Population dynamics and fisheries management of the round sardinella, *Sardinella aurita* in GSA 26, Egypt

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Introduction

Marine fisheries play an important role in the Egyptian economy and food security where it provides about 10% of harvested fish in Egypt (2000-2020). Sardines (family: Clupeidae) represent one of the most important fishes in the Egyptian sector of the Mediterranean Sea fisheries (Fig. 1). They are the most common fish group and represent about 33% of the total fish production from Mediterranean and 47% of the purse-seine fishery. They mainly caught by purse-seiners. The sardine catch in Egyptian Mediterranean consists of at least six species of which *Sardinella aurita* is the most common one. However, during the last twenty years a considerable decline in sardine landing along the Egyptian Mediterranean coast has been observed.

For the rational exploitation and management of *S. aurita* stock in the Southeastern Mediterranean (GSA26) information on its dynamics and biology is essential. The present study was carried out to discuss and estimate the basic parameters required for assessing and managing the stock of *S. aurita* in the Egyptian Mediterranean GSA26. The obtained results are helped to suggest some applicable reference points and to propose some regulatory measures for Sardine fisheries management and conservation.

Material and Methods

Data collection

Samples of *S. aurita* were collected monthly from the commercial catches of purse-seine fishery at Port Said landing sites during the period from January 2019 until January 2021. All collected fishes (1340 fish) were measured for the total length to the nearest o.1 cm and weighed to the nearest 0.1 g total weight. Sex, maturity stage and otoliths were taken for each specimen of *S. aurita*. The sample size range was 7.0 – 22.7cm TL and the weight range was 3 - 95 g. The data were grouped into classes of one centimeter intervals for further analysis.

Methods

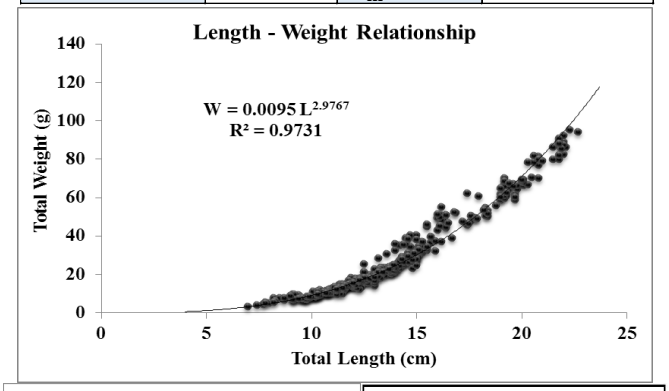
Annual rings on otoliths were counted using optical system consisting of Nikon Zoom - Stereomicroscope focusing block, Heidenhain's electronic bidirectional read out system V R X 182, under transmitted light. Lengths by age were back - calculated using Lee's (1920) equation. The relation between the total length (L) and total weight (W) was computed using the formula $W = aL^b$ The back-calculated lengths were used to estimate the growth parameters ($L\infty$ & K) of the von Bertalanffy growth model. The growth performance (ø) of *S. aurita* population in terms of length growth was computed using the index of Pauly and Munro (1984) as $ø = \text{Log } K + 2 \text{ Log } L$. The data were analyzed to estimate the total, natural and fishing mortality (Z, M and F). Yield per Recruit analysis (Y/R) was conducted based on the exploitation pattern resulting from the XSA model and population parameters.

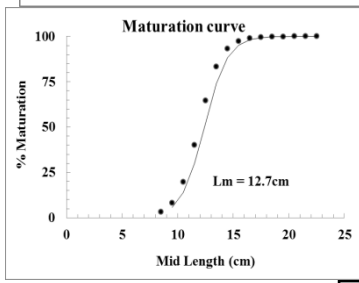
A logistic function relating the proportions of mature individuals to total length of the fish was used to determine the length at first maturity, while the length at first capture (Lc) was determined by analyzing the probability curve of Pauly (1984).

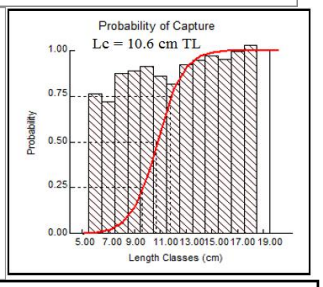
Fig. 1. Egyptian Mediterranean coast with the main landing sites

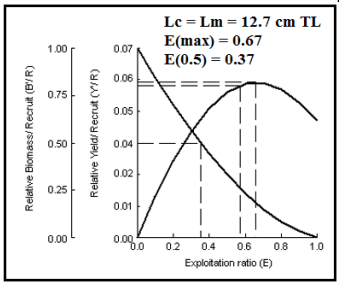
Results

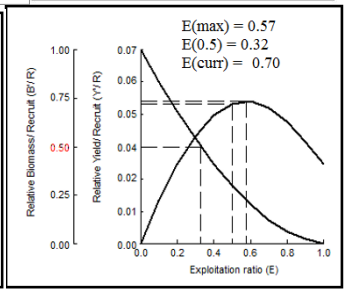
Parameter	Value	Parameter	Value
Age (Otolith)	3 years	**Z**	2.20/year
K	0.51/year	**M**	0.67/year
L	25.78 cm	**F**	1.53/year
t_o	-0.22	**E**	0.695
Ø	2.53	**L_c**	10.6 cm TL
		L_m	12.7 cm TL











Conclusion

Round sardine stock is overfished and needs an effective management plan to reduce the fishing effort and increase the mesh sizes of fishing gears in the Egyptian Mediterranean waters. It is worth mentioning that overfishing, illegal mesh sizes and destructive fishing techniques are not the only reasons for declining the sardine production in Egyptian Mediterranean waters. The availability of food and some environmental and climate changes that greatly reduce the survival rate of sardine eggs and larvae also affect the occurrence and abundance of sardine shoals. Besides, the cessation of Nile flood after the construction of Aswan High Dam leads to the decrease of nutrients and sediment, that arrive to Mediterranean by the floodwater and this was an important factor that affected all small pelagic resources, especially sardine.