

**PRELIMINARY ANALYSIS OF THE STATUS OF TRAWL FISHERY
IN THE GULF OF SUEZ, WITH SPECIAL REFERENCE TO SHRIMP**

By

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ABSTRACT

Catch, effort and catch per unit fishing effort for shrimp and total catch in the Gulf of Suez during the fishing seasons from 1988/1989 to 1990/1991 were investigated. The total trawl catch during the investigated fishing seasons were 3556.2, 3604.0 and 2951.1 tons. Shrimp catch during the same period were 364.3, 499.3 and 560.6 tons. The estimated number of fishing days were 13555 (1988/1989), 13628 (1989/1990), and 12259 (1990/1991). The catch (Kg.) per fishing day for the total trawl catch were 262.4 (1988/1989), 264.4 (1989/1990) and 240.7 (1990/1991), while the catch per fishing day for shrimp were 26.9 (1988/1989), 36.6 (1989/1990) and 45.7 (1990/1991).

INTRODUCTION

Catch, effort and catch per unit fishing effort statistics are of vital importance for the evaluation of the status of an exploited fish stock. The catch per unit fishing effort (CPUE) is a good measure of the relative abundance of the exploited stocks. In addition, informations about effort and catch per unit effort are essential data for the estimation of maximum sustainable yield (MSY) and the corresponding level of fishing effort (fMSY) by means of surplus production models.

This paper presents an analysis of the data concerning catch, effort and catch per unit effort of trawling covering three fishing seasons from 1988/1989 to 1990/1991. Also a comparison between the present data and those of sanders *et al.* (1984) was carried out to evaluate the effect of increasing fishing effort, injected into the trawl fishery, on the status of shrimp stocks in the Gulf of Suez.

MATERIALS AND METHODS

I- Collection of catch statistics :

Data concerning monthly shrimp and total trawl catches during the fishing seasons 1988/1989, 1989/1990 and 1990/1991 were obtained from the fisheries Office of the Ministry of Agriculture at Suez Governorate.

II- Estimation of fishing effort :

Informations used for the estimation of fishing effort, injected into the trawl fishery, were obtained through a weekly interviewing of a sample of skipper at Ataka Fishing Harbour during the above mentioned fishing seasons and the following data were collected :

- 1.. The name of the vessel.
2. Data of landing.
3. The number of crew.
4. Motor horse power.
5. Number of fishing days.
- 6.. Number of shots per fishing day.
7. Number of hours trawling per shot.
8. Length of the net.
9. Number of fish boxes for each species.
10. Length of the vessel.

The total fishing effort is then estimated from the obtained data as follows :

a - Estimation of the total fishing effort for the vessels landed in Ataka Fishing Harbour in the day of the interview. This effort was estimated by multiplying the fishing effort for the vessels which were interviewed by the following raising factor "R".

$$R = \frac{\text{Total catch landed in the day of the interview}}{\text{Catch of the vessel which was interviewed}}$$

b - Estimation of the total fishing effort for the vessels working during the month by multiplying the summation of the monthly fishing effort for the vessels which were interviewed by the following raising factor "R".

$$R = \frac{\text{total catch of the vessels working during the month}}{\text{the sum of the catch of the vessels interviewed in the month}}$$

c - Estimation of the monthly and annual total effort expressed by the following units :-

- Number of fishing day.
- Number of shots.
- Number of trawling hours.
- Number of monthly landing.

These data are used for estimation of the following values :-

III- Estimation of the effort was estimated by dividing the catch of shrimp and the trawl catch by the different units of fishing effort.

RESULTS

Catch composition of the Trawl fishery

The most economic important fish species or fish groups in the catch of the trawl fishery in the Gulf of Suez are listed according to their economic values in Table (1).

Species composition of large shrimp :

Table (2) shows the species composition of large shrimp collected from the Gulf of Suez during the fishing seasons 1988/1989 and 1989/1990. From this table it is clear that the catch of large shrimp composed of three species namely, *Penaeus japonicus*, *P. semisulcatus*, and *P. latisulcatus*. During the two fishing seasons 1988/1989 and 1989/1990 *P. japonicus* was the most abundant species and contributed 40.89 % and 51.56 % respectively. The proportion of *P. semisulcatus* was 30.20 % and 19.31 % during the fishing seasons 1988/1989 and 1989/1990 respectively. The percentages of *P. latisulcatus* were nearly constant during the fishing seasons 1988/1989 and 1989/1990 and contributed 28.9 % and 29.13 % respectively.

Table (1): Catch composition of the trawl fishery in the Gulf of Suez.

English Name	Latin Name of of the common species	Local Name
Large Shrimp	<i>Penaeus japonicus</i>	Gambary
	<i>P. semisulcatus</i>	Gambary
	<i>P. latisulcatus</i>	Gambary
Lizard fish	<i>Saurida undosquamis</i>	Haret
Stripped snapper	<i>Pomadasys stridens</i>	Shokhrom
Thread fin bream	<i>Hemipterus japonicus</i>	Sakh
Cuttle fish	<i>Sepia spp.</i>	Sobia
Horse mackerel	<i>Decapterus maruadsi</i>	Bagha
	<i>Decapterus macrosoma</i>	
	<i>Trachurus indicus</i>	
Red mullet	<i>Upeneus spp.</i>	Barbony
Small shrimp	<i>Metapenaeopsis spp.</i>	Abo-Lecfa
Sharks and Rays		El-Kersh and Heddaia

Table (2): Species composition of large shrimp collected from the Gulf of Suez during the fishing seasons 1988/1989 and 1989/1990.

Species Fishing seasons	Weight of examined sample (kg.)	<i>P. japonicus</i>		<i>P. semisulcatus</i>		<i>P. latisulcatus</i>	
		Wt.	%	Wt.	%	Wt.	%
1988/1989	85.1	34.8	40.89	25.7	30.20	24.6	28.91
1989/1990	64.2	33.1	51.56	12.4	19.31	18.7	29.13
Total	149.3	67.9	45.48	38.1	25.52	43.3	29.00

Table (3): Monthly total catch and shrimp catch (ton) taken by the trawl fishery from the Gulf of Suez during the fishing season 1988/1989.

MONTH	TOTAL CATCH	SHRIMP CATCH	%
OCTOBER	711.1	163.5	23.0
NOVEMBER	660.5	56.5	8.5
DECEMBER	606.8	33.1	5.5
JANUARY	350.6	24.0	6.8
FEBRUARY	374.9	14.9	4.0
MARCH	256.4	21.6	8.4
APRIL	230.4	22.9	10.0
MAY	366.0	27.7	7.6
TOTAL	3556.3	364.3	10.2

Table (4): Monthly total catch and shrimp catch (ton) taken by the trawl fishery from the Gulf of Suez during the fishing season 1989/1990.

MONTH	TOTAL CATCH	SHRIMP CATCH	%
OCTOBER	906.2	186.8	20.6
NOVEMBER	761.4	95.4	12.5
DECEMBER	470.1	53.8	11.4
JANUARY	444.9	39.4	8.9
FEBRUARY	331.3	29.9	9.0
MARCH	215.0	26.2	12.2
APRIL	204.8	35.3	17.2
MAY	270.3	32.5	12.0
TOTAL	3604.0	499.3	13.8

Table (5): Monthly total catch and shrimp catch (ton) taken by the trawl fishery from the Gulf of Suez during the fishing season 1990/1991.

MONTH	TOTAL CATCH	SHRIMP CATCH	%
OCTOBER	646.3	201.1	31.1
NOVEMBER	487.8	108.1	22.2
DECEMBER	409.9	74.3	18.1
JANUARY	421.7	47.9	11.4
FEBRUARY	291.3	26.5	9.1
MARCH	149.4	23.0	15.4
APRIL	209.5	32.8	15.7
MAY	335.2	46.9	13.6
TOTAL	2951.1	560.6	19.0

Catch Statistics

The monthly total trawl and shrimp catch (in ton) landed in Ataka Fishing Harbour during the fishing season from 1988/1989 until 1990/1991 are given in tables (3,4 and 5). From these tables it is clear that the total trawl catch during the seasons 1988/1989 and 1989/1990 are nearly of the same magnitude and contributed respectively 3556.3 tons. A marked decline in the total trawl catch was recorded during the fishing season 1990/1991 where only 2951.1 tons were landed.

On the other hand, the shrimp catch showed a continuous increase from 364.3 ton during the fishing season 1988/1989 through 499.3 ton during the fishing season 1989/1990 and reached its highest value (560.6 ton) during the fishing season 1990/1991.

Month-wise data showed that the highest shrimp catch was landed during the first month (October) at the beginning of each fishing season and decreased greatly from month to month reaching its lowest value in February or March. After which a slight increase in the shrimp catch was observed during the next two months.

It was also observed that the first three months at the beginning of each fishing season are characterized by a high shrimp production where more than 50 % of the annual shrimp catch were landed during these three months. This reflects the relatively high stock abundance of shrimp at the beginning of each fishing season.

Fishing effort

The monthly estimated fishing effort represented by the number of fishing days, number of shots, number of trawling hours and number of landing during the fishing seasons from 1988/1989 to 1990/1991 are given in Tables (6,7 and 8). The tables show that the fishing effort, expressed by the different units, during the first two fishing seasons (1988/1989 and 1989/1990) are nearly of the same magnitude. In the last fishing season (1990/1991) the different units of fishing effort were found to be less than that in the previous two fishing seasons.

Catch per unit of fishing effort (CPUE)

The monthly estimated catch (weight) per unit effort represented by catch per fishing day, catch per shot, catch per hour trawling and catch per landing for the total trawl catch and shrimp catch during the fishing seasons 1988/1989, 1989/1990 are given in Table 9, 10 and 11. From these table it is obvious that the highest of total

Table (6) : Estimated fishing effort for the trawl fishery in the Gulf of Suez during the fishing season 1988/1989.

EFFORT MONTH	No. OF FISHING DAYS	No. OF SHOTS	No. OF HOURS TRAWLING	No. OF LANDING
OCTOBER	2097	13276	39518	225
NOVEMBER	2064	15708	39953	234
DECEMBER	1916	15950	38124	224
JANUARY	1756	13744	34357	195
FEBRUARY	1757	12530	29349	190
MARCH	1095	8759	22540	147
APRIL	1280	9906	23327	162
MAY	1590	11484	23690	225
TOTAL	13555	101357	250858	1602

Table (7): Estimated fishing effort for the trawl fishery in the Gulf of Suez during the fishing season 1989/1890.

EFFORT	No. OF FISHING DAYS	No. OF SHOTS	No. OF HOURS TRAWLING	No. OF LANDING
MONTH				
OCTOBER	2153	17154	46598	269
NOVEMBER	2112	16259	46207	263
DECEMBER	1883	14357	36335	213
JANUARY	1784	11829	31124	203
FEBRUARY	1685	12316	29856	198
MARCH	1172	8889	20107	141
APRIL	1278	10032	22232	168
MAY	1561	11200	23335	199
TOTAL	13628	102046	255794	1654

Table (8) : Estimated fishing effort for the trawl fishery in the Gulf of Suez during the fishing season 1990/1991.

EFFORT MONTH	No. OF FISHING DAYS	No. OF SHOTS	No. OF HOURS TRAWLING	No. OF LANDING
OCTOBER	1919	13595	36606	221
NOVEMBER	1734	12420	34020	203
DECEMBER	1689	11779	24344	193
JANUARY	1790	12211	29656	199
FEBRUARY	1362	10250	22385	179
MARCH	945	6641	13379	141
APRIL	1304	9238	20669	163
MAY	1513	10518	23920	196
TOTAL	12259	86652	204979	1495

Table (9): Catch (Kg.) per unit effort for shrimp and total trawl catch in the Gulf of Suez during the fishing season 1988/1989.

M O N T H	TOTAL CATCH				SHRIMP CATCH			
	Catch/ Fish. day	Catch/ Shot	Catch / hrs. trawling	Catch/ landing	Catch/ Fish. day	Catch/ Shot	Catch / hrs. trawling	Catch/ landing
Oct	339.1	53.6	18.0	3160.4	78.0	12.3	4.1	726.7
Nov	320.0	42.0	16.5	2822.6	27.4	3.6	1.4	241.4
Dec	316.7	38.0	15.9	2708.9	17.3	2.1	0.9	147.8
Jan	199.7	25.5	10.2	1797.9	13.7	1.7	0.7	123.1
Feb	213.3	29.9	12.8	1973.2	8.5	1.2	0.5	78.4
Mar	234.1	29.3	11.4	1744.2	19.7	2.5	1.0	146.9
Apr	179.7	23.2	9.9	1419.7	17.9	2.3	1.0	141.4
May	230.2	31.9	15.4	1626.7	17.4	2.4	1.2	123.1
T O T A L	262.4	35.1	14.2	2219.9	26.9	3.6	1.4	227.4

Table (10): Catch (Kg.) per unit effort for shrimp and total trawl catch in the Gulf of Suez during the fishing season 1989/1990.

M O N T H	TOTAL CATCH				SHRIMP CATCH			
	Catch/ Fish. day	Catch/ Shot	Catch / hrs. trawling	Catch/ landing	Catch/ Fish. day	Catch/ Shot	Catch / hrs. trawling	Catch/ landing
Oct	420.9	52.8	19.4	3368.8	86.8	10.9	4.0	694.4
Nov	360.5	46.8	16.5	2895.1	45.2	5.9	2.0	362.7
Dec	249.6	32.7	12.9	2207.0	28.6	3.7	1.5	252.6
Jan	249.4	37.6	14.3	2191.6	22.1	3.3	1.3	194.1
Feb	196.6	26.9	11.1	1673.2	17.7	2.4	1.0	151.0
Mar	183.4	24.2	10.7	1524.8	22.3	2.9	1.3	185.8
Apr	160.2	20.4	9.2	1219.0	27.6	3.5	1.6	210.1
May	173.2	24.1	11.6	1358.3	20.8	2.9	1.4	163.3
T O T A L	264.4	35.3	14.1	2179.0	36.6	4.9	1.9	301.9

Table (11): Catch (Kg.) per unit effort for shrimp and total trawl catch in the Gulf of Suez during the fishing season 1990/1991.

M O N T H	TOTAL CATCH				SHRIMP CATCH			
	Catch/ Fish. day	Catch/ Shot	Catch / hrs. trawling	Catch/ landing	Catch/ Fish. day	Catch/ Shot	Catch / hrs. trawling	Catch/ landing
Oct	336.8	47.5	17.7	2924.4	104.8	14.8	5.5	909.9
NOV	281.3	39.3	14.3	2403.0	62.3	8.7	3.2	532.5
Dec	242.7	34.8	16.8	2123.8	44.0	6.3	3.0	385.0
Jan	235.6	34.5	14.2	2119.1	26.8	3.9	1.5	240.7
Feb	214.9	28.4	13.0	1627.4	19.5	2.6	1.2	148.0
Mar	158.1	22.5	11.2	1059.6	24.3	3.5	1.7	163.1
Apr	160.7	22.7	10.1	1285.3	25.1	3.5	1.6	201.2
May	221.4	31.9	14.0	1710.2	31.0	4.5	2.0	239.3
T O T A L	240.7	34.1	14.4	1974.0	45.7	6.5	2.7	375.0

trawl catch per unit fishing effort were recorded during the first three months at the beginning of each fishing season. The lowest values of CPUE were recorded during April, except during the last fishing season (1990/1991) where the lowest values was observed during March.

On the other hand, the catch per unit effort of shrimp decreased from the beginning of each fishing season through February after which a noticeable increase in the values of CPUE during March each fishing season were recorded followed by an increase or decrease in the values of CPUE. This trend can be attributed to the arrival of a new recruit of shrimp to the fishing ground or to the accumulation of shrimp.

DISCUSSION

Most of the Egyptian Red Sea fisheries are located in the Gulf of Suez, which offers a large shallow area suitable for trawling. Besides, the Gulf of Suez is characterized by a relatively high productivity and the presence of economically important fish species and crustaceans specially shrimp.

Three fishing methods are used in the Gulf of Suez. These are: trawling, purse-seining and long line fisheries. The fishery of the first two methods is seasonal, general from October to the end of May, while the fishery of the long line is throughout the year.

In respect to the trawl fishery, 74 vessels were operated in the Gulf during the period from 1979/1980 to 1981/1982. This numbers was increased to 78 vessels during the fishing seasons from 1982/1983 to 1987/1988 and become 79 vessels in the fishing seasons from 1988/1989 to 1990/1991.

Shrimp are considered as one of the most valuable fishery resources in the Gulf of Suez and contributed about 12 % of the total trawl catch. This being about 40 % of the gross revenue of the trawl fishery.

Due to the high price of shrimp and the strong demand on the local market, a rapid increase in the fishing effort was injected into the trawl fishery. This increased fishing effort had already affected the trawl production where only 2951 ton were landed during the last fishing season 1990/1991 compared with 5377.1 ton in the fishing season 1981/1982 (Table 12).

The trend in the shrimp catch during the investigated fishing seasons shows a minimum value (364.3 ton) during the fishing season 1988/1989 and a minimum value (560.6 ton) during fishing season 1990/1991.

Table (12): Catch, effort and catch per unit of fishing effort for the trawl fishery and shrimp catch in the Gulf Suez during the fishing seasons from 1979/1980 to 1981/1982 and from 1988/1989 to 1990/1991.

Fishing seasons	Total trawl catch	Shrimp catch	No. of fishing days	Catch per fishing day		Author
				Total trawl	Shrimp	
1979/80	4259.5	475.7	10561	403.2	45.0	Sanders
1980/81	4283.7	451.5	12352	427.8	36.6	and
1981/82	5377.1	494.9	11733	458.3	42.2	Kedidi
Mean	4640.1	474.0	11549	429.8	41.3	(1984)
1988/89	3556.3	364.3	13555	262.4	26.9	Present study
1989/90	3604.0	499.3	13628	264.4	36.6	
1990/91	2951.1	560.6	12259	240.7	45.7	
Mean	3370.5	474.7	13147	255.8	36.4	

Most shrimp fisheries around the world are characterized by annual catch variations. Garcia (1983) mentioned that the annual yield of shrimp is a function of the annual level of recruitment. He also mentioned that the cohort survival in lagoons and estuaries and therefore the level of recruitment are largely dependent on the local climatic conditions. Garcia & Le Reste (1981) stated that the climatological parameters such as rainfall, river discharges, annual thermal profile or solar activity can be overall indicators of climatic variations affecting many other parameters (hours of sunshine and hence primary production and photoperiodicity, salinity, chronology or relative length of seasons displacement of fronts, position or strength of currents and under currents) which are all also liable to influence the biological production of shrimp stocks (fecundity, postlarval recruitment, age at migration, growth and survival). They mentioned also that the variations in shrimp catch can be correlated to the effort and the improvements made to the fishing power of the fishing vessels.

The monthly shrimp catch during the fishing season from 1988/1989 to 1990/1991 showed that the first three months at the beginning of each fishing season are characterized by a high shrimp production where more than 50 % of the annual shrimp catch were landed during these months. This reflects the relatively high stock abundance of shrimp at the beginning of each fishing season.

The fishing effort, performed in the trawl fishery expressed as the number of fishing days, the number of shots, the number of trawling hours and the number of landing was estimated. The lowest fishing effort expressed as the number of fishing days, was recorded during the fishing season 1990/1991 (12259 fishing day), while the highest number of fishing days was observed during the fishing season 1989/1990 (133628 fishing day).

Generally, there is an increase in the trend of the fishing effort during the investigated fishing seasons compared with the fishing seasons from 1979/1980 to 1981/1982 (Sanders and Kedidi, 1984).

The decreased fishing effort during the last fishing season 1990/1991 was due to economic reasons, where the catch per unit effort was at its lowest level (240.7 Kg/fishing

The annual total trawl catch per unit effort represented by catch/fishing day, catch/short, catch/hour trawling and catch/landing shows its lowest values during the fishing season 1990/1991.

In respect to shrimp, the catch per unit fishing effort showed a continuous increase from fishing season to another. The lowest values of catch per different units of fishing effort were recorded during the fishing season 1988/1989 (26.9 Kg/fishing

day, 3.6 Kg/shot, 1.4 Kg/hours trawling and 227.4 Kg/landing) while the highest values were observed during the fishing season 1990/1991 (45.7 Kg/fishing day, 6.5 Kg/shot, 2.7 Kg/hours trawling and 375.0 Kg/landing).

As a general trend, the catch per unit effort for shrimp decreased from the beginning of each fishing season until February for the investigated fishing seasons, after which a noticeable increase in the value of catch per unit effort was observed. This trend can be attributed to the arrival of a new recruit to the fishing ground. The same observation was recorded for several penaeid shrimp around the world. Buckworth (1985) mentioned that double peak pattern in the catch per unit effort of shrimp is the most frequent trend. Garcia and Le Reste (1981) and Garcia (1985) demonstrated that most Penaeus stocks have a seasonally oscillating recruitment pattern with a main generation recruited of shore during summer and autumn and a secondary generation recruited during spring and this seasonality of recruitment is responsible for the seasonal variation in the catch per unit effort.

To evaluate the effect of increasing the number of trawlers on the status of total trawl production and shrimp production, a comparison between the catch, effort and catch per unit fishing effort during the periods from 1979/1980 to 1981/1982 and from 1988/1989 to 1990/1991 was carried out (Table 12). It is evident from the table that the increase of the number of vessels from 74 during the fishing seasons 1979/1980, 1980/1981 and 1981/1982 (mean number of fishing days = 11549) to 79 vessel during the fishing seasons 1988/1989, 1989/1990 and 1990/1991 (mean number of fishing days = 13147) was associated with a sharp decrease in the mean annual trawl catch from 4640.1 to 3370.5 ton during the fishing seasons from 1979/1980 to 1981/1982 and from 1988/1989 to 1990/1991 respectively. This means that the increase of the fishing effort expressed by the number of fishing days by about 13.84 % was associated with a decrease in the mean annual catch from 4640.1 to 3370.5 ton (about 27.36 %). This indicate that the stocks exploited by trawling in the Gulf of Suez are over exploited since the total annual catch decreases as the fishing effort increases.

Contrary to total trawl production, shrimp production seems to be not affected by the increase in the number of fishing days from 11549 to 13146 days during the fishing seasons (from 1979/1980 to 1981/1982) and (from 1988/1989 to 1990/1991) respectively. The mean annual shrimp production was 474.0 and 474.7 ton during the first and second periods respectively. This means that the increase in the number of fishing days from 11549 to 13146 (about 13.84 %) was associated with a slight increase in shrimp production in the order of 0.15%. This indicates that shrimp stock in the Gulf of Suez are in a situation of economic overfishing because the catch increase more slowly than fishing effort. This means over-investment, excessive production costs and no economic return.

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