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Some Biological Parameters of the Thin-Lipped Mullet Liza Ramada in Benghazi Coast - Libya

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Abstract: Age, mortality rate (fishing and natural mortality), exploitation rate, survivor rate and Yield per recruit for the species *Liza ramada* were established in Benghazi coast eastern coast of Libya. four age groups were determined, the Von Bertalanffy growth equation of all individuals were estimated at 35.4 cm, 0.187 per year, -1.14 years and 2.4 for L∞, k and t_0,respectively.

Total mortality estimated from linearized catch curve was equal = 0.4 per year, the natural mortality coefficient "M" and the fishing mortality coefficient "F" were estimated at 0.2 and 0.2 year respectively. The exploitation rate "E" was estimated 0.5 and survival rate "Z" was 0.7. Yield per recruit obtained was 46.8 gm at fishing mortality 0.2 and the maximum yield per recruit was 50.1 gm at maximum fishing mortality 0.4 per year.

Keywords: natural mortality, survival rate, exploitation rate, Yield per recruit, Benghazi coast.

Introduction

The thin-lipped greymullet (*Liza ramada*) is one of the most appreciated fish in Mediterranean sea (Nelson, 1994). It constitutes animportant part of inland fish production, especially in the brackish water of the eastern part of Libya coast. The fish species *L.ramada*represents amount number of the total fish production in Eastern coast of Libya (Rafala and El-Mor 2014).*L. ramada*is the principal species contributing to fish production; however, due to its economic importance and its common presence at all the sample sites, *L. ramada*, was selected for investigation. Because of the economic importance of mullets, their biology in different Libyan water bodies has been extensively studied (Shakman&Kinzeibach (2007)**.**

The population dynamic study serve in measure the fish response to ecosystem, help to detect endangered species (population viability analysis, PVA), able the decision maker to manage the fisheries (sustainable yield), and to understand ecosystem dynamics and ecological processe**s.**

The aims of the study were summarized as fallow.

- Define the species status, through determine the age, mortality rate (fishing and natural mortality), exploitation rate, and survivor rate.
- State Yield per Recruit and cross pending fishing mortality.

Material and methods

The Study area

The study area is located on the east coast of Libyan Mediterranean sea. It includes all coast of Benghazi and the area around it which is located between 32°36'N and 20°03'. (Figure1). The coast line is characterized by lagoon marshes and sand dunes. Depth of the fishing area is about 20 meters. Length of the fishing area in front of the city of Benghazi is more than 5 km (Al-Hassan and Silini , 1999).

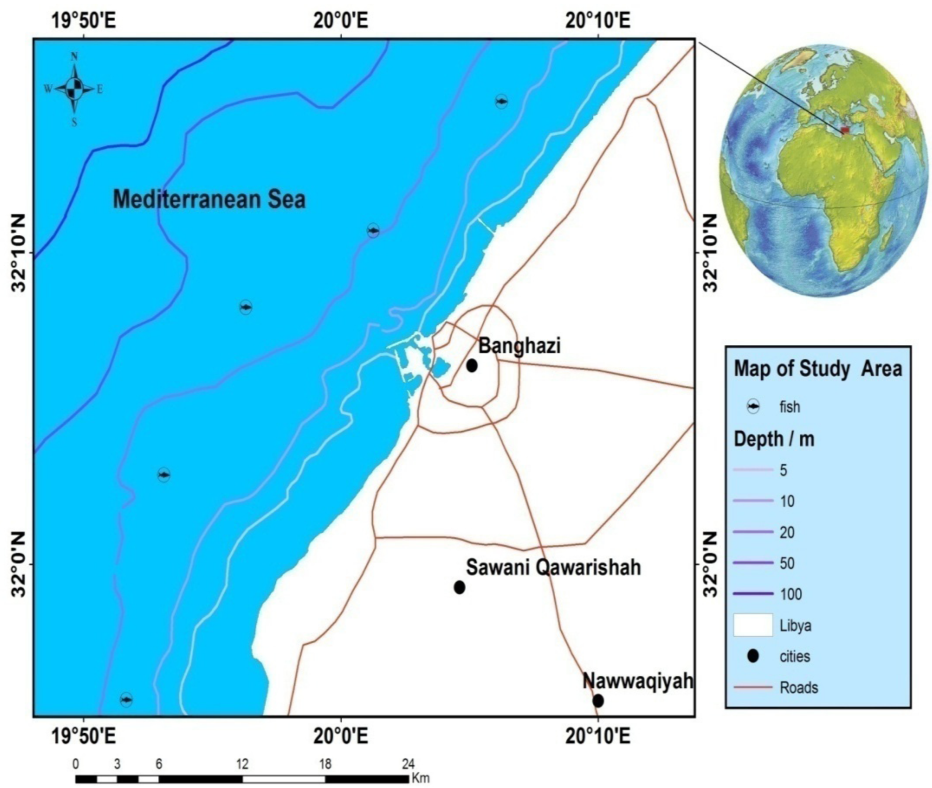

Figure 1. *Benghazi coast (the study area)*

Data collection

Monthly samples of*L. ramada* were obtained during the period November 2014 to December 2015 (almost 30 fish/ month), from fishermen working at different locations along the eastern coast of Libya near Benghazi. These fishermen usually use small boats with engines and fish with nets, hooks and lines. Because of the war and conflicts in Benghazi fishing port, the fishing activities were limited to shallow near shore coastal waters. Gears like trawling nets are no more used because of insecurity. The obtained monthly samples were taken to Marine Biology Laboratory of Omar El-Mukhtar University where each fish was measured to the nearest cm (Total length) and weighed to the nearest gram. 10 scales were removed from the pectoral region and stored in numbered envelops for later counting the annuli.

Aging of *L. ramada* was done by counting annuli on scales according to Hile, 1941,The dry scales taken from the 218 fishes were washed by tap water and then placed in hydrogen peroxide (H_2O_2) for one day to remove surface tissues, then placed between two slides and examined under the low power of the microscope.

The growth parameters of the Von Bertalanffy were estimated by using the Von Bertalanffy (1938) equation: $Lt = L\infty \{1-\exp[-k(t-t_0)]\}$.

Where: Lt, is the length at time t, L∞, is the asymptotic length, that is the mean length of individuals of a given stock if they were left to grow in defefinitely, K, is growth constant, t, is the age of the fish at "Lt" length, t_o, is the age of fish at length zero.

Total mortality was estimated using The linearized catch curve methods, based on age composition data. Ln $C(t_1, t_2) = q-z*t$. where: Lnc (t_1,t_2)= number of fishes. Z= slope = total mortality, t = age of fishes. q= constant.

The natural mortality rate for the species studied was estimated by Taylar equation 1959. M= (2.996*k)/(2.996+(k*t_o). where k and t_o are Von Bertalanffy parameters growth. Following Ricker (1975) and Gulland (1985) fishing mortality coefficient was obtained by subtracting the natural mortality from total mortality coefficient according to the equation: F = Z-M**.** Where: F = fishing mortality coefficient (Fishing mortality). Z = total mortality coefficient (Total mortality). M = natural mortality coefficient (Natural mortality).

The survival rate for the species was estimated from Ricker (1975) equation: $Z = -\log_e S$ Or $e^{-z} = S$. Z = total mortality.

The exploitation rate was estimatedfollowing Gulland (1985).

E = F/Z. Where: F = fishing mortality. Z = total mortality.

Yield per recruit was estimated followed Per sparre (1992).

Y/R = F*exp(-M*(Tc-Tr))*W∞*(1/z-3s/z+k+3s2/z+2k-s3/z+3k)

s= exp(-k*(Tc-to)

k= von Bertalanffy growth parameter.

t_o= von Bertalanffy growth parameter.

T_c= age at first capture.

T_r= age at recruitment.

W_∞= asymptotic body weight.

F= fishing mortality.

M= natural mortality.

Z= F+M, total mortality.

Results

218 scales were studied for age determination, Four age groups were determined from scale reading. Age groups, one, two and three were more abundant, representing 86% from the total fish sample.

Table 1. *showed age, length groups and mean length of L.ramada from Eastern coast of Libya*

Age	Length group	Mean length	No.
Reading from scale			
1	17-20	18.3	72
2	20-23	21.5	56
3	23-26	25	60
4	26-29	27	30
5			
Total			218

The parameters of the Von Bertalanffy growth equation of all individuals were estimated at 35.4 cm, 0.187 per year, -1.14 years and 2.4 for L∞, k and t_0,respectively.

Total mortality estimated from linearized catch curve was equal –slope (b), b from equation in figure 2 equal -0.361, meaning that z= 0.361 = 0.4 per year.

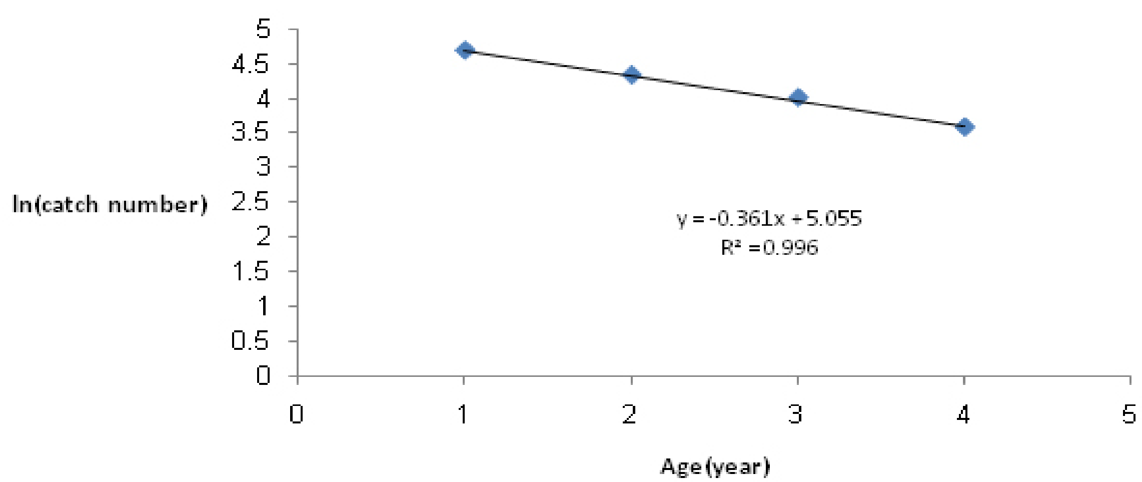

Fig.2. Linearized catch curve based on average age composition of *L. ramada* from Benghazi coast 2014-2015.

The total mortality coefficient Z. the natural mortality coefficient M and the fishing mortality coefficient F were estimated at 0.4, 0.2 and 0.2 year respectively for *L. ramada.* The exploitation rate E was estimated 0.5 and survival rate was 0.7 (Table 2). Gulland (1971) suggested that the optimum exploitation rate for any fish stock is about 0.5 at F=M and more recent. Pauly (1987) proposed a lower optimum F that equals to 0.4 M. The current estimated fishing mortality and exploitation rates for the species were relatively in optimum level of exploitation.

Table 2. *The values of total mortality (Z), Natural (M), fishing mortality (F), survival rate (S) and exploitation rate (E) for L.ramada from Benghazi coast 2014-2015.*

Total mortality (Z)	Natural mortality (M)	Fishing mortality (F)	Survival rate (S)	Exploitation rate (E)
0.4	0.2	0.2	0.7	0.5

Yield per recruit was estimated by applied the following equation:

Y/R = F*exp(-M*(Tc-Tr))*W∞*(1/z-3s/z+k+3s2/z+2k-s3/z+3k).

S = exp(-k*(T_c-t_o)

k= 0.187.

L∞= 35.4cm.

t_o= -1.14

T_c= 2.4

T_r . age at recruitment =1

W_∞= asymptotic body weight =310gm.

F= fishing mortality =0.2

M= natural mortality= 0.2

Z= F+M, total mortality = 0.4

L_c = length at first capture = 17.05 cm

From Table 3, it was appear that yield per recruit obtained was 46.8 gm at fishing mortality 0.2 and the maximum yield per recruit was 50.1 gm at maximum fishing mortality 0.4 per year, these meaning that ours present result lower than maximum level.

Table 3. *The fishing mortality as function to estimated yield per recruit for L. ramada in Benghazi coast 2014-2015.*

Fishing Mortality (F)	Yield per Recruit (Y/R)
0.1	36.00
0.2	46.8
0.3	49.6
0.4	50.1
0.5	49.6
0.6	48.9
0.7	48.1
0.8	47.3
0.9	46.5
1.0	45.8

1.1	45.2
1.2	44.6
1.3	44.1
1.4	43.7
1.8	42.2
1.9	41.9
2.0	41.6

Discussion

The total mortality coefficient Z. the natural mortality coefficient M and the fishing mortality coefficient F were estimated at 0.4, 0.2 and 0.2 year respectively for L. ramada. The exploitation rate 'E' was estimated at 0.5 and survival 'S' rate was 0.7. Its cleared that from the results this species in optimum level of exploitation (0.5), this very clearing, when that the values of natural and fishing mortality were a same, the exploitation rate will be optimum (Yerli 1991,and Thomson 1966), in the present study F= M= (0.2 per year), Nearly the same results mention by Glamuzinaet al,. 2007 in the neretva river in the delta (Eastern AriaticCroatidan coast), for the same species L. ramada, natural mortality was estimate at 0.32 per year. Total mortality (Z) was estimated at 0.70 per year (range 0.55-0.85 per year). Fishing mortality was estimated at 0.38 per year and the exploitation ratio at E = 0.54. Gulland (1971) suggested that the optimum exploitation rate for any fish stock is about 0.5 at F=M and more recent. Pauly (1987) proposed a lower optimum F that equals to 0.4 M. these results seem to be logic, no extensive fishing activities in Benghazi coast due to conflicts, beyond that, this species able to live in different habitats (Nelson 1994). The thin-lipped mullet, L. ramada is a pelagic species inhabiting various habitats (Thomson 1966), 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 (Fischer et al. 1987).

Yield per recruit is the expected yield per fish recruited in the stock at a specific age (Blaber,1987), it plays animportant role in advice for management, particularly as it relates to minimum size controls (Restrepo, 1999). Fisheries management needs estimates of harvest levels that provide maximum yield on a long term basis. Beverton& Holt (1957) model can be used to forecast the effects of development and management measures, such as increase or reduction of fishing fleets, changes in minimum mesh sizes, etc. Therefore this model forms a direct link between fish stock assessment and fishery resource management, as we know that Libyan waters are potentially moderately productive in fish (Zupanovic& El-Buni (1982).

In this study, the length at first capture (the length at which 50% of the fish is retained by the gear and 50% escape) was estimated as L_c = 18,45 cm for L. ramada. Plot in relative yield per recruit (Y'/R) against fishing mortality rate (F) for L. ramada, shows that the maximum (Y'/R) was obtained at F_{MSY} = 0.4, which very low than actual present fishing mortality =0.2, exploitation rate was at optimum level E = 0.5.

The results showed that the stocks of L. ramada at Benghazi coast were under exploited. For the management purpose, the current exploitation rate must be increased yield per recruit from 46.8 gm to 50.1gm and increasing level of fishing mortality from 0.2 to 0.4 per year. Wijeyarutne and Costa 1986, mention that for better management on fisheries rebuild is to control or balance between input effort (number of boats and fishers) and output (yield and production of fisheries resources).

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