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Stock Assessment and Potential management of *Sardinella aurita* Fisheries in the East Mediterranean sea (North Sinai coast).

Nabil. F. Abd EL Hakim[1]; Attaia. A. omar[2]; Mohsen. S. Hussein[1]; Salah, M. Kamal[3]; Mohammed. G. Desoukt[3]; Hosam M. Agouz[3].

1- Fcaulty of Agriculture, AL-Azhar University, Cairo, Egypt.
2- General Authority for Fisheries Resources Development, EL-Arish, North Sinai, Egypt.
3- Department of Aquaculture, Central Laboratory for Aquaculture Research, Abbassa, Abo-Hammad, Shrkia, Egypt.

ABSTRACT

Age, growth and population biology of *Sardinella aurita* were studies from a small fishery of East Mediterranean Sea (North Sinai coast). 4450 specimens ranged between 6 and 22.9 cm total length and varied from 3 to 77.1 g total weight, were collected from January to December, 2010. The relationship between length and weight was estimated as $W=0.016\ L^{2.611}$. Age was determined using scales reading technique and the longevity of this species was found to be 4 years. Growth in length and in weight at the end of each year were calculated. The growth parameters of the Von-Bertalanffy equation were calculated as $L\infty= 28.37$cm, $K= 0.2336\ Yr^{-1}$ and $t_0= -0.9808$ Yr. Growth performance index Ø was estimated as 2.2742. Total, natural and fishing mortality rates were 0.99.7 Yr^{-1}, 0.3507 Yr^{-1} and 0.53 Yr^{-1} respectively. The currently exploitation rate (E=0.6) indicate that the stock of *S. aurita* in North Sinai fishery is not overexploitation. The mean index of growth performance is lower than that for the another regions this may be related to unsuitable environment.

Keywords: Sardinella aurita; growth; mortality; East Mediterranean sea.

INTRODUCTION

Family Clupeidae are of the most essential Kinds for catching in the Western part of the Mediterranean. In the off-shore waters of Italy, France and Spain (Ben-Tuvia, 1958) fishery is based on it. In Egypt, *S. pichardus* and *S. aurita* were of the greatest importance due to the absence of *S. pilchardus* as well as its small sizes, and this species is of little commercial value in the investigated area. In spite of the round sardinella, *S. aurita* is the most important (about 86% of total catch) in Mediterranean coast of Sinai fishery, there is a little information on fishery of this species.

The aim of this study is to provide detailed assessment of the fisheries for *S. Aurita* in the East Mediterranean sea (North Sinai) by:

1- Assessing the exploitation status of the spices.
2- Management of its fisheries through the use of length analysis and yield per recruit based on the demographic structure of the catch and biological parameters for the species.

The sensitivity of the results to the natural mortality value has been also tested.

MATERIAL AND METHODS

The fish resources of the Mediterranean coast of Sinai is exploited by three main fishing gears, the Purse-seine nets (53 Units), Trammel nets (164 Units) and Long line gear (9 Units).

This study was carried out during the period from January to December (2010). During this period, an extensive data collection program was applied, through recording the information on the fishing fleet operating in the Mediterranean coast of Sinai. The data of the catch weekly recorded for each species or species fish category for the different fishing gears. The fishing data for the previous period from 1989 to 2009 were collected from the General Authority for fish Resources Development (GAFRD) reports. The commercial catch was classified into sixteen fish categories; i.e. Sardine Spp., Crabs, Cattle fish, small shrimp, Horse mackerel, Shrimp, Cartilaginous, Fish, Sigans, Spanish mackerel, Indian Mackerel, Mullets, Snapper, Groupers, Kawakaw, Trash fish and Others.

For biological parameters, 4450 fish individuals of both sexes combined of *Sardinella aurita* were collected monthly from January to December 2010. The measurements as total length to the nearst millimeter and total weight to the nearest one gram of the fish were recorded for each specimen. For age determination, the scale samples were removed from the left side of each fish behind the tip of pectoral fin for 4450 specimens. (Paul, 1968).

Parameters estimate are taken from the biological studies on the *Sardinella aurita* including Von-Bertalanffy (1934) growth curves ($L\infty$, K and t_0), length-weight relationship, length at sexual maturity (L_{50}), natural mortality (M) and fish mortality (F).

1-Length-weight relationship:

The relationship between length and weight was described by the equation ($W=CL^n$), where W is the total weight (g.) and L is the total length (cm.), C and n constants (Martin, 1949).

2-Scales preparation and Age determination:

In the laboratory, the scales were cleaned and stored dry in envelopes for the subsequent study. Later on, scales were Ø for the soaked overnight in 10% ammonia solutions. 5-7 scales were placed between tow glass slides, and examined by a projector with 33X magnification. The total radius of the scale of the longer axis as well as the distance form the focus of the scale to the successive annuli were measured to the nearest 0.01 cm. According to Whitney and Calender (1956), the best regression to use was that of fish length and average scale radius as:

$L=a+bR$

Where: L is total length of fish in cm.

R is magnified scale radius in cm. (a) and (b) constants representing the intercept and the slope of straight line respectively.

3-the back-calculated:

The length at previous ages, were back calculated from scale measurements using Lea's equation (1910): $Ln=(Sn/S)L$ where

Ln= is length of fish at age "n"

Sn= is magnified scale radius to "n" annuals

S= is magnified total scale radius

L= is first length at capture

4- Growth parameters:

The Von-Bertalanffy models, (1934 and 1949), $L_t=L\infty(1-e^{-K[t-t0]})$

Was used to describe growth in size, where L_t is the length at age t, $L\infty$ the asymptotic length, K the body growth coefficient and defines the growth rate towards $L\infty$ and t_0 the hypothetical age at which a fish would have zero Length the values of $L\infty$, K and t_0 were estimated by Plotting L_t VS L_{tt1} using the Ford (1933), Walford (1946) procedure. The growth performance index was calculated by using the Phiprime test ($Ø^{/}$)=Log K+2LogL∞ (Munor and Pauly, 1983) which can be used to compare growth performance under environmental stresses (Pauly, 1994).

5- Mortality rates:

Total mortality (Z) was estimated by a method of Pauly (1980) as LnN=a+bt where Ln is natural Logarithmic of the number of fish in the sample (N) against their respective age (t) and a and b are constants.

Natural mortality coefficient was estimated by using the equation of Pauly (1980), LogM=[-0.0066-0.279 LogL∞+0.6543 LogK+0.4634 LogT].

Fishing mortality coefficient (F) was estimated directly by subtracting the value of the natural mortality from the value of the mean total mortality as F=Z-M.

6- The Exploitation rate (E):

Estimation the exploitation rate (E) can be estimated by Gulland (1971) equation: E=F/(F+M), where E is exploitation rate, F is fishing mortality and M is natural mortality.

7- Recruitment and yield per recruit:

Recruitment is the process by which young fish enter the exploited area and become liable to contact with fishing gear. It can be estimated by equation of Gulland (1969):

R = R/ em (tc-tr)

Where:

R is the number of recruits, i.e. the number of fish a live at age Tr.

R\ is the number of fish a live at the age Tc at which they are first retained by the gear in.

M is the natural mortality

Tc is the age at first capture

Tr is the age at recruitment

R\ = C (F + M) / F

Where C is the annual catch number

Concerning to the yield per recruit of *Sardinella aurita* it was calculated by Gulland (1969) and Marten (1978).

RESULTS

The data of the annual variation in fish yield composition in the East Mediterranean sea (North Sinai) during the period from 1989 to 2010 are given in table (1).

Sardinella aurita, which had the most important value in the catches of north Sinai coast is amounted to 928 tons and representing 83% of the total catch during 1989. But thereafter, catches of Sardines decreased to around 51-77.9% of the total catch from 1990-1996. Then they increased during 1997 and reached 3819 (93.5%) during 2001. A slight decreased in Sardine production took place during 2005 reaching only 783 Tons (73.2%). Then increased during 2005 reaching 3241 tons (93.7%).Vigorously dropped to only 219.1 tons (19.5% of the total catch) during 2010.

Crabs had the second important value during the period from 1989 to 2010. Production of crabs gradually increased and reaching its maximum amount 334.1 tons (29.7%) during 2010.

The production of cattle fish fluctuated during the period from 1989 to 2010 between 2.0 tons (0.2% in 1989) and 88 tons (2.4% in 2008).

Spanish mackerel, Groupers and others were greatly varied according to their importance in the total yield of the North Sinai fishery, during the period of study.

Table 1: The Annual variation in the total fish yield composition of the Mediterranean coast of Sinai from 1989 to 2010.

Year	Sardine		Med. Horse Mackerel		Spanish Mackerel		Groupers		Cattle fish		Crabs		Others		Total yield
	Ton	%	Ton	%	Ton	%	Ton	%	Ton	%	Ton		Ton	%	Ton
1989	928.0	83.0	5.0	0.4	2.0	0.2	23.0	2.1	2.0	0.2	1.0	0.1	157.0	14.0	1118
1990	310.0	51.0	12.0	2.0	34.0	5.6	26.0	4.3	32.0	5.3	3.0	0.5	191.0	31.4	608
1991	725.0	70.9	44.0	4.3	43.0	4.2	20.0	2.0	10.0	1.0	3.0	0.3	177.0	17.3	1022
1992	2247.0	87.7	15.0	0.6	9.0	0.4	29.0	1.1	47.0	1.8	8.0	0.3	208.0	8.1	2563
1993	1543.0	82.4	21.0	1.1	7.0	0.4	34.0	1.8	46.0	2.5	3.0	0.2	218.0	11.6	1872
1994	2003.0	83.7	70.0	2.9	12.0	0.5	13.0	0.5	44.0	1.8	17.0	0.7	233.0	9.7	2392
1995	1240.0	79.1	53.0	3.4	9.0	0.6	17.0	1.1	23.0	1.5	3.0	0.2	223.0	14.2	1568
1996	993.0	77.9	57.0	4.5	25.0	2.0	12.0	0.9	44.0	3.5	3.0	0.2	140.0	11.0	1274
1997	2568.0	90.1	105.0	3.7	14.0	0.5	16.0	0.6	37.0	1.3	14.0	0.5	97.0	3.4	2851
1998	5014.0	95.0	38.0	0.7	9.0	0.2	11.0	0.2	49.0	0.9	9.0	0.2	148.0	2.8	5278
1999	11478.	98.0	58.0	0.5	3.0	0.0	7.0	0.1	25.0	0.2	4.0	0.0	140.0	1.2	11715
2000	3293.0	84.4	37.0	0.9	19.0	0.5	7.0	0.2	24.0	0.6	4.0	0.1	517.0	13.3	3901
2001	3817.0	93.5	58.0	1.4	11.0	0.3	11.5	0.3	22.0	0.5	12.0	0.3	152.5	3.7	4084
2002	1300.0	77.4	60.1	3.6	19.6	1.2	17.1	1.0	49.1	2.9	27.7	1.6	206.8	12.3	1680.4
2003	1025.0	73.2	96.0	6.9	10.0	0.7	17.0	1.2	93.0	6.6	54.0	3.9	105.0	7.5	1400
2004	827.0	69.7	113.8	9.6	8.2	0.7	14.8	1.2	46.9	4.0	11.4	1.0	165.0	13.9	1187.1
2005	783.0	73.2	39.0	3.6	18.0	1.7	21.0	2.0	70.0	6.5	43.0	4.0	95.0	8.9	1069
2006	3241.0	93.7	15.0	0.4	5.0	0.1	6.0	0.2	56.0	1.6	71.0	2.1	64.0	1.9	3458
2007	1950.0	83.4	73.0	3.1	15.0	0.6	10.0	0.4	74.0	3.2	77.0	3.3	139.0	5.9	2338
2008	3014.0	83.8	53.	1.5	20.0	0.6	10.0	0.3	88.0	2.4	180.	5.0	231.0	6.4	3596
2009	1032.0	62.0	15.0	0.9	15.0	0.9	11.0	0.7	74.0	4.4	258.	15.5	260.0	15.6	1665
2010	219.1	19.5	69	6.2	19.2	1.8	8.4	0.7	82.0	7.2	334.1	29.7	392.9	35	1125
Average	2252	86	50	1.9	15	0.6	16	0.6	47	1.8	52	2.0	194	7.4	2626

Biological parameters

1- Length-weight relationship:

The observed total length of 4450 *Sardinella aurita* caught from north Sinai coast from January to December 2010 ranged from 6 to 23.9 cm and the observed total weight from 3 to 77.1 g. (Table 2). The length weight relationship (Fig. 1) was described by the power equation as:

$W = 0.0158\ L^{2.6821}$

To avoid the bias which may be caused by the weight of stomachs, gonads and their seasonal variation, the length-weight relationship were estimated using the gutted weight by equation. $W = 0.016\ L^{2.6411}$ (Fig. 2).

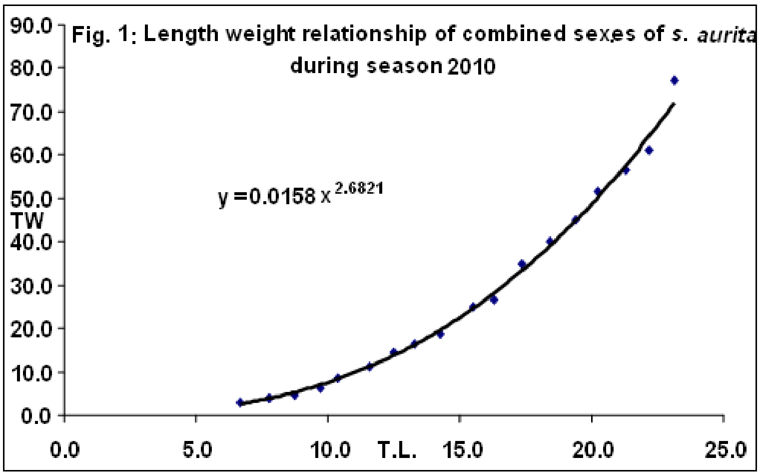
2- Body length-scale radius relationship:

4450 specimen were collected for ageing and growth analysis. Age estimated ranged between 0-5 years, age-length Key were calculated (Table 3). The mean fish length and the average scale radius per each length group are given with the ratio of fish length to scale size in (Fig. 3). Data for *S. aurita* between fish length and scale radius show a linear trend on their scatter diagram where described by the equation:

$L = -0.6683 + 2.1321\ S$

Table 2: Observed and calculated total weight and gutted weight for combined sexes *S. aurita* 2010 in Mediterranean cost of Sinai

No. of fish	T . L	ML	T. W. in gm		Gutted W. in gm	
			Av. T. W. Observed	Calculated T. W.	Av. gutted W. Observed	Calculated gutted W.
100	6-6.9	6.7	3.0	2.5	2.7	2.4
174	7-7.9	7.8	3.9	3.9	3.6	3.6
216	8-8.9	8.8	4.7	5.3	4.4	4.9
270	9-9.9	9.7	6.2	7.0	5.7	6.5
624	10-10.9	10.4	8.5	8.4	8.0	7.7
256	11-11.9	11.6	11.2	11.2	10.0	10.3
348	12-12.9	12.5	14.6	13.8	13.3	12.6
596	13-13.9	13.3	16.5	16.3	15.3	14.8
432	14-14.9	14.3	18.7	19.7	17.4	17.9
566	15-15.9	15.5	25.0	24.7	23.0	22.4
134	16-16.9	16.3	26.6	28.2	24.6	25.5
152	17-17.9	17.4	34.9	33.5	32.1	30.2
104	18-18.9	18.4	40.0	39.1	36.5	35.1
268	19-19.9	19.4	45.0	44.9	40.9	40.3
30	20-20.9	20.2	51.6	50.3	44.2	45.0
78	21-21.9	21.3	56.4	57.7	49.5	51.6
86	22-22.9	22.2	61.2	64.5	53.3	57.5
16	23-23.9	23.1	77.1	72.1	69.3	64.2
4450						



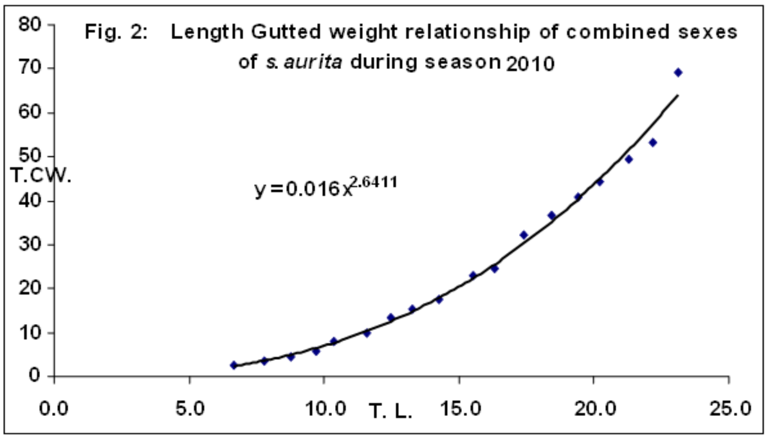
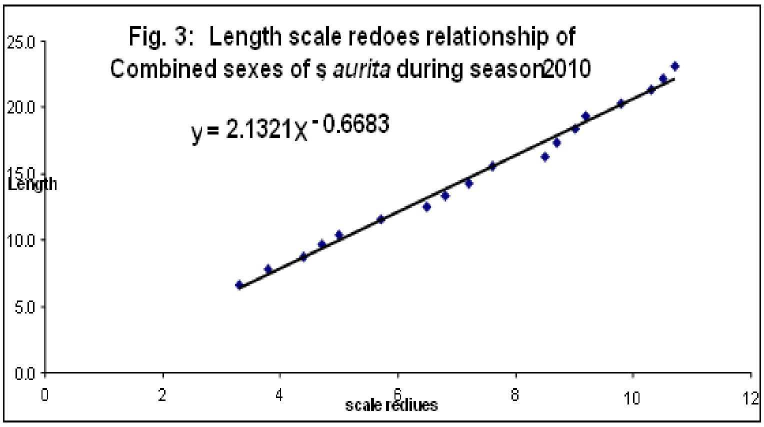


Table 3: Age-length key of combined sexes of *S. aurita* during season 2010.

	age0	age1	age2	age3	age4	age5	NI	Pi
6-6.9	100						100	2.2
7-7.9	174						174	3.9
8.8.9	216						216	4.9
9-9.9	270	0					270	6.1
10-10.9	130	494					624	14.0
11-11.9		256					256	5.8
12-12.9		316	32				348	7.8
13-13.9			596				596	13.4
14-14.9			392	40			432	9.7
15-15.9			454	112			566	12.7
16-16.9				134			134	3.0
17-17.9				122	30		152	3.4
18-18.9				80	24	0	104	2.3
19-19.9				130	106	32	268	6.0
20-20.9					20	10	30	0.7
21-21.9					44	34	78	1.8
22-22.9					24	62	86	1.9
23-23.9						16	16	0.4
total	890	1066	33.1	618	248	154	4450	100.0



3- The back-calculations:

The average back-calculation length and annual increment of the combined sexes (Table 4) are 10.6, 14.23, 17,26 and 19.66 cm for age 1, 2, 3, and 4 respectively. The highest annual increment occurred during the first year of life, while a noticeable decrease is observed in the second year, reaching its minimal value during the fourth year of life.

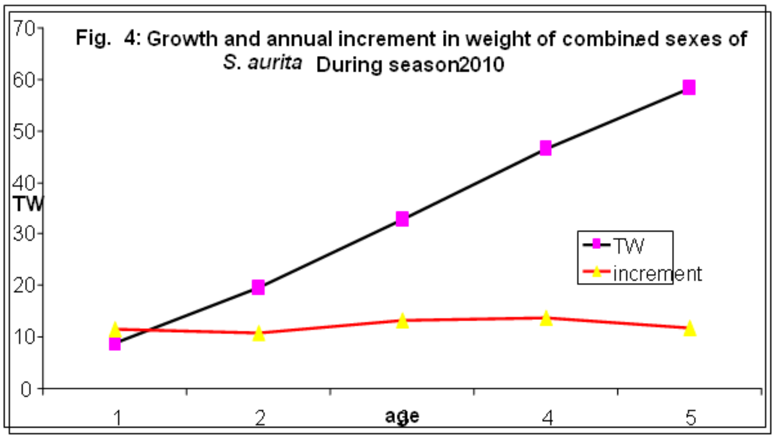
Table 4: Back–calculation length at the end of different years of life of combined sexes (♀♂) of *S. aurita* (2010)

Age group	No. of fish	Average calculated lengths at the end of each year (cm)				
0	760	I	II	III	IV	V
I	1196	10.60				
II	1474	10.59	14.23			
III	618	10.41	14.19	17.26		
IV	248	10.63	14.23	17.31	19.66	
V	154	10.44	14.27	17.25	19.61	21.38
Increment	4450	10.60	3.63	3.03	2.40	1.72

The average back-calculation weights at the end of each year of life for *S. aurita* were estimated by applying the length-weight relationship and the results are given in (Table 5 and Fig 4).

Table 5: Average estimated weight and increment of weight at during, 2010 of combined sexes of *S. aurita*.

Age group	No. of fish	Average estimated weight at the end of each year(gm)				
	760	I	II	III	IV	V
I	1196	8.9				
II	1474	8.9	19.6			
III	618	8.5	19.4	32.8		
IV	248	9.0	19.6	33.1	46.6	
V	154	8.5	19.7	32.8	46.3	58.3
Increment	4450	11.4	10.7	13.3	13.7	11.7



The result in the Table (4) show that the maximum value of annual weight increment successively and reaches its maximum at the end of fourth group of life.

4- Growth parameter:

The parameters of Von-Bertalanffy theoretical growth model ($L\infty$, K and t_0) were calculated as $L\infty$ = 28.37 cm, K= 0.2336 Yr^1 ant t_0 = - 0.9808 ant the obtained equation was L_t= 28.37 (1-$e^{-\ 0.2336\ [t+9808]}$). The asymptotic length is higher the maximum observed length. The growth performance index for *S. aurita* was about 2.2742.

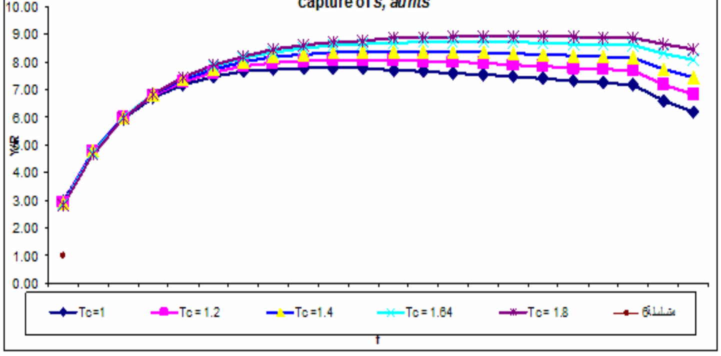
5-Mortality and Exploitation rates:

The total mortality coefficient (Z) by different method for *S. aurita* from the Mediterranean coast of Sinai at season 2010 defined as the total loss by natural and fishing death of individuals. The mean total mortality (Z=0.8807). The natural mortality (M= 0.3507 Yr^1) versus fishing mortality (F= 0.53). The current established exploitation rate was 0.60 (E=60%).

6- Recruitment and yield per recruitment:

Fig. (5) show that the fishing mortality (F=0.53 and age at first capture [T_c=1.64) or length at first capture [L_c=13 cm]) give a yield of 8.637 gm per recruit. The maximum yield per recruit is obtained with fishing mortality coefficient is lower than the fishing mortality coefficient produce the maximum yield per recruit. This mean that increase of fishing mortality coefficient by a bout 32.2% from 0.53 to 0.7 would increased the yield per recruit by only 0.97%.

fig (5) Y/R of s.aurita during 2010 of different fishing mortality and age at first capture of *s, aurits*



DISCUSSION

Present results indicated that the total catch from Mediterranean coast of Sinai fishery was pronounced it’s fluctuation between lower catch 608 tons during 1990 and higher catch 11715 tons during 1999. This catch fluctuation was influenced by abundance of sardine. The decline in the catch of sardine recorded by 219 tons in 2010 and 310 tons in 1990. However, a positive correlation between total catch and catch of Sardine was observed (r=0.99). The composition of catch in the Mediterranean coast of Sinai fishery was slightly changed during the period, 1991 to 2008 where the sardine dominated in catch by over 70% from total catch. The fluctuation of catch may be due to availability of food and environmental changes. These results are in agreement with results by wadie (1998) where found that the several factors or responsible for construction of the high Dam. Tow important factors that effect the occurrence and abundance of Sardine shoals can be detected quality and quantity of food and some environmental changes that have acted in such a way so as to greatly reduce the survival rate of sardine eggs and larvae. Before 1965 the River Nile discharge was the main reason for the high biological productivity of the Shelf waters. This was due the large amounts of organic substances and mineral particles through its tow Tributaries (Damietta and Rosetta). Increases in sardine catch in recent years may be attributed to introduction of new fishing gear effective for sardine fisheries, in addition certain environmental changes occurred, that are favorable for high sardine production.

In the present study the power “n” was 2.682 by using the length-weight relationship and when using the gutted weight the power “n” was 2.6411 indicated acute negative allometric growths for *S. aurita*. The previous results for the same species show that “n” value ranged from 2.4 to 3.179 according to EL-Aiatt, 2004 and 2.526 as reported by Salem *et al*., 2010, both results obtain from Mediterranean coast, EL-Arish. Also, agreement with EL-Maghraby *et al*., 1970 where found that the power “n” equal 2.4176. In spite of Abdalla and EL-Haweet (2000) and Faltas (1983) in studing the length-weight relationship of *S. aurita* in East and west Alexandria found seprately that the value of power “n” 3.1793 and 3.1764 in East and 3.1482 in west Alexandria respectively. Also, Moutopoulos and Stergiou, 2002 mentioned that the power “n” for *S. aurita* was 2.804 and 3.12 respectively. The relationship between body length and weight can also be change with many condition factors as season, sex, food, matyrity stage and techniques, of sampling (Le-Cren 1951). The slightly negative allometric growth in AL-Arish, Mediterranean coast, may be related to unavailable of food and unsuitable of environment.

The body length and scale radius relationship show a linear on their scatter diagram L= -0.6683+2.132S. This results agree with Salem *et al.*, 2010 (L= -0.4847+2.0893 R and with EL-Aiatt (2004) [L= -0.7994+2.1604 S at season 2000 and L= -0.7670+2.1356S at season 2001). The average back-calculation length at the end of each year was 10.6, 14.23, 17.26 and 19.66 cm for age 1, 2, 3, and 4 respectively. The obtained results showed the highest increment in length occurred at the first year 10.6 cm of *S. aurita*, after which the annual increment in length decreases with further increase in age. The length of Sardine, *S. aurita* in the present study was lower than that obtained by Faltas, 1983 where he found the length at the end of each year of the first fourth years for *S. aurita* 12.7, 15.9, 18.7 and 21 cm respectively. Also, Salem *et al.*, 2010 where found the length at the end of the first fourth years for the same species at season 2007, 11.1, 14.7, 18.0 and 19.8 cm. The obtained results by EL-Aiatt, 2004 where found the length at the end of the first fourth years for the same species 12.38, 15.91, 18.77 and 20.54 at season 2000 and 12.18, 15.23, 18.56, 20.02 at season 2001 respectively.

In this study, there is a well agreement somewhat between the calculated length and calculated weight and length and weight by using Von-Bortalanffy equation.

The asymptotic length ($L\infty$= 28.37), the body growth coefficient (K=0.2336 Yr-1) and the maximum length (L_{Max}=23.1) are different than most Mediterranean stock which obtained by Buaziz *et al*., 2001 (L_{Max}=25.5; $L\infty$=34.96; K= 0.236 Yr^{-1} in Algeria coast and Gaamour *et al*., 2001 (L_{Max}= 27.35; $L\infty$= 31.32; K= 0.240 Yr^{-1}) in Tunisia coast, the hypothetical age at which a fish would have Zero length (t_0= -0.9808) similar which obtained by Buaziz *et al*., 2001 (t_0= -0.717) and Salem *et al*., 2010 (t_0= -0.878) for the same species. Differences in growth parameter may be due to genetic structure; temperature, food available and diseases (Pauly, 1994 and Wooton, 1998).

The index of growth performance (Ø) is considered a useful tool for comparing the growth curves of different populations of the same species and/or of different species belonging to the same family (Gayanilo and Pauly, 1997; Sparre and Venema, 1992).

In this study, the value of growth performance (Ø=2.27). This result is agreed with Gammour *et al*., 2001 (Ø=2.27) in Tunisia coast, and Salem *et al*., 2010 in Mediterranean coast of Sinai, but lower compared with Chesheva, 1998 (Ø=2.66) in Mouretania coast. In the Mediterranean sea, the mean index of growth performance is lower than for the another regions (Tsikliras *et al*., 2005).

Several methods were used for estimating the total mortality coefficient. In the present study, the results estimation of annual total mortality coefficient (Z), defind as the total loss by natural and fishing death of individuals as 0.8807 Yr^{-1}. Different results were obtained by Hashem and Faltas, 1982 estimated the total mortality for *S. aurita* in Alexandria region (1.377). Salem (2010) 1.49 and EL-Aiatt, 2004 (1.262) and (1.519) in season 2000 and 2001 respectively for *S. aurita* in EL-Arish region.

The natural mortality (0.3507 Yr^{-1}) versus fish mortality (0.53) observed for *S. aurita* indicated the balanced position of the stock. The natural mortality is the mortality created by all other causes than fishing, such as perdition including cannibalism, diseases, spawning street, starvation and old age. Perdition and starvation mortality are linked to the ambient ecosystem. The same species may have different natural mortality rates in different areas depending on the density of predators and competitor's whose abundance is influenced by fish activities (Sparre and Venema, 1992). Gulland, 1971 suggested that, fishing mortality should be about equal to natural mortality, resulting in an exploitation rate of 0.5 $Year^{-1}$. However, exploitation rates should be very conservative for relatively long lived species (Newman and Dunk, 2003). In this work the current established exploitation rate was 0.60 (E=60%). The current exploitation rate is optimally exploited stock (50%) according to Gulland (1971). Salem *et al*., 2010 mentioned for *S. aurita* in EL-Arish region, the optimum exploitation rate which produces maximum and economic sustenable yield (E_{Max}=0.87 and $E_{0.1}$= 0.71). in our study the curren exploitation rate is less than the predicted (E_{Max}) and ($E_{0.1}$), where this mean that the stock is not overexploited.

Results of recruitment and yield per recruitment show that the maximum yield per recruit is obtained with fishing mortality coefficient 0.7. This means the present level of fishing mortality coefficient is lower than the fishing mortality coefficient produces the maximum yield per recruit. Also, this mean that increase of fishing mortality coefficient by about 32.1% from 0.53 to 0.7 would increased the yield per recruit by only 0.97%.

In conclusion, the natural mortality (0.3507 Yr^{-1}) versus fish mortality (0.53) observed for *S. aurita* in north fishery indicates the balanced position of the stock. The current exploitation rate is less than the predicted (E_{Max}) and ($E_{0.1}$), where this means that the stock is not overexploitation. In north Sinai fishery, the mean index of growth performance is lower than for the another regions, may be related to unavailable of food and unsuitable of environment.

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Arabic Summary

تقييم المخزون وادارة مصايد اسماك السردين المبروم فى ساحل شرق البحر الابيض المتوسط (ساحل شمال سيناء)

نبيل فهمي عبد الحكيم[1]، عطية على عمر[2]، محسن صالح حسين[1]، صلاح محمد كمال[3]، محمد جابر دسوقي[3]، حسام محمود العجوز[3].

1- كلية الزراعة جامعة الازهر، القاهر، مصر.
2- الهيئة العامة لتنمية الثروة السمكية، العريش، شمال سيناء، مصر.
3- قسم الاستزراع السمكي، المعمل المركزي لبحوث الثروة السمكية، العباسة، ابو حماد، شرقية، مصر.

تم جمع عينات من اسماك السردين المبروم شهريا من يناير الى ديسمبر (2010) من مصايد شرق البحر المتوسط بمنطقة العريش (شمال سيناء). ومن خلال 4450 سمكة سردين تراوحت اطوالها من 6 سم الى 22.9 سم واوزانها من 3 جرام الى 77.1 جرام، تم حساب العلاقة بين الطول والوزن من خلال المعادلة $W=0.016L^{2.6411}$. تم حساب العمر بإستخدام قراءة القشور وتم حساب النمو فى الطول والنمو فى الوزن عند نهاية كل مجموعة عمرية. تم تقدير مقاييس النمو بإستخدام معادلة فون برتلنفي ووجد ان الطول اللانهائى $(L\infty)$= 28.37 سم ومعامل النمو (K)= 0.2336 وتم تحديد النفوق الكلي بعدة طرق وكان المتوسط لهذه الطرق (Z)= 0.3507 والنفوق بالصيد (F)= 0.53 ومعدل الاستغلال (E) =0.6 ويدل على ان المخزون السمكي من اسماك السردين فى منطقة شمال سيناء لم يستغل الاستغلال الكامل وانه لاتوجد خطورة على المخزون. ولقد دل معامل اداء النمو (Ø=2.2742) للاسماك فى المنطقة انه اقل اداء عن اسماك السردين الموجودة فى مناطق اخري وربما يرجع ذلك الى قلة الغذاء الطبيعي فى المنطقة وربما يرجع ايضاً الى الظروف البيئية غير المناسبة لنمو السردين.