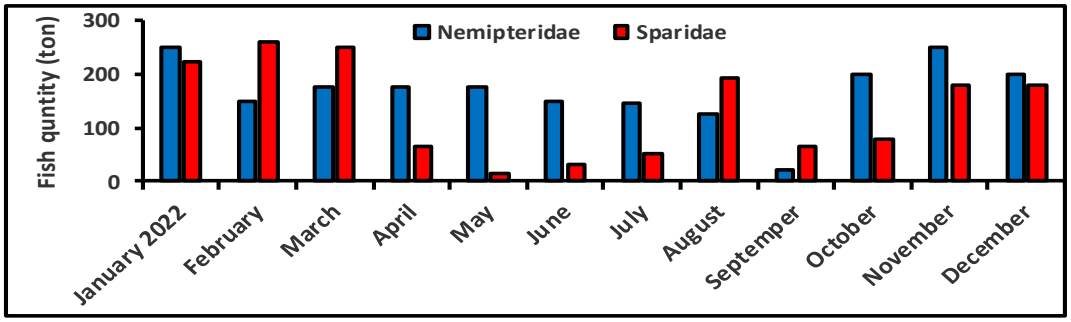

Fig. 4. Monthly variations of marketed fish from Nemipterridae and Sparidae families at landing site from January to December 2022

The overall mass fish of Mugilidae marketed was 1635 tons during the investigated year, accounting for 12.04% of the total catch in the current year. Three species dominated the catch: *Planiliza klunzingeri*, *Planiliza carinata*, and *Mugil cephalus*. The mass of fish varied between 20 tons in May, representing 1.42% of the total catch for the month, and 250 tons in August, accounting for 17.78% of the total catch in May, with the mean ± SD of 163.25± 71.42. (Fig. 5).

The quantity of marketed fish from the family Lethrinidae during the present year was 1375 tons, representing 10.12% of the total quantity. This family contains three species in the present study, with the largest amount of catch coming from *Lethrinus nebulosus*. The lowest quantity of catch was 10 tons in February, forming 1.21% of the overall catch during these months, while the highest quantity was 200 tons in April, constituting 14.16% of the aggregate catch for that month. The mean ± SD was 114.58 ± 49.56 (Fig. 5).

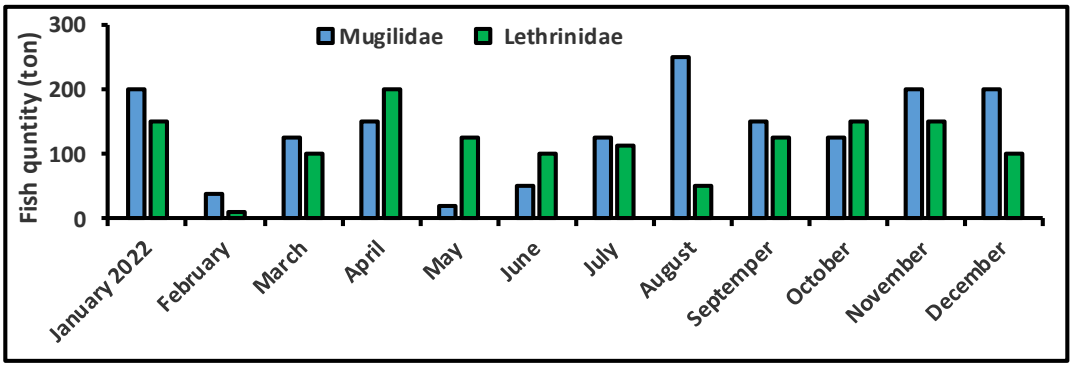

Fig. 5. Monthly variations of marketed fish from Mugilidae and Lethrinidae of marine species from January to December 2022

The total mass of Carangidae species was 1045 tons, representing 7.69% of the total catch in the investigated year. The current family is represented by 10 species in the present study. The species *Parastromateus niger*, *Alepes djedaba*, and *Atropus atropos* were the most abundant species in the present investigation. The amount of catch ranged from one ton in February representing 0.12% of the total catch in this month, and 310 tons in August, constituting 21.86% of the overall catch in August, with mean ± SD 87± 94.27 (Fig. 6).

Small fish encompassed various small species of commercial fish from different families. The total mass of these groups in the present investigated year was 1945 tons, forming 14.32% of the total catch. The minimum amount of small fish was 100 tons in June, equivalent to 7.18% of the overall catch, while the maximum amount was 250 tons in November, representing 17.95% of the total catch. The mean ± SD was 162.08 ± 39.45 (Fig. 6).

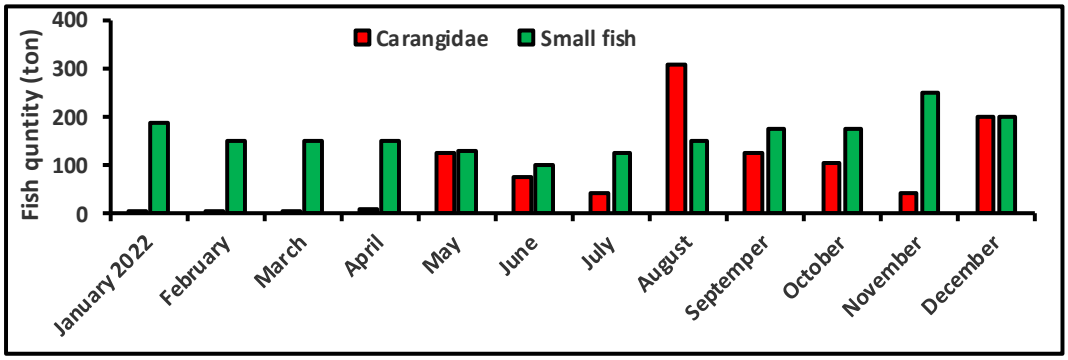

Fig. 6. Monthly variations of marketed fish from Carangidae and small fish of marine species from January to December 2022

The weight relative abundance revealed in commercial fishing that five families additional to the small fish were dominant at the Al-Fao marketing site, forming 70.37% of the total weight of the marketed fish: Nemipteridae, small-size fish, Mugilidae, Sparidae, Lethrinidae, and Carangidae formed 14.46, 14.32, 12.04, 11.74, 10.12 and 7.69%, respectively (Fig. 7).

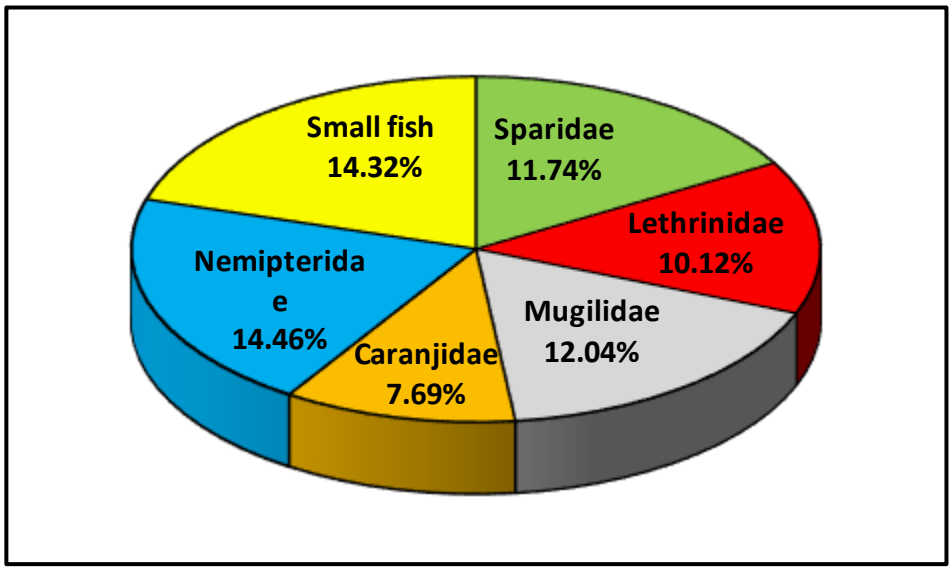

Fig. 7. The percentage of the most abundant families and small- sized fish collected from Al-Fao landing site during January to December 2022

DISCUSSION

As the world's population continues to grow, so does the demand for food in general, and animal protein in particular **(Kim *et al.*, 2019)**. Animal protein is one of the most important protein sources for humans because it provides energy and contains several

essential nutritional components, such as essential amino acids, zinc, iron, and vitamins **(Elmadfa & Meyer, 2017)**. Therefore, fish have a major role in meeting the world's increasing demand for animal protein. Fish are expected to become increasingly important as the world's population increases **(Boyd *et al*., 2022)**.

The present study collected 41 commercial fish species belonging to 14 families. In contrast, **Younis *et al.* (2014)**, in their description of the commercial fish status in Iraqi marine waters, found that commercial fish were affiliated with 16 families. **Mohamed (2018)** listed 31 commercial fish affiliated with 15 families. **Mohamed and Abood (2020)** recorded 35 species belonging to 18 families from artisanal fisheries northwest of the Arabian Gulf, whereas **Al-Shamary and Younis (2022)** discovered 37 commercial fish and 19 families. The present study results converge with the previous studies in the number of species and families, and the slight differences may be due to temporal and spatial variations among these studies.

The relative weight abundance of families and small fish are completely different from what **Younis *et al*. (2014)** mentioned regarding the kind of families that are prevailing in the catch, and in the quantity of fish mass collected, they found that Mugilidae, the most abundant family, formed 23.13% of the total catch equivalent to 717.014 tons, while in the present study, it was found that Nemipteridae, the most abundant family, represented 14.46% of the overall catch, and the mass of catch was 1965 tons. This variation may be due to the quantities of fish brought from Iranian, Bahraini, and sometimes even Omani waters in the last years. **Mohamed (2018)** reported that Mugilidae had the highest catch from the period 2008 to 2016 (1824 tons), followed by Chirocentridae (*Chirocentrus dorab*) with 558.3 tons, Carangidae with 409.5 tons, Dorosomatdae with 872.0 tons, Lethrinidae with 221.0 tons, Haemulidae with 158 tons, Sparidae 150 with tons, Platycephalidae with 110 tons, and Stromateidae (Pampus argenteus) with 96 tons. The present study showed a huge variation between previous studies in the quantity of fish brought to the landing site due to the large quantities of fish brought from outside Iraqi marine waters. The present results correspond with the findings of **Mohammed and Abood (2022)** considering the dominance of Nemipteridae and Mugilidae. However, they disagree with them in catch statistics trends. The aforementioned authors listed annual landings from Nemipteridae as 1265, 1920, and 1225kg during 2017, 2018, and 2019, respectively, while the current study mentioned 1965 tons in 2022. Additionally, **Mohmmed and Abood (2022)** reported annual landings from Mugilidae for the period from 2017 to 2019 as 753, 1267, and 1439kg, respectively. The differences were very large compared to the current study, 1635 tons during the year 2022, and the reason is due to the landing of large quantities of this family species from outside Iraqi waters.

The Arabian Gulf, especially its northern part, includes a diverse range of environments, including muddy, sandy, and rocky bottoms represented by rocky reefs **(Al-Kandari *et al*., 2020)**. The family Nemipteridae, represented by *Nemipterus*

japonicas and *Nemipterus bipunctatus*, formed the most abundant family in the north of the Arabian Gulf due to the preference of coastal muddy or sandy bottoms that are available in the north of the Gulf. In addition to food resources, mollusks, crustaceans, echinoderms, and polychaetes are obtainable **(Froese & Pauly, 2024)**. The other most abundant family is Sparidae, represented by five species. These species are distributed widely in the Arabian Gulf, with their most common habitats being estuaries. They can also inhabit shallow waters along the shore and are demersal in deeper waters. Most species of Sparidae are carnivores, feeding on invertebrates that are available in the present regions, which allows the family species to occur in a high abundance **(Iwatsuki & Heemstra, 2015; Tanaka & Iwatsuki, 2015)**.

The small fish occupied a high percentage in the catch. It occupied the second rank with 1945 tons (14.32%) due to the use of bottom trawl nets that include small mesh sizes. Notably, the bottom trawl nets are the most common and widely used fishing tools **(Selvam *et al*., 2021)**. Unfortunately, this type of net contributes to the depletion of fish stocks, the catching of large quantities of small fish of various species, and the destruction of the bottom of the marine environment **(Younis *et al*., 2014**; **Steadman *et al*., 2022)**.

On the other hand, climate change creates various changes leading to a rise in temperature and salinity via increasing the evaporation process and putting pressure on fish to vary their spatial and temporal distribution in both directions (horizontal and vertical) **(Gillanders *et al*., 2022)**. Changes in temperature and salinity are followed by a sequencing of variations in the food web and spawning time and place aligned with changes in water currents, which negatively impact fish diversity **(Nhat *et al*., 2024)**.

CONCLUSION

The study concluded that these large quantities of marketed fish at the Al-Fao landing site could not have been solely caught from Iraqi marine waters. This is clear by comparing the quantities in the present study with previous studies, and perhaps a large percentage of the fish was brought from the Iranian, Bahraini, or even the Omani waters.

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