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# Catch composition and management of daytime purse seine fishery on the Southern Mediterranean Sea Coast, Abu Qir Bay, Egypt

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## Abstract

*The present work aimed to obtain precise data on the catch of the purse seine net operating at daytime from sunrise till noon in Abu Qir Bay during 1997 and 1998. Sardine, anchovy, mullet and rabbitfish were recorded as the main target fish groups. Twenty-seven species were recorded as by-catch species. Catch per unit effort was estimated to be 93 kg/day/boat. The percentage of each target species in the catch and its length frequency distribution were presented. The length range of by-catch species and the season of catch were recorded. Daytime purse seine in Abu Qir Bay is an effective method but should regulated by directing the fishing to deeper waters outside the bay rather than the inshore coastal area to conserve many economic species of this important fishery.*

**Keywords:** Purse seine, Target, By-catch species, Management.

## Introduction

A purse seine is a type of ancient fishing equipment that has been used for a longtime in coastal fisheries throughout the world and extensively used in the Mediterranean Sea. Purse seine is a fishing method capable of harvesting large quantities of surface-schooling pelagic fish by surrounding the school with an encircling net. In Egypt, the first large-scale use of the purse seine was in the Suez Bay north of the Red Sea fishery during the 1960s and after a few years on the Egyptian Mediterranean coast. It is commonly used on dark nights with artificial lights for fish attraction carried on two or three small boats. One mother boat is used to release and collect the net. Purse seines have revolutionized the sardine fishery because of their efficiency in capturing schools. It is considered to be the second most important piece of fishing equipment in the Egyptian Mediterranean Sea water (ALSAYES, 1992). Abu Qir Bay is an open bay east of Alexandria city on the southern Mediterranean Sea coast. The Bay catch contributes about 26.5% of the fish catch from Egyptian Mediterranean waters and in 1996 was 13553 tonnes (GAFRD, 1996). The fish is landed at two fishing harbour in the bay; Abu Qir and El-Maaddiya. By the end of the eighties the fishermen of Abu Qir harbour had started to use a purse seine in daytime with one boat only and without lights. Recently the fishermen of

El-Maaddiya harbour have followed those of Abu Qir and use this method on a wide scale.

When HASHEM *et. al.* (1982) & WASSEF *et. al.*, (1985) studied the commercial purse seine (Shansholla) fisheries of the Egyptian Mediterranean Sea coast, referring to sardine fishing, they described the night purse seine catch only. ALSAYES (1992) described the design of purse seines operating on the Egyptian Mediterranean coast with special reference to the Abu Qir catch. However, no studies mentioned daytime purse seine.

The aim of the present study is to clarify the target and by-catch species of the daytime purse seine operating in Abu Qir Bay, and the nature of the commercial fishing operations that are necessary for reasonable fishery management of this important fishery.

## Materials and Methods

*Study area:*

Abu Qir Bay (Fig. 1) is a shallow semi-circular basin in the southeastern part of the Mediterranean Sea, east of Alexandria city, located between the mouth of the Rosetta Branch of the Nile River in the east and the Abu Qir headland in the west (31° 17' & 31° 27'N and 30° 05' & 30° 20'E). The Bay has a maximum depth of 16m and shoreline of about 50km in length, connected the south with Boughaz El-Maaddiya (3m in depth) to Lake Idku, which is a shallow (0.5-1.5m in depth), brackish, coastal lagoon. The bay receives discharges of agricultural and industrial effluents via the El-Tabia pumping station. The average salinity of the bay is 38% with pH about 8.1 (FAMMY, 1997).

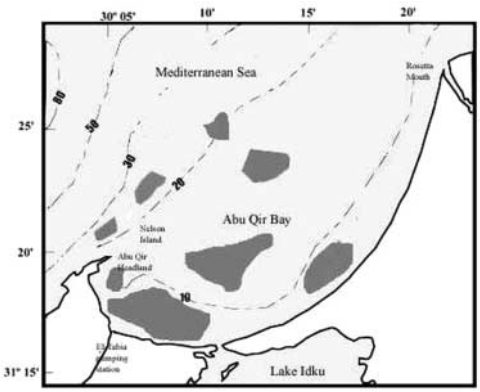


***Fig. 1:*** Study area with the fishing ground of daytime purse seine during 1997 and 1998.

*Fishing gear and vessel data:*

In the present study, investigation was carried out aboard four different commercial fishing vessels (13-15m in length, 4-5m in width with inboard 55-75hp engine power) using a purse seine net operating at daytime from sunrise till noon. The purse seine net had a float line about 160m long with about 300 buoys (a buoy every 50cm) and a lead line of about 140m with a weight of 125g every 30cm. The purse rings had a special line attached to the lead line with a ring every 4m. The maximum altitude of the net (stretched net depth) was about 40m in the central part with stretched mesh size varying between 16 and 18mm. The net dimension was proportional to the boat size. About 12-17 fishermen usually carried out hauling of the net manually within 20 minutes, with the help of a power block used to collect the purse line only. Fishing operations were carried out about 23 days monthly or 276 days year-round. Reasons given for stopping fishing were roughness of the sea, heavy rains, poor catches on the previous days, and holidays. Fishing was usually carried out in the daytime except at the peak of sardine fishing season, when night fishing is carried out with or without lights. About sixty purse seiners were working in the Abu Qir Bay during 1997 and 1998, most of them operating in daytime (GAFRD, 1998).

Data were collected every one and half months (two times per season) from March 1997 to October 1998. The author on board recorded catch composition and discarded fish. Samples were collected during a total of 9 fishing trips that carried out 45 hauls in 6 fishing seasons. The following haul-specific

**Table 1**
**Catch percentage of major fish groups caught by daytime purse seine of Abu Qir Bay during 1997 and 1998.**

| Date | Sardine | Anchovy | Mullets | Rabbitfish | Others | Catch (kg) |
|---|---|---|---|---|---|---|
| Mar.1997 | 40 | 40 | 0 | 0 | 20 | 90 |
| May 1997 | 45 | 25 | 10 | 10 | 10 | 110 |
| July 1997 | 0 | 30 | 40 | 15 | 15 | 140 |
| Sep.1997 | 80 | 5 | 5 | 5 | 5 | 130 |
| Nov.1997 | 85 | 8 | 2 | 0 | 5 | 115 |
| Dec.1997 | 90 | 10 | 0 | 0 | 0 | 85 |
| Feb.1998 | 50 | 35 | 0 | 0 | 15 | 110 |
| June1998 | 0 | 15 | 35 | 45 | 5 | 120 |
| Aug.1998 | 30 | 20 | 25 | 25 | 0 | 45 |

information was recorded during the trip: hauling time, catch weight, species composition, and operation area. Catches of the other purse seine boats working around the sample boat were recorded. To collect information about the purse seiners' catch a monthly visit to the fishing harbour was made. Samples were taken to the laboratory for measuring the fish length (cm) and weight (g).

*Fish school detecting:*

Fishing was based largely on the coastal waters inside the bay. Schools of fish could often be seen from far away, especially if they swim near the surface. Birds flying up and downs and diving into the water were the best sign of a school of fish. Recently some boats have used echosounders for fish school detection. Most of the commercial fishing boats tended to gather and fish in regions where target species are abundant.

## Results

Results of nine sample cruises, observation of surrounding boats catches during collecting sample time and 16 interviews with fishermen at Abu Qir and El-Maadia fishing harbours were used to calculate the catch per unit effort (CPUE) of daytime purse seiners during the study period (Fig. 2). It was estimated to be 93kg/ day/ boat, it was higher in summer and autumn due to the presence of sardine inside the bay. For each boat, 7 to 9 hauls per day were made in different places, mainly inside the Bay. During the season of *Sardinella aurita* in September, fishermen followed it even outside the Bay.

*Species composition:*

Catches consisted of 37 species during the study period. Clupeioids species: *Sardinella aurita, Sardina pilchardus, Dussumieria acuta and Sardinella maderensis* were grouped under one category called sardine. While mugilidae species: *Mugil cephalus, Liza ramada, Liza aurata* and *Liza salien* were grouped and called

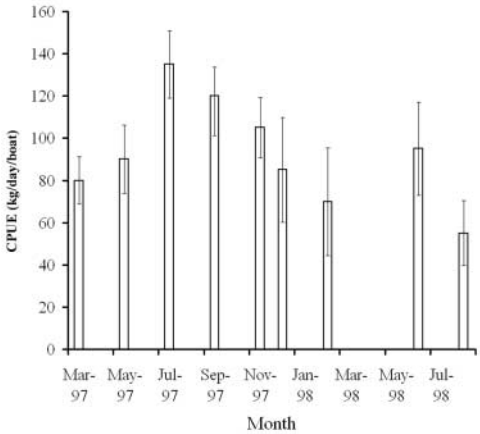


***Fig. 2:*** Monthly variation of the catch per unit effort (CPUE) kg/day/boat, of daytime purse seine at Abu Qir Bay during 1997-1998. Bars indicate standaed error.

mullet. Catches were divided into target and by-catch species. Four groups of species occurred regularly in the catch and can be considered as the main target species (Table 1). Among these groups, sardine was dominant, accounting for 40 to 90 % by weight, followed by anchovy (*Engraulis encrasicolus*), which accounted for 5 to 40% of the catch. Sardine, the main target species, was absent for two months during early summer 1997 when mullet became the target species, moreover *Siganus rivulatus* (rabbitfish) became a target species in some months. *Pomatomus saltatrix* (blue fish) and *Scomberomorus commerson* (mackerel) were a target species whenever present. Other fish included *Gobius niger* (black goby), *Hemiramphus far* (halfbeak), *Lithognathus mormyrus* (striped sea bream), *Terapon puta* (terapon), *Trigela spp* (jacks), *Trichiurus lipterus* (ribbonfish), *Sphyrina spp* (barracuda), *Moron punctata* (sea bass) and *Sparus aurata* (sea bream) occurred in most of the samples as by-catch. *Solea vulgaris* (solea), *Mullus barbatus* (red mullet), *Serranus spp* (grouper), *Penaus spp* (shrimp) and *Sepia spp* (squid) were seasonally caught.

*Seasonal distribution:*

*Engraulis encrasicolus* was present all year round. Among sardine catches, *S. aurita* was the dominant species in quantity (80-90%). It appeared in the catch from early summer till late autumn, and was followed by *S. pilchardus* (10-15%) which dominated the catch during the cold weather (winter). However *D. acuta* and *S. maderensis* were rare, especially the latter. *L. ramada* was the dominant mullet catch in winter and spring, while *M. cephalus* dominated in summer and autumn. *L. aurata* and *L. salien* were scarce, especially the latter (Table 2).

*Size composition:*

The mean length and weight of each target species in the catch, and its catching season are shown in Table 2. Three sardine species were caught with mean length of about 12cm and a mean weight varying from 11-13g. *E. encrasicolus* was caught with a mean length of 8cm and less than 3g in weight. Mullet species were caught with higher mean lengths of 15-18cm and weights of 65-80g, while rabbitfish were caught with a mean length of 12cm and mean weight of about 19g.

Length frequency of the four target species over the whole period of study was presented in Figs. 3a and b. The length range of *S. aurita* was from 5 to 18cm with a peak at 9.5cm, *S. pilchardus* had a small length range (6-15cm) with a high peak at 12.5cm, while *D. acuta* had a peak length frequency of 9.5cm. *E. encrasicolus'* length range was small, from 3 to 12cm with a peak of 8.5cm. *L. ramada* had a wide length range from 3 to 25cm with a peak of 16.5cm.

**Table 2**
**Catch season, mean length (cm) and weight (gm) of target species of daytime purse seine operating in Abu Qir Bay during 1997 - 1998.**

| Species name | | Catch season | Length (cm) | Weight (gm) |
|---|---|---|---|---|
| Scientific | Arabic | | | |
| *Sardinella aurita* | Sardina mabrom | June-Dec. | 12 | 13 |
| *Sardina pilchardus* | Sardina zarqa | Nov.-May | 11 | 10 |
| *Dussumieria acuta* | Sardina mfatara | Dec.-May | 12 | 12 |
| *Engraulis encrasicolus* | Anshoga | All year | 8 | 3 |
| *Liza ramada* | Tobar | Dec.-May | 15 | 65 |
| *Mugil cephalus* | Bouri | July-Nov. | 18 | 80 |
| *Mugil aurata* | Asfar-wedn | Nov-May | 17 | 75 |
| *Siganus rivulatus* | Batata | Feb.-Nov. | 12 | 19 |

**Table 3**
**By-catch fish species of daytime purse seine operating in Abu Qir Bay during 1997 and 1998.**

| Species name | | Catch season | Length (cm) |
|---|---|---|---|
| Scientific | Arabic | | |
| Gobius niger | Abu-kirsh | All year | 4-11 |
| *Hemiramphus far* | Abumonqar | All year | 12-13 |
| *Lithognathus mormyrus* | Mourmar | All year | 3-15 |
| *Alectis alexandrina* | Khaffaf | All year | 5-16 |
| *Parexocoetus mento* | Tayara | Spring | 4-15 |
| *Terapon puta* | Shokhroum | Spring and Autmn | 7-14 |
| *Sparus aurata** | Denees | Spring and Summer | 5-21 |
| *Solea vulgaris** | Mousa | Spring and Summer | 7-27 |
| *Scomberomorus commerson** | Derak | Summer | 8-39 |
| *Mullus barbatus** | Barboni | Summer | 4-11 |
| *Moron punctata* | Nokt | Summer | 9-23 |
| *Sphyrina sp** | Maghazel | Summer | 11-19 |
| *Tilapia zillii* | Bolti | Summer | 7-9 |
| *Siena aqualla** | Lout | Summer | 6-31 |
| *Stiphanalapus sp* | Khanzear | Summer | 5-11 |
| *Trigela sp* | Farkha | Summer | 9-18 |
| *Trichiurus lipterus* | Seif | Summer | 11-21 |
| *Collinymus sp* | Raqad | Summer | 12-19 |
| *Oratasqualli mantus* | Shukara | Summer | 10-16 |
| *Belon Belon** | Kherman | Autmen | 25-32 |
| Crabs | Kaboria | Autmn | 2-12 |
| *Alepes djedaba** | Mera | Autmn | 4-12 |
| *Umberina serousa* | Shefsh | Winter | 20-26 |
| Cuttle fish | Sobbeat | Winter | 5-15 |
| *Pomatomus saltatrix** | Miass | Winter | 7-25 |
| *Serranus sp** | Wakar | Winter | 7-17 |
| *Penaus sp** | Gambari | Winter | 6-16 |

*Species has economic importance.

*M. cephalus* had the higher minimum length among the target species (13cm) with a peak between 16 and 20cm, while *L. aurata* had a length range from 8 to 22cm with a peak of 17cm. The length range of *S. rivulatus* was from 2 to 18cm and its peak was only 4.5cm.

*By-catch species:*

Small fish (< 10cm) of several species were recorded notably (Table 3). Red mullet, which is of economic importance, was recorded with a very small length range from 4 to 11cm in summer. Moreover, small fish of solea and some members of sparidae were recorded, also in summer.

Many invertebrates like shrimps, crabs and cuttlefish were caught, especially in cold weather when fishermen fished near the shoreline at a depth of less than 10m.

## Discussion

Purse seines are extensively used in the Mediterranean Sea to catch small pelagic fish (sardine and anchovy). These fish are the main target species of Abu Qir purse seine boats. They live in midwater or near the surface and their life span rarely exceeds a few years. These species form schools composed of many individuals that allow fishermen using purse seine nets to catch them. Their economic

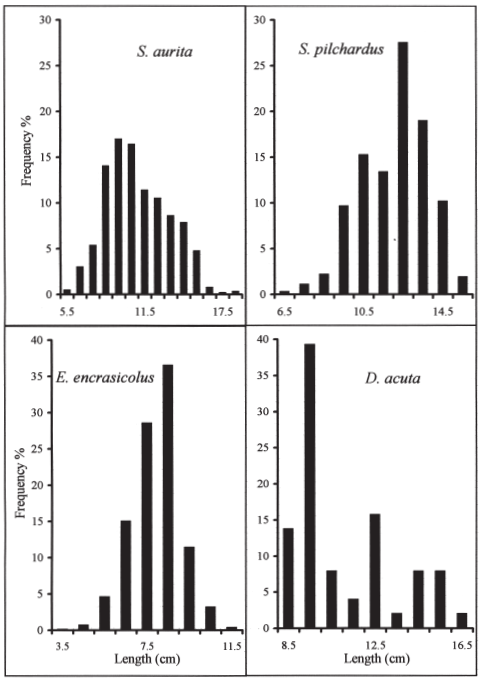


*Fig. 3a:* Length (cm) frequency (%) distribution of first target species of daytime purse seine catch in Abu Qir Bay during 1997-1998.

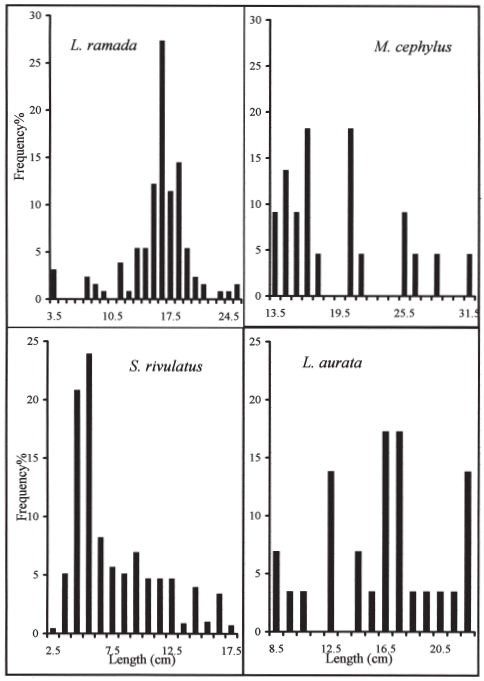


*Fig. 3a:* Length (cm) frequency (%) distribution of secondary target species of daytime purse seine catch in Abu Qir Bay during 1997-1998.

importance is a function of the quantities caught rather than their relatively low prices. Despite of their small size, they are traditionally appreciated in Mediterranean countries. Small pelagic fisheries are mainly attached to continental shelves, from the coast to 200 meters in depth. Fisheries of small pelagic fish contribute nearly half of the total marine fish catch in the world. Because of the high variability of these populations, variations in total world landings tend to be controlled by the variations in the small pelagic fisheries (ANONYMOUS, 1994).

Purse seine is divided into two major types: with some boats operating on dark nights and others operating during daytime. There is no great difference between them except that the former use artificial light on dark nights around small boats to gather fish, and have a larger net size.

Due to avoidance of any previous data about catch composition of the daytime purse seine in all Egyptian fisheries, catch composition of night purse seine was used for the comparison with the present study results. Regarding the landing composition of the night purse seine catch along the Alexandrian coast during the period from 1976 to 1978, the most abundant species were *S. aurita*, where *S. pilchardus, E. encrasicolus, Boops boops* and *Trachurus mediterraneanus* were respectively next in abundance (HASHIEM, 1982 ). Moreover, during 1984 in Abu Qir Bay the catch at night was composed mainly of sardines (51%), followed by atherina (28%), then grey mullet and sea bass together comprised about 10% of the catch (ALSAYES, 1992). A similar result was recorded in the present study in daytime except for the absence of *B. boops , T. mediterraneanus* and *Atherinomorus lacunosus.*

Some fish are easy to capture by purse seine at night, while others (e.g. herring and mackerel schools) escaped capture in about half of the sets in daylight (MISUND, 1993).

This may the same reason for the absence of *B. boops* and *T. mediterraneanus* in the daytime catch. However, there is no evidence that atherina is present in purse seine catch. There is a strong possibility that what it refers to as atherinea was actually anchovy. Anchovy is found regularly in domestic markets from purse seine fisheries or as a by-catch species, mainly of trawl fisheries. It is curious to note that some studies (e.g., ALSAYES 1992 & GAFRD, 1999) discussed the catches of the Egyptian purse seine fishery without even mentioning the anchovy (*E. encrasicolus*) that constitutes about 20% by weight in the present study, and mentioned atherina probably, instead of it.

Fishing by night purse seiners occurs largely in the coastal water outside of the bay, while fishing in daytime occurs, on most days within the bay. Thus, encouragement to fish in offshore water is needed to decrease the pressure on the shallow water fisheries.

Similar to the present results for the daytime purse seine, peak catch rates had been reported by HASHEM, *et.al.* (1982) between July and September for the night catch. This peak is probably related to pulses of moving pelagic fishes specially sardines from offshore to inshore or coastal water, and so become available to purse seine.

Coastal fisheries exploit a large variety of species. Commercial by-catch included about 27 species, representing from 5 to 20% of the total catch according to fishing season. Complaints have been voiced that purse seiners kill large quantities of pre-recruited juveniles of some important commercial species (LAEVASTU, 1988). In the present study, the bulk of the catch consisted of small fish and juveniles mixed with target species. It is worth noting that discards of some species (e.g. small red mullets and small pandora) are sold in the market at low prices in a mixed category. Moreover, many small fish (less than 5cm in length) are thrown back into the sea after every haul. Discarding at the sea is a serious problem in fisheries and a source of uncertainty in resource management. Estimating fish mortality based on landing rather than catch which include discards, is likely to be biased downward.

Purse seines have no major effects on the ecosystem unless the lead lines are towed on the seabed. In Abu Qir Bay most of the daytime purse seiners work inshore within depths from 5 to 20m, the lead line of the net reaches the bottom in the shallow areas, especially near the Al-Tarh region. Catch includes shelf resources (bottom fish and invertebrates) and small to medium sized pelagic fish, indicting high pressure on the resources.

*Management:*

Increasing attention has been paid over recent years to the economic performance of fisheries. Inshore seine fishery should be controlled. Increasing juvenile catches in the inshore seine fishery will lower the total catch and intensify the effect of the trawl fisheries. A minimum legal size (MLS) is seen as a fishery management tool with the ability to protect juvenile fish, maintain spawning stocks, and control the sizes of fish caught. Mesh size selection by purse seiners is not a problem because a small mesh is used to avoid gill netting of fish. Even a complete stoppage of the purse seine fishery is unlikely to have a detectable beneficial effect on the main target species stock i.e., sardine and anchovy, due to its offshore-inshore movements.

Annual catch recording should distinguish between the two methods of purse seine. Protection of juveniles through a closed season-area can improve the catch rate and reduction of unwanted by-catch. In Abu Qir Bay, fishing by any fishing method should be prohibited in inshore water to conserve the juvenile of important species and the bottom fauna.

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