

**FOOD AND FEEDING OF SARDINES AND THEIR EFFECT ON
THE CONDITION OF FISH CAPTURED BY DIFFERENT
FISHING METHODS.**

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ABSTRACT

Food habits of *Sardinella aurita* and *Sardinella maderensis*, ranging from 9 to 28 cm total length, captured by, purse-seines and gill-nets from near Alexandria, were determined during approximately the whole year (1977). Marked variations in diet composition between fish caught by the different gears were found. Both species, taken by light attraction and purse-seines were described as particulate feeders, where as those captured by gill nets and beach seines were distinguished as filter feeders.

The length-weight relationship and condition values were also determined to show the dependence of fish condition on its food and feeding habits. The condition values of sardine taken by beach-seine (inshore fish) represented fish in over all better condition than those of the same size, capture by gill nets and purse-seines at the same area (off shore fish).

INTRODUCTION

Sardine gill net(Ghazl-El-Sardine) was a highly important gear in the local fisheries before the construction of the Aswan High dam and the regulation of the Nile flood. This fishing method has been replaced by purse seine (Shanshoulla) since 1969, to compensate the drastic drop in fish production especially in sardine catch.

However, the sardine gill net is still in use in some places such as the area west of Alexandria to Agmy, where the sardine fisheries has not been seriously affected by the cessation of the Nile flood.

Increasing fishing pressure and steady decrease of suitable habitat place more and more emphasis in sound management which in turn will ultimately determine the fate of the sardine as well as numerous other pelagic fish.

Such management requires a through knoweledge of the ecology of the species in question. A knowledge of food habits is vital in assessing the ecological requirments of a species.

Previous studies on food habits of local sardine species were reported on inshore fish. Virtually no research has been published on the subject for sardine caught by purse-seine. The present study was achieved to gain information on the ecology of *S. aurita* and *S. maderensis* in the Egyptian Mediterranean waters. Objectives of this study were to determine: (1) food habits of the two species, and (2) the length weight relationship and the coefficient of condition of fish in relation to the gear used in fishing.

MATERIAL AND METHODS

Random samples of sardine catch were collected monthly from the landings of purse seines and sardine gill-nets operating on the fishing grounds near Alexandria. Sampling extended throughout the whole year (1977).

In the laboratory, fish were weighed to the nearest gm. and measured to the nearest mm. total length individually. The guts were then carefully dissected out and were preserved in 5% neutral formalin solution. Later, stomachs were firstly opened and their degree of fullness determined by an average of visual estimates of fullness of all the stomachs in the associated size class. A full stomach recieved 20 points and an empty stomach zero points, with intermediate values to as low as 5 points.

Then, food organisms were seperated to the lowest indentifiable taxonomy under a binocular microscope with transmitted light (magnification X 50). Finally, the food points allotted were divided among the various food items (categories) by bulk composition. Percentage frequency of occurrence, and percentage of diet composition were determined as described by Wassef et al. (1985). Each stomach content was examined separately.

A number of 238 and 50 stomachs of *S. aurita* and *S. maderensis* respectively ranged from 9 to 26 cm length, were investigated in the present work. On the other hand, 903 and 345 specimens of the two species respectively were used in the analysis of length-weight relationship. This relation was calculated for sexes combined , according to the formula of Lagler (1956). The coefficient of condition (K) values also determined according to Lagler (1956) using the formula: $K = 100 W/L^3$ where W is total fish weight in gm. and L is total length in cm.

RESULTS AND DISCUSSION

I. Stomach Content Analysis

A. Sardine Captured by Purse-seine

The diet of *S. aurita* and *S. maderensis* caught by purse-seine are summarized in table (1).

TABLE (2)

Seasonal variation in the relative abundance of different food items of *S. aurita* and *S. maderensis* caught by gillnet.

Food Items	Winter		Spring		Summer		Autumn	
	<i>S. aurita</i>	<i>S. mad</i>	<i>S. aurita</i>	<i>S. mad</i>	<i>S. aurita</i>	<i>S. mad</i>	<i>S. aurita</i>	<i>S. mad</i>
1- Phytoplankto								
Melosira	+++	Trace	++	+	+++	+++	++	
Navicula	++	" "				+		
Nitzschia	++	" "						
Boddulphia	+	" "	+++	+	+++			
Coscinodiscaeas	+							
Gyrosigama	+					+		
Ceratium						+	+	
2- Zooplankton								
Surirella								++
Copepods	+++	" "	+	+++	+++	+		
Copepoda nauplii	+++			+++	++	+		+
Cirripedia nauplii	++				++			+

It is clear that the composition of Sardine food varied considerably in conjunction with the gear used. This confirm the statement of Vucetic (1963 and 1964) that a striking difference was found between food of sardine captured by other gears.

II- Length-Weight Relationship and Condition Factor :

A- Sardine Caught by Purse-seine

The formulae relating the length to weight of *S. aurita* and *S. maderensis*, calculated according to Lagler (1956) are as follows :

For *S. aurita*

$$\text{Log } W = -2.3241 + 3.1464 \text{ Log } L \text{ East of Alexandria.}$$

$$\text{Log } W = -2.3726 + 3.1482 \text{ Log } L \text{ (West of Alexandria).}$$

For *S. maderensis*

$$\text{Log } W = -1.6985 + 2.6332 \text{ Log } L \text{ (East of Alexandria).}$$

$$\text{Log } W = -1.8518 + 2.7947 \text{ Log } L \text{ (West of Alexandria).}$$

Where *W* and *L* are the total fish weight (g) and length (cm) respectively. As shown from tables 3 and 4, the weights of fish captured from West Alexandria for a given size group are somewhat greater than those of fish caught from East of Alexandria. These weight differences may be attributed to better habitat or more favourable conditions (such as food availability) in West than in the East of Alexandria.

Coefficient of condition (*K*) which is an expression of the relative condition "robustness" of fish, was determined and ranged between 0.58 and 0.89 for *S. aurita* and from 0.75 to 0.94 for *S. maderensis*. These values are usually used to indicate suitability of the environment or to compare fish from different localities.

Fish examined during this study were in good condition. On the average, condition values of *S. aurita* increased slightly with the increase in length. However those of *S. maderensis*, has no particular trend with increasing length of fish.

B. Sardine Captured by Gill Nets

The length-weight formulae calculated for the two studied species are

$$\text{Log } W = -1.8976 + 2.8164 \text{ Log } L \text{ for } S. \text{ aurita}$$

$$\text{Log } W = -1.9006 + 2.8449 \text{ Log } L \text{ for } S. \text{ maderensis}$$

(*K*) values were computed to range between 0.68 and 0.98 for *S. aurita* with a mean of 0.77 and between 0.73 and 1.00 for *S. maderensis* with a mean of 0.83 (tables 3 and 4).

Since values of constants *a* and *n* of *L/W* formulae:

$$\text{Log } W = \log a + n \log L$$

, varied within wide limits for very similar data and are sensitive to quite insignificant variations (Beverton and Holt 1957), it is more preferable to compare the present data with others using the calculated weights and condition factors for the same size group. For example, previous work on sardine of local waters has been reported by El-Maghraby, 1960; Soliman et al., 1970 and Al-Sayes et al., 1979 (tables 3 and 4).

The sardine of gill-net varies from those of purse-seine. It was found that smaller sizes (less than 14 cm) of *S. aurita* captured by gill nets, were slightly heavier than those of purse-seine where as the reverse is true for bigger sizes (over 15 cm). For *S. maderensis*, on the other hand, fish caught by gill nets at West of Alexandria have more or less the same weights of those of purse-seine, operating in the same area, but they have higher weights than those from East of Alexandria.

TABLE (3)

Calculated weights and Condition Factors of *S. aurita* of different authors, compared with that of the present study.

Authors	Fish length (cm.).													
	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Soliman <i>et al.</i> , 1970 Alexandria	7.4 (0.74)	9.9 (0.74)	13.0 (0.75)	16.7 (0.76)	21.0 (0.77)	26.1 (0.77)	31.8 (0.78)	38.5 (0.78)	46.0 (0.79)	54.0 (0.79)	63.9 (0.80)	74.4 (0.80)	85.9 (0.81)	98.7 (0.81)
Al-Sayes <i>et al.</i> , 1979 E. Harb, Alexandria.	8.8 (0.86)	11.5 (0.86)	14.9 (0.86)	19.9 (0.86)	23.7 (0.86)	29.2 (0.87)	35.4 (0.86)	42.2 (0.87)	50.4 (0.86)	59.3 (0.86)	69.2 (0.87)	80.1 (0.86)	92.0 (0.86)	105.3 (0.87)
Present study : Sardine gill net, El-Max	8.3 (0.83)	10.8 (0.81)	13.9 (0.80)	17.4 (0.79)	21.4 (0.78)	26.0 (0.77)	31.2 (0.76)	37.0 (0.75)	43.4 (0.74)	50.6 (0.74)	58.4 (0.73)	67.0 (0.72)	76.4 (0.72)	86.6 (0.71)
Purse-Seine, East Alexandria.	7.1 (0.71)	9.6 (0.72)	12.7 (0.73)	16.4 (0.75)	20.7 (0.75)	25.8 (0.76)	31.7 (0.77)	38.4 (0.78)	46.0 (0.79)	54.7 (0.80)	64.3 (0.80)	75.1 (0.81)	87.1 (0.82)	100.3 (0.82)
Purse-Seine, West Alexandria.	7.5 (0.75)	10.1 (0.76)	13.3 (0.77)	17.1 (0.78)	21.6 (0.79)	26.9 (0.80)	32.9 (0.80)	39.8 (0.81)	47.7 (0.82)	56.6 (0.83)	66.5 (0.83)	77.6 (0.84)	89.8 (0.84)	103.3 (0.85)

M.B. : Condition Factor in parenthesis.

TABLE (4)
Calculated weights and condition factors of
S. maderensis of different authors, compared with that of the present study.

Fish length (cm.)	10	11	12	13	14	15	16
Anchor							
El-Maghraby, 1960 Alexandria	9.9 (0.99)	13.1 (0.98)	15.6 (0.96)	20.9 (0.95)	25.8 (0.94)	31.4 (0.93)	37.8 (0.92)
Sotimmetal., 1970 Alexandria	8.6 (0.76)	11.3 (0.85)	14.5 (0.84)	18.3 (0.83)	22.6 (0.82)	27.6 (0.82)	33.3 (0.81)
Al-Sayes <u>et al.</u> , 1979 E. Harb. Alexandria	9.6 (0.96)	12.7 (0.95)	16.3 (0.94)	20.6 (0.94)	25.6 (0.93)	31.3 (0.93)	37.8 (0.92)
Present study :							
Sardine gill net, El-Max.	8.8 (0.88)	11.5 (0.86)	14.8 (0.86)	18.6 (0.85)	22.9 (0.83)	27.9 (0.83)	33.5 (0.82)
Purse-seine, East Alexandria	8.6 (0.86)	11.1 (0.83)	13.9 (0.80)	17.2 (0.78)	20.9 (0.76)	25.0 (0.74)	29.7 (0.73)
Purse-seine, West Alexandria.	8.8 (0.88)	11.4 (0.86)	14.6 (0.84)	18.2 (0.83)	22.4 (0.82)	27.2 (0.81)	32.6 (0.80)

N.B.: Condition factor in parentheses.

The weight values, given by Soliman et al. (1970), are smaller than those obtained in the present study for *S. aurita* of purse-seine, west of Alexandria but similar to those of *S. maderensis*.

Moreover, comparison of the relative weights of Sardine taken by various gears pointed out that sardine, captured by beach seine (Al-Sayes et al., 1979) are heavier than those of the present work's. Sardine inhabits inshore waters, taken by beach-seine have better feeding conditions than those taken by gill net and purse-seine (offshor fish). This may be attributed to the fact that inshore waters are usually rich in plankton (Halim et al., 1967).

The weight values of *S. maderensis*, given by El-Maghraby (1960) expressed the average weights of sardine before the construction of Aswan High Dam, these values are obviously higher than those of the present study which may indicate a better feeding condition, caused by the Nile flood at that time.

CONCLUSIONS

The food items of sardine captured by purse-seine using light attraction are completely different from that of sardine captured by gill net and beach-seine.

It was found that sardine caught by purse-seine are particulate feeders. Their food are composed mainly of decapodes, fish larvae, isopodes, amphipodes and polychaetes. Decapodes constituted the most important food item for both species (*S. aurita* and *S. maderensis*).

While sardine captured by gill nets are filter feeders. They feed exclusively on phytoplankton (mainly diatoms) and to some extent on zooplankton (mainly copepods).

The length-weight relationship and condition factor of sardine in the catches of gill nets, purse-seine and beach-seine were also different. The sardine of beach seine (inshore fish) are heavier than that of gill nets and purse seine (off-shore fish). Also the fish condition is intimately to the feeding habit of the fish, which is related to the fishing gear used.

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