Status of fisheries resources of bitter lakes, Suez Canal, Egypt

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ABSTRSCT

In this study, the Fisheries database were collected from GADFR (2007) and interviews with fishermen to throw a light on fisheries resources in the environment of Bitter lakes. Fishing boats, gears, number of fishermen and catch. The total catch of 2007 was 3090919 kg and the highest catch value was in summer, whereas the minimum catch value was in winter. The study gives new insight for a better understanding the fisheries of the study area and help decision makers to make proper management of the Bitter Lakes.

INTRODUCTION

The Bitter Lakes have an important role as apart of very important waterway; Suez Canal, and as a valuable fishing area (Figure 1). It has wonderful beach used for tourism. Moreover, it represents variable resource ecosystems that are threatened by human impacts; tourist villages, fish landing sites, agricultural lands, and electric power station. These activities affect the lakes boundaries and their water quality; the electric power stations that discharge hot water in the lakes through the outflow of their cooling system (Madkour, 1992). The tourist villages and agricultural land surrounding the lake boundaries affect the water quality of the lake due to drainage discharge along the western lakes side (GADFR, 2007).

Fisheries activities are considered as food source to people in the area of study and as a source of employment for fishermen. The Bitter Lakes have no accurate fisheries database till now. So it was important to conduct a study about fisheries resources in the lakes to get sustainable development for the area of Bitter Lakes.

The main objective of the present study is to throw a light on fisheries resources of the Bitter Lakes to give suitable recommendations for the development plans of the area under consideration.

MATERIAL AND METHODS

Fisheries data

Data were collected from the General Authority for Development of Fish Resources (GADFR) by fisheries enumerators in each landing site in the Bitter Lakes for year 2007 to give information about the fisheries status at such Lakes with information about monthly and annual yield.

Fisheries interviews

Interviews with fisher men have been created in each landing site of the study area. They included the following items which served in the management of the study site:

- List of the most recent fishing landing sites for the study area.
- List of the types of gears, habitat fished and where the fishermen are from.

- List of the approximate number of boats.
- Seasonal catch composition and target species at different areas of study.

RESULTS

Description of the study area

The Bitter Lakes are located between 99 kilometers at El-Deversoir and 130 km at Gineifa according to the kilometric scale of the Suez Canal. The study area is bounded by latitudes 30°:10´ - 30°:26´ N, and longitudes 32°:10´-32°:40´ E. Bitter Lakes are Great Bitter Lakes and Little Bitter Lakes which are connected to each other as shown in Figure 1. There is many roads to reach the study area, the Cairo - Ismailia and Cairo - Suez highways and Ismailia - Suez railways.
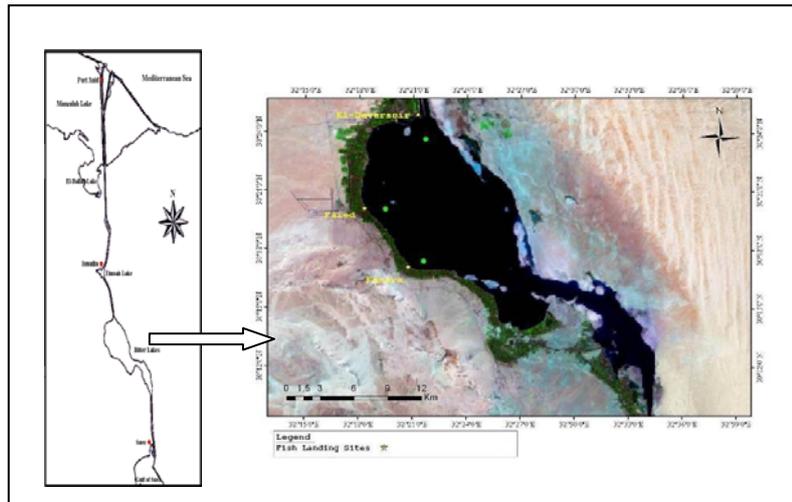
In general, the surface sediments of the bottom floor of the Bitter Lakes were sandy-clay to sandy mud. The inertidal zone was mainly rocky from the building structures and jetties along shore line. The subtidal zone was mainly soft bottom, covered with seagrasses composed of submerged *Halophila stipulacea* and to much lesser extent of *Holodule uninervis.* There was little representation of seaweeds including Chlorophyta as *Caulerpa prolifera* and *Ulva* sp., Rhodophyta as *Laurencia* sp., *Acanthophora* sp. and *Sarconema* sp. This grass bed extends over large areas of the Bitter Lakes in shallow water, constitutes an important type of subtidal soft bottom habitat for the juvenile fishes, crustaceans and mollusks. Echinoderms were represented by sea stars and sea cucumbers, and there are many crustaceans as some crab species and invertebrates such as jellyfish (*Cassiopeia* sp.).

Fisheries status

Fishing boats

The fishing boats found in the lake are composed of rowing boats made of wood, and its length ranged from 6 to 8 m, whereas its width ranged from 2 to 3 m, and its depth about 60 cm and using oars and sails. There are small boats present in few numbers, their length ranged from 4 to 5 m; made from wood covered with fiberglass materials. Motorized boats are forbidden from coast guard. Numbers of fishing boats in different landing sites are given in Table (1).

Fishing gears

A-Gill net

El-Habla (modified gill net)

This is one layer net with small mesh size of 1.5 cm and a head rope. The net has no foot rope instead; they fix stones to open the net in the water, (Figure 2). This net is used for fishing *Liza carinata* and *Liza ramada.*

Gill netting was modified as Darak net which is used for *Acanthocybium solandri* and *Argyrosomus regius* catch. This is one layer net with mesh size 12.5 cm and a head rope with cork fitted on it, whereas the foot rope with lead, (Figure 3).

The crab net

This net is one layer; its length ranged between 30 and 40 m, its width ranged from 75 to 100 cm. The upper line of the net has floats, the distance between each is about 3 m, the lower line is fitted with weights, the distance between each is 40 cm, and the mesh size of the net is 9.5 cm (Figure 4).

B. Trammel Nets

Tammded net is composed of three parallel layers, the outer two layers have a wide mesh size from 8 to 10 cm, and the inner one has a fine mesh size of 2.5 cm as shown in Figure (5). The net has lead in foot rope and cork in head rope and used for fishing *Solea aegyptica* and cuttle fishes.

Karkaba net, the net height is 2 m, the outer two layer mesh size ranged from 12.5 and 14 cm and the inner layer mesh size is 3 cm. The head rope has cork and the foot rope with lead. It is used mainly for fishing *Liza carinata* and *Liza ramada.*

C- Verandah Net

Verandah net is manufactured from bamboo, as shown in Figure (6), the net forms a vertical barrier which encourages the fish to jump and horizontal net where the fish fall in. In this method, a fish shoal is encircled by a transportable net wall, forming the barriers which the fish tries to overcome.

On the upper edges of this vertical encircling net, horizontal catching nets are fitted and held by bamboo rods every 50 cm floating on the water. These catching net consists of three layers net, the outer two layers mesh size is 14 cm and the inner layer mesh size is 3.5 cm. It is used to catch mullet fishes like *Mugil cephalus.*

D- The Beach Seine

The beach seine consists of two parts net wings and net bag. The net has two wings one on each side of the net bag. The length of each wing is about 80 m (it varies from place to place) and the height is about 5 m, while the net wing is divided into two parts, the first part is about 60 m long, with a mesh size of 7 cm; next to the net bag, the second part with length of about 20 m and a mesh size of 3.5 cm. The head rope of the wing is fitted with floats, the distance between each being 25 cm, while the foot rope of the wing is fitted with weights, also 25 cm apart. Each wing has a handle for pulling the net by the fishermen. The net bag has upper surface, with length of 9m and mesh size of 2.7 cm; lower surface with length of 9 m and mesh size of 1.4 cm (Figure 7).

The mouth of the bag has a radius of about 5 m and the head rope has some floats to keep the bag open, while the foot line of the bag mouth is fitted with weights which keep the bag creeping on the sandy or sandy-muddy bottom.

The bag has a small opening at its posterior end which is kept closed during the fishing operation and is mainly used to get the catch out of the net after fishing.

E- Fishing trap (TAHWEETA)

A barrier trap using bamboo consists of a barrier wall leading to enclosed catching chamber. The wall barrier has bamboo rods fixed to the net every 1 m with mesh size that varied from 4 to 3.5 cm and its height of 2 m. The head rope with cork and foot rope with lead fixed every 1 m the inner part are enclosed chamber, its net

with mesh size 1.5 cm. This trap is used for fishing Shrimp and benthic fishes; *Rhabdosargus haffara* and *Sparus auratus* (Figure 8).

F- Long Line

Long line is used in fishing *Acanthocybium solandri*, *Sparus auratus* and *Argyrosomus regius*, each unit is composed of 200m. There is a branch line every 50 cm, each bearing one hook, the branch line reach 1.5 m in length. Through the time of fishing each hook baited with a small fish or a part of its flesh. The beginning of the line is fixed in a buoy then the fishermen leave the line in the water, while the boat is moving, after that the end is fixed in another buoy. After suitable time, the long line is collected and the fishes are removed and the hooks fixed in a basket, (Figure 9).

G- Bivalves Dredge:

Bivalves dredge consists of a net bag with strong frame made of steel; its width ranged from 75 to 90 cm, whereas its height is 45 cm, used to fish the bivalves' species; *Mactra* sp. and *Gafrarium* sp. (Figure 10)

Landing sites in study area

There were three landing sites on the Great Bitter Lakes namely: Fanara, El-Deversoir, and Fayed. Fanara was the first in the yield (1524289 kg) of the landing sites, number of boats and fishermen. The second was El-Deversoir (1312550 kg), and the third was Fayed (254080 kg). The number of fishermen in the Bitter Lakes was 2145 fishermen as shown in Table (1). Most of them is coming from Fayoum governorate and the rest from Ismailia (GADFR, 2007). GADFR stopped new license registrations since 1997, so this introduces the unlicensed fishermen under illegal conditions.

Monthly catch composition of landing sites

A- Fanara

The catch composition in this site included sixteen species presented by molluscs; bivalves (*Mactra* sp.), and Cephalopoda (*Sepia* sp.), crustaceans; crabs and shrimps (*Portunus pelagicus and Metapenaeus* sp.), and fishes; *Liza carinata*, *Mugil cephalus*, *Liza ramada*, *Argyrosomus regius*, *Acanthocybium solandri*, *Sardinella* sp., *Rhabdosargus sarba*, *Terapon jarbua, Alepes djedaba, Siganus rivulatus, Platycephalus indicus,* and *Solea aegyptica*.

The highest catch in Fanara was the bivalves (*Mactra* sp.) in 2007 accounted by 555540 kg, and the highest monthly catch (70700 kg) was in April. Mullets represented by *Liza carinata*, *Mugil cephalus*, and *Liza ramada* come in second grade by total catch of 293400 kg, and the highest monthly catch (45285 kg) was in November, followed by Crustacea represented by crabs (*Portunus pelagicus*) and shrimps (*Metapenaeus* sp.) by total catch of 380710 kg, it attained highest catch of 56025 kg in June. The lowest total catch (3081 kg) was attained by *Solea aegyptica* and the highest monthly catch was in May (675 kg). (Table 2)

B- El-Deversoir

The catch composition in this site included eleven species presented by molluscs; bivalves (*Mactra* sp.), and Cephalopoda (*Sepia* sp.), crustaceans; crabs and shrimps (*Portunus pelagicus and Metapenaeus* sp.), and fishes; *Liza carinata*, *Mugil cephalus*, *Liza ramada*, *Argyrosomus regius, Acanthocybium solandri, Sardinella* sp., and *Rhabdosargus sarba*.

The highest catch in El-Deversoir in 2007 was bivalves (*Mactra* sp.), which attained 671000 kg and the highest monthly catch of bivalves was in May of 86000 kg. Followed by mullets represented by *Liza carinata*, *Mugil cephalus*, and *Liza ramada*, which attained 276000 kg. The highest monthly catch (40150 kg) was in October. Crustaceans which represented by crabs (*Portunus pelagicus*) and shrimps

(*Metapenaeus* sp.) came in third grade by total catch of 148900 kg, and the highest monthly catch (17400 kg) was in January. The lowest catch was attained by *Sardinella* sp. of (14750 kg), and the highest monthly catch was in June (4150 kg). (Table 3)

C- Faied

The catch composition in this site included eight species presented by molluscs; Cephalopoda (*Sepia* sp.), crustacean crabs and shrimps (*Portunus pelagicus and Metapenaeus* sp.), and fishes; *Liza carinata*, *Mugil cephalus*, *Liza ramada*, *Argyrosomus regius,* and *Acanthocybium solandri.*

The highest catch of Faied in 2007 was mullets represented by *Liza carinata*, *Mugil cephalus*, and *Liza ramada*, which attained 182434 kg in total catch. The highest monthly catch of 21296 kg was in April. Crustaceans were represented by crabs (*Portunus pelagicus*) and shrimps (*Metapenaeus* sp.) come in third grade by total catch of 58726 kg, and the highest monthly catch was in June of 6445 kg. The lowest catch was *Argyrosomus regius* which recorded only in April by 1240 kg, as shown in Table (4).

DISCUSSION AND RECOMMENDATIONS

In the present work, the surface sediments bottom floor of the Bitter Lakes was sandy-clay to sandy mud. The intertidal zone was mainly rocky and the subtidal zone was mainly soft bottom substrate, covered with seagrasses and seaweeds. This grass bed, which extends over large areas of the Bitter Lakes in shallow water, constitutes an important type of subtidal soft bottom habitat for the juvenile fishes, crustaceans and mollusks. This is in agreement with Ahmed *et al.* (2004) who studied the Bitter Lakes.

In the current study, the fishing gears used in the Bitter Lake have little modification from ideal fishing gears. The gill net was modified to El-Habla, Darak net and Crab net. The trammel net was modified to Tammded and Karkaba nets. This modification is to increase catchability of the net. The catch per unit area in the Bitter Lakes was 61.81 compared with El-Bardaweel Lake which was 28.65 showing that the catchability increase in the Bitter Lake resulted from net modifications (GADFR, 2007).

The number of fishermen in the Bitter Lakes reached 2145 fishermen, the maximum number of fishermen was recorded in Fanara area followed by El-Deversoir area and lastly by Faied area. Increase in fishermen number in different landing site was according to fishing area.

El-Mor, (1993) mentioned that the total fish catch during 1989 was amounted to 284753 kg, mullets contributed by 46.4%, followed by shrimps 19.8%, crabs 8.3% sea bream 6.9%, *Argyrosomus regius* 4.3%, and sea bass 0.6%. In the other hand the present study concluded that, the catch was 3090919 kg (GADFR, 2007). The catch composition could be categorised as following; the first category was bivalves represented by (*Mactra* sp. and *Gafrarium* sp.) with 40% of catch. The second category was mullets represented by (*Liza carinata*, *Mugil cephalus*, and *Liza ramada*) with 24 % of catch. Third category was crustaceans represented by crabs (*Portunus pelagicus*) and shrimps (*Metapenaeus* sp.) with 19% of catch. The others of 17% from catch represented by Cephalopoda (*Sepia* sp.), fish species; *Terapon jarbua, Rhabdosargus sarba* and other fish. In the current work, the highest catch value was in summer, whereas the minimum catch value was in winter (GADFR, 2007), this in agreement with (El-Mor, 1993).

Since the Bitter Lakes represent a most important, vital and strategic region in Suez Canal, which is characterized by highly intensive rate of development, the following recommendations should be considered to

- Establish fisheries database (catch composition, total annual catch, fishing gears and boats and problems facing the fishing area) with continuous update.
- Increase awareness of fishermen for illegal fishing gears and bi-catch risk in future catch.

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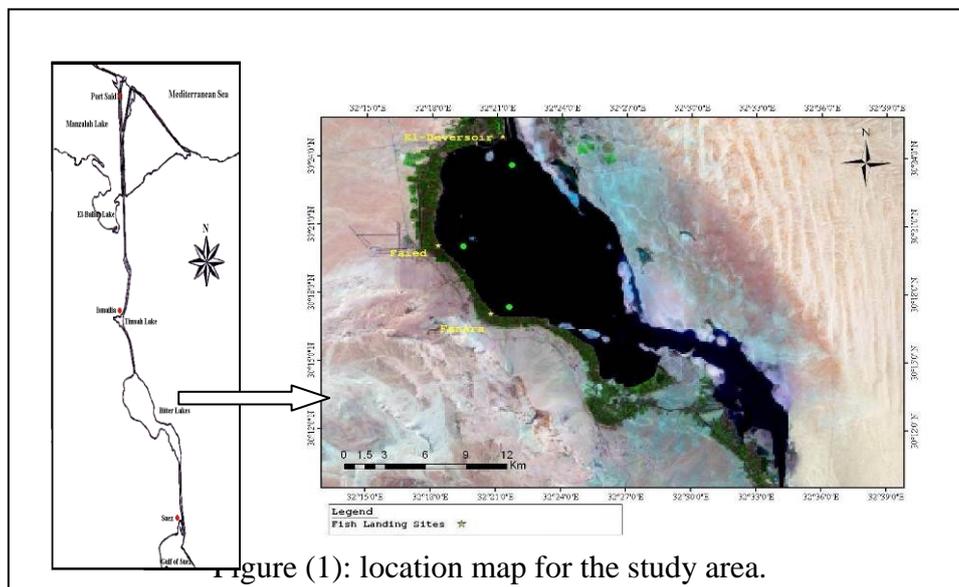
Figure (1): location map for the study area.

Table (1): Boats and fishermen numbers on each landing site.

Landing sites	Number of boats	Number of fishermen
El-Deversoir	159	795
Faied	97	485
Fanara	173	865
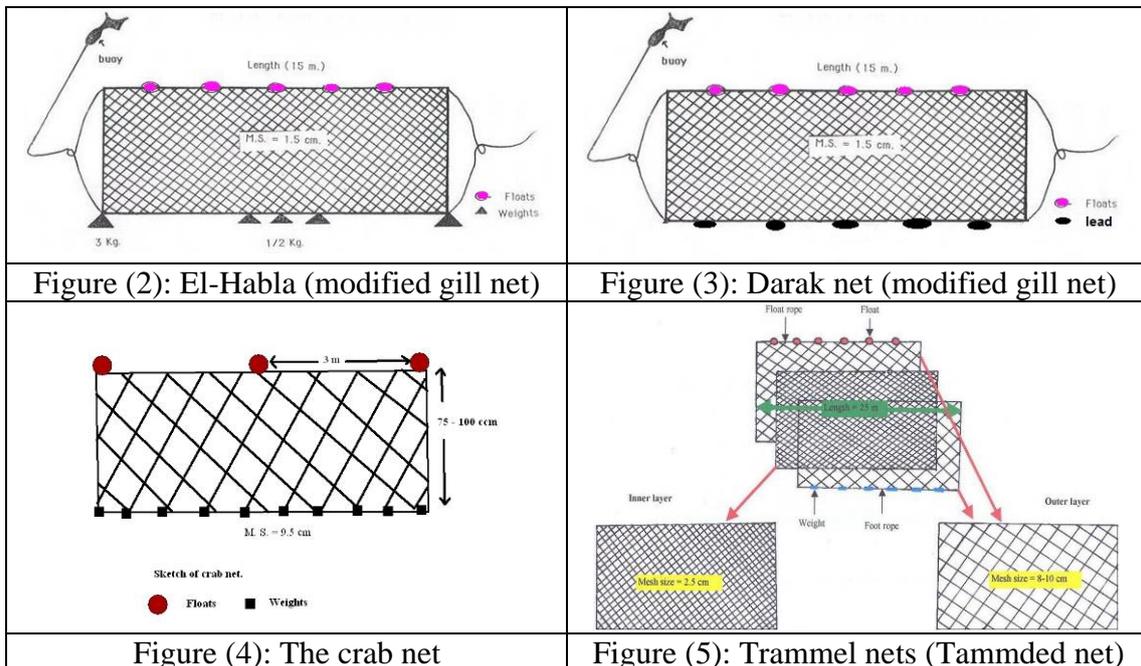
Figure (2): El-Habla (modified gill net)	Figure (3): Darak net (modified gill net)
Figure (4): The crab net	Figure (5): Trammel nets (Tammded net)

 Figure (6): Verandah net	 Figure (7): The beach seine
 Figure (8): Fishing trap (Tahweeta)	 Figure (9): Long line
 Figure (10): Bivalve dredge	
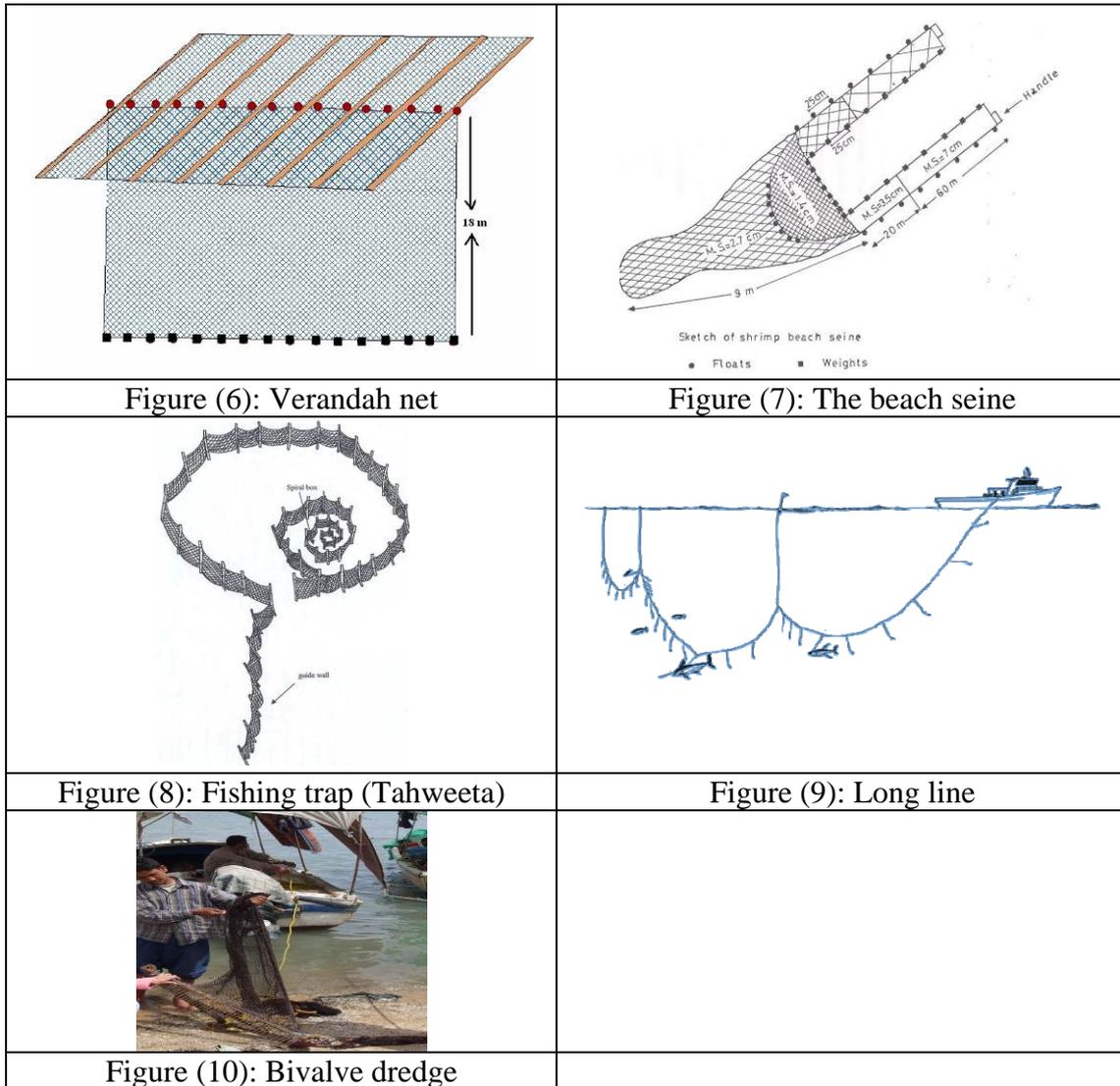
Table (2): The total catch of target species at Fanara landing site after (GADFR, 2007).

Target species	January	February	March	April	May	June	July	August	September	October	November	December	Total
Mactra sp.	5370	44900	57450	70700	47600	55400	48250	43200	48670	43000	38800	52200	555540
Liza carinata	21200	13285	7300	7650	7800	3430	11300	8350	34550	24400	39600	25550	204415
Mugil cephalus	3625	2715	1970	2710	3000	3815	2840	1840	3255	7600	1775	1425	36570
Liza ramada	7360	6780	2875	2540	3435	3220	4930	2900	3860	8150	3910	2455	52415
Portunus pelagicus	17960	10730	13200	18200	16370	28125	24625	19750	20045	5800	28450	21800	225055
Metapenaeus sp.	7890	8060	10100	18450	14800	27900	20850	15350	11190	8000	5730	7335	155655
Sepia sp.	1225	2240	2165	2065	2035	1375	1555	1130	2085	5100	1745	1700	24420
Argyrosomus regius	1560	1990	5850	5315	2225	3150	3820	1535	3120	5400	2120	1060	37145
Acanthocybium solandri	7045	5630	4625	4345	4600	6580	5850	2505	4025	5200	4735	2345	57485
Sardinella sp.		5220	7570	9350	11350	8880	8850	5040	4465	0	3680	3380	67785
Rhabdosargus sarba	1110	2505	4595	1079	2495	1640	1030	715	2135	5000	975	753	24032
Terapon jarbua	3085	6380	4310	3575	4550	3325	5490	3025	4730	0	5070	3215	46755
Alepes djedaba	450	2085	551	1550	1245	685	865	1456	2750	0	1650	1390	14677
Siganus rivulatus	290	1025	595	1110	975	665	940	2770	2560	0	1785	1375	14090
Platycephalus indicus	320	880	250	710	445	480	355	440	375	0	430	484	5169
Solea aegyptica	145	155	286	580	675	220	150	210	230	0	310	120	3081
Total number	78635	114580	123692	149929	123600	148890	141700	110216	148045	117650	140765	126587	1524289

Table (3): The total catch of target species at El-Deversoir landing site after (GADFR, 2007).

Target species	January	February	March	April	May	June	July	August	September	October	November	December	Total
Mactra sp.	62000	62000	60000	68000	86000	53000	64000	45000	32000	41000	40000	58000	671000
Liza carinata	9800	6600	7600	7800	8700	2350	2100	28300	34550	24400	20800	2000	155000
Mugil cephalus	9400	6300	8200	8200	8300	2450	2000	700	1300	7600	3900	1950	60300
Liza ramada	9600	6100	8200	7600	7700	2350	1950	600	2700	8150	3900	1850	60700
Portunus pelagicus	9000	6400	7800	8000	7800	3500	2500	5050	5600	6000	5800	2000	69450
Metapenaeus sp.	8400	5700	8400	7800	8400	4850	2650	9950	7950	7800	5200	2350	79450
Sepia sp.	9200	6300	8200	7800	7900	2850	2000	2700	3500	4900	4900	1800	62050
Argyrosomus regius	8600	6600	8600	8400	7800	2550	1800	300	1750	5400	4200	1750	57750
Acanthocybium solandri	0	0	0	0	400	4200	4050	3100	3500	5100	4800	3550	28700
Sardinella sp.	0	0	0	0	400	4150	3300	3950	0	0	0	2950	14750
Rhabdosargus sarba	7200	5800	8400	6200	8000	2650	1900	350	1850	5300	4000	1750	53400
Total number	133200	111800	125400	129800	151400	84900	88250	100000	94700	115650	97500	79950	1312550

Table (4): The total catch of target species at Faied landing site after (GADFR, 2007).

Target species	January	February	March	April	May	June	July	August	September	October	November	December	Total
Liza carinata	14973	9735	14361	15960	15324	7206	9525	7295	12413	12645	17535	9985	146957
Mugil cephalus	1249	604	1136	1141	1092	1216	868	1368	1236	1136	1423	558	13027
Liza ramada	2021	1585	2734	4195	2552	1322	1589	1048	1753	1731	1093	827	22450
Portunus pelagicus	2285	1819	2510	3226	2554	2910	2063	1353	2344	2091	1604	1418	26177
Metapenaeus sp.	3050	2223	3187	3091	3030	3535	2586	1586	2690	2200	3141	2230	32549
Sepia sp.	621	581	1188	1337	1062	789	765	695	736	722	1649	0	10145
Argyrosomus regius	0	0	0	1240	0	0	0	0	0	0	0	0	1240
Acanthocybium solandri	0	0	0	0	0	0	0	0	0	0	0	1535	1535
Total number	24199	16547	25116	30190	25614	16978	17396	13345	21172	20525	26445	16553	254080