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Current status of *Liza ramada* (Risso, 1810) (Mugilidae) caught by trammel net (Ballah) at El-Gamil region, Manzala Lake, Egypt

El-Azab E. Badr El-Bokhty* and Amal M. Amin
Fishing Gear Lab. and Fisheries Biology Lab., NIOF, Alexandria

*Corresponding Author:elbokhty@yahoo.com

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ABSTRACT

Liza ramada, the target species caught by trammel net (Ballah) at El-Gamil region, north of Lake Manzala, is studied to estimate the life history parameters by using length–frequency data of 842 specimens. The life span was estimated as 4 years. It exhibited a negative allometric growth (b=2.94). The von Bertalanffy growth parameters were L_∞= 30.45cm, K= 0.48 yr^{-1} and t_0 =-0.339 yr^{-1} with a derived growth performance index of Ø′ =2.6 .The mean annual instantaneous total, natural and fishing mortality coefficients were 1.47, 0.71and 0.76/year, respectively. The exploitation rate was estimated as 0.52. The probability of capture ensured that 50 percent (Lc) of the fish caught was estimated at length 12.18 cm which is 31.2% lower than the length at first sexual maturity (17.7 cm) and lower by 40.1% than the estimated L_{opt} value (20.4 cm). This result reflects the smaller mesh sizes of the inner layer of nets used by fishermen. Therefore an urgent recommendation should be applied to prevent the illegal fishing gears, increase the mesh sizes especially for the inner layer of trammel net used as well as improving the quality of water discharged into the lake to increase the yield per recruit of *Liza ramada,* protect fish stocks and to secure a profitable fisheries and optimum catch efficiency for the future.

INTRODUCTION

Due to anthropogenic disturbance, many natural aquatic resources have suffered severe decline in abundance and yields, and some have even been driven to the point of collapse (Lorenzen *et al.*, 2016). Lake Manzala is considered one of the most important lakes in Egypt It represents 32% of the lakes fish production in Egypt and 44% of the

Northern lakes. The lake exposed to high levels of pollutants from industrial, domestic and agricultural resources (Ibrahim *et al.*, 1999) .The Lake receives annually about 4000 million cubic meters of untreated industrial, domestic and agricultural drainage water, through several drains. Mullets are euryhaline fish widely distributed in tropical and subtropical and estuaries. Mullets are catadromous spawning migrating fish, the young life before maturity remains predominantly in the system of rivers and lakes (El-Deeb *et al.*, 1996). Thin-lipped mullet, *Liza ramada* (Risso, 1826) is a pelagic species inhabiting various habitats, from shallow brackish and marine waters close to lagoons, estuaries and river deltas, and surviving in extreme salinity conditions as well as abrupt changes of water quality (Thomson, 1990). It is found along East Atlantic coasts, the Mediterranean and the Black Sea .

Trammel nets are widely used not only at Lake Manzala but also all over the northern Delta lakes and River Nile and its tributaries (El-Bokhty, 2017). They are an effective fishing gears in multispecies fisheries. In this respect, numerous numbers of economic or non-economic species including the target species are caught by these nets (Kalaycı and Yeşilçiçek, 2012). Two types of trammels are used in the lake, one for Tilapia called locally as Daba and the other called as Ballah used mainly for catching mullets at the northern part.

The biology and dynamics of Mugilid species were studied in the different water bodies in Egypt (Youssef , (1973); Abdel-Baky and Bahnasawy , (1993); Khalil, (1997) El-Gammal and Mehanna , (2004); Mehanna , (2006) ; Mehanna and El-Gammal (2007); El-Aiatt *et al*. (2018) and Mehanna, *et al*. (2019). This is the first study concerning the age, growth, and mortality rates with length at first capture, length at first sexual maturity and optimum length of *Liza ramada* in Manzala Lake during 2018 seasons. Information about (L_c, L_m and L_{opt}) provides important baselines that can be used to detect future shifts in *L. ramada* stock in Manzala Lake.

MATERIALS AND METHODS

Study site: Lake Manzala, the largest brackish coastal lake (about 700 km^2), serves three governorates of Nile Delta namely, Port Said, Dakahlia and Damietta. It is located in the northeastern shoreline of the Nile delta between Long 31° 45' and 32° 15'E and. Lat 31° 00' and 31° 25' N (Fig. 1). The lake is shallow with an average depth of about 1.0 m. It is connected to the Mediterranean Sea via three outlets, facilitating the exchange of the biota and water from the lake to the sea, these outlets are El Boughdady, El-Gamil, and the new El-Gamil (Mohamed, 2008).

Fig. (1). Manzala Lake

Fish Sampling and Data Collection: Muglid and total catch data in Manzala Lake were analyzed according to catch reports of CAPMAS (1995 - 2016) and GAFRD (2012 - 2018). Fish samples were taken seasonally from fishermen working with trammel net (Ballah) at the northern area (El-Gamil) near El-Boughaz, where the more saline water entering the lake Manzala.

TRAMMEL NET: In Manzala Lake, two types of trammel nets are used by the fishermen, Trammel net (Daba) for catching tilapia fish which are widely used along most areas of the lake and trammel net (Ballah) which are restricted for catching surface mullets at the more saline northern area (El-Gamil) of the lake. In general, the design of the two types is nearly the same in construction except that the mesh size of inner layer of trammel net (Ballah) is narrower and more slacked than that of Tilapia catching trammel net (Daba), beside the depth of the net is lower and supplied with little lead pieces on the lead rope to work on surface.

The trammel net (Ballah) has an outer large layers of mesh sizes varying between 124.21, 114.9 and 116.81 mm, while the inner layer mesh sizes varied between 34.72 34.7 and 34 .86 mm among different fishermen (Fig. 2)**.**

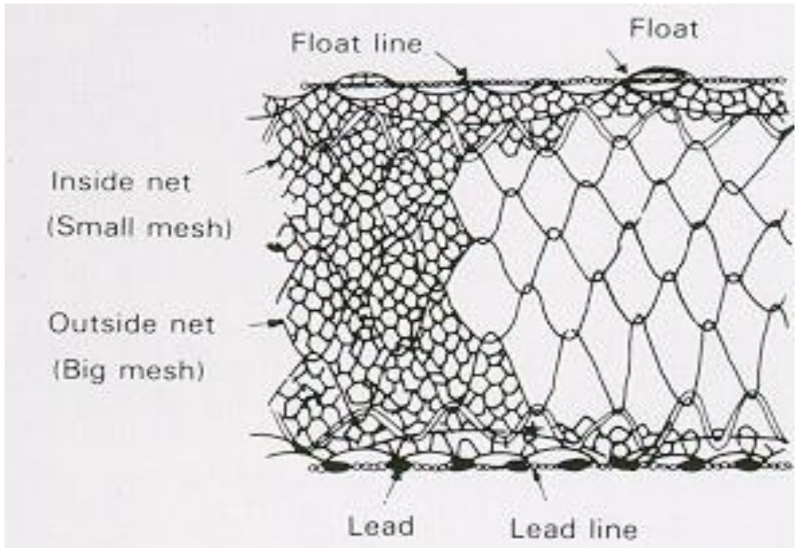


Fig. (2). Trammel net

During the period from January to December (2018), a total of 952 fish were collected and sorted in the laboratory to the species level. Majority of the catch (842) was represented by *Liza ramada* fish. Hence, it is considered as the target fish species caught by surface trammel net (Ballah). The total length to the nearest 0.1 cm and total weight to the nearest 0.1 gm was measured for each fish.

Length-weight relationship: The relation between length and weight of fish was analyzed by using the following equation $W = a\ L^b$ (Ricker, 1975) Where, W=weight of fish (gm); TL=total length of fish (cm). The values of (a) and (b) were given a logarithm transformation according to the following formula Log W = log a + b Log L (Pauly, 1983). Where, *b* represents the slope of the line and (a) is the intercept. The coefficient of determination (R^2) was used as an indicator of the quality of this regression. The value of (*b*) provides information on the fish growth type (isometric or allometric). The relationship was tested for significance by using Minitab 18 software.

Age determination: Aging is determined by using the modal progression analysis (Bhattacharya, 1967), incorporated with FiSAT software (Gayanilo et al. 1996) to identify the approximated modal lengths at the different age cohorts.

Growth , Mortality and Survival Rates: The length frequency data of *Liza ramada* was used to estimate the von Bertalanffy growth parameters such as the asymptotic length (L_∞) and the growth coefficient (K) was obtained by using ELEFAN method incorporated in FiSAT II software (Gayanilo *et al.*1996).

These parameters were used for the estimation of different mortality rates (Z, M and F) and exploitation rates of *Liza ramada* stock. The Phi-prime index ($\text{Ø}'$) for the species concerned was used to estimate the growth performance index as ($\text{Ø}'$) = log K+ 2 log L_∞ (Munro and Pauly, 1983; Moreau *et al*., 1986). Survival rate (S) was estimated from the relation $S= (e)^{-z}$ (Ricker 1975).

The age at zero length (t_o) was calculated from empirical equation (Pauly, 1979) as: $Log\ (-t_o) = -0.392 - 0.275 Log L_\infty - 1.0381K$. The lifespan (longevity T_{max}) was estimated following Pauly's equation $T_{max}=3/K + t_o$.

The total instantaneous mortality rate (Z) was estimated using length-converted catch curve method (Pauly, 1984a) as implemented in FiSAT II. The instantaneous natural mortality rate (M) was estimated according to Hewitt and Hoenig (2005) $M = 4.22/T_{max}$. The instantaneous fishing mortality rate (F) was calculated from the expression F=Z-M. The exploitation ratio (E) was derived from E=F/Z (Pauly, 1980). If an E close to 0.5, so it is considered to describe an optimal level of exploitation, whereas E>0.5 refers to a state of over exploitation.

Length at First Capture (L_c), Length at First Maturity (L_m) and L_{opt} is the size class with the maximum egg production (L_{opt}): The length at first capture (L_c) is estimated using Beverton and Holt, (1966) $L_c = 40\% L_\infty$. 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: $T_c = - (1/k * \ln\{1- (L_c/L_\infty)\}+t_o)$. To estimate the length at first maturity (L_m) for the assessed species, the following equation; $Log\ (L_m) = 0.8979* \log (L_\infty) - 0.0782$ was used according to Froese and Binohlan (2000). The corresponding age at first sexual maturity (T_m) was computed by converting Lm to age as $T_m = -1/k* \ln (1- L_m/L_\infty) + t_0$. L_{opt} is estimated from the von Bertalanffy growth function as: $L_{opt} = L_{inf} * (3 / (3 + M/K))$ (Beverton 1992).

RESULTS

Total fish production and Mullet catch from Manzala Lake: During the period from 1995 to 2016, the total fish production fluctuated between the maximum value at 2013 (81365 thousand MT) to minimum value at 2007(36783 thousand MT) with the mean 58039 thousand MT. During the same period the mullet fish catch showed an increasing trend during the period 2006-2013 (Fig. 3) with an apparent decrease during the last three years (2014-2016). The main fish species were recorded as tilapia which contributed (49% of total fish production of the lake), followed by catfish (15.9%) and mullets (13%) (GAFRD, 2016).

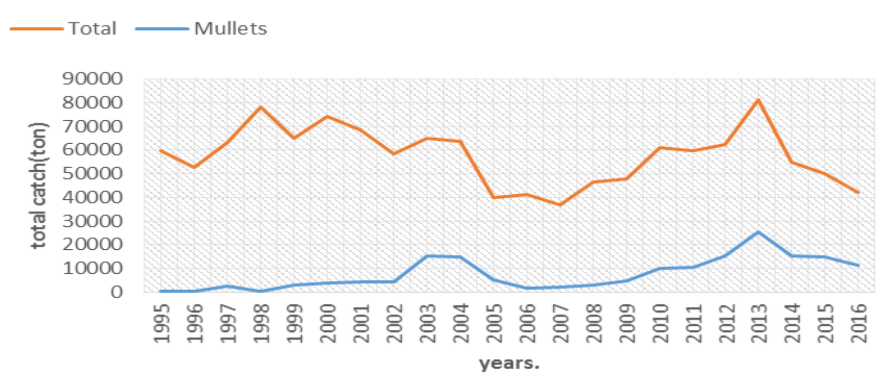


Fig. 3.Total and Mugilidae catch from the Manzala lake during the fishing period from 1995 to 2016..

Species composition of fish caught by trammel net (Ballah) at El-Gamil region during 2018: As shown at Table (1), a total of 952 fish were caught by surface trammel nets (Ballah) at El-Gamil region of Manzala Lake during 2018. Three species of mullets were recorded. *Liza ramada* represented the majority of the catch both by number (88.45 %) and weight (82.5g). Hence, it is considered as the target fish species caught by such nets. *Mugil cephalus* ranked the second order by a total percentage in number (9.56%) and weight (15.06 %.). While, *Liza saliens* represented only 0.32%, 1.67% from numerical abundance and weight respectively. In addition, *Dicentrarchus punctatus* was recorded only by 1.5 % and 0.45% in respective order also.

Table (1). Annual species composition of fish caught by trammel net (Ballah)

	Liza ramada	***Mugil cephalus***	***Liza saliens***	***D. punctatus***	**others**
No.	842	91	3	14	2
No %	88.45 %	9.56 %	0.32 %	1.47 %	0.21 %
Length Range (cm)	11.2 – 29.2	12.6- 37.1	16.4 - 18	14.5 – 17.9	
Mean (cm) ± S.D.	19.86 ± 3.4	20.12 ± 7.2	17.3 ± 0.82	16.25 ± 1.36	
Weight Range (gm)	11 – 230	20 – 516	37-51	29 - 53	
Mean (gm)	77.43 ± 48.77	357.5 ± 24.2	46 ± 7.8	38.3 ± 4.87	
Wt %	82.50 %	15.06 %	1.67 %	0.45 %	0.33 %

Seasonal length frequency distribution of *Liza ramada*:

Seasonal length frequency distribution of *Liza ramada* caught off Manzala Lake during 2018 as represented in Table (2), it shows that the total length ranged from 11.2 to 29.4 and ranged in weight from 11 to 230 gm. Small sizes of *L. ramada* increased during spring and summer (< 15-cm). While, the large sizes appeared at autumn and early winter (Fig. 4).

Table (2). Seasonal average lengths and weights of *Liza ramada* caught off Manzala Lake by trammel net Ballah during 2018

Season	**Winter 2018**	**Spring**	**Summer**	**Autumn**	**Total No.**
No.	175	248	274	145	842
Length Range (cm)	12.3 – 28	11.2 – 27.6	12 – 22.9	13.3 – 29.4	11.2 – 29.4
Mean (cm) ± S.D.	20.35±3.181	19.53±4.06	16.38±2.01	21.3±3.13	19.86±3.4
Weight Range (gm.)	16 – 212	11 - 193	16 - 110	20 - 230	11 - 230
Mean (gm.) ± S.D.	76.78±46.95	72.6±42.77	53.87±23.99	79.77±48.19	77.43±48.77

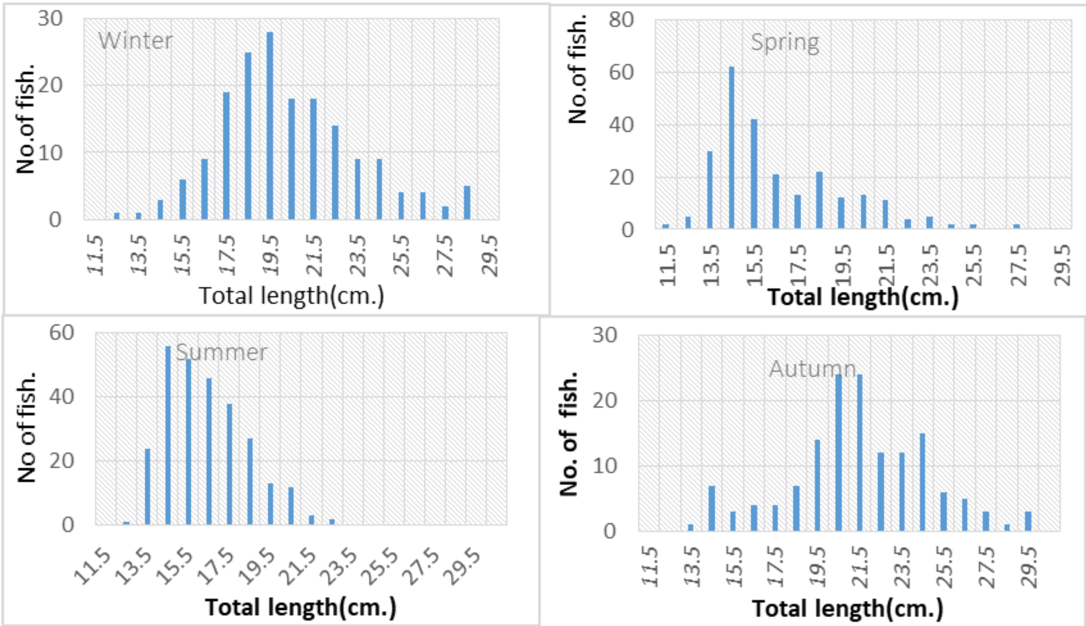


Fig.(4). Seasonal length frequency distribution of *Liza ramada* caught by trammel net (Ballah) from El-Gamil region, Lake Manzala during 2018

Length weight relationship: The size of *L. ramada* ranged from 11.2 to 29.4 cm with a mean total length of 19.86 (±3.4 cm). The weights ranged from 11 to 230 gm (mean 77.43±48.77gm). The logarithmic transformation of the length weight relationship gave a straight line (Figure 5). The value of exponent b was =2.937. The relationship between weight and length of *Liza ramada* was highly significant at $p < 0.05$ and shows that about 99 % (R^2=98.6) of variation in total weight of the fish can be explained by the following linear regression model;

$$\log_{10}(\text{Total weight (gm)}) = -1.981 + 2.937 \log_{10}(\text{Total length(cm)})$$

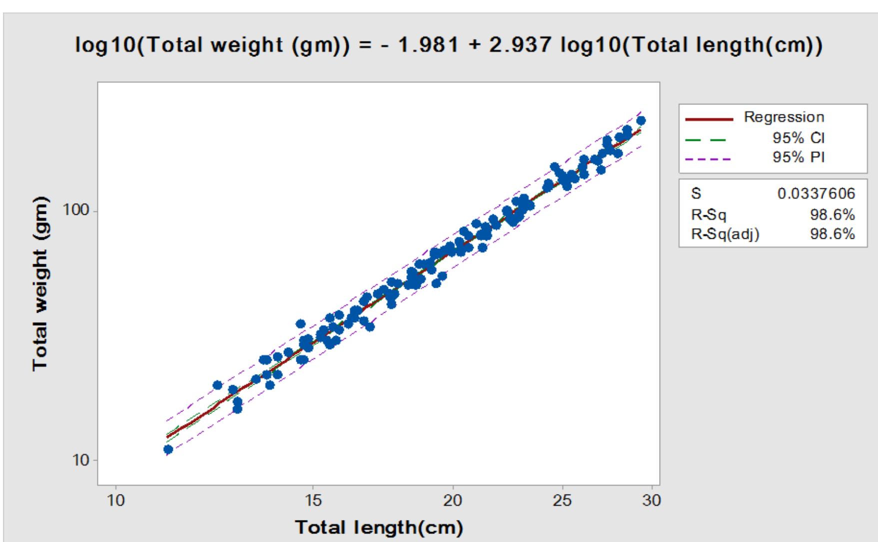


Fig. (5). Length weight relationship of Liza ramada caught by trammel net (Ballah) during 2018.

Age determination: The modal progression method (Bhattacharya, 1967), was adopted to identify the modal lengths of different age cohorts. By using the total annual length frequency distribution of *L. ramada*, four age groups have been detected (Fig.6). Table (2) showed the approximated age lengths were at 14.74cm, 19.9 cm, 24.9 cm, and 27.95 corresponding the four age groups.

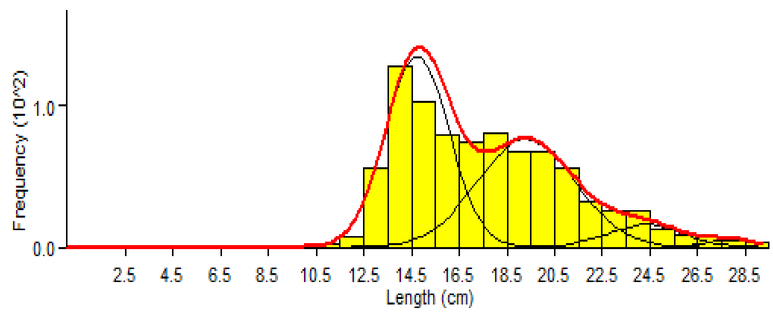


Fig. (6). Age cohorts of L*iza ramada* as estimated by Bhattacharya's method

Table (3). Mean age lengths of *L. ramada* as estimated by Bhattacharya method.

Age group (Yr.)	Computed Mean Lengths (cm)	S.D.	Population	S.I.*
1	14.74	1.33	351	n.a
2	19.90	2.05	415	2.15
3	24.90	1.56	63	2.13
4	27.95	0.99	13	2.08

Note (*): S.I., Separation Index of different cohorts shouldn't be less than 2.

Age composition: The age composition as predicted from the length frequency of *L. ramada* revealed that age groups one and two were the most dominant forming 91% of the annual total (41.7%) for age group one and 49.3% for age group two). Age group three (7.5) and age group four was (1.5%) as shown at Fig.(7). It was revealed that age group one began to increase during spring and summer as shown by seasonal age slicing, while older ages began to disappear (Fig. 8).

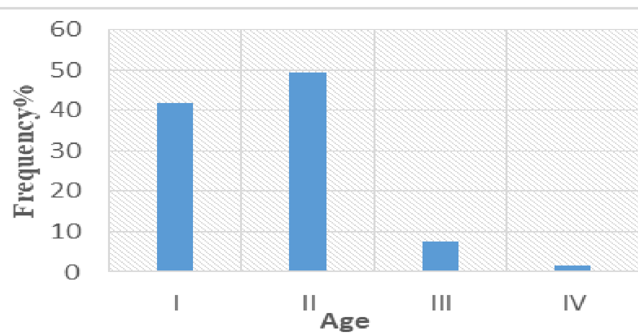


Fig.7. The age composition of L.ramada from the Manzala Lake 2018.

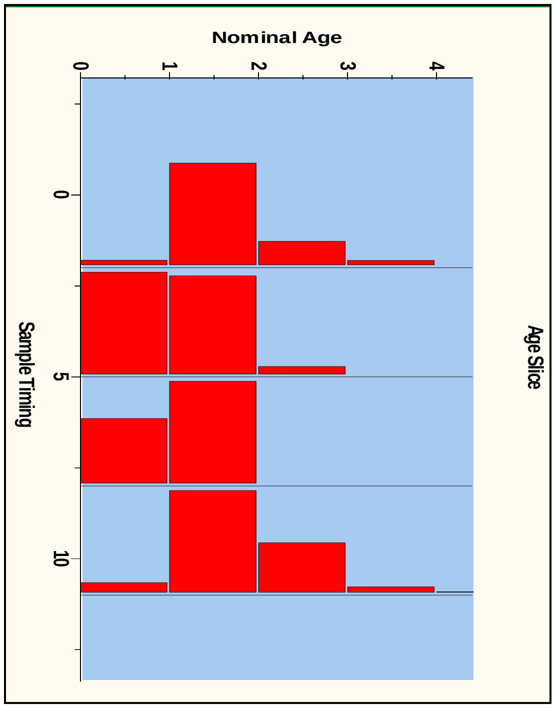


Fig.(8). Seasonal age slices of *Liza ramada* caught off Lake Manzala,
(2=winter, 5=spring, 8=summer and 11=autumn), 2018

Increment in Length and weight: Growth in length of *L. ramada* showed rapid growth at the end of the first year of life (14.74 cm.), whereas in the following years the rate of growth slows down. The annual increment of growth in weight increases with a further increase in age until it reaches its maximum value at age group III (61.44 gm.), after which it shows a gradual decrease with a further increase in age (Figs. 9 and 10).

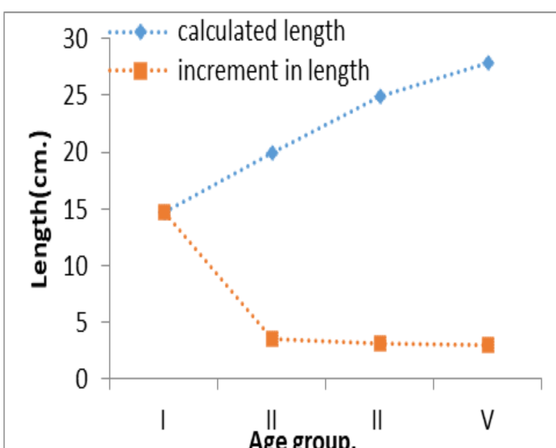


Fig.9.Growth in length and increment of *L .ramada*

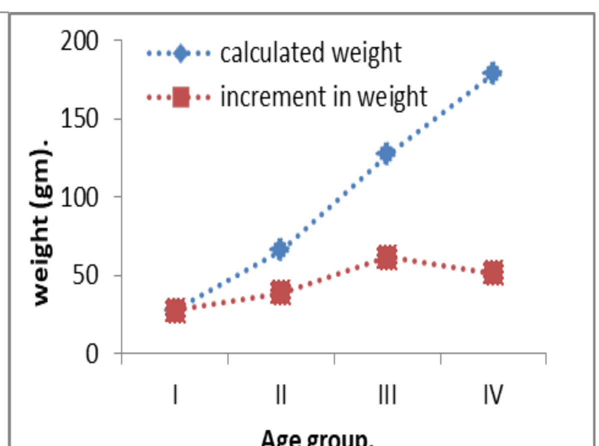


Fig.10.Growth in weight and increment of *L.ramada*

Growth, Mortality and Survival Rates: Estimation of growth and mortality parameters are used to characterize the state of various fish populations and as input variables for bio-demographic models like those of Beverton and Holt (1957). These models are applied to predict consequences of management measures, like changes in effort and mesh size, on the yield. In the present study, the Von-Bertalanffy growth parameters of *L. ramada* were L_∞=30.45cm, the growth constant (which determines how fast the fish approaches its L_∞) K=0.48 year^{-1} and zero-aged length (t_0) = -0.339 year^{-1}. Survival rate of *L. ramada* was estimated as 0.229. The growth performance index (Ø = 2.6) was nearly the same for the same species in lake Borollus (Ø =2.66) as estimated by Hosny and Hashem (1995).

The annual total mortality rates of Z, M and F are estimated as 1.47 yr^{-1}, 0.71 yr^{-1} and 0.76 yr^{-1} respectively with an exploitation rate (E=0.52) (Fig. 11).

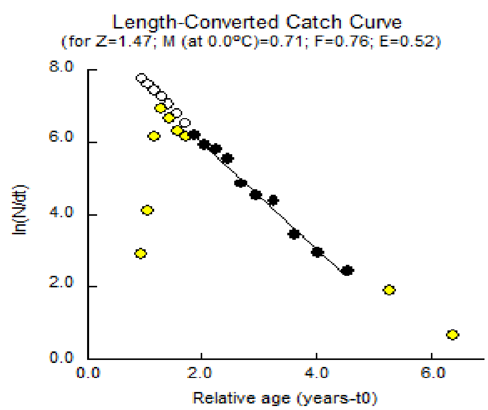


Fig.(11). Length converted catch curve of *L. ramada* ,
El-Gamil region, Manzala Lake, 2018

The optimum length of maximum yield (L_{opt}): It was estimated as 20.4cm and the value of L_{opt}/L_∞ calculated was 0.67.

Length at first capture (L_c) and length at first maturity (L_m): The length at which 50% (L_c) of the fish vulnerable to be captured was calculated at 12.18cm. While, the length at first sexual maturity (L_m) was estimated at 17.7 cm.

Annual length frequency and L_c , Lm and L_{opt}: Configuring L_c, L_m and L_{opt} values on the annual length frequency curve (Fig 12) reveals that much of the catch obtained by trammel net (Ballah) are below 17.7 cm (L_m) where *L. ramada* became matured for the first time and below also the length at maximum yield 20.4 cm (L_{opt}) as shown that the curve is peaked at 14.5 cm total length.

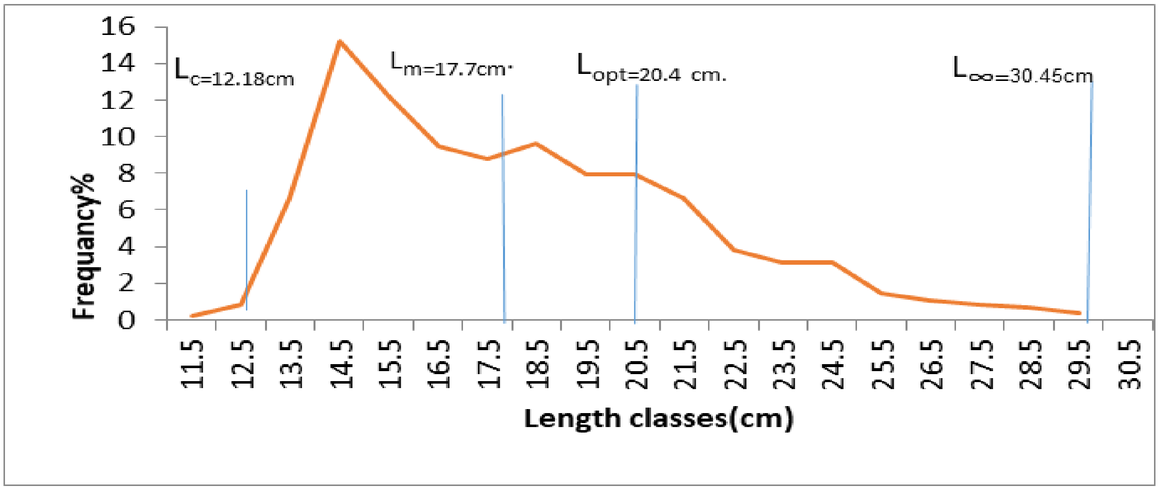


Fig.(12). Length frequency data of *Liza ramada* catches in Manzala configured with L_c , L_m, L_{opt} and L_∞ values

The yield per recruit as a function of T_c and M values: The yield per recruit was calculated by using three different values of T_c (0.725,0.967and 1.24). The obtained results indicate that the yield per recruit increases with the increase of the age at first capture (Fig. 13). While, yield per recruit is conversely related with the change of the natural mortality coefficient (M) (Fig. 14).

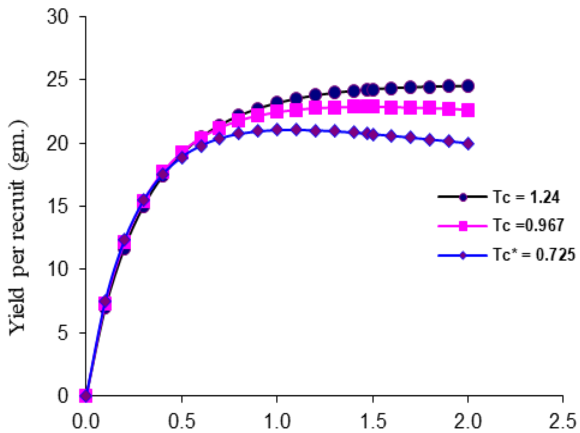
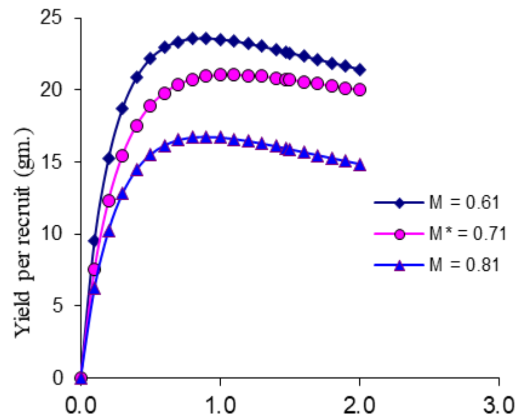


Fig. (13). Yield per recruit (gm.) of *liza ramada* from the Manzala Lake as a function of fishing mortality and age at first capture.



Fig(14) .Yield per recruit (gm) *Liza ramada* from the Manzala Lake as a function of fishing mortality and natural mortality.

DISCUSSION

Egyptian coastal lakes constitute about 25% of the total Mediterranean wet lands. These lakes have an economic importance in terms of that providing more than 75% of total fish production in Egypt. Recently, the coastal deltaic lakes have been subjected to pronounced ecological degradation. Huge amounts of sewage and industrial wastes, in addition to pesticides, insecticides and fertilizers that used for agricultural fields around the deltaic lakes are poured directly without any treatment in the drain system which discharges in turn into the deltaic lakes. Such heavy discharges of pollutant greatly altered the ecosystem of the lakes (Negm *et al.*, 2018). The total fish production in Manzala Lake during the period from 1995 to 2016 revealed that Manzala Lake produced 59.6 thousand MT (14.6% total fish production in Egypt) during 1995 and declined to 42.3 thousand MT (3.4%) during 2016. In Egypt, mullet fish especially *Mugil cephalus* and *Liza ramada* are economically very important fish because they have high market value and have been cultivated successfully by fish farmers. Mullet species recorded a high peak at 2013 with an apparent decrease during the following three years (2014-2016). The dominant trend is a decline in marine species (mainly mullets) this is due to increases in the volume of introduced drainage water and a decrease in salinity.

As revealed from the species composition of fish caught by trammel net (Ballah) from El-Boughaz area (El-Gamil), three mullet species were recorded namely; *Mugil cephalus*, *Liza ramada*, and *L. saliens*. *Dicentrarchus punctatus* appeared in catch due to the beginning of dredging the boughazes at Manzala Lake. Khalil (1997) reported a fourth species *L. auratus*. While, a fifth species, *Chelno labroses,* was reported by Youssef (1973) during the 1960's. In the present work, *Liza ramada* dominated the catch, comprising roughly 88.5% followed by *M. cephalus* comprising 9.6 percent. *Liza saliens* and *Dicentrarchus punctatus* were of minor importance, contributing numerically only by 0.3 and 1.5 % respectively. These results are closed to those recorded by Khalil, (1997) where *Liza ramada* dominated by 88% and *M. cephalus* recorded 7.5% and other species were of 4.5 percent of the total catch.

Length weight relationship: Most fish species tend to change shape as they grow. A fundamental tool for studying morphological variations and life history patterns in many fish species and fish population is finding the relationship between the length–weight (Santos *et al.*, 2002). The length–weight relationships' regression parameters ("a" and "b") of *Liza ramada* from different localities around the world are compared at Table (4). It is clear that the present observation on Length-weight relationship ($Wt = 0.014*L^{2.94}$) of sexes combined agree with those obtained by El-Aiatt *et al.* (2018) in Bardaweel Lagoon and Mehanna *et al*. 2019 in Timsah Lake and higher than that recorded by Mehanna (2019) in the Bitter lakes. On the other hand, these results were lower than that obtained by Kraiem *et al.* (2001) Edku in Lake and El-Gammal and Mehanna, 2004 in the Wadi El -Raiyan Lakes The exponent b in the length–weight relationship of fish may be influenced by many factors such as number of specimens studied, habitat, feeding rate, stage of maturity, sex, health and overall fish condition as spawning period and gonad development, and environmental conditions (Abowei *et al.* ,2009). Besides, the value of (b) varies between stocks and between areas.

Table (4). Estimated length-weight parameters for *L. ramada* from previous studies around the world.

Author	b	a	Length range	Sex	Locality
Campillo, 1992	2.940	0.0176		♂	France
	2.840	0.0257		♀	
Djabali *et al.* 1993	3.000	0.0120		♂♀	France
Koutrakis and Sinis, 1994	3.013	0.0177	1.5-39.5 cm TL	♂♀	Greese
Kraiem *et al.* 2001	2.821	0.0184	12.1-36.7 cm TL	♂♀	Morocco
	3.141	0.0057	12.3-39.0 cm TL	♂♀	Tunisia
	3.130	0.0060	12.2-40.8cm TL	♂♀	Edku Lake
Koutrakis, and Tsikliars., 2003	2.94	0..0107	1.7-7.4 cmTL	♂	Greece
			1.6-8.3cm.TL	♀	
El-Gammal& Mehanna, 2004	3.072	0.0064	19.0-49.5 cm TL	♂♀	Wadi El-Raiyan Lakes
Mehanna, 2006	3.134	0.0052	16.9- 42 cm TL	♂♀	Bardawil Lake
Mehanna and El-Gammal 2007	3.058	0.0068	18.0-41.6 cm TL	♂♀	Bitter Lakes
	3.0299	0.0077	14.0-42.4 cm TL	♂♀	Timsah Lake
Glamuzina *et al.* 2007	2.852	0.014	25.6-48.0 cm TL	♂	Croatia
	3.278	0.003	27.5-58.0 cm TL	♀	
Kasimoglu *et al.* 2016	2.25	0.0005	21.7-40.4 cm TL	♂♀	Turkey
Mohammed *et al.* 2016	2.847	0.16		♂♀	Libya
El-Aiatt *et al.*2018	3.07	0.0063	13-36.7	♂	Bardawil Lake
	2.98	0.0087	15-36.7	♀	
	2.95	0.0095	15-36.7	♂♀	
Mehanna *et al.* 2019	2.7695	0.017	12 – 42 cm TL	♂♀	Bardawil Lagoon
	2.7687	0.017	11 – 47 cm TL	♂♀	
Mehanna *et al.* 2019	2.8262	0.0151	16.0-48.0 cm TL	♂♀	Bitter Lakes
	2.9366	0.0104	15.0-50.4 cm TL	♂♀	Timsah Lake
Present study	2.94	0.010	11.2-29.4 cm TL	♂♀	Manzala Lake

Age composition: It is revealed that the maximum life span was four years old. It is showed that the age groups one and two were the most dominant age groups forming 91% of the total samples (41.7% for age group one and 49.3% for age group two). An apparent increase of age group one was noticed at spring and summer seasons (as revealed from seasonal age slicing, Fig. 8) due to entering new recruits and become allowable to the fishery. The dominance of young fishes in the catch is probably due to the lower meshed sizes of the inner layer of the trammels used by fishermen. This is confirmed by Purbayanto *et al.* (2000) who stated that the selectivity pattern of the trammel net depends on the mesh size of the inner net. Age groups three and four represented only (7.5) and (1.5%) respectively which may return to growth overfishing and increased efforts, hence, disappeared in spring and summer. In accordance with Khalil (1997) who recorded four age groups also, but the fourth one was rarely represented for *L. ramada* in Manzala Lake. While, Yossef (1973) recorded only three age groups. Our results revealed lower age groups in Manzala Lake in comparison with other coastal areas around the world. This may be related to the difference in the size range and size selectivity of the sampling gear as well as the maximum length in the sample, the method which used to determine ages and difference in environmental condition between different localities.

Growth Parameters (L_∞, K and t_o) and Longevity (T_{max}): Table 5 summarizes the growth parameters for *liza ramada* around the world. In this study, L_∞ was calculated at 30.45 cm, the growth coefficient *K* was 0.48. The asymptotic length estimated for *Liza ramada* was lower than maximum lengths in other localities. L_∞ and *K* are negatively correlated, when L_∞ is high, the *K* is low (Ricardo Sousa *et al*., 2017) the growth performance index (Ø′) was estimated as 2.6. It is a specific parameter, meaning its value within related taxa is usually alike and has narrow normal distributions (Sparre and Venema, 1992).

Growth performance index (Ø′) of *L. ramada* in different localities ranged from 2.4 to 2.9. Such differences may be related to temperature (Ricker, 1975), salinity and possibly to differences in food items and may also be a manifestation of the observations that similar species experience different growth rates in different habitats (Golani,1993)).

Table (5). Longevity, L∞, K and Ø ' of *L. ramada* from previous studies

Location	Age (yr)	L∞ (cm)	K	Ø '	Author
Manzala lake	3				Yossef 1973
Tunisia		31.6	0.45	2.7	Farrugio ,1975
Tunisia		47.8	0.32	2.9	Chauvert,1989
France		47	0.15	2.5	Campillo, 1992
Tunisia	8	47.8	0.32	2.86	Djabali *et al.* 1993
Portugal	5	51.3	0.1	2.42	Djabali *et al.* 1993
Manzala lake	3- little at age four	33.5	0.35	2.59	Khalil 1997
Greece		33.5	0.35	2.6	Koutrakis and Sinis, 1994.
Egypt (Burullus lake)	6	56	0.15	2.67	Hosny and Hashem, 1995
France	6	47	0.15	2.52	Stergiou *et al.* 1997
Moroco	5	50.7	0.2	2.71	Moura and Gordo, 2000
Portugal		51.39	0.11	2.5	Moura and Gordo, 2000
Tunisia	5 (males) 7 (females)	53	0.21	2.77	Kraiem *et al.* 2001
Edku Lake	4	59.3	0.14	2.69	Kraiem *et al.* 2001
Croatia		44.1 59.96	0.014 0.003	2.852 3.278	Glamuzina *et al.* 2007
(Bardawil lake)	5		0.54		Mehanna, 2006
(Timsah Lake)	5	45.4	0.45	2.97	Mehanna and EL-GammalL 2007
Bitter Lakes	5	44.9	44	4.9	Mehanna and EL-GammalL 2007
Turkey		48.9	0.21	2.5	Kasimoglu *et al.* 2016
Libya		35.4	0.19	2.4	Elawad *et al.* 2016
Bardawil lagoon	**5** Mal**e** **7** Female	45 49.92	0.4 0.35	2.5 2.9	Mehanna *et al.* 2019
Bitter lakes	**7**	49.8	0.48	3.07	Mehanna *et al.* 2019
Timsah Lake	6	52.2	0.46	3.09	Mehanna *et al.* 2019
Manzala lake	**4**	**30.45**	**0.48**	**2.64**	**Present study**

Length and age at first maturity: In the current study the length at first maturity (L_m) was 17.7 corresponding to age 1.5 year. It's lower than all previous studies (Muus and Dahlström, 1978) recorded that L_m=25.9cm; El-Halfway *et al.* (2007) noted that L_m = 18.6 and 19.8cm for male and female respectively and El-Aiatt et al. (2018) found that L_m =27.6cm (for male) and 28.9cm (for female). These differences as a result of environmental factors and food availability as mentioned before. In this study the frequencies of the small lengths < 22.0 cm appear in summer and the smallest one 11.2 appeared in spring which indicated that recruitment of *liza ramada* became allowable to the fishery from spring to summer which in turn caused an elevation of age group one during these two seasons. Whereas, we recorded that the percentage of the larger-aged groups increased in autumn and early winter which indicates that the spawning migration occurs at this period from the lake to the sea. These results agree with Khalil, (1997) who recorded that *L. ramada* spawning migration is in autumn and early winter from October to early January, with a peak in November and early December. In addition he estimated the recruitment period~~s~~ of *L. ramada* in Manzala Lake from December to July, with a peak in March and April.

Mortality and exploitation rates: Total (Z =1.47), natural (M=0.71) and fishing (F=0.76) mortalities rate of *L. ramada* in manzala Lake. It was found that, the level of exploitation rate (F/Z) is higher than 0.5, it was (E=0.52), this result indicate that, the stocks of the species under study is overexploited. Beverton and Holt, 1957 suggested that M/K ratio for most fish species should be within the range 1.0 - 2.5 and the optimal value is 1.5 (Jensen, 1996). In our study M/K values exceeds 3 (3.063) which is more than double the optimal value.

If all fish are given a chance to reach the size of maximum growth rate (L_{opt}), reproduce before being caught, so growth and recruitment overfishing is theoretically impossible (Myers and Mertz, 1998) and impact on expected life-time fecundity per recruit is reduced (Goodyear, 1993) and a fishery would obtain the maximum possible yield (Beverton, 1992). The information about (L_c , Lm and L_{opt}) provides important baselines that can be used to detect future shifts in *L. ramada* stock in Manzala Lake. In the present study length at first capture is 12.8 cm, which is lower by 31.2% than the length at first sexual maturity of (L_m=17.7 cm.) and lower also by 40.1% than the estimated L_{opt} (20.4 cm.). This reflects how much is the narrowness of mesh sizes of the gears used by the fishermen and diversification of capturing from gilling, wedging or snagging as gill nets beside trammeling and pocketing (Fabi et al. 2002). This is evident from the sharp increase of the catching curve at lower lengths and its multimodal characteristics. This necessitates prohibiting such nets from being used at the lake for conservation of *L. ramada* stock or increasing the mesh sizes used and carrying selectivity studies for that concern. Also using large meshed inner layer of trammel nets by fishermen and prevention of illegal fishing gears will cause an increase in t_c values (which is a reflection of L_c value) leading finally to an increase in the yield per recruit of *Liza ramada*. At the same time, improving the quality of the lake water by decreasing and treatment of the different anthropogenic pollutants discharged into the lake will certainly cause a decrease in the species natural mortality (M) leading finally to an increase in yield per recruit.

CONCLUSION

Liza ramada stock in Manzala Lake is now in situation of overexploitation. The age at first capture, which is related to the mesh size must be increased by increasing the mesh sizes of the inner layer of such trammel nets. Our results also point to need to protect this species during spawning migration at autumn and early winter from October to early January by panning off fishing at the areas near lake-sea outlets in order to save the spawning migration process to the sea.

Trammel net fisheries have selective impacts on the fish community which may lead to an immediate effect of reducing the proportion of large species which is reflected by the poor abundance (poor ages) of large sized classes in the stock. Therefore, it is urgent to enforce immediate fishing regulations for protecting aquatic resources and preventing illegal fishing methods. Basic information on the fishing gear selectivity is necessary also to conserve the stock and for better sustainable performance of trammel net used.

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Arabic Summary

الملخص العربى

الحالة الراهنه لأسماك الطوبار المصيدة بالشباك الثلاثية (البله) من منطقة الجميل – بحيرة المنزلة – مصر

العزب العزب بدر البختى و أمل محمد أمين

معمل شباك و طرق الصيد و بيولوجيا المصايد بالمعهد القومى لعلوم البحار و المصايد

تمت دراسة الحالة لأسماك الطوبار المستهدفة بشباك غزل البله الثلاثية في منطقة الجميل ببحيرة المنزلة باستخدام التوزيع الطولي لعدد ٨٤٢ سمكة حيث تبين أن أقصى طول افتراضي لها 30.45 سم و معامل النمو k=0.48 و معامل أداء النمو الطولي يساوى 2.6 . و معدلات الوفاه الكلية و الطبيعية و الصيد فكانت على الترتيب كالآتي : Z=1.47 و M=0.71 وF=0.76 وكذلك معدل الاستغلال لها E=0.52 .

كما تبين من منحنى الصيد الكلى لهذا النوع أن أصغر طول يصبح عنده 50 % منه متاح للصيد بهذه الشبكة يصل إلى 12.8سم و هو ما يعتبر أقل من الطول 17.7الذى يحدث عنده أول نضوج جنسي للسمكة و أقل أيضا من الطول 20.4 الذى يصل عنده حجم السمكة لأكبر وزن مما يعكس صغر حجم عيون شباك الصيد خاصة الطبقة الداخلية لمثل هذه الشباك مما يتطلب منع الشباك الغير قانونيه أو زيادة سعة العيون لتتوافق مع الأطوال على الأقل التى يحدث عندها النضوج الجنسي . كما يتطلب تحسين بيئة مياه البحيرة للتقليل من معدل الوفيات الطبيعية من أجل زيادة إنتاج الصغار و للمحافظة على المخزون السمكي لها و زيادة كفاءة المصايد لهذا النوع للأجيال القادمة .