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INVESTIGATION OF BEACH SEINE CATCH OF ABU QIR BAY (EGYPT)

BY

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ABSTRACT

The catch of small beach-seines operating in Abu-Qir Bay during the period of June 2000 - May 2001 was investigated. It amounted about 8 Kg/haul, classified into economic (30%) and trash (70%) catches. The economic catch was mainly composed of ***Tilapia zillii*** *(52%),* ***Siganus rivulatus*** *(13%) and* ***Scomberomorus commerson*** *(12%). Trash catch was composed of 36 families (63 spp.), of which Gobiidae (34%), Siganidae (20%). Engraulidae (17%) and Teraponidae (9%) were mainly components of it. The most important species, which cause a drastic deterioration to fish stock, have a minimum total length of 2-5 cm. Therefore, some measures should be introduced to that gear to be banned in the nursery ground.*

INTRODUCTION

Beach-seines are used on an extensive scale along the Egyptian Mediterranean coast, particularly in front of the Nile Delta. They cause a considerable increase in landing of trash species. Faltas (1997) reported that trash species of beach-seines operating in Abu Qir Bay during the period of October 1994 - September 1995 represented about 80% of their total catch, of which 47% of the total trash catch included juveniles of commercially important species.

The aim of the present work is to continue the investigation of the beach-seine fishery (statistics, species and size composition, and species abundance) in Abu Qir Bay to monitor variations occurred that help in suggesting measures for their fisheries management.

MATERIAL AND METHODS

The study area, Abu Qir Bay, is a shallow semi-circular basin with a depth of about 12 m. It lies between 30° 5′ to 30° 22′ longitude E and 31° 16′ to 31° 21′ latitude N, situated between Rosetta mouth and Abu Qir city (Fig. 1) It receives different sources of land drainage via El-Tabia outflows

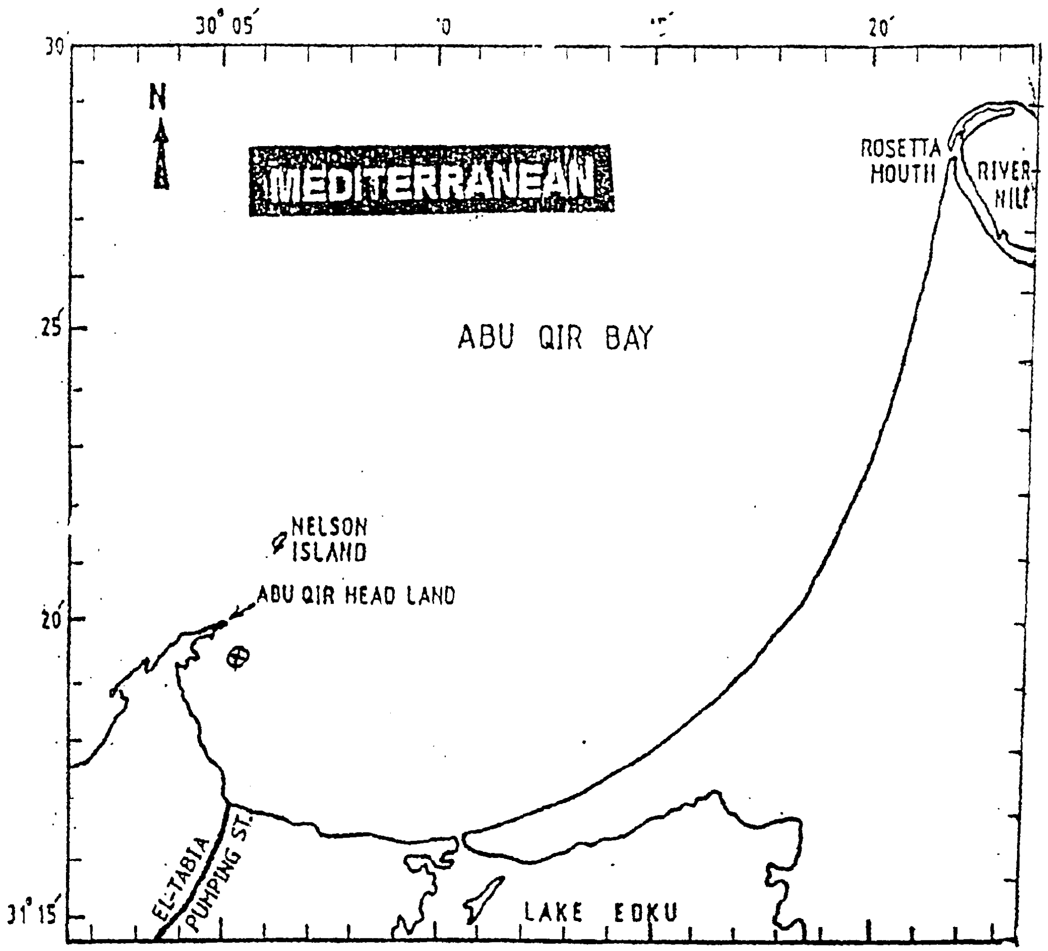

Fig. 1: Study area showing the position of sampling ⊗

Random samples of trash catch (3-5 Kg) as well as landing statistics were collected twice a month from small beach seiners operating in Abu Qir Bay during the period from June 2000 to May 2001. The trash samples were sorted and identified to species level using the key of Whitehead *et al.* (1986) Total lengths of fish individuals were measured in centimetres and their corresponding weights were taken in grams

The small beach-seines used in Abu Qir Bay have lengths ranging from 150 to 240 m with bag mesh bar of average 6 mm (Faltas, 1997)

The species diversity was investigated by the Shannon Diversity Index (H') (Shannon and Weaver, 1963) using the following equation:

$$H' = -\sum_{1}^{S}(n_i / N)\ln(n_i / N)$$

Where $\mathbf{n_i}$ is the total number of certain species, **N** is the total number of all species and **S** is the number of different species.

The seasonal overlapping of different species was tested by the following formula given by Schoener (1970):

$$T = 1 - 0.5\sum_{i=1}^{n}\left|P_{xi} - P_{yi}\right|$$

Where $\mathbf{P_{xi}}$ and $\mathbf{P_{yi}}$ are proportions by number of species (**i**) in seasons (**x**) and (**y**) respectively. When the index of overlap (T) equals to zero, this indicates that there is no overlapping between the two seasons (**x**) and (**y**) and when the value of this index reaches one, this indicates that both seasons have the same species of the same proportionality. Values higher than 0.6 are considered to be significant (Macpherson, 1979).

RESULTS

The total catch of beach-seine operating in Abu Qir Bay varies between 4.871 Kg/haul (spring) and 12.864 Kg/haul (autumn) with an average of 7.897 kg/ haul. It can be classified into two main categories: economic (30.15%) and trash (69.85%) catches (Table 1)

Table 1: Seasonal abundance (Kg/ haul) of economic and trash catches of small beach-seines in Abu Qir Bay (June 2000 - May 2001)

Season	Total catch (Kg/haul)	Economic catch (Kg/haul)	Trash catch (Kg/haul)
Summer	7.206	1.531 (21.25%)	5.675 (78.75%)
Autumn	12.864	5.053 (39.28%)	7.811 (60.72%)
Winter	6.646	0.772 (11.62%)	5.874 (88.38%)
Spring	4.871	2.167 (44.49%)	2.707 (55.57%)
Total	7.897	2.381 (30.15%)	5.516 (69.85%)

I. Economic Catch:

Economic catch varies between 0.772 Kg/haul (winter) and 5.053 Kg/haul (autumn) having an average of 2.381 Kg/haul (Table 1). Its major components are Cichlidae, Siganidae and Scombridae represented by *Tilapia zillii* (52.37%), ***Siganus rivulatus*** (12.65%) and ***Scomberomorus commerson*** (12.25%) respectively. Altogether comprise about 77% by weight of the total economic catch (Table 2). Fresh water origin species, *T. zillii*, is existing in high percentage revealing a pronounced establishment in the area, while ***Oreohromis aureus*** showed extremely rare occurrence (only 2 specimens).

Table 2: Species composition of the economic catch category of small beach-seines in Abu Qir Bay (June 2000 - May 2001)

Family / Species	% Weight
Pisces	
F. Cichlidae	
Tilapia zillii	52.37
F. Siganidae	
*Siganus rivulatus**	12.65
F. Scombridae	
*Scomberomorus commerson**	12.25
F. Sparidae	
Boops boops	3.27
F. Mugilidae	
Liza ramada	3.03
Crustacea	
F. Penaeidae	
Penaeus karathurus	1.75
F. Portunidae	
*Portunus pelagicus**	2.31
Callinectes sapidus	2.23
Cephalopoda	
F. Sepiidae	
Sepia officianalis	4.20
F. Loliginidae	
Loligo vulgaris	2.80
Others (each < 1% by weight)**	**3.14**

* Lessepsian species

** *Sphyraena chrysotaenia**, *Lithognathus mormyrus*, *Mullus surmuletus*, *Plectorhinchus mediterraneus*, *Diplodus sargus*, *Sparus aurata*, *Octopus vulgaris*

II. Trash Catch:

Trash catch varies between 2.707 Kg/haul (spring) and 7.811 Kg/haul (autumn) with an average of 5.516 Kg/haul (Table 1). Thirty-six families were represented in the trash catch embracing 63 species (Tables 3 and 4). The most frequent families are Gobiidae (34.24%), Siganidae (19.83%), Engraulidae (17.29%) and Teraponidae (9.02%) by weight. Altogether amounts about 80% of the trash catch. This catch can be divided into:

a. Juveniles of commercially important species:

They constituted of 30 species contributing 28.55% of the total weight of the trash catch, of which ***S. rivulatus*** (19.82%), *T. zillii* (3.72%) and ***Diplodus vulgaris*** (1.78%) are the main species representing 25.32% of the total weight of the trash catch (Table 3).

b. Low valued species:

They constituted about 64.68% of the total trash catch weight comprising 23 species. The family Gobiidae (***Gobius niger*** and ***Gobius paganellus***) formed the largest percentage by weight (34%) beside the families Engraulidae (***Engraulis encrasicholus***) (17%) and Teraponidae (***Terapon puta***) (9%) (Table 3).

c. Non-edible species:

They formed about 6.77% of the total trash catch, of which, Pisces had an insignificant portion (0.12 %) represented by 8 species, of which ***Parablennius gattarugine***, ***Lipophrys basiliscus***, ***Syngnathus typhle***, and ***Syngnathus acus*** were recorded for the first time in the Egyptian Mediterranean waters (Table 3).

Table 3: Species and size composition of trash catch category of small beach-seine in Abu Qir Bay (June 2000 - May 2001)

Species	%		AV.	Total length (cm)	
	Number	Weight	Wt (g)	Range	Mean
a. Juveniles of commercially important species					
Pisces					
Siganus rivulatus	27.16	19.82	2.5	2-10	5.3
Tilapia zillii	5.11	3.72	2.4	2-11	4.5
Diplodus vulgaris	1.30	1.78	4.6	3-10	6.5
Diplodus annularis	0.28	0.28	3.4	3-8	5.9
Diplodus sargus	0.09	0.16	5.9	5-8	6.9
Mullus surmuletus	1.39	0.92	2.2	4-12	5.7
Liza ramada	0.24	0.51	7.2	8-13	9.4
Pomatomus saltator	0.38	0.22	2.4	2-9	4.9
Crustacea					
*Portunus pelagicus**	0.08	0.54	23.9		
Others[1] (each <0.1% by weight)	0.55	0.60			

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Continue

Species	%		AV. Wt. (g)	Total Length (cm)	
	Number	Weight		Range	Mean
b. Low valued species					
Pisces					
Gobius niger	16.49	23.95	4.9	5-12	7.2
Engraulis encrasicholus	30.46	17.29	1.9	5-9	6.9
Gobius paganellus	5.44	10.16	6.3	4-9	7.6
*Terapon puta**	3.69	9.02	8.2	3-13	7.8
Atherina boyeri	4.58	2.55	1.9	3-9	6.3
Hyporamphus picarti	0.42	0.54	4.4	4-15	12.1
Stephanolepis hispidus	0.06	0.47	28.5	9-12	11.7
*Stephanolepis diaspros**	0.18	0.18	3.4	3-7	5.8
Crustacea					
*Trachypeneuus curvirostris**	0.38	0.13	1.1	4.6	5.6
*Oratosquilla massavensis**	0.02	0.10	21.3	11-16	13.7
Others[2] (each < 0.1% by weight)	0.15	0.29			
c. Non-edible species					
Pisces[3] (each <0.1% by weight)	0.09	0.12			
Crustacea					
Liocarcinus vernalis	1.18	5.92			
Carcinus aestuarii	0.28	0.73			

1. *Epinephelus aenus*, *Lithognathus mormyrus*, *Diplodus cervinus*, *Oreochromis aureus*, *Plectorhincus mediterraneus*, *Dicentrarchus punctatus*, *Argyrosomus regius*, *Sardinella aurita*, *Boops boops*, *Serranus hepatus*, *Mugil cephalus*, *Solea vulgaris*, *Alepes djedaba**, *Serranus cabrilla*, *Epinephelus alexandrinus*, *Siganus luridus**, *Epinephelus gauza*, *Trachynotus ovatus*, *Liza ramada*, *Sphyraena chrysotaenia**, *Penaeus karathurus*

2. *Oxyurichthys papuensis**, *Gobius cobitis*, *Hemiramphus far**, *Bothus podas*, *Citharus linguatula*, *Echelus myrus*, *Parexocoetus mento**, *Callionymus filamentosus**, *Trachinus araneus*, *Spicara smaris*, *Crangon crangon*, *Penaus semisulcatus**, *Parapenaeus longirostris*.

3. *Parablennius gattarugine*, *Parablennius tentacularis*, *Apogon taeniatus**, *Lipophrys basiliscus*, *Syngnathus typhle*, *Syngnathus acus*, *Hippocampus hippocampus* , *Apogon imberbis*.

* Lessepsian species.

Table 4 : Percentage abundance of major families in trash catch of small beach-seines in Abu Qir Bay (June 2000 - May 2001)

Family	% Weight
Pisces	
Gobiidae	34.24
Siganidae	19.83
Engraulidae	17.29
Teraponidae	9.02
Cichlidae	3.79
Atherinidae	2.55
Crustacea	
Portunidae	7.19
Others* (each < 1%)	6.09

**Haemulidae*, *Sciaenidae*, *Sphyraenidae*, *Moronidae*, *Soleidae*, *Mullidae*, *Carangidae*, *Clupeidae*, *Pomatomidae*, *Serranidae*, *Mugilidae*, *Hemiramphidae*, *Monacanthidae*, *Callionymidae*, *Trachinidae*, *Bothidae*, *Citharidae*, *Exocoetidae*, *Congridae*, *Blenniidae*, *Syngnathidae*, *Apogonidae*, *Penaeidae*, *Crangonidae*, *Squillidae*, *Centracanthidae*, *Sepiidae*, *Loliginidae*, *Octopedidi*.

III. Lessepsian (Red Sea Immigrants) Species:

They numbered 16 spp. forming about 28% of the economic portion and 30% of the total trash catch weight.

IV. Seasonal Abundance of the Trash Species:

From Table (5), it is found that the abundant juveniles of the trash catch are *S. rivulatus*, *T. zillii*, *G. niger*, *G. paganellus*, *T. puta*, *Mullus surmuletus*, and *Liocarcinus vernalis* in summer ; *S. rivulatus*, *G. niger*, and *E. encrasicholus* in autumn; *G. niger*, *E. encrasicholus*, *G. paganellus*, *T. puta*, and *Atherina boyeri* in winter and *D. vulgaris* and *E. encrasicholus* in spring..

The diversity index (H') showed a relatively higher value in summer (1.95) than low values in autumn and spring (1.31 - 1.33).

Investigating the seasonality of trash species, the overlap between summer and both autumn (T = 0.525) & winter (T = 0.528) were relatively higher compared to spring and both winter (T= 0.370) and summer (T = 0.142). A moderate overlap index was shown for autumn with both winter (T = 0.499) and spring (T = 0.432).

V. Size Composition:

As presented in Table (3), the most important species have minimum total lengths of 2-5 cm with a mean total length of less than 10 cm.

Concerning the size composition of the most economic species, the majority of fishes have lengths in the range of 3-6 cm for *T. zillii* and *S. rivulatus* and 5-7 cm for *D. vulgaris* and *M. surmuletus* representing (74%) , (85%) , (68%) and (84%) respectively (Fig. 2).

Table 5: Seasonal abundance (number / haul) of the trash species of small beach-seine in Abu Qir Bay (June 2000 - May 2001)

Species	Number of individuals/haul			
	Summer	Autumn	Winter	Spring
S. rivulatus	682	1066	27	7
T. zillii	267	29	37	2
D. vulgaris				85
D. annularis	18			1
M. surmuletus	76			15
L. auratus	15			
P. saltator	5	14	5	
G. niger	304	513	239	26
E. encrasicholus	10	1011	554	424
G. paganellus	191		152	14
T. puta	92	15	121	14
A. boyeri	41	9	250	
H. picarti	12	11	3	2
T. curvirostris		25		
L. vernalis	67		6	5
C. aestuarii		12		
Others	31	21	6	23
Total	1811	2726	1400	624
Diversity index (H')	1.95	1.31	1.61	1.33

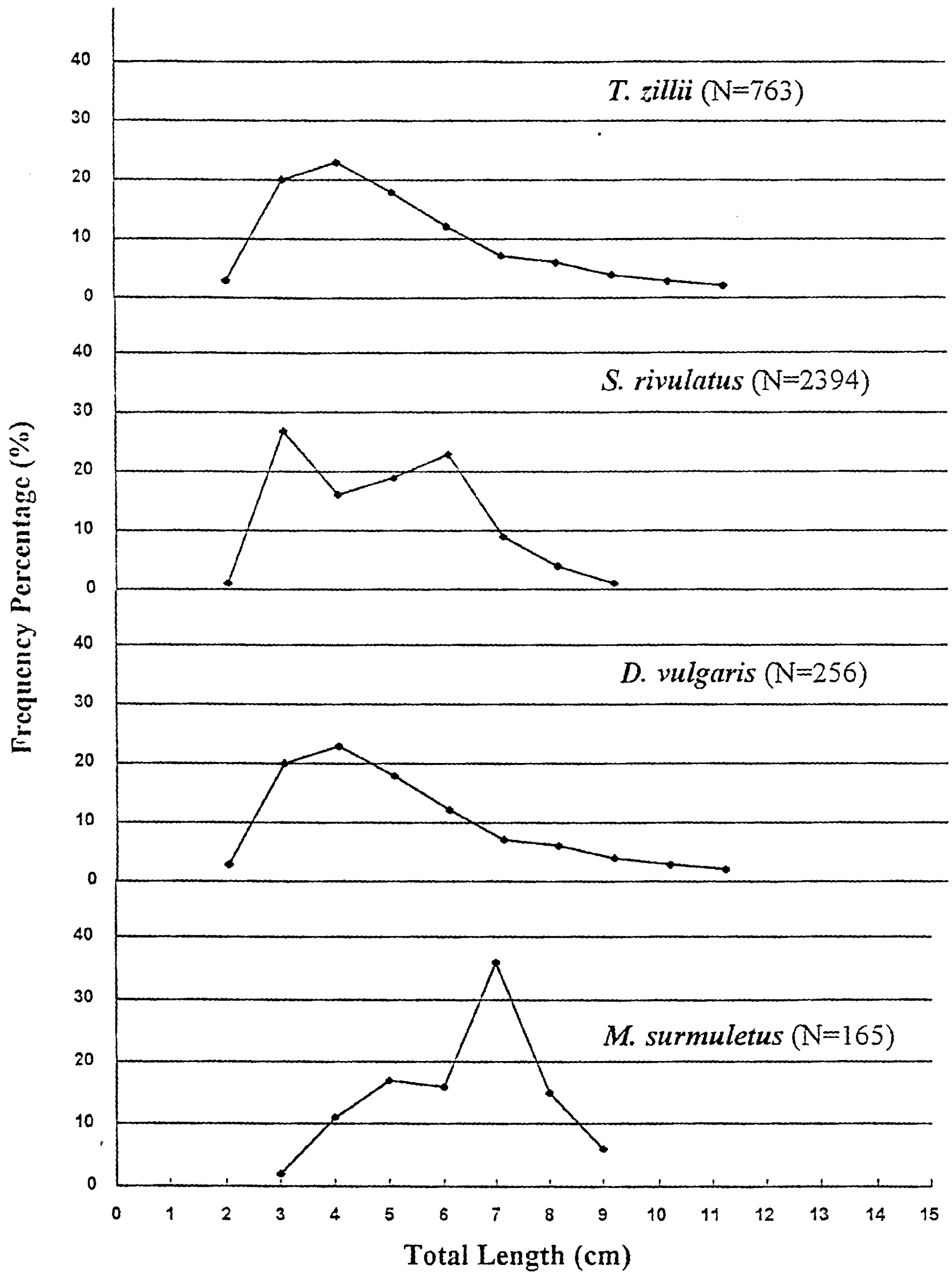

Fig. 2 : Size composition of the most economic species captured by small beach-seines in Abu Qir Bay (June 2000 – May 2001).

(N = number of fish)

DISCUSSION

The average catch rate of beach-seine (8 Kg/haul) was smaller than that given (13 Kg/haul) by Faltas (1997) in the same area (Abu Qir Bay). This can be attributed to the higher status of water pollution due to industrial wastes and sewage (El-Sharkawi, 1991; El Deek & Nessim, 1994; El-Sherif & Gharib, 1994; Saleh, 1994; Eid *et al.*, 1996; El-Nady,1996; El-Komi, 1997; El-Rayes *et al.*, 1997).

Economic catch, which composed 30% of the beach-seine catch, mainly belongs to families Cichlidae, Siganidae and Scombridae. This finding is mostly different than that of Wimpenny (1934), Rafail (1971) in Port-Said and Faltas (1997) in the same area as they mentioned that Mugilidae, Sciaenidae, Siganidae, and Portunidae were the major components of beach-seines catch, although sardine comprised a considerable portion as recorded by previous authors and also for beach-seine catch of the Eastern Harbour of Alexandria (Al-Sayes *et al.*, 1981),.

Tilapia zillii is a new fresh water invador that established itslef and flourished in this area contributing about half of the economic catch by weight. This is due to relatively decreasing salinity (El-Rayes *et al.*, 1993; El-Nady, 1996) since Abu Qir Bay receives land drainage and Nile waters in large quantities. In addition, even *T. zillii* is originally fresh water species, it can tolerate wide range of salinity i.e. it is more euryhaline (Fryer & Iles, 1972) where it occurs in hypersaline habitats as the Suez Bay 42-43‰ (Bayoumi, 1969) and Bardawil Lagoon 41-45‰ (Chervinski & Horing, 1973). Although Chervinski (1982) pointed out that *T. zillii* does not reproduce in seawater, El-Zarka *et al.* (1970) showed that *T. zillii* was found to reproduce in Lake Qarun at salinity of about 29‰ or more.

In the present study, trash species numbered 63 spp. (36 families) compared to 48 ones (30 families) by Faltas (1997) . On the other hand the Eastern Harbour was composed of 41 spp. (25 families) (Al-Sayes *et al.*, 1987). This species diversity richness can be attributed to that Abu Qir Bay is a shallow sheltered area characterized by presence of vegetation giving favorable conditions for small fish assemblages in this area. The importance of vegetation for abundance and survival of yearlings has been demonstrated by Adams (1976) and Thorman & Wiederholm (1986). Sheltering behavior was observed for many species which can be attributed to reduction of predation risk and avoidance of adverse conditions as excessive currents or turbulence (Shulman, 1984; Koppel, 1988). Shulman (1984) and Behrents (1987) showed the importance of shelter availability for recruits and survival of juveniles. Further, Samaan and Mikhail (1990) reported that Abu Qir Bay lies among highly fertile habitats in Egypt due to eutrophication by the continual discharges. Also El-Komi and Beltagy (1997) indicated that the bottom fauna and flora were more dense in Abu Qir Bay.

The present study revealed that trash catch shared many species (35 spp.) with those given by Faltas (1997). This share (35 spp.) is subjected to changes in its relative abundance (Table 6). It is shown that some previously dominant species become scarce e.g. ***Lithognathus mormyrus*, *Liza ramada*, *Sphyraena chrysotaenia*, *Oxyurichthys papuensis***, and ***Oratosquilla massavensis*** while the catch of ***G. niger*** is much reduced. On the contrary, the catches of ***S. rivulatus*, *D. vulgaris*, *T. puta*, *A. boyeri***, and ***L. vernalis*** are increased. This can be attributed to pollution increase, salinity decrease (as mentioned before) or species competition particularly the presence of the new invador (*T. zillii*) existing in relatively larger numbers. The catch drop of ***G. niger*** can be attributed to the over-fishing as reported by Faltas ***et al.***, (2000) who mentioned that its exploitation ratio equals about 0.79.

Concerning the seasonality of the species (Table 5), it is shown that ***S. rivulatus*** was most abundant in autumn & summer and ***D. vulgaris*** in spring. This is in agreement with Abdel-Maguid (1997) who reported that sparid and siganid fish were most abundant in the warm months. ***G. niger*** dominated the catch in all seasons except spring. This can be explained through juvenile recruitment at those seasons since its spawning season as reported by Abdel-Maguid (1997), started from February and continued until May. Also, ***G. paganellus*** was rare in spring, this agrees with Abdel-Maguid (1997) who mentioned that ***G. paganellus*** used caves in the rocks as a shelter in spring.

From the present investigation, there is an urgent need for closed areas or season in addition to mesh size regulation for beach-seines. Closed areas or season will protect the smaller fish of many species to grow and migrate to deeper waters later. Mesh size regulation is a mean of achieving an increase in production by protecting small fish. To large extent, these measures will benefit the trawling and other gear fisheries since beach-seines adversily affect fish stocks by catching large quantities of juveniles which enrich the stocks of the deeper waters. Further, many of demersal fish come to shallower grounds to breed or feed during their early life stage going to deeper water as they grow bigger. So, these restrictive measures are necessary to ensure the proper fisheries management particularly in the nursery grounds.

Table (6): Comparison between relative abundance (W%) and mean length ($\overline{L}$) of species of the present study with their corresponding values of beach-seine trash catch as given by Faltas (1997).

Species	Faltas (1997)		Present study	
	W%	$\overline{L}$ (cm)	W%	$\overline{L}$ (cm)
S. rivulatus	2.79	5.4	19.82	5.3
S. luridus	0.05	6.8	0.01	6.0
D. vulgaris	0.03	6.0	1.78	6.5
D. sargus	0.24	5.3	0.16	6.9
D. annularis	0.09	4.3	0.28	5.9
L. mormyrus	1.27	6.5	0.08	9.2
L. ramada	3.90	6.7	<0.01	1.0
M. cephalus	<0.01	5.0	0.02	3.5
P. mediterraneus	0.11	6.1	0.05	7.8
S. aurita	0.80	8.3	0.02	9.0
A. regius	0.01	6.7	0.02	5.0
S. vulgaris	<0.01	5.0	0.01	9.0
A. djedaba	0.58	10.0	0.01	6.0
M. surmuletus	0.02	5.8	0.92	5.7
D. punctatus	0.02	6.3	0.03	11.0
S. chrystotaenia	0.67	12.0	<0.01	5.0
P. saltatc	0.07	7.5	0.22	4.9
T. ovatus	0.08	4.6	<0.01	5.0
G. niger	61.08	6.6	23.95	7.2
G. paganellus	0.08	13.2	10.16	7.6
O. papuensis	0.82	13.5	0.07	20.0
E. encrasicholus	11.24	7.4	17.29	6.9
H. picarti	0.26	10.3	0.54	12.1
S. diaspros	0.24	5.0	0.18	5.8
T. puta	0.10	6.2	9.02	7.8
C. linguatula	0.07	6.3	0.04	7.9
A. boyeri	0.09	5.0	2.55	6.3
A. taeniatus	0.07	4.9	<0.01	3.0
A. imberbis	0.07	6.5	0.02	5.0
P. pelagicus	0.26		0.54	
O. massavensis	7.30		0.10	
T. curvirostris	0.03		0.13	
P. karathurus	0.06		0.05	
C. aestuarii	0.86		0.73	
L. vernalis	0.76		5.92	

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