



An Overview of the Commercial Catch from Beach Seine Fishing Method in the Southern Mediterranean Sea off Port Said, Egypt

Manal M. Sabrah¹, Mohamed Ismail², Fedekar F. Madkour², Mohamed E. A. Kassem^{2*}

¹ National Institute of Oceanography and Fisheries, Fisheries Division, Suez, Egypt

² Department of Marine Science, Faculty of Science, Port Said University, Port Said, Egypt

*Corresponding Author: Mohamadkassem@sci.psu.edu.eg

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ABSTRACT

The Mediterranean Sea is one of the most novel habitats with a high diversity of marine species. This study presents detailed quantitative and qualitative description of the beach seine netting commercial catch caught from the southern coast of Mediterranean Sea off Port Said, Egypt. In total, more than 2 tons of commercial catch were collected from 2018 to 2021. The current study represents the first of its kind to cover such an extended period along Port Said shoreline and the amount of commercial catch from this method. The study demonstrated that the collected catch has a variety of traits, since the fish and macroinvertebrate species constituted of different families. The study identified 41 fish and macroinvertebrate species, which belong to 13 orders and 23 families. There was a noticeable seasonal catch variation, where the seasonal catch of beach seine varied between the highest catch of 501kg/ haul in autumn and the lowest one 132kg/ haul in winter.

INTRODUCTION

The Mediterranean Sea is one of the largest marginal and semi-enclosed seas in the world. It is a marine water body that is located between Europe to the North, Africa to the South and Asia to the East. It is connecting to the Atlantic Ocean via the narrow Strait of Gibraltar in the west, to the Marmara Sea and the Black Sea through the Dardanelles in the northeast and the southeast region linked with the Red Sea and the Indian Ocean through the Suez Canal (Lionello *et al.*, 2006). It covers twenty-one countries across three continents; Africa, Asia and Europe, commonly known as the northern and southern Mediterranean regions (El Rhazi *et al.*, 2020). Southern regions include the Northern African coast, from east to west Egypt, Libya, Tunisia, Algeria and Morocco.

The Egyptian coastal region that faces the Mediterranean Sea stretches around 1,100 km, spanning from Salloum in the west to Rafah in the east. The coastal region possesses significant economic value due to its diverse ecological composition and

important habitats. Additionally, it offers ecosystem services that are attractive to investors and supports many recreational human activities (Emam *et al.*, 2013; Abdel Ghani *et al.*, 2023).

Egypt's Mediterranean coast is divided into four fishing grounds: Western region (Alexandria, El-Mex, Abu-Qir, Rasheed, El-Maadiya, Mersa Matrouh), eastern region (Port Said, El-Arish), Damietta region and the Nile Delta (LFRPDA, 2004). The Egyptian fishery yield in the Mediterranean Sea experienced a growth of approximately 50384 tons in 2021, while it recorded 49896 tons in 2020, signifying a 0.97% upward trend (LFRPDA, 2021).

Several studies have focused on the fisheries in the Egyptian region, providing valuable insights into the environmental, the fisheries and the economic aspects of this sector (Al-Kholy & El-Wakeel, 1975; Al-Sayes *et al.*, 1981; El-Karashily & Saleh, 1986; El-Mor *et al.*, 2002; Akel, 2003, 2005; Alsayes *et al.*, 2009; Mehanna *et al.*, 2013; Akel & Philips, 2014; Rizkalla & Ragheb, 2016; Guerriero *et al.*, 2017; Mehanna *et al.*, 2018; Mehanna & Farouk, 2021; El-Beltagy *et al.*, 2022; Mehanna, 2022).

The current work aims to study the commercial catches of unmanaged beach-seine netting on the fisheries in the Egyptian Mediterranean Sea, Port Said region, by species identification and quantification of beach seine fisheries of commercial catch. In addition, the study demonstrates the current impact on the future of fishery on the Egyptian Mediterranean region

MATERIALS AND METHODS

1. Study area

Port Said one of the costal governate in the north-eastern sector of Egypt, is bordered by the Mediterranean Sea to its north, the Suez Canal to its east and the eastern portion of Lake Manzala to its west (Seif *et al.*, 2022).



Fig. 1. Sampling site from the Mediterranean Sea, Egypt (Location of Port Said coast)

2. Fishing operation and data collection

The beach seine fishing method is one of the most common fishing methods along Port Said coast and usually used to catch some economic fish species all over the year. Sampling was monthly conducted throughout the period from 2018 to 2021, with some

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closing period during COVID19 (2020/2021). After the fishing operation, the catch was classified by the fishermen into two categories: Commercial catch and non-commercial catch. Detailed data on the commercial catch was collected during fieldwork and the species classification was done according to the field identification guide (**Bariche, 2012**). Species quantity, species length and total species weight of the beach seine commercial catch was collected during fieldwork, with supplementary data obtained by observing auctions.



Fig. 2. Beach seine fishing method

RESULTS

1. Commercial and non-commercial catch percentages of beach seine netting during the sampling period off Port Said

The study showed the non-commercial catch from beach seine nets comprised almost 74% of the total catch (Fig. 3), whereas the target commercial catch represented only 26% of the total catch during the study period.

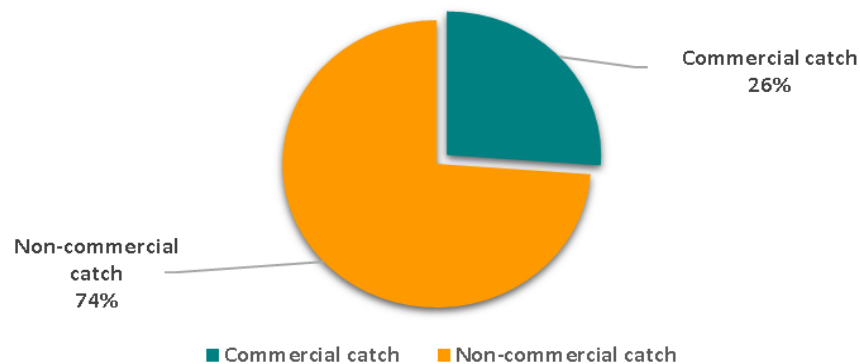


Fig. 3. Commercial and non-commercial catch percentages of beach seine netting during the sampling period off Port Said

2. Commercial catch species composition of beach seine during period of survey

This study demonstrated that the commercial species that were collected from the study region have a variety of traits since the fish and macroinvertebrate species

belong to various families. This investigation identified 41 fish including macroinvertebrate species, divided into 13 orders and 23 families.

Family Carangidae represent more than 50% of the total commercial catch, followed by Clupeidae represented by 13.39%, Mugilidae represented 9.06%, followed by Penaeidae 6.86%, Portunidae 3.80%, Trichiuridae 3.17%, Moronidae 2.65%, Pomatomidae 1.61%, Terapontidae 1.52%, Scombridae 1.51%, Sciaenidae 1.45%, Soleidae 1.20%, and Rhinopteridae 0.72%. In addition, Siganidae, Sparidae and Cichlidae, were represented by 0.22%, 0.10% and 0.01% respectively. The other species were represented by very small quantities from the total beach seine catch (Table 1).

Table 1. Family composition percentage and their catch weight (Kg) from beach seine commercial catches during the present study period

Family	Catch weight (Kg)	%	Family	Catch weight (Kg)	%
Carangidae	1080.95	52.06	Rhinopteridae	15.00	0.72
Clupeidae	278.05	13.39	Lobotidae	5.00	0.24
Mugilidae	188.17	9.06	Siganidae	4.53	0.22
Penaeidae **	142.36	6.86	Hemiramphidae	4.25	0.21
Portunidae*	78.93	3.80	Sparidae	2.05	0.10
Trichiuridae	65.85	3.17	Engraulidae	2.00	0.09
Moronidae	55.05	2.65	Gobiidae	2.00	0.09
Pomatomidae	33.50	1.61	Cichlidae	0.25	0.01
Terapontidae	31.50	1.52	Dussumieriidae	0.25	0.01
Scombridae	31.40	1.51	Eriphiidae*	0.10	0.05
Sciaenidae	30.20	1.45	Platycephalidae	0.10	0.05
Soleidae	24.90	1.20	Total catch weight (Kg)/ 23 family	2076.39	
Fish, * Crab and ** Shrimp					

3. Seasonal distribution of commercial species composition of beach seine during the period of survey

The seasonal average catch of beach seine in the Port Said varied as follows: 501kg/ haul in autumn; 268kg/ haul in summer; 143kg/ haul in spring; and 132kg/ haul in winter (Fig. 4).

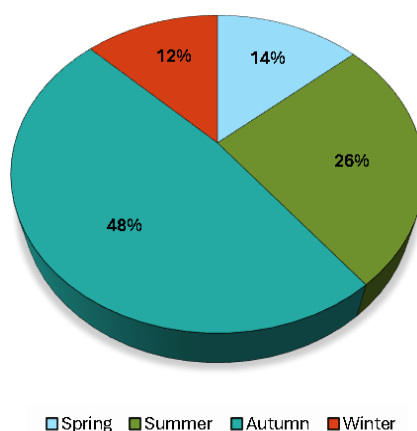


Fig. 4. The seasonal catch of beach seine in the Port Said during study period

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The analysis of the most economic and commercial species of beach seine netting in the four seasons illustrated that there were obvious seasonal family variations throughout the monitoring period. The seasonal variations of each family were represented as follows:

a. Family Carangidae

Family Carangidae is the most abundant in the commercial catch, it was observed throughout the four seasons and composed of two species, *Caranx rhonchus* and *Caranx crysos*. The results indicated that autumn yielded the highest catch for this family, while winter represented the lowest catch. *C. crysos* constituted the largest portion in the catch, amounting to 978.5kg. Eminently, *C. rhonchus* was observed exclusively during spring and autumn only, while *C. crysos* was primarily caught in spring, summer and autumn (Fig. 5).

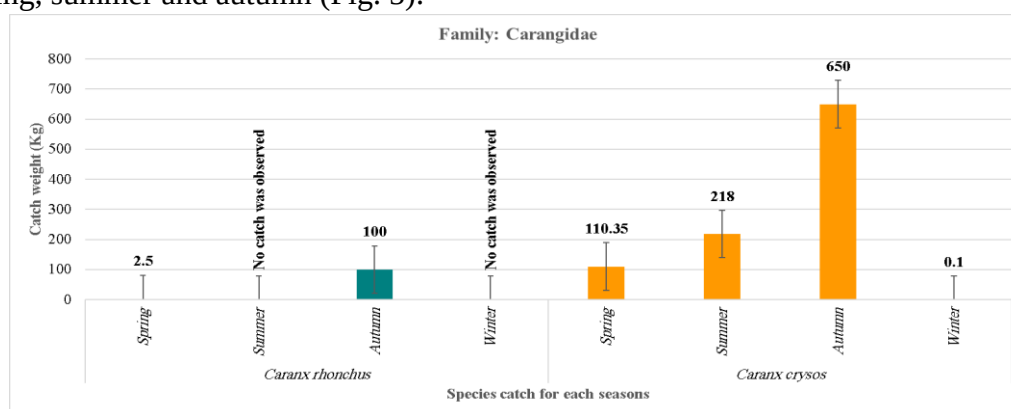


Fig. 4. Seasonal distribution of family Carangidae species from the beach seine during the period of survey

b. Family Clupeidae

Family Clupeidae was the richest in species number compared to the other families. Five species belonging to the family Clupeidae were observed in this study: *Dussumieria elopsoides*, *Herklotsichthys punctatus*, *Sardinella aurita*, *Sardinella maderensis*, and *Sardina pilchardus*. *D. elopsoides* was observed only during the autumn season, while *S. aurita* and *S. maderensis* were found only during spring and summer. *H. punctatus* and *S. pilchardus* were noted in all seasons, except winter (Fig. 6).

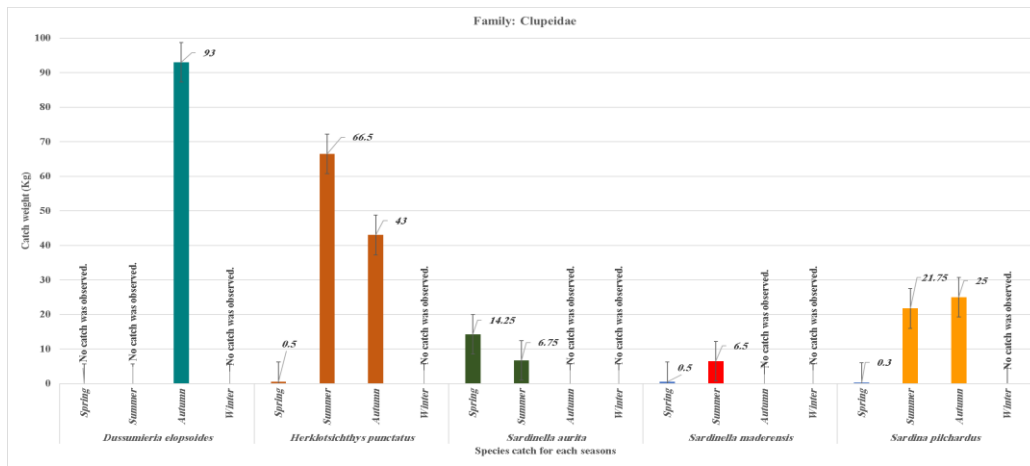


Fig. 6. Seasonal distribution of family Clupeidae species from the beach seine during the period of survey

c. Family Mugilidae

This family exhibited a similar abundance to the previous family (Clupeidae), comprising five species: *Chelon labrosus*, *Chelon ramada*, *Chelon saliens*, *Chelon auratus*, and *Planiliza carinata* (Fig. 7). Seasonal distribution patterns revealed that species *C. labrosus* and *C. ramada* were observed throughout the four seasons, followed by species *C. auratus* which was observed in three seasons, albeit absent in winter. Species *C. saliens* was only observed in autumn with a low abundance, while the last species (*P. carinata*) was extremely rare, being observed only once in autumn with a sample weight of around 100 grams.

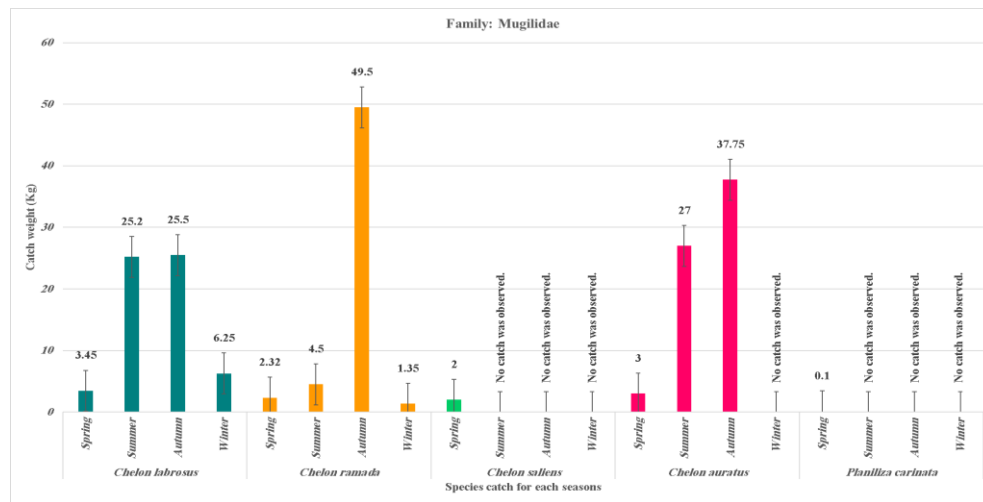


Fig. 7. Seasonal distribution of family Mugilidae species from the beach seine during the period of survey

d. Family Moronidae

It comprises *Dicentrarchus labrax* and *Dicentrarchus punctatus*, which are present in the four seasons (Fig. 8). *D. labrax* was the dominant species despite its scarceness

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during autumn. *D. punctatus* was observed consistently throughout the study but in lower weights.

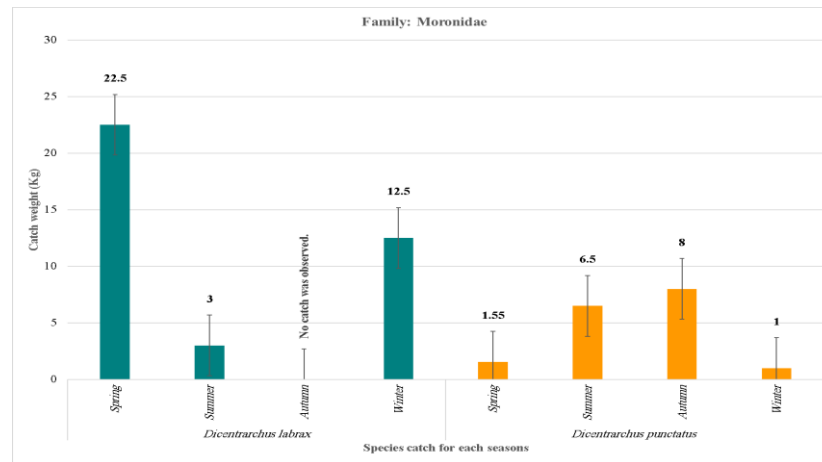


Fig. 8. Seasonal distribution of family Moronidae species from the beach seine during the period of survey

e. Family Penaeidae

The study showed that, family Penaeidae was represented by four economically important shrimp species: *Metapenaeus monoceros*, *Metapenaeus stebbingi*, *Penaeus semisulcatus*, and *Xiphopenaeus kroyeri*. Seasonal distribution patterns showed that *Xiphopenaeus kroyeri*, the most recent species to colonize the Mediterranean, was observed throughout the year. This species was particularly scarce during the summer months. *M. monoceros* was observed in all seasons, except autumn, and represented the second highest catch for this family. Remarkably, *M. stebbingi* was observed in autumn only. While, the last species (*P. semisulcatus*) was only observed in summer with very low abundance (Fig. 9).

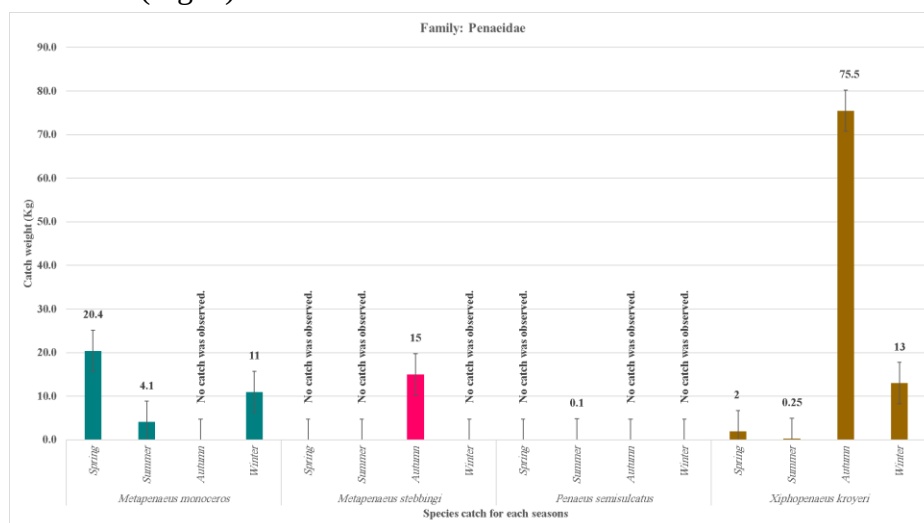


Fig. 9. Seasonal distribution of family Penaeidae species from the beach seine during the period of survey

f. Family Pomatomidae

The family was monotypic, with *Pomatomus saltatrix* being the only species recorded. Field surveys confirmed the presence of this economically important species during spring and summer (Fig. 10).

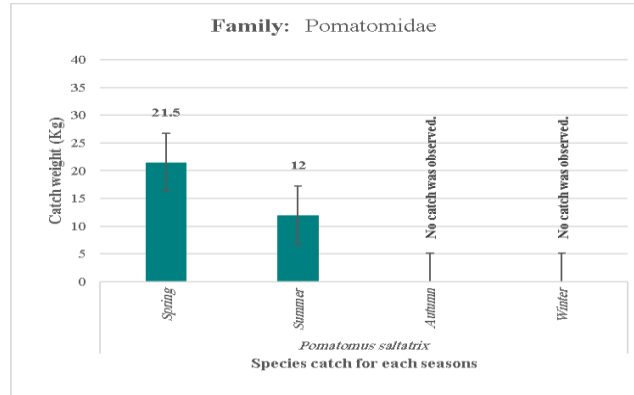


Fig. 5. Seasonal distribution of family Pomatomidae species from the beach seine during the period of survey

g. Family Portunidae

Crabs have high economic value, especially in Port Said Governorate. They were observed throughout the year, with two species being identified: *Callinectes sapidus* and *Portunus pelagicus*. The *Callinectes sapidus* was only observed during autumn, while the *P. pelagicus* was present throughout the study period. Summer yielded the highest catch, while winter was recorded with the lowest catch (Fig. 11).

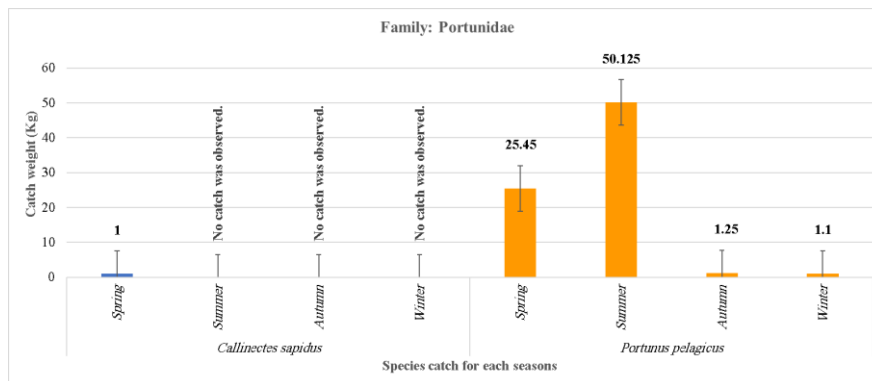


Fig. 6. Seasonal distribution of family Portunidae species from the beach seine during the period of survey

h. Family Siganidae

Family Siganidae was observed throughout the year, with two species being identified: *Siganus luridus* and *Siganus rivulatus* (Fig. 12). *Siganus luridus* was only deected during spring, while the *S. rivulatus* was present throughout the study period. The autumn yielded the highest catch, while the spring recorded the lowest catch.

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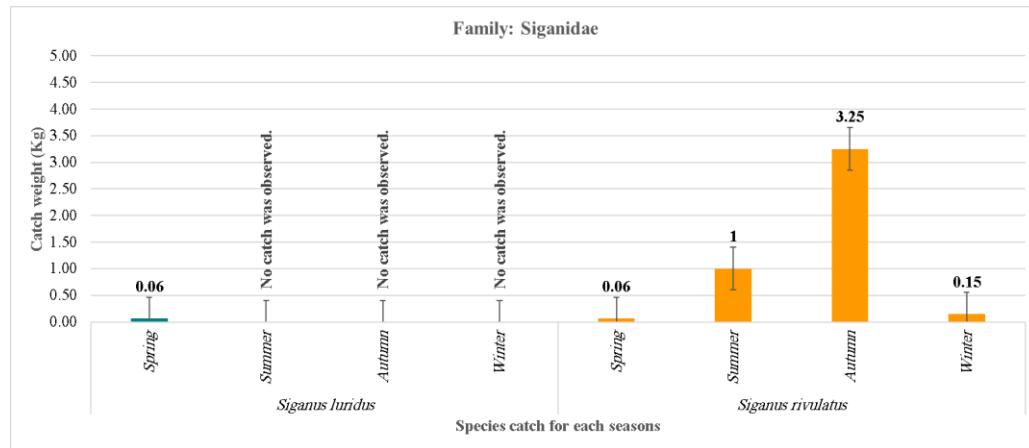


Fig. 12. Seasonal distribution of family Siganidae species of beach seine during the period of survey

i. Family Sparidae

Family Sparidae was represented by three species: *Diplodus puntazzo*, *Diplodus sargus*, and *Sparus aurata*. The *Diplodus puntazzo* and *Diplodus sargus* species were observed in low abundance (only during winter), while the *S. aurata* was more abundant and was observed throughout the year. The highest catch for *S. aurata* was recorded in spring, and the lowest in autumn (Fig. 13).

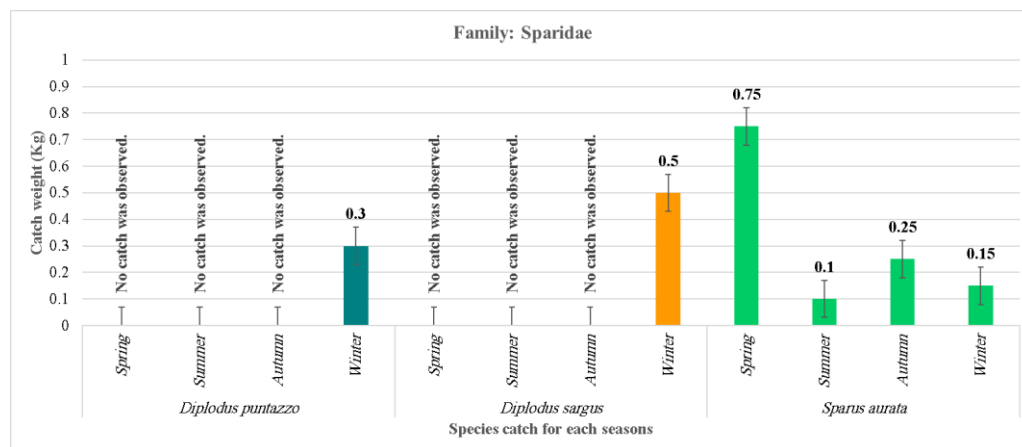


Fig. 13. Seasonal distribution of family Sparidae species from the beach seine during the period of survey

j. Family Scombridae

The Scombridae family was represented by a single species, *Scomberomorus maculatus*. This species was caught during autumn and was observed throughout the year, albeit in varying abundance (Fig. 14).

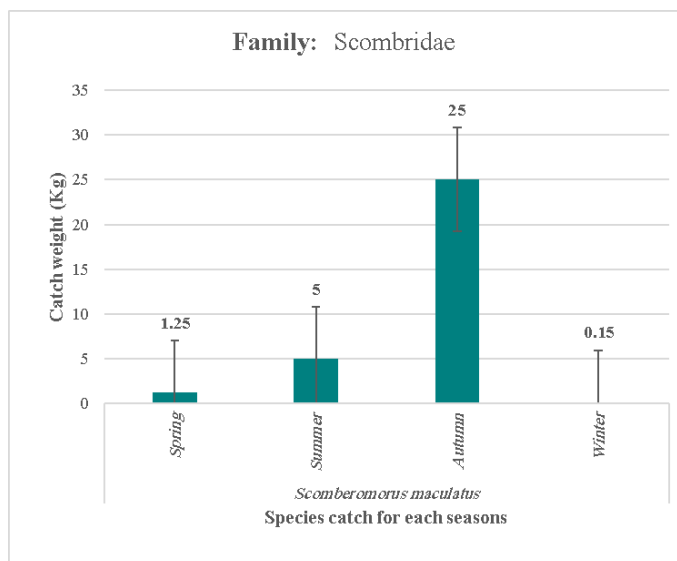


Fig. 14. Seasonal distribution of family Scombridae species from the beach seine during the period of survey

k. Family Soleidae

The family Soleidae was represented by a single species, *Solea aegyptiaca*. This species was caught during the late autumn and winter and was observed throughout the year, except during summer (Fig. 15).

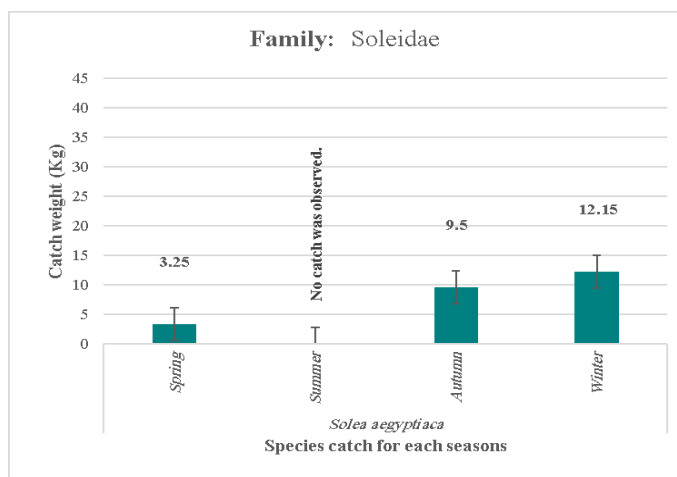


Fig. 15. Seasonal distribution of family Soleidae species from the beach seine during the period of survey

l. Family Trichiuridae

Family Trichiuridae was represented by a single species, *Trichiurus lepturus*. This species was caught during the summer and was observed throughout the year, except during the winter (Fig. 16).

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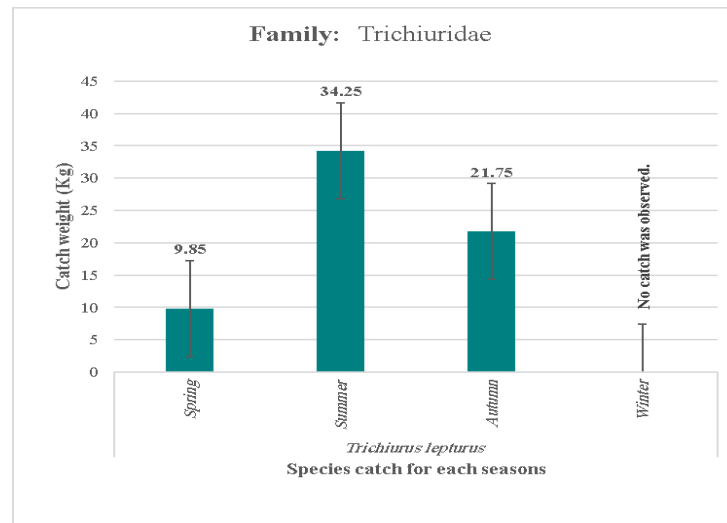


Fig. 16. Seasonal distribution of family Trichiuridae species from the beach seine during the period of survey

m. Family Sciaenidae

Family Sciaenidae represented the most economically important fish in Port Said, with *Argyrosomus regius* being the sole representative. Seasonal distribution and field observations revealed that this species was notably abundant during spring throughout the study period. It was observed that smaller individuals, ranging from 5 to 15cm, were the primary target of the fishery, with these fish being sold to fish farms (Fig. 17).

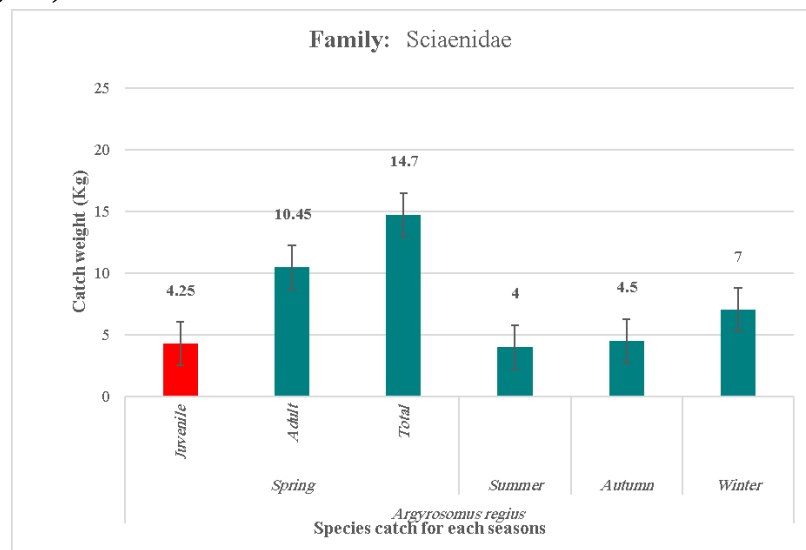


Fig. 17. Seasonal distribution of family Sciaenidae species from the beach seine during the period of survey

n. Families Rhinopteridae, Eriphiidae, Hemiramphidae, Platycephalidae and Terapontidae

Families Rhinopteridae, Eriphiidae, Platycephalidae, and Terapontidae were all observed exclusively during spring. Each of these families was represented by a single species, with the exception of Hemiramphidae, which was represented by two species: *Hemiramphus far* and *Hemiramphus archipelagicus*. Recently, a significant amount of juvenile cownose rays have been accidentally captured and marketed for consumption in commercial fisheries (Fig. 18).

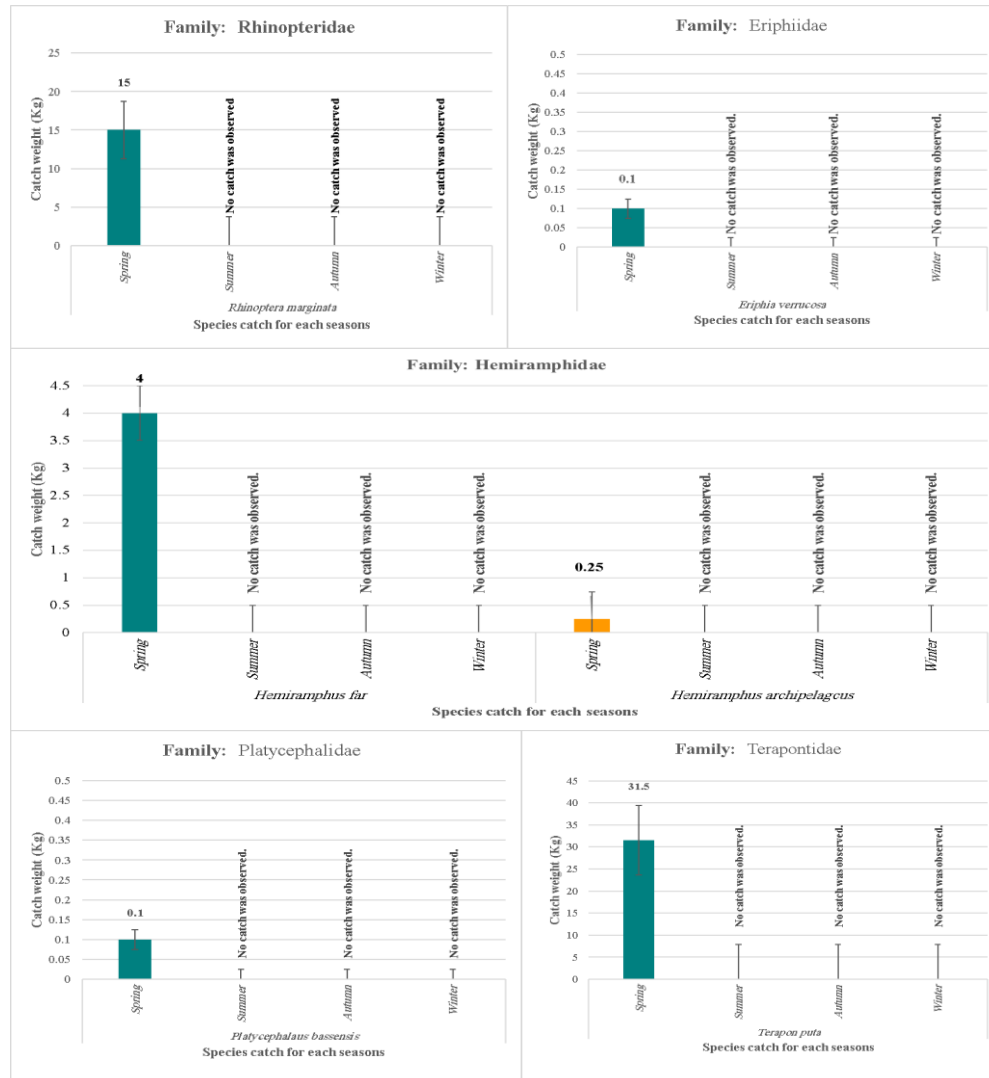


Fig. 18. Seasonal distribution of families Rhinopteridae, Eriphiidae, Hemiramphidae, Platycephalidae and Terapontidae species from the beach seine during the period of survey

o. Families Dussumieriidae, Engraulidae and Lobotidae

Families Dussumieriidae, Engraulidae and Lobotidae were all observed exclusively during the summer (Fig. 19). Each of these families was represented by a single species. Dussumieriidae was represented by *Etrumeus sadina*. *Engraulis encrasicolus* was the only species belonging to the Engraulidae family that was found in commercial catches, with a meager quantity of 2 kilograms. This species was primarily sold as non-commercial catch and used in aquaculture feed. The Lobotidae family was represented solely by *Lobotes surinamensis*, a species that was extremely rare along the Port Said coast. Only one individual of this family was observed, weighing approximately 5kg.

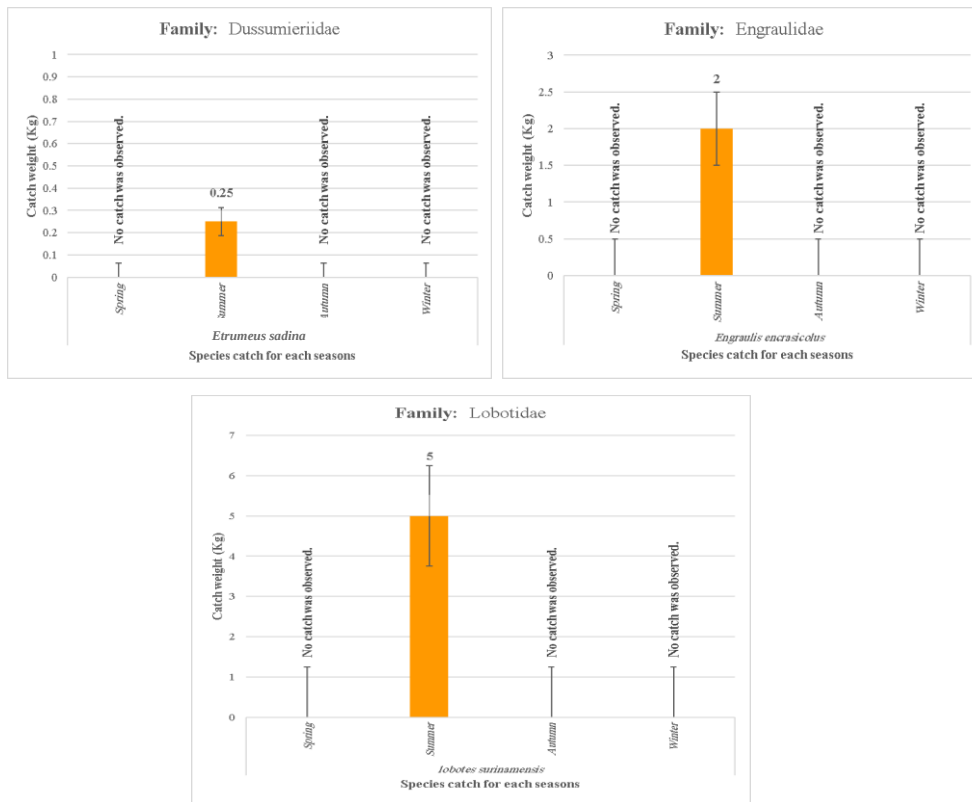


Fig. 19. Seasonal distribution of families Dussumieriidae, Engraulidae and Lobotidae species from the beach seine during the period of survey.

p. Families Gobiidae and Cichlidae

Families Gobiidae and Cichlidae were each represented by a single species. The *Gabius cobitis* was observed exclusively in autumn, while the *Oreochromis aurea* was rarely sighted during winter (Fig. 20).

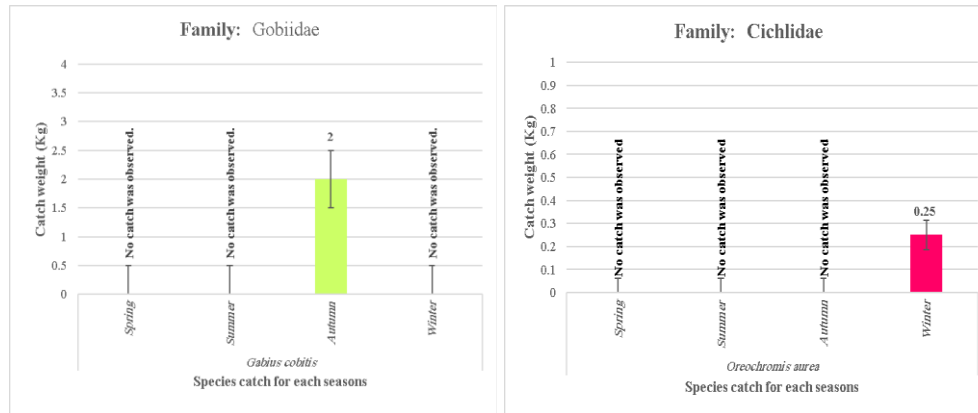


Fig. 20. Seasonal distribution of families Gobiidae and Cichlidae species from the beach seine during the period of survey

DISCUSSION

Fishing operations can significantly impact fish populations, stocks, and yields, as well as altering ecological interactions among species and the overall productivity and functioning of marine ecosystems (Gray & Kennelly, 2003).

This study represents the latest research undertaken on the coastal seine within the Mediterranean Sea. Specifically, this investigation focused on the beach seine, locally termed "Dahra", fishery off the coast of Port Said. The study extended over a period exceeding three years, making it one of the most comprehensive studies of its kind in the region.

Non-commercial catch of the beach seine constituted a significant proportion of the total catch, amounting to almost 74%, while the targeted commercial catch represented only 26%. The available data indicate a significant increase in catch amount during the warmer months (August to October) compared to the colder months (January to March). This pattern can be attributed to the increase in the biological activity of fish species during spring and summer, higher demand for seafood and the influence of environmental factors, such as increased water temperature and marine currents. Furthermore, the data revealed variations in catch volumes among different fish species, with certain species contributing more significantly to the total catch (LFRPDA, 2020).

Akel and Philips (2014) observed the highest catch quantities during summer, followed by autumn, with the lowest catch occurring in spring (from the Eastern Harbor, Alexandria, Egypt). Cilbiz *et al.* (2020) reported that the production levels declined steadily throughout the fall season, with no individuals observed in late fall or winter in İznik Lake (Turkish). While, the findings of Farrag *et al.* (2023) in the United Arab Emirates regarding the Sea of Oman, showed that the highest catch quantities were

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observed during the winter months, followed by autumn, with the summer season recording the lowest catch.

The results of this study indicate that the variations in catch quantities among the different studies can be attributed to several factors, including differences in water quality and climatic conditions across the study areas, as well as variations in marine biodiversity. These findings suggest that environmental factors such as water quality and temperature play a significant role in determining catch quantities and seasonal distribution patterns of marine species

Autumn was the most preferred season for fishermen in this study area, as the natural conditions were generally favorable for fishing. However, the biodiversity was lower compared to other seasons within the non-commercial catch, and it ranked third in terms of targeted commercial catch. This is typically due to the dominance of certain species in the area, which can lead to a decline in the abundance of other species. Additionally, coastal areas are often spawning or nursery grounds for some fish species. **Gibson *et al.* (1993)** and **Whitfield and Pattrick (2015)** suggested that the fish species present in autumn, for some biological reasons, are fewer than in spring and summer.

In the present study, the seasonal average catch of beach seine in the study area varied with the highest catch of 501kg/ haul in autumn and the lowest of 132kg/ haul in winter. **Al-Sayes *et al.* (1981)**, In Eastern Harbor, Alexandria data were available for all seasons except winter, marking an average catch of 228.12 kg/haul in autumn, 138.68kg/ haul in summer, and 14.32kg/ haul in spring. In this context, **Akel and Philips (2014)** stated that the average of beach-seine catch was 38.3kg/ haul in autumn, 56.7kg/ haul in summer, 35kg/ haul in spring, and 21.75kg/ haul in winter. While in Abu Qir Bay, Alexandria, as reported by **Faltas and Akel (2003)**, the average catch was 12.864kg/ haul in autumn, 7.206kg/ haul in summer, 4.871kg/ haul in spring, and 6.646kg/ haul in winter.

The results of our research indicate that the variation between the study region and other sites in Alexandria can be related to several factors. Port Said's geographical position, near the Nile River and mixed with Boughaz El -Gamil canals, produces a unique biological environment marked by increased nutrient availability and a more dynamic ecosystem. The disparities in pollution levels among the other study regions may have significantly influenced the observed biodiversity patterns.

CONCLUSION

The results of beach seine catch indicate alarming levels, particularly when considering the total annual catch quantities. It was evident that the noncommercial fish volume was 74% constituting fish with no market value, which would have been significantly amplified, resulting in high economic losses. Given that the estimated price per kilogram of these species ranged between 15 and 25 Egyptian pounds, and their

occasional use as feed in fish farms, the natural fish stock in the Mediterranean Sea was threatened for minimal economic return. This directly contradicts the United Nations Sustainable Development Goals, specifically Goal 14 concerning life below water.

Since we cannot prevent this destroying fishing method due to the economic and social fishermen status, thus to conserve the aquatic environment, appropriate mesh sizes should be used to reduce the catch of juvenile and small fish. In addition, a strong fishery management should be implemented through data collection and stock monitoring throughout all the fishing areas using this fishing method.

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