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Fishing Gears, Catch Composition and Relative Abundance of Commercial Species in Suez Canal Lakes, Egypt

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ABSTRACT

The Suez Canal has three lakes including Timsah, and the Great and Little Bitter Lakes, which are important fishery resources in Egypt. These lakes produce highly economically important fish species, viz. grey mullet, shrimp, cuttlefish, striped piggy, crab, soles, gastropods and bivalves. The Timsah Lake is located nearly halfway along the Suez Canal between 30° 13' 00" to 32° 35' 18" N and 32° 16' 30" to 32° 18' 30" E. It is a shallow-water basin with an average depth of about 6m and a surface area of nearly 15km^2. It is a brackish lake with significant variations in salinity. The Bitter Lakes (30°20′ N, 32°23′ E), the largest water bodies along the Suez Canal, are saline lakes with a surface area of about 250km^2. The total annual commercial landings from Suez Canal lakes varied between 6289 and 2260 tons during the last 20 years. In 2020, a total of 3428 tons landed corresponded to a value of almost 300 million LE. A number of fishing methods are used in the lakes including gill nets, crab nets, shrimp nets, beach seine, hattata and trammel nets. The present work investigated the fishing methods used in Suez Canal lakes, their characteristics, the catch composition, catch trend and the relative abundance of different commercial species measured by the catch per unit fishing effort CPUE.

INTRODUCTION

Egyptian fisheries (which includes the management, catching, processing & the marketing of fish stocks) and aquaculture (the farming of fish) provide an important source of food, employment, income and recreation for the Egyptians, and remakably millions of them depend on fish and fisheries for their livelihoods **(Mehanna, 2020, 2021)**.

The Suez Canal is considered as a passage way to the immigrant fauna either from the Red Sea or the Mediterranean. It is also suitable for these fauna to live in. When it was opened in 1869, the Suez Canal connected two different environments, that of the tropical Red Sea (an area extremely rich in species) and the evironment of the sub-

tropical eastern Mediterranean (an area with rather low number of species). Therefore, it seemed justified to expect that the canal might cause a mixing of great zoogeographic importance **(Thorson, 1968)**.

The Suez Canal contains three lakes: The Timsah, and the Great and the Small Bitter Lakes (Fig. 1). The Suez Canal lakes are considered as an important fishery resource in Egypt. They produce high economic fish species like grey mullets, Tilapia, shrimps, molluscs, crab, striped piggy, seabass, seabream, cuttlefish and rabbitfish. There are about 820 sailing non-motorized boats operated in Suez Canal lakes, working with several fishing methods, such as gillnets, trammel nets, shrimp nets, beach dredge, hattata, crab nets and beach seine **(Eid, 2019; Mehanna *et al.*, 2019a, b; GAFRD, 2020).**

Catch and fishing effort statistics have vital importance for the evaluation of an exploited fish stock status. The catch per unit fishing effort (CPUE) is a good measure of the relative abundance of the exploited stocks. In addition, information about effort and catch per unit effort is essential data for the estimation of maximum sustainable yield (MSY) and the corresponding level of fishing effort (f_{MSY}) by means of surplus production models **(El-Gammal *et al.*, 1994; Mehanna & El-Gammal, 2007; Mehanna *et al.*, 2021)**.

One of the main challenges facing the fisheries management is the fishing gears used. Although Egypt implemented some fisheries' regulations for the conservation and development of the lakes production, unfortunately these regulations couldn't ensure the sustainability of the Egyptian lakes and the conservation of commercial fish stocks. Thus, the present study focused on the characteristics of the fishing gears used in the Suez Canal lakes in addition to investigating the relative abundance of different fish species with a commercial importance in the area of the Suez Canal lakes.

MATERIALS AND METHODS

1. Study area

The Timsah Lake (Fig. 1) covers an area of about 14km^2 between 30° 34' 0.01" N and 32° 16' 59.99" E near the middle of the Suez Canal at the point 80km south the city of Port Said. The depth of the lake ranges between 6 and 13m. Lake Timsah receives saltwater mainly from the Suez Canal and freshwater from different sources including the Ismailia Canal, rare seasonal streams and sewage outlets, creating salinity stratification in the lake's water.

The Bitter Lakes (30°20′ N, 32°23′ E) are the largest water bodies along the length of the Suez Canal (Fig. 1), containing about 85% of the system's water. The Great and Small Bitter Lakes, separated by narrows, are saline lakes situated between the northern and southern parts of the Suez Canal **(Touliabah & Taylor, 2004; Mehanna *et al.*, 2019a, b; Osman *et al.*, 2022)**. The Bitter Lakes have a surface area of about 250km², acting as a buffer for the canal, which reduces the effect of tidal currents **(Mehanna *et***

***al.*, 2019a, b)**. Since the canal has no locks, sea water freely flows into the lakes from both the Mediterranean and the Red Seas, replacing water lost due to evaporation. The Great Bitter Lake has a surface area of about 194km^2, with depths ranging between 18 and 28m.

2. Collection of fishery statistics

Data concerning the annual catch of different fish species and fishing effort of Suez Canal lakes were obtained from the General Authority for Fish Resources Development annual statistical book **(GAFRD, 2020)**.

Fishing activities in Suez Canal lakes were observed and recorded throughout monthly visits to the fishing grounds during the period from January 2022 to December 2022 (Fig. 2). The field visits were undertaken twice monthly to interview the fishermen, recording the real information about the fishery characteristics during their fishing trips. Fishing gears and methods, net characteristics (mesh sizes, height and length of nets) data were collected. Additionally, the length and number of fishing boats and number of fishermen per boat were recorded. The catch and species compositions were investigated, and the catch per unit fishing effort (ton/boat) was estimated.

Fig. 1. Suez Canal and its lakes






Fig. 2. Field trips and interviewing the fishermen

RESULTS AND DISCUSSION

1. Fishing effort and fishing gears

A number of fishing gears are used in Suez Canal lakes by about 820 wooden small sailing and oaring boats. The fishing boats never exceed 7m in length and have an average width of about 1.8m, with two or three fishermen working on each boat. Both trammel (three layers nets) and gill nets (one layer nets) are used in different ways.

Grey mullet trammel net, Ghazl tobara, targets the pelagic species with a net depth of 3m. The fishing gear includes 30 fishing units of trammel net reaching 750m in length. Each fishing gear is supported by an upper rope with floating units, separated from each other by about 80cm, and it has a lower rope loaded by parts of lead with an average weight of 50g and separated from each other by about 40cm.

Crab trammel net, ghazl kaboria or nattata, is about 350 to 750m long, with a depth of nearly 0.5 to 2m. It targets the crab and cuttlefish with some other species that are caught as bycatch.

Karkaba is about 150m in length and one meter in depth. It sets in the water over night or spreads throughout the day. It targets *Solea* spp., *Liza ramada, Mugil cephalus,* haffara, file fish and *Liza carinata*. While, the sinking shrimp net, ghazl gambary ghates, targets the shrimp.

Beach seine or ghazl sardina is a seine net operating from the shore line, and it mainly targets sardines and jacks. Whereas, Ghazl lout (meager) and derak (Spanish mackerel) are caught via seine nets of 150m long for a net unit and 7m deep.

The catch using these methods is composed of seabreams (*Sparus aurata*, *Rhabdosargus haffara* and *Oblada melanurus*), soles (*Solea solea* and *S. aegyptiaca*), grey mullets (*Liza ramada, L. carinata, L. aurata* and *Mugil cephalus*), crabs (*Portunus pelagicus* and *Callinectes sapidus*), cuttlefish (*Sepia* spp.), Tilapia species and shrimps (*Penaeus japonicus, P. semisulcatus, P. kerathurus* and *Metapenaeus* spp.). On the other hand, the bivalves and gastropods are collected using small beach dredges.

Besides these methods, there are some illegal fishing gears operating in the lakes, for example El- Hattata (50m in length x 5m in depth), El-Habla (25m long x 6m deep), El-Shelb (4m x 4m), and floating ghazl sigan (150m in length x 3m in depth).

2. Catch composition

The catch composition of Suez Canal lakes during the period from 2001 to 2020 is displayed in Fig. (3). Upon addressing the catch statistics during the investigated period, it was found that, the species groups represented in the Suez Canal lakes are bivalves (32.4%), grey mullets (24.3%), crab (12%), shrimp (7.2%), Tilapia spp. (4.7%), cuttlefish (3%), striped Piggy (2.9%), meagre (1.7%), rabbitfish (1.7%), sardine (1.6%), spanish mackerel (1.26%) and seabreams (1.67%). Notably, soles, seabass, lizardfish, flathead fish, jacks, file fish, needle fish are also represented in the catch but in extremely small quantities.

It is obvious that mullets are the most important fish groups in the Suez Canal catch with species composition represented by four species; *Liza carinata, L. ramada, L. aurata* and *Mugil cephalus*. This finding agrees with that of **Mehana and El-Gammal (2007)** who found that, mullets contributed about one half of the total fish production from these lakes. Additionally *Liza carinata , L. ramada, L. aurata* and *Mugil cephalus* are the main constituents of the commercial catch of mullet in the Suez Canal lakes. In addition, **Eid (2019)** mentioned that *L. ramada* constituted about 60% of the total mullet catch at Lake Timsah and 27% at Bitter Lakes, while *L. carinata* formed about 34% of the total mullet catch at Lake Timsah and 66% at Bitter Lakes. *L. aurata* comes in the third grade, which constituted only about 6% at Lake Timsah and 7% at the Bitter Lakes, while *M. cephalus* rarely appeared.

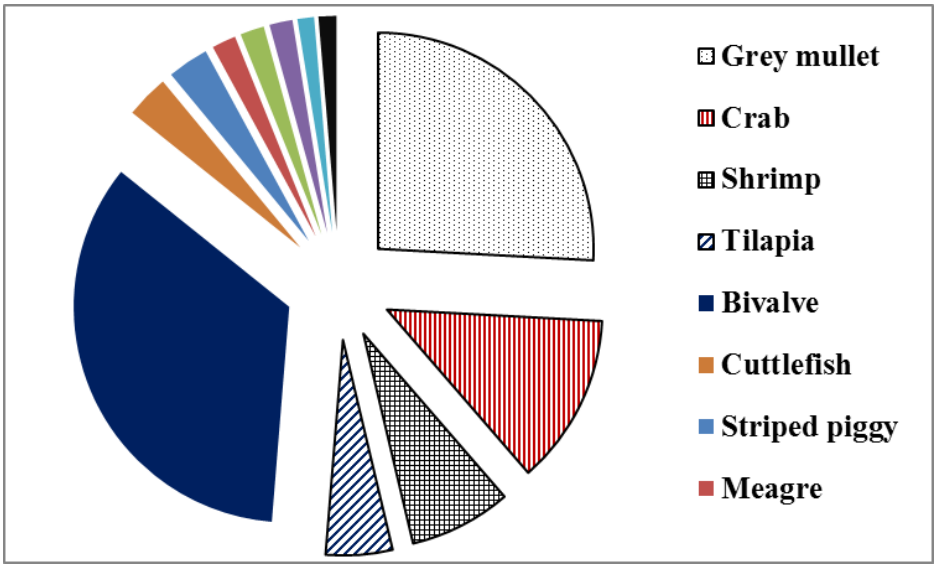


Fig. 3. Catch composition in Suez Canal lakes during 2001-2020

3. Catch trend

The annual total fish production from the Suez Canal lakes during the period from 2001 to 2020 (Fig. 4) fluctuated between a minimum of 2260 ton during 2018 and a maximum of 6289 ton during 2005, with an average of 4403 ton. The catch of grey mullet varied from a minimum of 351 ton during 2016 to a maximum of 2394 ton during 2002, with a mean of 1068 ton. Whereas, tilapia species fluctuated between a minimum of 84 ton (2018) and a maximum of 397 ton (2001), with a mean of 206 ton. Striped piggy contributed to a minimum of 60 ton (2009) and a maximum of 195 ton (2013), with a mean of 127 ton during all investigated years. Meagre catch varied between a minimum of 28 ton (2015) and a maximum of 148 ton (2006), with a mean of 77 ton. The shrimp catch varied between a minimum of 118 ton (2016) and a maximum of 558 ton (2001) with a mean value of 316 ton. While, the crab catch fluctuated between a minimum of 241 ton during 2018 and a maximum of 725 ton during 2003, recording a mean value of

527 ton during the period from 2001 to 2020. Cuttlefish catch varied from 77 (2012) to 196 (2002) ton, with a mean of 133 ton during the investigated period, while the sparid species catch (*Sparus aurata*, *Rhabdosargus haffara* and *Oblada melanurus*) fluctuated between 29 ton (2018) and 103 ton (2006), registering a mean value of 64 ton (Fig. 5).

Generally, the fish production in the Suez Canal lakes showed a decreasing trend during the period of study, and the same trend was noticed for all the commercial species, except for striped piggy and sardines. For seabass and lizardfish, they have become extremely rare in the catch since 2012.

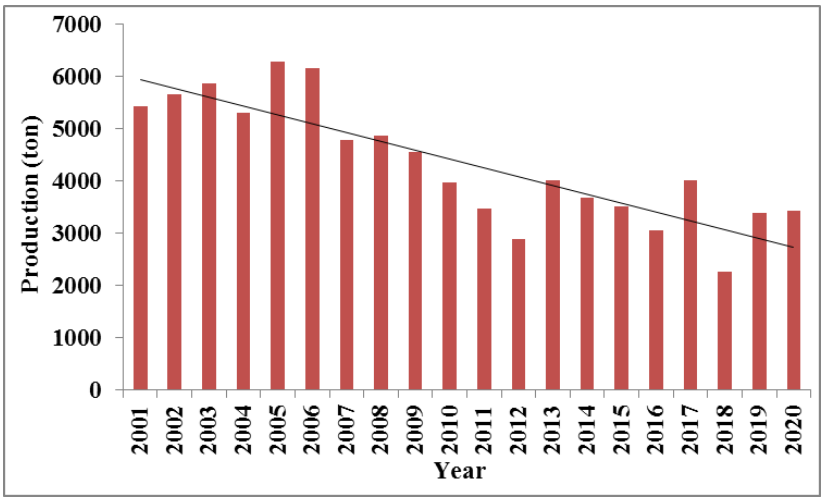
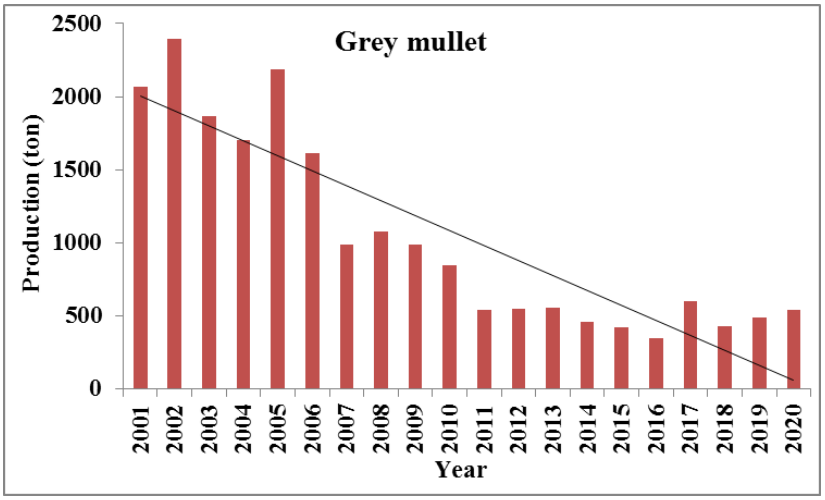
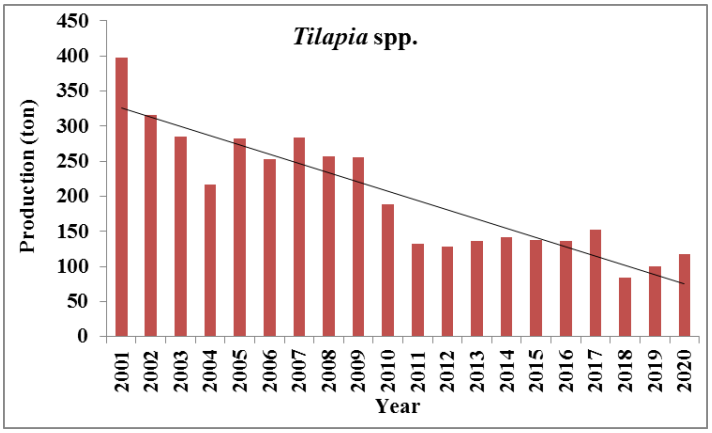
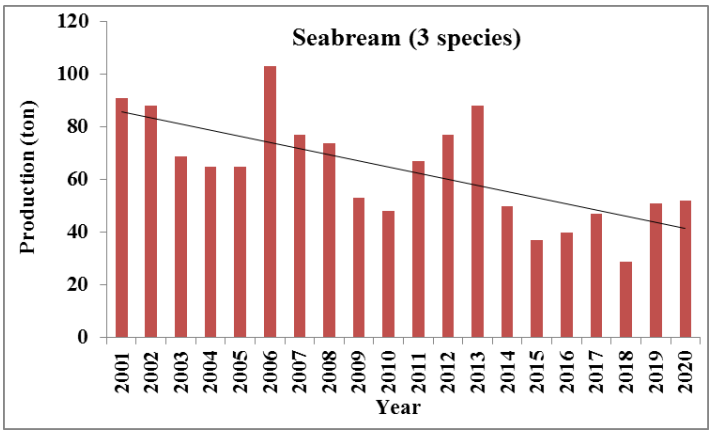
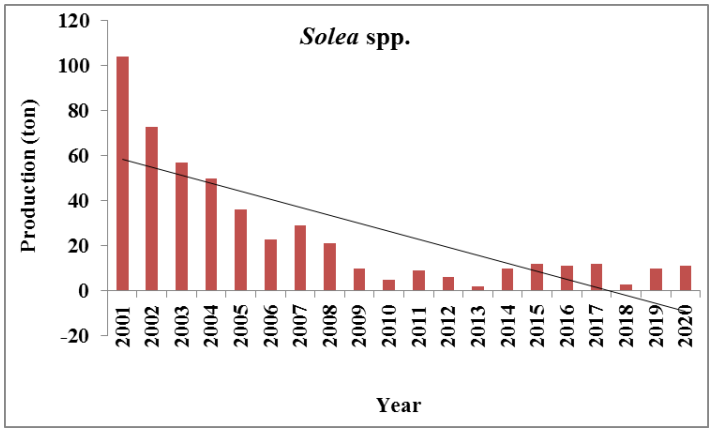


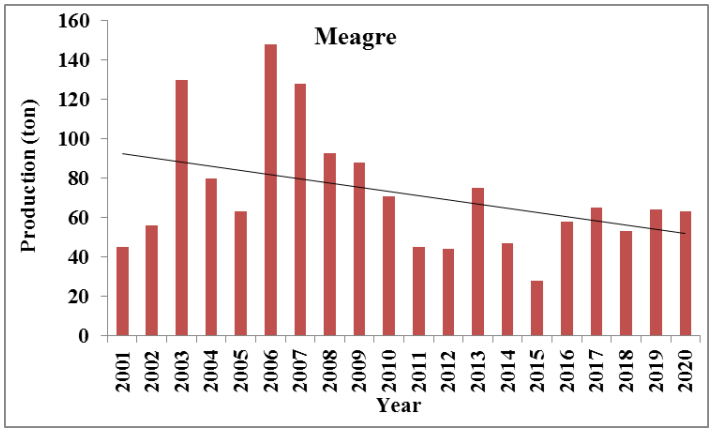
Fig. 4. Total annual catch fluctuations from Suez Canal lakes during 2001-2020

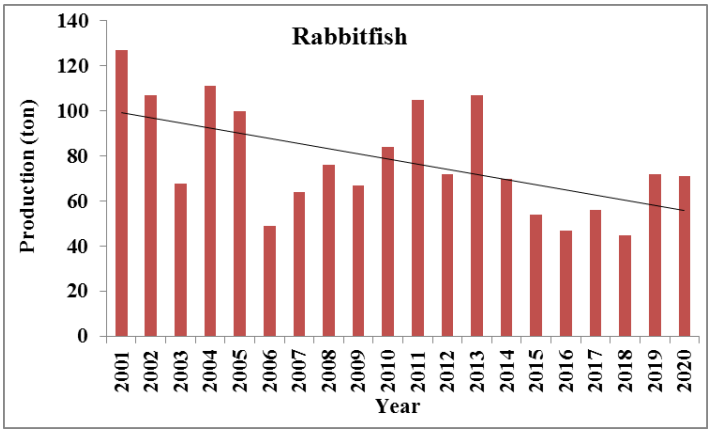


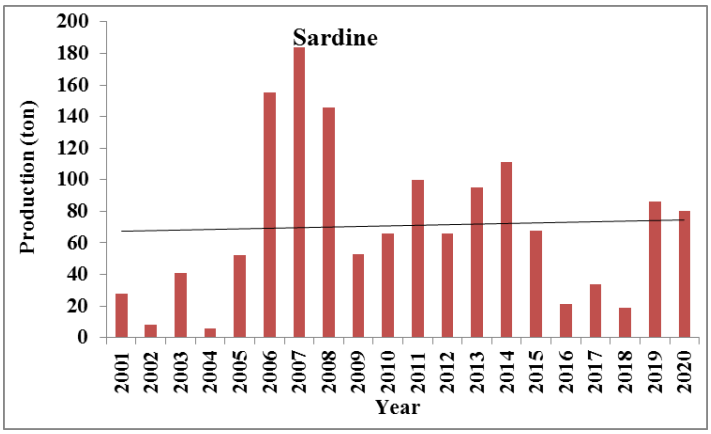

Tilapia spp.
Production (ton)
Year

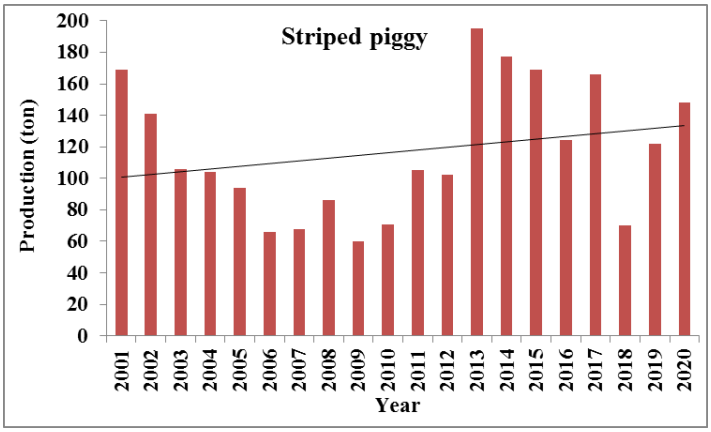

Seabream (3 species)
Production (ton)
Year

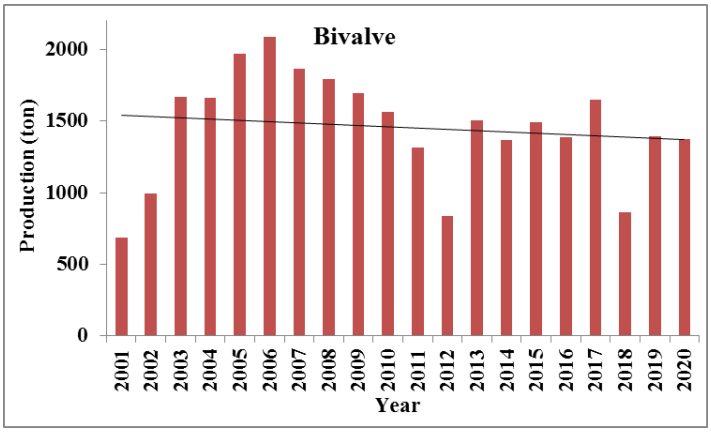

Solea spp.
Production (ton)
Year


Meagre
Production (ton)
Year


Rabbitfish
Production (ton)
0
20
40
60
80
100
120
140
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Year


Sardine
Production (ton)
0
20
40
60
80
100
120
140
160
180
200
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Year


Striped piggy
Production (ton)
0
20
40
60
80
100
120
140
160
180
200
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Year


Bivalve
Production (ton)
0
500
1000
1500
2000
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Year

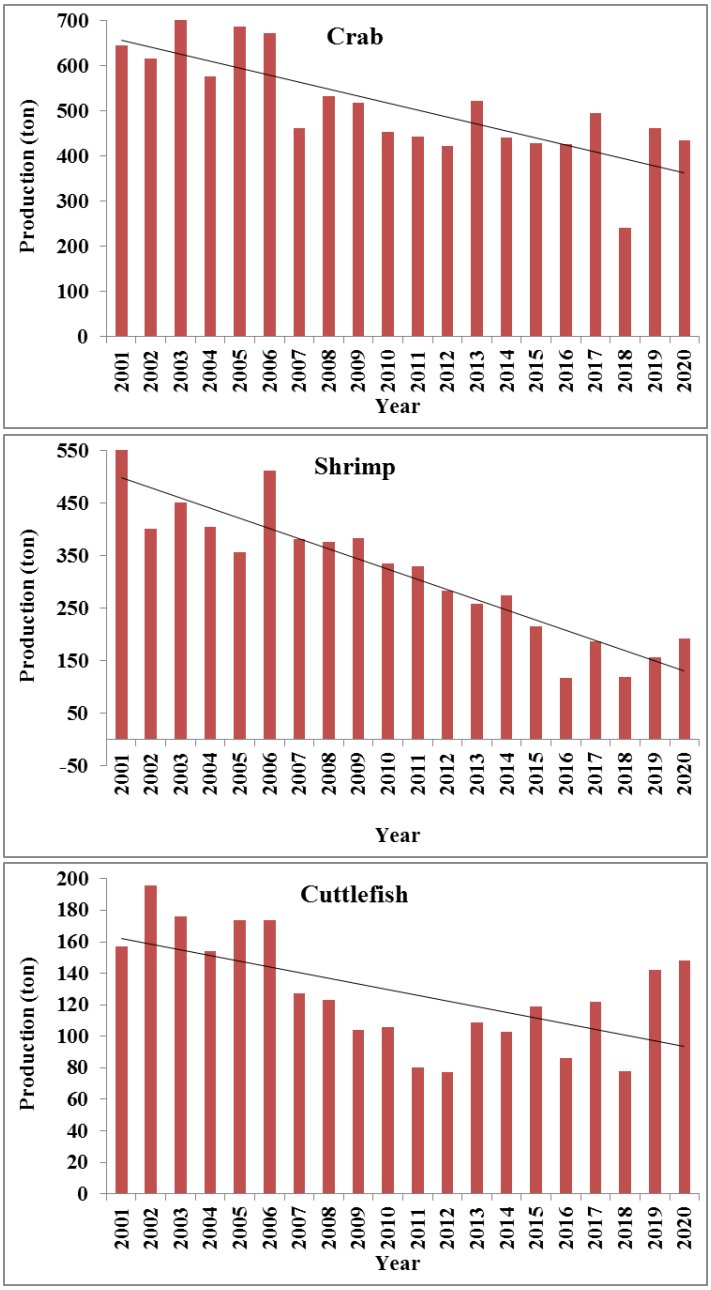


Fig. 5. Catch trend for commercial species in Suez Canal lakes

4. Fishing effort and catch per unit fishing effort (CPUE)

The fishing effort (standardized number of fishing boats operated in the Suez Canal lakes) during the fishing seasons from 2001 to 2020 (Fig. 6) fluctuates from season to another between a minimum of 700 fishing boats during the fishing year 2001 and a maximum of 820 fishing boat during 2020.

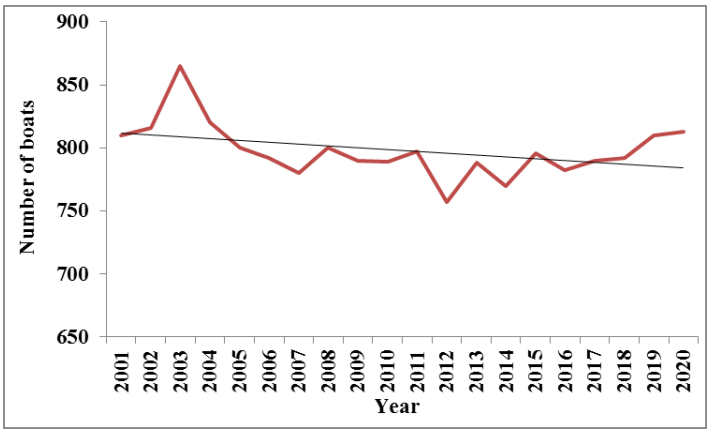


Fig. 6. Fishing effort variations in Suez Canal lakes during 2001-2020

The catch per unit fishing effort has been extensively used to measure changes in the abundance of fish population. The annual catch per unit of fishing effort (expressed as the catch per fishing boat "C/f") for the total and commercial species catch during the fishing seasons from 2001 to 2020 are shown in Figs. (7, 8).

In respect to the total catch, a slight fluctuation was detected between the values of CPUE with a maximum value of 7.9 (ton / fishing boat) during 2005 and a minimum value of 2.8 (ton / fishing boat) during the fishing season 2018 (Fig. 7). A serious decline was remarkably noticed in the relative abundance of fish stocks in the Suez Canal lakes.

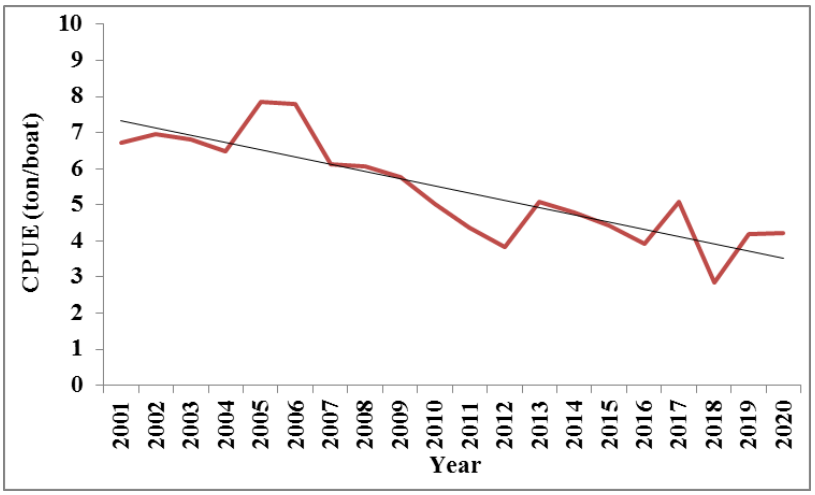


Fig. 7. Relative abundance of total fish production in Suez Canal lakes during 2001-2020

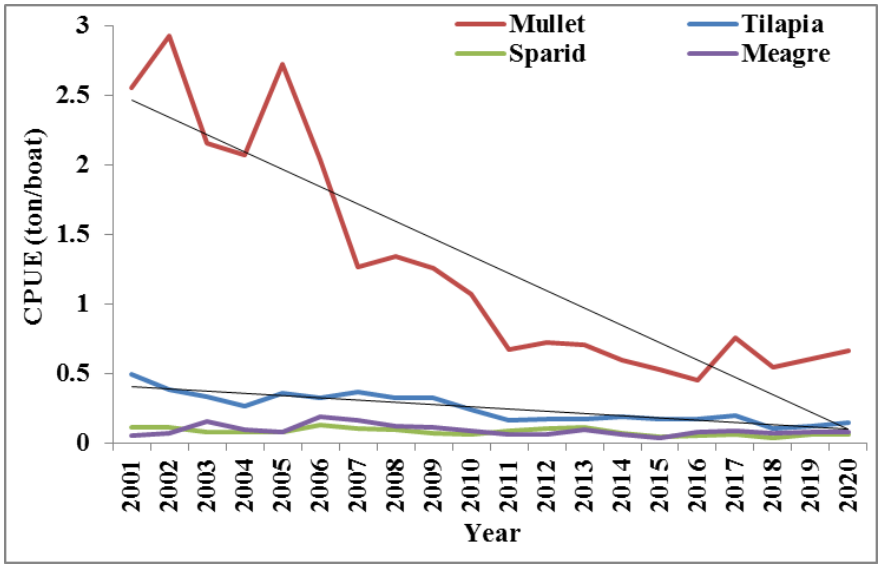
On the other hand, CPUE for commercial fish stocks in Suez Canal lakes showed a decreasing trend in the last 20 years, reflecting the decline of relative abundance of these stocks. Mullet catch/effort fluctuated between a maximum value of 2.9 ton / fishing boat during 2002 to a minimum value of 0.45 ton/fishing boat during the fishing season of 2016. The CPUE of tilapia species fluctuated between a minimum value of 0.11 ton/boat during 2018 and a maximum value of 0.49 ton/boat during 2001. Soles catch per

fishing boat fluctuated between 0.002 (2013) and 0.13 (2001) ton/boat; striped piggy catch/fishing effort varied between 0.07 (2009) and 0.25 (2013) ton/boat; meager catch per unit effort fluctuated between 0.03 (2015) and 0.19 (2006) ton/boat; sparid catch per unit effort varied from 0.04 (2018) to 0.13 (2006) ton/boat; sardine catch per unit effort fluctuated between 0.007 (2004) and 0.24 (2007) ton/boat; while for rabbitfish catch per unit effort, it fluctuated between 0.06 (2018) and 0.16 (2001) ton/boat (Fig. 8).

For the invertebrates catch, bivalve catch per unit effort fluctuated between 0.85 (2001) and 2.64 (2006) ton/boat; shrimp catch per unit effort varied between 0.15 (2016) & 0.69 (2001) ton/boat; cuttlefish catch per unit effort fluctuated between 0.10 (2018) and 0.24 (2002) ton/boat; whereas for crabs, the catch per unit effort varied between 0.30 (2018) and 0.86 (2005) ton/boat (Fig. 8).

The decrease in the values of CPUE for both total catch and commercial species catch throughout the last 20 years indicates the decrease in the relative abundance for the investigated fish populations in the Suez Canal lakes. However, only two species showed an increasing trend in their relative abundance, which are the striped piggy and sardines.

Although the relative abundance was estimated using the available data obtained from GAFRD annual statistical reports, it should be estimated for each lake separately and for each species. Moreover, the fishing effort should be more reliable and precise, and another measure viz. the number of fishing days or number of fishing hours is preferable to using the number of fishing boats. Nevertheless, the obtained results reflect the fishery status of Suez Canal lakes and the need for detailed studies based on the analytical models and both biological and dynamical parameters of the commercial fish stocks in the lakes.



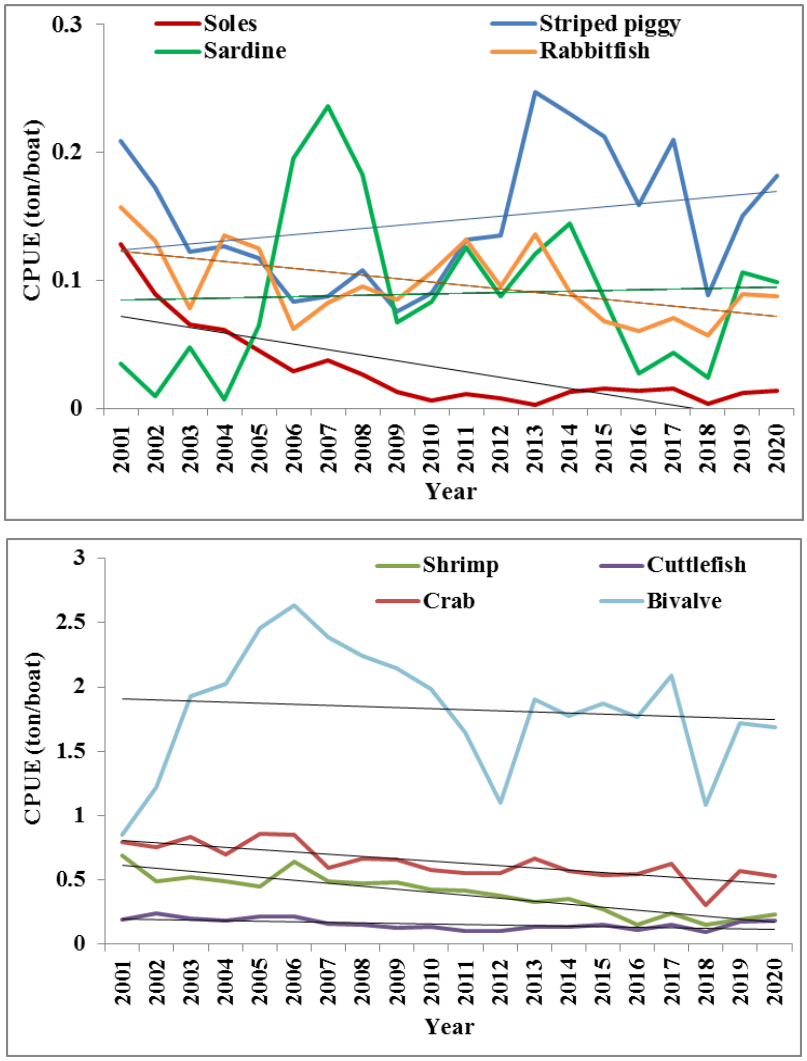


Fig. 8. Relative abundance of different fish groups in Suez Canal lakes during 2001-2020

CONCLUSION

In conclusion, catch and effort data are very important for the evaluation of fishery status. Therefore, its reliability is an urgent need to detect the real fishery status, giving the right advice about the fishery management. The fisheries management includes different management measures among which the fishing gears used and their characteristics are considered. Based on the obtained results, the catch and effort statistics need urgent improvement to give these data for each fishing ground separately and to give a real information about the catch composition by species for each fishing ground, as well as recording all units of fishing effort specific for different fishing areas. As the preliminary results showed an overfishing status for the Suez Canal lakes, detailed studies should be undertaken based on biological and ecological parameters to achieve the sustainability of Suez Canal lakes fisheries. Furthermore, there is a need to re-evaluate all fishing gears used in the Suez Canal lakes to improve their selectivity and banning the illegal ones.

REFERENCES

El-Gammal, F. I.; Al-Zahabi, A. S. and Mehanna, S. F. (1994). Preliminary analysis of the status of trawl fishery in the Gulf of Suez, with special reference to shrimp fishery. Bull. Inst. Oceanogr. Fish., ARE, 20 (2): 157-174.

Eid, N. M. (2019). Comparative study on stock assessment of family Mugilidae between Timsah and Bitter lakes, PhD Thesis, Suez Canal University.

GAFRD (2020). Annual statistical report of General Authority for Fish Resources Development GAFRD, 2020.

Mehanna, S. F. (2004). Population dynamics of keeled mullet, *Liza carinata* and golden grey mullet *Liza aurata* at Bitter Lakes, Egypt. Egypt. J. Aquat. Res.30 (B): 315–321.

Mehanna, S. F. (2020). Challenges faced the small scale fisheries and its sustainable development. ICAR- Central Marine Fisheries Research Institute, Research Centre Mangalore, 7-10 January 2020.

Mehanna, S. F. (2021). Egyptian Marine Fisheries and its sustainability, pp. 111-140. In: Sustainable Fish Production and Processing (Ed. Galanakis, Ch. M.). Academic Press, Elsevier, 325 p.

Mehanna, S. F. and El-Gammal. F. I. (2007). Population characteristics and reproductive dynamics of the thinlip mullet *Liza ramada* (Risso, 1810) at Suez Canal Lakes, Egypt. Egyp. J. Aquat. Biol. Fish., 11 (3): 307-324.

Mehanna, S. F.; El-Sherbeny, A.; El-Mor, M. and Eid, N. (2019a). Comparative study on *Liza ramada* (Risso, 1827) fishery status and management between Suez Canal Lakes, Egypt. Egypt. J. Aquat. Biol. Fish., 23(3): 271-282.

Mehanna, S. F.; El-Sherbeny, A.; El-Mor, M. and Eid, N. (2019b). Age, Growth and Mortality of *Liza carinata* Valenciennes, 1836 (Pisces: Mugilidae) in Bitter Lakes, Suez Canal, Egypt. Egypt. J. Aquat. Biol. Fish., 23(3): 283-290.

Osman, Y. A.; Mehanna, S. F. and Eid, N. M. (2022). Morphometric Analysis of Sagittal Otolith in Thin-Lipped Mullet *Chelon ramada* (Risso, 1827) From Two Different Lakes, the Great Bitter and Timsah, Suez Canal, Egypt. Egypt. J. Aquat. Biol. Fish., 26(6): 619-633.

Touliabah, H. and Taylor, W. D (2004). The phytoplankton of Great Bitter lake, Egypt, including the impacts of nutrient-laden and heated effluents. Afr J Aquat Sci 29:259-264.