

The occurrence and seasonal abundance of the pilchard larvae *Sardina pilchardus* (Walb.) in the southeastern Mediterranean waters off the Egyptian coast between El-Agami (long. 29° 45' E) and El-Arish (long. 33° 45' E) (Fig. 1), were studied from ichthyoplankton samples collected seasonally during the period from December 1981 to October 1984. The sampling methods and stations sampled are described in EL-RASHIDY & DOWIDAR (1990).

Results and Discussion.

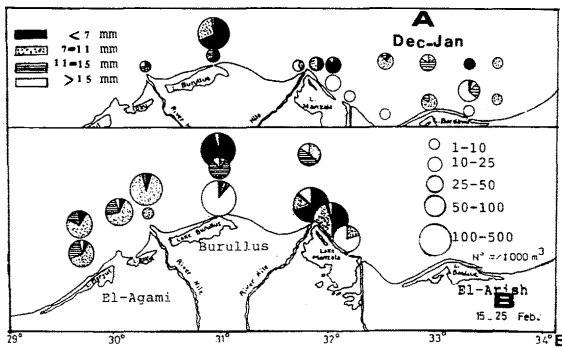
A total of 808 pilchard larvae ranging in size from 3 mm to 25 mm, were recorded in 127 ichthyoplankton samples collected from 93 stations in the study area during the period from autumn to spring.

Pilchard larvae first appeared in the plankton in late November when one specimen, 12 mm long, was recorded on 28 November in the middle zone (depth 55 m) indicating the beginning of the spawning season.

The spawning activity of the species increased progressively during the winter months, in late December-early January cruise. The larvae were widely scattered in the inshore zone from Rosetta to El-Arish (fig. 1), and ranged in length from 3 to 21 mm, the greatest density was found in the middle zone which harbored 74% of the larvae fished during this cruise, most of them (63%) were of smaller size (< 11 mm) (Table 1).

The spawning activity of *S. pilchardus* in the area, reached its peak in February, when 75% of the total larvae fished were recorded from 80% of the stations sampled, ranging in length between 3 mm and 25 mm (Table 1). The water temperature during this month reached its annual minimum (16-18°C) and conditions of homothermal and homohaline water column exists. Most of the larvae, i.e. 67%, occurred in the inshore zone (Table 1).

In April (15-26 IV), the larvae were scarce, 7 specimens (with length range 13-23 mm), were irregularly dispersed in the inshore and middle zone. The absence of smaller larvae probably reflects the low spawning activity in late March and end of spawning season in April.



Unfortunately, data on the reproductive biology of pilchard in our waters are completely lacking. However, as in other Mediterranean regions, the present results showed that this species is a true winter spawner. The breeding season extends from mid-November to April with the peak in February. The observed breeding temperature ranged from 16°C to 21.5°C and the salinity range 37.6-39.7‰. These results corroborate those given for this species in other Mediterranean regions, where the reported breeding temperature ranges between 8 and 23°C and salinity 23-38.8‰; the temperature range of the adult fish 8 to 28°C (DEMIR and DEMIR, 1961; ZAVODNIK, 1970).

As to the spawning grounds, it is generally believed that the species breeds in deeper waters, 40-90 m (FISHER, 1973; YANNOPOULOS and YANNOPOULOS, 1979). In the Egyptian Mediterranean waters, newly hatched larvae occur in both inshore (20-30 m depth) and middle-offshore (50-150 m) zones (fig. 1). CIHANGIR (1990) reported that hatching of Pilchard larvae require 2-3 days at 16-19°C. It is thus obvious that spawning of the species occur in both inshore and middle offshore zones. Whether this pattern reflects the presence of two stocks of adult fish, a local endemic stock spawning in the inshore zone, and a migratory stock invading the area in early winter for spawning and feeding could not be revealed with certainty from the present results.

Whether the fish spawn in surface or subsurface waters is not easy to clarify from available data. However, during the December cruise, about 50% of the pilchard larvae caught occurred in subsurface waters (20-25 m) most of them were of smaller size (3-7 mm) indicating that spawning may occur in subsurface layers (DEMIR and DEMIR, 1961).

Table (1): Percentage occurrence of the different size groups of Pilchard larvae in the study area (based on the actual numbers in each sample).

Cruise	Zone	3.1-7 mm	7.1-11 mm	11.1-15 mm	15.1-19 mm	> 19 mm	Total
Dec-Jan. (22/12/81-4/1/82)	Inshore	5.3	5.3	2.4	2.8	4.3	20.1
	Middle	40.7	22.0	3.8	6.2	0.96	73.7
	Offshore	0.5	1.4	3.3	0.96	NR	6.2
February (15-25/2/84)	Inshore	23.3	14.2	1.0	16.6	11.7	66.8
	Middle	0.7	13.4	5.6	0.7	NR	20.3
	Offshore	6.9	3.9	1.7	0.34	NR	12.9
April (15-26/4/82)	Inshore	NR	NR	14.3	NR	42.8	57.1
	Middle	NR	NR	--	42.8	NR	42.8
	Offshore	--	--	--	--	--	--

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The distribution and abundance of the larvae of *Sardinella aurita*, Valen. in the Mediterranean waters overlying the continental shelf off the Egyptian coast (Fig. 1) were studied seasonally during the period from December 1981 to October 1984. The study area, stations sampled, sampling methods were previously described by EL-RASHIDY & DOWIDAR (1990).

RESULTS & DISCUSSION

A total of 863 larvae of *S. aurita* were recorded in the ichthyoplankton samples collected during the warm months from July to October. The larvae were completely absent in other months. The length of the recorded larvae ranged between 3 and 21 mm. The larvae of *S. aurita* first appeared in the plankton samples collected during the first half of July when a total of 88 larvae were recorded, 75% of them occurred in the offshore station off Burullus (Fig. 1A). The recorded larvae covered the length range 3 to 19 mm, but most of them (60%) had length from 7 to 11 mm (Table 1). Assuming the same rate of growth given by OLIVER & NAVARRO (1952) the older larvae caught during this cruise were probably spawned around mid June.

In late July - early August cruise, the larval density was low and mostly concentrated in the inshore, (< 50m) depth and middle zones (Fig. 1A) and ranged in length from 3 to 13 mm (Table 1).

The larval density of *S. aurita* reached its peak during the second half of August when about 88% (758) of the larvae fished in all cruises were recorded (Fig. 1C) ranging in length from 3 to 21 mm. The majority of them (77%) had lengths between 5 and 15mm (Table 1). As shown in Fig. 1C, 92% of the sampled larvae occurred in the inshore zone. From late July throughout August the larvae were not recorded in the offshore zone. In early October only 2 specimens 10 and 15 mm were recorded from the inshore waters off El Agami and probably reflecting the end of the spawning season.

The present pattern of larval occurrence and abundance, clearly demonstrates that *S. aurita* is a typical summer breeder. The spawning season mostly begins in June, reaches its peak in late August and ends in October. The temperature range recorded during this period varied between 21°-29.5°C. These results generally conform with those reported by other authors working on the reproductive biology of the species (BEN-TUVIA, 1960; EL-MAGHRABY, 1960).

Concerning the spawning grounds of *S. aurita*, it is believed that the final stage in gonad maturation takes place in the spawning grounds away from the coast (EL-MAGHRABY, 1960). This may explain, at least partly, the abundance of larvae (311 mm) in the offshore zone at the beginning of the spawning season. According to the local current regime, it is more probable that these larvae belong to an offshore stock which perform regular migrations to the coastal region off the Nile Delta during this period. On the other hand during the peak of larval occurrence most of the larvae occurred in the coastal waters and none occurred in the offshore waters. This picture may substantiate the suggestion that the populations of *S. aurita* present in the Egyptian Mediterranean waters are composed of two stocks, an endemic stock widely distributed in the coastal waters (< 50 m depth) all the year round and which spawns throughout the period from June to early October with a peak in August, and a migratory stock from the offshore waters that invades the area for feeding and spawning. The high larval density recorded at the offshore station off Burullus in early July would suggest that, this area acts as a suitable breeding ground for the species.

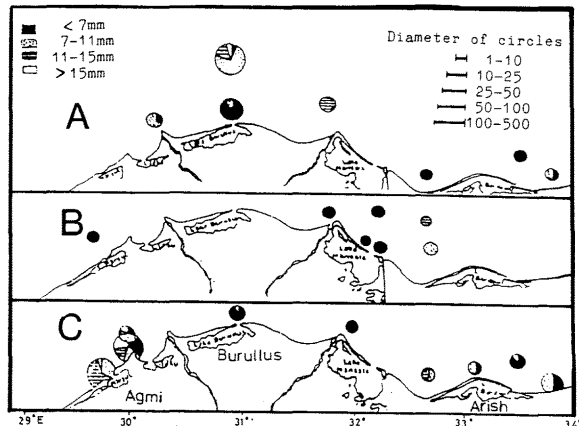


Fig.1. Distribution and abundance of different size groups of *S. aurita* larvae in the inshore, middle and offshore zones in the study area during (A) July, (B) July-August, and (C) August cruises.

Table 1. Occurrence of the different size groups (mm) of *S. aurita* larvae in the inshore, middle and offshore zones of the study area.

Cruise	Zone	3.1-7	7.1-11	11.1-15	15.1-19	>19	Total
6-18 July 84	Inshore	13.6%	3.4%	1.1%	NR	NR	18.2%
	Middle	2.3%	NR	4.5%	NR	NR	6.8%
	Offshore	4.5%	56.8%	11.4%	2.3%	NR	75.0%
28/7-4/8/83	Inshore	46.7%	6.7%	NR	NR	NR	53.3%
	Middle	40.0%	NR	6.7%	NR	NR	46.7%
17-25 August 82	Inshore	24.8%	24.0%	32.4%	10.4%	0.4%	92.1%
	Middle	4.1%	2.5%	0.6%	0.6%	NR	7.9%

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