Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 23(1): 13 – 26 (2019)
www.ejabf.journals.ekb.eg

Basic Parameters for Assessment and Management of the Short-Finned Squid *Illex coindetii* (Verany, 1839) (Cephalopoda, Ommastrephidae) from the deep water off the Egyptian Mediterranean Sea.

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ARTICLE INFO
Article History:
Received: Dec. 25, 2018
Accepted: Jan. 22, 2019
Online: Jan. 30, 2019

Keywords:
Mediterranean Sea
Illex coindetii
Short-Finned Squid
Growth parameters
Mortality
Spawning period

ABSTRACT

This research is the first study of *Illex coindetii* from the deep sea fishing ground adopted in the Egyptian Mediterranean Sea. That assist to prevent stock reduction by estimation of growth parameters, mortality, and size at maturity which taken as a reference point of minimum legal size to prevent stock depletion. Specimens of *Illex coindetii* were collected from bottom trawl vessels at 250:850 m depths from the Egyptian Mediterranean Sea. A total of 370 *Illex coindetii* individuals 189 males and 157 females and 24 unidentified sexes were carried out seasonally in 2016. The length-weight relationship showed negative allometry for females and sexes combined "b" 2.01, 2.64 and positive allometric growth for males "b"3.16. There has been a difference between the sexes with concern length-weight relationships with males being smaller and lighter than females. Age was determined using length frequency analysis. The asymptotic length (L_∞), the growth rate (K) and (t_0) were estimated as 21 cm, 0.570 year^{-1} and -0.341 years for males, 31.5 cm, 0.22 year^{-1}and -0.755 year for females and 31.5 cm,0.28 year^{-1} and -0.587year for sexes combined respectively. The annual total mortality (Z), natural mortality (M) and fishing mortality (F) were estimated at 2.94, 1.05 and 1.89/year for males while those of females were 2.76, 0.746 and 2.02 and 2.79, 0.74, 2.05/year for the sexes combined respectively.ML_{50} was estimated as, 14.35 cm for females and 11.51 cm for males. Two peaks in GSI were attained of mature females, one in spring and the other in autumn. The result of the exploitation rate of the sexes combined (0.73) indicated overexploitation which was higher in females (0.73) than males (0.64).

INTRODUCTION

Cephalopoda is a group of mollusks that include squid, nautilus, cuttlefish, and octopus the importance of cephalopods as a world-wide fisheries resource continues to increase, they are good protein and lipid source however, their short life cycles and variable growth rates make stocks unstable and vulnerable (Pierce and Guerra, 1994). Squids represent the largest fraction (more than70%) of world cephalopod capture production. Since 1996, squid's landings have constantly exceeded 3 million tons and peaked in 2007 with about 4.3 million tons and about 4 million tons in 2012, (FAO, 2014). In the Egyptian Mediterranean waters, the cephalopods constitute 9.8% of the total fish catch of which 61% are cuttlefishes, 3.5% octopuses, and 0.21% squids. (Riad, 1993). Illex genus contains four species: *Illex argentinus, Illex illecebrosus,* *Illex oxygonius and Illex coindetii*. In the present work will throw light on the state of the stock of *Illex coindetii* from the deep water off the Egyptian Mediterranean Sea. It is an Ommastrephid inhabiting the water column on the continental slope and shelf lives a wide range of depths from 20 to 1100 m, being common between100 and 400m (Guerra, 1992). It is widely distributed in the Mediterranean Sea generally caught by bottom trawls. Distribution of *I. coindetii* has been studied in the eastern Mediterranean by several authors (Belcari and Viva, 1989; Roper *et al*., 1998; González *et al*., 1992 b; Guerra, 1992; Katagan *et al*., 1993 and Perdichizzi *et al*., 2011). There is some data concerning its biology (Nigmatullin and Vovk, 1972; Sánchez, 1981; Sánchez, 1982; Ragonese and Jereb, 1992; González, 1994; Jereb and Ragonese, 1995; Belcari, 1996; González, *et al*., 1996; Ceriola *et al*., 2006; Arkhipkin *et al*., 2000; Arvanitidis *et al*., 2002; Ceriola and Milone, 2016.and ; Salman, 2017). Recently, other studies have focused on the species in relation to fisheries and management (Sánchez, 1990; González *et al.* 1992a,;1992b, Tursi and D'Onghia, 1992 ; Martin, 1993 and Arvanitidis *et al*., 2002). The objective of the present investigation was to study the growth, seasonal changes in the gonads, and the length at maturity (L_{50}), mortality rates and exploitation rate of important species, *Illex coindetii* from the deep water off the Egyptian Mediterranean Sea for the future management of their stocks.

MATERIALS AND METHODS

Study area

Izbat El Burg fishing port is home to approximately 10,000 fishermen (constituting 1% of the total Egyptian fishermen). It is located in the northern part of Egypt opposite to Ras El Bar city; it lies 15-km, northeast of the Damietta Governance (Fig. 1).

Fig. 1: A map of the Egyptian Mediterranean Coast showing the sampling landing sites: Izbat El Burg port, Damietta Governorate.

Sampling analysis:

Illex coindetii samples were collected seasonally during 2016 from the vessels operating by the deep-water fishery off the Mediterranean, and landing their production at Izbat El Burg fishing port.

The mantel length-body weight (BW) relationship, a total of 370 specimens of *Illex coindetii* were taken for the estimation of all biological characteristics. The mantle length-weight relationship was estimated according to the equation of Le Cren (1951): $BW = a\ DML^b$, where (BW) is the total body weight, (DML) is the dorsal mantle length, while (a) and (b) are constants.

Aging:

Age determination was computed by applying Bhattacharya method (1967) depending on the dorsal mantle length frequency data (DML), which were analyzed using FISAT II (Gayanilo *et al*., 1996). ELEFAN I method was used to estimate the von Bertalanffy (1938) growth parameters, asymptotic length, L_∞ and the annual growth coefficient K. The constant "t_0" was estimated by (Pauly 1983) according to the following equation: $\log(-t_0) \approx -0.3922 - 0.2752 \log L\infty - 1.038 \log K$

Gonadsomatic index: (GSI) was determined by using the following equation:
GSI = (gonad weight /gutted body weight x 100).

Length at sexual maturity: Sex and maturity stages were identified in all samples. Length at sexual maturity (Lm_{50}) is the length at which 50% of *Illex coindetii* reach their sexual maturity; it was estimated by fitting the percentage maturity against mid-lengths (king, 1995). Lm_{50} is represented at the point on X-axis corresponding to 50% point on Y-axis.

Age at maturity it's the average age at which fish of a given population mature for the first time. It is calculated from the size at first maturity using the inverse of the von Bertalanffy growth, function: $t_m = t_0 - \ln(1 - L_m/L_{inf})/K$

Mortality was estimated by using Jones and van Zalinge method's (1981). This method was applied to investigate the annual instantaneous total mortality (Z) using the cumulated catch curve of the length composition information as follows:
$\text{Ln}(Cn) = a + (Z/K)\,\text{Ln}(L\infty - L)$, where Ln (Cn) is the cumulative frequency. A linear regression between Ln (Cn) and Ln (L∞- L) was done and the slope = -Z. The annual mortality (A) is computed as A = 1 - S where, S is survival rate, which is computed from the equation, $S = e^{-z}$ (Ricker, 1975).

Natural mortality (*M)* was estimated by Charnov *et al.* (2013) method, where von Bertalanffy growth parameters are used: $M = (L/L\infty)^{-1.5} \times K$, where $L\infty$ and K are (asymptotic length and growth coefficient), and L = fish length at age.

Fishing mortality (F) was expressed as F= Z - M and the **exploitation rate (E)** was estimated as F/Z according to (Gulland, 1971).

Length and age at first capture (L_c) was computed by $L_c = 40\% \, L_{max}$ (Beverton and Holt, 1964), where L_{max} is the maximum length while the corresponding age at the first capture (T_c) was computed by converting L_c to age using the von Bertalanffy growth equation as follows :$T_c = t_0 - (1/k * \text{Ln}[1 - (L_c/L_\infty)])$.

The optimum length at capture was calculated by (Beverton, 1992) formula:
$L_{opt} = 3L_\infty / (3 + M/K)$

RESULTS

Length frequency distribution

Samples of *Illex coindetii* were collected seasonally from the trawl deep water vessels operating in the Mediterranean Sea and represented in Fig (2). It is clear that the dorsal mantle length range was 11.3 to30.7cm with mean 14.8 ±3.7 and the largest specimen was recorded in winter, while in spring the smallest specimen was noted as the length range was 10.5-13cm with mean 13.6±1.9 whereas the range recorded in summer was 7 to27.9 cm with a mean 14.9±3.7. In autumn the length ranged from 5.6 -19.2 cm and the mean was 11.7±3.3.

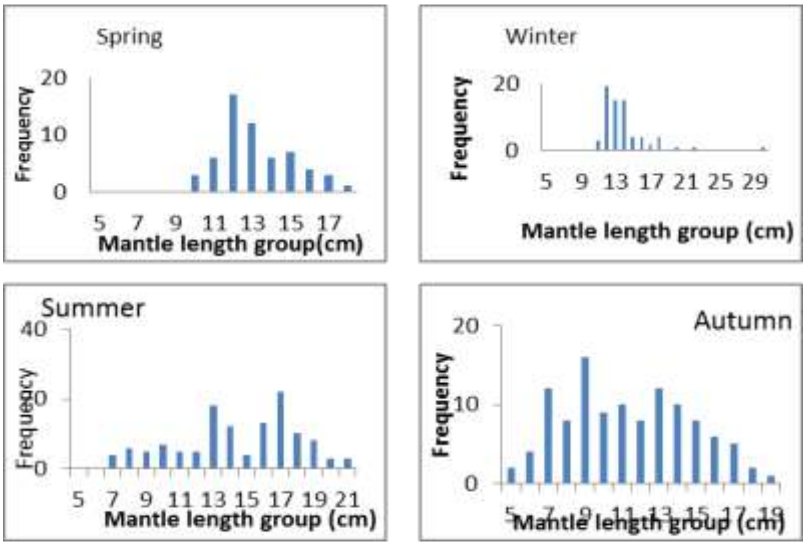

Fig. 2: Seasonal Mantle - Length frequency distribution for *Illex coindetii* from the deep water off the Egyptian Mediterranean Sea**.**

Length-weight relationship:

A total of 370 specimens of *Illex coindetii* (189 males and 157 females and 24 unidentified sex were analyzed. Males were slightly smaller and lighter than females (***p*** < 0.001 for both total mantle length and body weight). Mean total mantle length for males was 12.17±2.8 cm (min = 5 cm; max = 20 cm), while in females, it was 15.77± 3.3 cm (min = 7 cm; max = 30.7 cm). Mean weight for males (91.3±55.26 g; min = 6.5 g; max = 229 g), which was lower than that for females (133.2±82.1 g; min = 14 g; max = 812.8, g) Fig (3). The values for mean weight by sex were simply compared by two-sample t-test. The results show that females were larger than males and significant difference (p<0.05) between males and females (differences 41.9, pooled standard deviation 68.74, standard error7.4 to 23, 95% CL 27.3 to 56.5 test statistic t 5.645, DF 344, significance level (p=0.0001) significant difference.

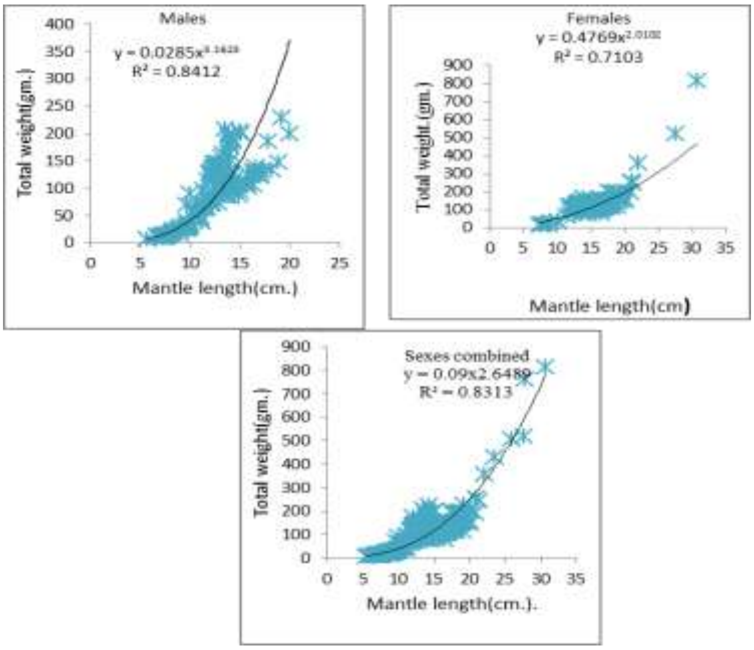

Fig. 3: Dorsal Mantle Length –Weight relationship of *Illex coindetii* males, females and sexes combined..

The regression between DML and BW for females and sexes combined showed a sharp negative allometric growth as all values of b (2.01,2.648) were significantly different from the isometric 3 ($p < 0.05$). In contrast, the calculated b value for males (3.16) was significantly higher than 3 and therefore revealed a positive allometric growth indicating that weight increases faster than length Table. (1).

Table 1: Mantle length-weight relationship parameters *of Illex coindetii* (males, females, and sexes) from the deep water off the Egyptian Mediterranean Sea.

L-W parameters	Males		Females		Sexes combined.	
	Min-Max	Mean ± SD	Min-Max	Mean ±SD	Min-Max	Mean ±SD
Length	5.6-20	12.17±2.8	7.4-30.7	15.77±3.3	5.6-30.7	13.9±3.8
Wight	6.5-229	91.3±55.26	14-812.8	133.2±82.1	6.5-812.8	114.9±86.3
(a)	0.02		0.47		0.09	
(b)	3.16		2.01		2.64	
(r)	0.84		0.71		0.83	
(No.)	189		157		370	

Aging

The length frequency data of *Illex coindetii* was analyzed by Bhattacharya (1967) method for (189) males, (157) females and sexes combined (370) and the results illustrated at (Fig. 4, Table 2). It is shown that the males achieved lengths of 7.24, 12.30 and 16.44 cm, at the end of zero, 1^{st} and 2^{nd} year, respectively, where females attained 7.5.13.45,17.33 and 20.4cm at the end of zero, to 3^{rd} year and the pooled sexes reached 7.3,12.46.17.19 and 20.84 cm at the end of zero, to 3^{rd} respectively. The age group I was recorded by a high percentage (72.6, 64.5 and 58.1%) for males, females, and sexes combined respectively.

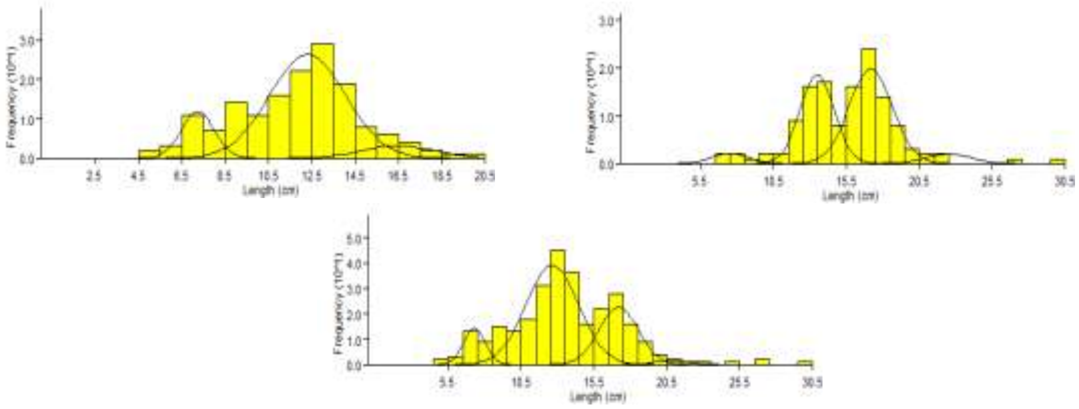

Fig. 4: Length frequency of *Illex coindetii* males, females and sexes combined separated into normally distributed components using Bhattacharya method.

Table 2: Mean length with standard deviation (SD) and Age composition for each age group of *Illex coindetii* as estimated by the Bhattacharya method.

Sex	Mean length at age group (Mean ±SD) with Age composition							
	0	%	I	%	II	%	III	%
Males	7.24±0.76	24.20%	12.3±1.76	72.60%	16.44+_1.69	3.20%		
Females	7.5±1.2	4.50%	13.45±1.756	64.50%	17.33±1.25	27.75%	20.4±1	3.30%
Sexes combined	7.3±0.74	19%	12.46±1.61	58.1	17.19±1.35	19.60%	20.84±1.22	3.30%

Growth

The growth parameters were evaluated using ELEFAN I and the results showed that $L\infty$ for males, females, and pooled sex was 21, 31.5 and 31.5 cm, respectively, and the values of annual growth rate (k) were 0. 570, 0.22 and 0.28/year, while t_0 was calculated at -0.314, -0.755 and -0.587, respectively.

Sex ratio

To study sex ratio about 346 individuals of *Illex coindetii* 189(55%) males and 157(45%) females were investigated. Sex ratio showed highly significant values from the expected 1:1 in all length groups were (X^2 ranged from 3.24 to 27.0, P <0.05) excepted of length groups 13-14cm, was no significant difference where both male and female populations occurred ($p > 0.05$) (Table.3) where females were dominant after the length group (19-20 cm.).

Table 3: Variation in Sex ratio according to size group of *Illex coindetii* from the deep water off the Egyptian Mediterranean Sea.

Mid-length	Total. No	Male		Female		Sex ratio	P -value	X^2
		No.	%	No.	%			
5-6	5	5	100.00	0	0.00	-----	-----	-----
7-8	22	18	81.82	4	18.18	1: 0.22	*0.003	8.91
9-10	30	27	90.00	3	10.00	1: 0.11	*0.000	19.20
11-12	72	58	80.56	14	19.44	1: 0.24	*0.000	26.88
13-14	100	59	59.00	41	41.00	1: 0.69	0.072	3.24
15-16	50	14	28	36	72	1: 2.60	*0.002	9.68
17-18	48	6	12.50	42	87.50	1: 7	*0.000	27.00
19-20	13	2	15.38	11	84.62	1: 5.50	*0.013	6.231
21-22	4	0	0.00	4	100.00	-----	-----	-----
2728	1	0	0.00	1	100.00	-----	-----	-----
29-30	1	0	0.00	1	100.00	-----	-----	-----

* Significance difference

Seasonal variation of sex ratio:

Seasonal variations of sex ratio for *Illex coindetii* (Table 4) clear that males dominated the catch in all seasons with higher ratio during summer (65%).Generally, for the whole period of investigation; males accounted 55% of the total catch with sex ratio (1: 0.83). The chi-square value computed was 2.96; p = 0.085(p >0.05) this value showed no significant difference between both sexes.

Table 4: Seasonal variation in the sex ratio of *Illex coindetii* from the deep water off the Egyptian Mediterranean Sea.

Season	Males		Females		Sex ratio	Chi-Square	Sig.
	No	%	No	%	M: F	Value	P-value
Winter	34	49%	35	51%	1: 1.03	0.14	0.904
Spring	52	48%	56	52%	1: 1.08	0.148	0.700
Summer	73	65%	39	35%	1: 0.53	10.32	*0.001
Autumn	30	53%	27	47%	1: 0.90	0.158	0.691
Total	189	55%	157	45%	1: 0.83	2.96	0.085

Gonado-Somatic Index (GSI):

The seasonal mean values of GSI of *Illex coindetii* (Fig. 5), it is clear that there were two peaks in GSI of males and females, one in spring and the other in autumn

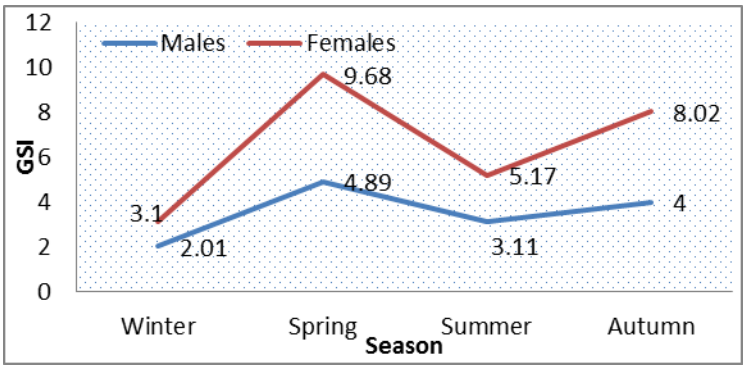

Fig. 5: Seasonal variation in Gonad somatic index of *Illex coindetii* from the deep water off the Egyptian Mediterranean Sea.

Length at first sexual maturity

Lm_{50} values ranged between 11.0 and 11.9 cm with a mean length of 11.51± 0.325 for males and between 14-14.9 with mean length14.35 ±0.298 for females Fig (6). T-test showed that there was a significant difference for (L_{m50}) between sexes in *Illex coindetii*. (P <0.05) (Difference 2.84), (pooled standard deviation 0.311), (SD, 0.105), (95%CI2.625 to 3.05), (statistic t 26.96) with high significance level p<0.0001.

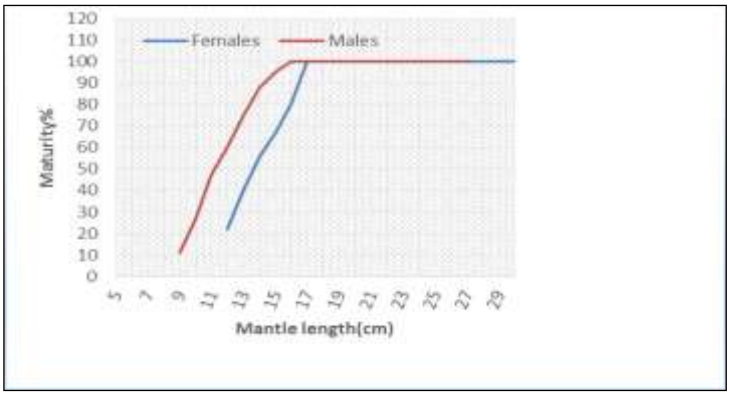

Fig. 6: Length at first sexual maturity for *Illex coindetii* from the deep water off the Egyptian Mediterranean Sea.

The length age at first capture (L_c) was estimated as 8, 12 and 12 for males, females, and sexes combined respectively, which corresponding to age 0.527, 1.566 and 1.23.

The optimum length at capture (L_{opt})

L_{opt} was calculated as 13.36, 17.38 and 18.6 cm for males, females, and sexes combined of *Illex coindetii*.

Mortality and exploitation rates

The annual instantaneous total mortality (Z) were 2.94, 2.76 and 2.79 / year for males females and sexes combined Fig (7). The calculated survival rates (S) were0.05%, 0.06%, and 0.06 % respectively, then the mean annual mortality was 99.95% for males, 99.94% for females and 99.94 sexes combined. The mean values of natural mortality (M) were 1.05, 0.74 and 0.74/year, respectively. The fishing mortality was estimated at 1.98, 2.02 and 2.05/year. The exploitation ratio was lower in males 0.64 than in females 0.73 and 0.73 for sexes combined.

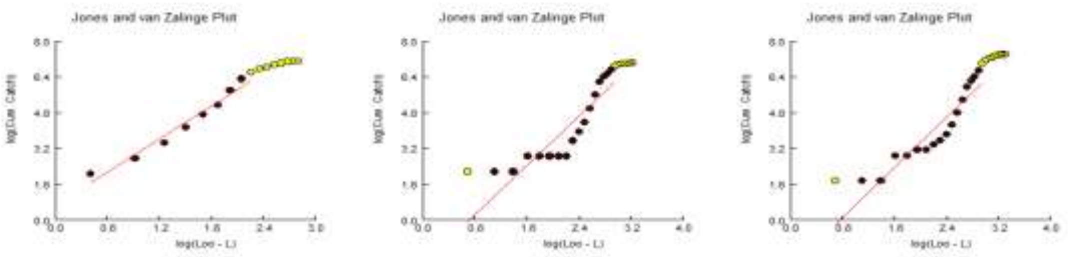

Fig. 7: Total mortality rates for males, females, and sexes combined for *Illex coindetii* by Jones and van Zalinge's (1981).

DISCUSSION

Length–frequency data provide valuable information about the life history of a fish species and give information on the dynamics of fish populations and help identify problems such as age-unsuitability, slow growth or excessive mortality. However, the reliability of the analysis largely depends on the sampling approach and the size of the samples investigated. *Illex coindetii* is a medium-sized squid, commonly reaching 200–250 mm ML throughout its distributional range (Roper *et al.*, 2010a). Large specimens of longer than 300 mm ML were captured on both sides of the Atlantic and the Mediterranean. In the present study, the maximum mantle length is recorded for females at 30.7 cm while for males equal 20 cm. This corresponds to (González *et al.,* 1996) in northeast Atlantic recorded 379 mm mantle length for females and 279 mm, for males. While the maximum size of 320 mm ML reported for males by (Sánchez *et al.* 1998b; Roper *et al.*, 1998; Ceriola *et al.*, 2006; and Perdichizzi *et al.,* 2011).

In the current study, there was a significant difference of the dorsal mantle length-weight relationship between males and females ($p < 0.05$) with 'r' values of 0.84 and 0.71 for males and females respectively. The growth exponent ('b' values) was 2.01for females indicating sharp negative allometric growth. The predicted ('b') for males was 3.16 significantly more than 3 appearing a positive allometric growth indicating that weight increases faster than length. The significantly higher slope was observed in male compared to female indicating faster growth of male.

This result approves with the previous results were achieved from different regions of the Mediterranean Sea and the eastern Atlantic, as well as the different year. (Ragonese and Jereb, 1992; González *et al*., 1992a; Jereb and Ragonese, 1995; Belcari, 1996; Hernandez- Garcia and Castro, 1998; Sanchez *et al.,* 1998; Arkhipkin, Jereb and Ragonese, 2000; Arvanitidis *et al.*, 2002) are found that allometric length-weight relationship which is positive in males ($b>3$) and negative in females ($b<3$). In contrast with (Sanchez *et al*., 1998) from Spanish coasts and (Ceriola *et al.*, 2006) from the South Adriatic stated that both sexes show positive allometry. Moreover, (Belcari, 1996) stated that mature animals show positive allometry growth while immature show negative allometry. (Belcari, 1996 and Ceriola *et al.*, 2006) found that the morphometric changes occurring during the gonad maturation induce a positive allometric growth in males and isometric growth in females. The change of "b" values depends primarily on the shape and the fatness of the species, and various factors like temperature, salinity, food, sex and stage of maturity (Sparre and Venema, 1992).

Estimation of age and growth is essential for proper understanding the life history and reproductive strategies of harvested species, as well as its parameters, are necessary for assessment and fisheries management plan. The growth and lifespan of *Illex coindetii* were examined for the first time from fishing in deep water off the

Egyptian Mediterranean Sea noted two age groups with zero group of male and three age groups with zero group of females and sexes combined. This is comparable to (González *et al.*, 1996; Sánchez *et al.*, 1998; Arkhipkin *et al.*, 2000 Ceriola *et al.* 2016) stated that the lifespan of females *I. coindetii* usually showed a faster growth rate and longer than males. Table (5) shows that lifespan estimates of *I. coindetii* vary from (6 to 24 months). Arkhipkin *et al.*, 2000 in the Sicily Channel stated that the same lifespan for males and females ranged from 6-7 months based on statoliths reading. While *Illex coindetii* lives less and grows faster than in the northwestern Mediterranean Sea. (Sánchez, 1995) found that *I. coindetii* lifespan was 12-18 months for females and males, used length frequency distribution. (González *et al.,* 1994) in the Galician waters reported that the lifespan was 15 months for two sexes, used Model progression analysis. (Mangold-Wirz, 1963a) in the western Mediterranean Sea, used length frequency analysis and concluded that the life span 20 and 24 months for males and females respectively. (Ceriola and Milone 2016) recorded female lifespan ranged from128 to 234 days longer than males 124-178 days. The variances in lifespan are due to the differences of individual size in the sample and in environmental condition especially temperature which affected on growth.

Table 5: Maximum mantle length and lifespan of *Illex coindetii* from the Northeast Atlantic and the Mediterranean Sea.

Method	M	F	Lifespan (months)		Region	Reference
	ML(mm)	ML(mm)	Female	Male		
cohort monitoring	200	263	24	20	Western Mediterranean	Mangold-Wirz (1963a)
cohort monitoring	140	170	17.7	16.6	Catalan Sea	Sánchez (1984)
MPA	279	379	15	15	Galician waters	González (1994)
			12	18	Northwestern Mediterranean Sea	Sánchez, 1995
statoliths	230	300	10	8	West Sahara	Arkhipkin (1996)
statoliths			18	18	Western Mediterranean Sea.	Sánchez *et al.* (1998b)
statoliths			6–7	6–7	Sicilian Channel	Arkhipkin *et al.* (2000)
MPA	217	286	18	11	Southern Celtic Sea Bay of Biscay	Arvanitidis *et al.* (2002)
statoliths	156	210	128-234 days	124-178 days	Central Mediterranean	Ceriola and Milone 2016
Bhattacharya (1967)	20 cm.	30.7cm.	2 years With zero group.	3 years With zero group.	Deep water off the Egyptian Mediterranean Sea.	Present study

MPA=modal progression analysis

In the present study sex ratio by length frequency of *Illex coindetii* revealed that males represented 55% of the total catch with a sex ratio (1:0.83). It is close to the previous study in the Mediterranean and in the eastern Atlantic recorded about 50 % .While it is vary slightly between areas. In the Mediterranean, Sicilian Channel it fluctuates between 46.4 and 46.6 % whereas in the Catalan Sea counted 53.2 %. In the eastern Atlantic it varies between 43.8 % and 55.9 % in the western African coast 16°– 29°N and 11°–15°N respectively. In the present study sex ratio showed highly significant values in all length groups were (X^2 ranged from 3.24 to 26.88, P <0.05) except length group at sexual maturity13-14 cm were no significant difference (P >0.05). Length at first sexual maturity L_{m50} values was 11.51cm for males and 14.35 cm for females. The nearly similar results observed in different parts of the Mediterranean Sea. (Arvanitidis *et al*., 2002) from the neighboring Greek Seas found that ML_{50} males 113 mm ML; females 179 mm ML. (Ceriola *et al*., 2006) from Adriatic reported ML_{50}, males 137 mm ML; females 146 mm ML. (Jereb and Ragonese, 1995) from Sicilian Channel estimated ML_{50}, were 120 mm and 150 mm for males and females respectively. (Perdichizzi *et al*., 2011) from the southern Tyrrhenian Sea found that ML_{50}, males 105 mm ML; Females 150 mm ML. (Salman, 2017**)** in the Aegean Sea, Eastern Mediterranean, was observed. ML_{50} was 139.3 mm ML for males' and 164.8 mm ML for females. All previous results attained that the males were reached maturity at a smaller size than females.

Seasonal variation in gonad somatic index clear that females recorded higher GSI than males in all seasons. There were two peaks in GSI of females, and males one in spring and the other in autumn. This result agrees with the previous results were attained from other areas of the Mediterranean.(Sanchez , 1995 and Ceriola *et al*., 2006)) from the Mediterranean coasts of Spain were reported that the spawning of *I. coindetii* occurred throughout the year with increased in some seasons. Our results agree with (Salman, 2017**)** in the Aegean Sea, eastern Mediterranean, recorded two peaks in GSI of females, one in spring and the other in autumn/early winter. While in comparing (Perdichizzi *et al*., 2011), recorded that two reproduction peaks observed, one in early summer and the other in autumn. The previous results point out spawning may occur year-round, but seasonal peaks exist and differ widely through the geographic range.

The total mortality coefficient (Z) for the sexes combined of *Illex coindetii*, was 2.79. The calculated survival rate (S) was 0.06 that's means about 0.06% only of *Illex coindetii* survive per year after their first year of life. The calculated annual mortality rate was (A) = 99.94%. The obtained results show that the natural mortality coefficient (M) was found to be 0.74, with a percentage of 0.27% of the total mortality. While fishing mortality was estimated at 2.05 with the percentage of 0.73%. The previous result illustrated that *Illex coindetii* from the deep water off the Egyptian Mediterranean Sea is exposed to high fishing pressure. The current exploitation rate was recorded as 0.73 this value was more than 0.50 for the optimum condition of exploitation (Gulland, 1971). This means that the stock of *Illex coindetii* was overexploited. The length at first capture (L_c) which related to the trawl cod-end mesh size was examined as 8cm, 12 cm and 12 cm for males, females, and sexes combined respectively. It is obvious that L_c is lower than the length at maturity (L_{m50}), which was found to be 11.51cm for males and 14.35 for females. The length, which gives the maximum possible yield (L_{opt}) the optimum length at capture was estimated at 13.36, 17.38 and 18.6cm for males, females, and sexes combined respectively. It is clear that it was larger than a length at first maturity and length at first capture. The previous analysis suggested that *Illex coindetii* exposed to overexploitation where the equilibrium between the amount of fishing and the conservation not found for this species in this area.

CONCLUSION

Illex coindetii stock from the deep water off the Egyptian Mediterranean Sea must be managed by decreasing the present fishing pressure and increasing the length at first capture (L_c) by taking size at first maturity (L_{m50}) as a reference point of minimum legal size to prevent stock depletion. The spawning season was found to take place during spring and autumn, so it is recommended to reduce fishing activity during this period.

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