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SOME BIOLOGICAL PARAMETERS OF THE RED PORGY*PAGRUS PAGRUS* IN BENGHAZI COAST (EASTERN LIBYA)

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ABSTRACT: *Commercial fish samples from Benghazi coast were studied during December 2014 to November 2015.The number of sample collected was 254 fish, number male fishes 81 and female 143, and 30 immature, the sex ratio male to female was 1:1.8:Age groups estimated, 4 years groups determined from scales reading. The von Bertalanffy growth equation fitted to the most recent, back-calculated lengths from all the samples* $Lt = 31.4*(1-e^{(-0.237*(t+1.04))}$, *For male=* $Lt= 35.04*(1-e^{(-0.2*(t+0.643))}$, *and for female was* $Lt=33.5*(1-e^{(-0.19*(t+0.239))}$. *Growth performance index was, 2.1, 2.4, and 2.3 for whole sample, male and female, respectively. Total mortality (Z) equal 0.9 per year. Natural mortality (M) about 0.3 per year. Fishing mortality (F) is therefore 0.6 per year. The survival rate value of P.pagrusin Benghazi coast was found to be 0.4, while the exploitation ratio was 0.7. Age at first capture Tc = 1.4 year at length at first capture Lc = 13.9cm, while length at recruitment (Lr) was 9.6 cm and the corresponding age at recruitment (tr) was 0.5 year, the value of Yield per recruit equal 29.8 gm at fishing mortality 0.6 per year,* F_{max} *found to be 0.5 at maximum Yield per Recruit 30.23 gm, lower than ours result 0.6 .*

KEYWORDS: Benghazi Coast, Recruitment, Exploitation Ratio, Pagruspagrus, Fishing Mortality.

INTRODUCTION

The red porgy (*Pagruspagrus*), or common seabream, is a species of fish in the family Sparidae. It is found in a wide variety of locations that range from Europe to the Caribbean(Ball,.*et al* 2007). *P. pagrus* known as grade one fishes commercially, is an important component of commercial and recreational fisheries in many parts of its range, especially in Libya coast (Ali, 2008) . In fact, *P. pagrus* may be more resilient to exploitation in some cases given these aspects of its biology and behavior (Manooch 1976, Davis and Berkson, 2006). In many different rejoin their stock biomass is well below the biomass that could support maximum sustainable yield. So significant reductions in fishing mortality will be needed for rebuilding the stock in this region (Vaughan and Prager 2002).So more conservation require among this demand species, which usually facing high consume. Recently, population dynamic deals with the laws of growth,ageing, exploitation, survival, and causes of death of living organisms (Per spare, 1992). A fishery is an area with an associated fish or aquatic population which is harvested for its commercial or recreational value. Fisheries can be wild or farmed. Populationdynamics describes the ways in which a given population grows and shrinks over time, as controlled by birth, death, and

Due to the commercially important of this species (*P.pagrus*) in the eastern rejoin of the Libyan coast, we try to study the ageing, growth, mortality, recruitment, survival and exploitation rate in Benghazi coast.

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MATERIAL AND METHODS

Monthly samples of*P.pagrus* were obtained during the period November 2014 to December 2015 (almost 30 fish/ month), from fishermenworking at different locations along the coast of Benghazi. Thesefishermen usually use small boats with engines and fishwith 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.

The von Bertallanfy growth parameters "K" and "L∞ were obtained according to Von Bertalanffy, 1938. Total and natural mortalities were estimated following Gulland, 1985 and Richer, 1975 in order. The fishing mortality was estimated by subtraction. The yield per recruit was then calculated according to PerSparre, 1992.

A total of290 fishes (random samples) of *D. vargrus*, taken from the catch of 2015, from Benghazi coast were used for age determination based on the numbers of growth rings per scale following Hile (1941).

The growth parameters (L∞, k and t_o), were obtained from the lengths at different ages of back calculated using Lee„s formula (1920) as follows:

$Ln = [(Sn / S)*(L - a)] + a$

Where Ln is the calculated length in cm., L is the total length in cm, Sn is thescale radius from the nucleus to the annual mark, S is the total scale radius in micrometer division from the nucleus to the anterior edge of the scale and a is the intercept on the Y axis inthe length scale relationship. The back calculated lengths were used to estimate the growth parameters of the Von Bertalanffy growth model (1938) by fitting the Ford (1933) and Walford(1946) plot.

$Lt = L\infty \{1-exp [-k (t-t_0)]\}$

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 indefinitely.K, is growth constant.t, is the age of the fish at "Lt" length.t_0, is the age of fish at length zero.

The growth performance index (φ')was examined using Munro's formula $\varphi' = \log(k) + 2\log(L\infty)$.

The total mortality (Z), was estimated using the linearized catch curve based on age composition data based on Gulland (1985) and Ricker (1975).

Ln C(t1, t2) = q-z*t (slope was = -Z).

The natural mortality rate (M) for the species studied was estimated by Taylar equation 1959.

M= (2.996*k)/(2.996+(k*to), where k and t_0 are VonBertalanffy parameters. Thefishing mortality coefficient (F), was obtained by subtracting the natural mortality from total mortality coefficient.The survival rate (S), for the species was estimated from Ricker (1975) equation: $Z = -\log_e S$ Or $e^{-z} = S$**,** By using the values obtained for total mortality rate and the equation

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of Richer, 1975, the values of survival rates were obtained for all species.The exploitation rate (E), was estimatedfollowing Gulland (1985), E = F/Z.

RESULTS

Age composition:From Table 1. It appears that four age groups were found, the most abundant age groups were age group 2+ (44.9%) at length group 17-20 cm, and age groups 3 + (26.4%) at length group 20-23 cm,while age group four is of very low abundance (9.8%).

Individuals of specie of *P. pagruss* from Figures 2,3,4, showed that, both sexes seem to be grew faster during the first three years of life, attaining approximately 61% (19.3 cm) of their maximum length (31.4 cm), for male attained 60% (21.2 cm) of their maximum length (35.04 cm) at four first years, and female attained 63% (21.1 cm) of their maximum length (33.5 cm) during first five years. The average back calculated lengths for each age group of *P. pagrus*are represented in Table (2). When we fit the equation of Von Bertalanffy growth, Figures (2, 3,4), it appear that the length at zero age equal 6.6 cm for both sex, 4.2 cm for males and 1.5 for females, the growth started to be steady when the length attained approximately 27cm at age equal 8 years for whole samples.

The general equation of Von Bertalanffy growth equation for both sexes was: $Lt = 31.4*(1-e^{(-0.237*(t+1.04))}$, For male= $Lt= 35.04*(1-e^{(-0.2*(t+0.643))}$ and For female= $Lt=33.5*(1-e^{(-0.19*(t+0.237))}$.

The total mortality (Z) estimated equal 0.9 per year. Natural mortality as estimated by Taylar‟s formula was about 0.3 per year. Fishing mortality is therefore 0.6per year.The survival rate value of *P.pagrus*in Benghazi coast was found to be 0.4, while the exploitation ratio was 0.7. The value of Yield per recruit equal 29.8 gm at fishing mortality 0.6 per year, F_{max}(maximum fishing mortality) found to be 0.5 at maximum Yield per Recruit 30.23 gm, lower than ours result 0.6. Length and age at first capture (L_c and tc) as obtained in the present study were found to be 13.9 cm and 1.4 year, while length at recruitment (L_r) was 9.6 cm and the corresponding age at recruitment (t_r) was 0.5 year.

Table.1. Age groups, length groups from scale reading, and percentage for *P. pagrus* from Benghazi coast 2014-2015.

Age	Scale method		
	Length group	Frequency	percentage
1+	14-17	48	18.9
2+	17-20	114	44.9
3+	20-23	67	26,4
4+	23-26	25	9.8
5+			
Total		254	100%

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Table 2. The observed and back calculated length for both sexes, male and female of *P.pagrus* from Benghazi coast 2015.

Age (year)	Both sex		Male		Female	
	Observed length (cm)	Calculated length (cm)	Observed length (cm)	Back Calculated length (cm)	Observed length (cm)	Back Calculated length (cm)
1+	15.1	12.2	14.0	9.9	15.1	12.0
2+	17.8	16.3	17.5	14.1	17.5	15.5
3+	20.2	19.4	19.4	18.4	19.8	19.7
4+	24.2	22	21.9	21.1	22.3	21.4

Table 3. The values estimated for male, female and both sexes of L_∞, k and t_0, for *P. pagrus*from Benghazi coast 2014-2015.

Categories	Equation	a	b	L∞ (cm)	k (per year)	t_0(year)	φ'
Male	Y= 0.822x-6.238	6.238	0.822	35.04	0.2	-0.643	2.4
Female	Y= 1.215x-7.200	7.200	1.215	33.5	0.19	-0.237	2.3
Both sex	Y=0.789x+6.622	6.622	0.789	31.4	0.237	-1.041	2.1

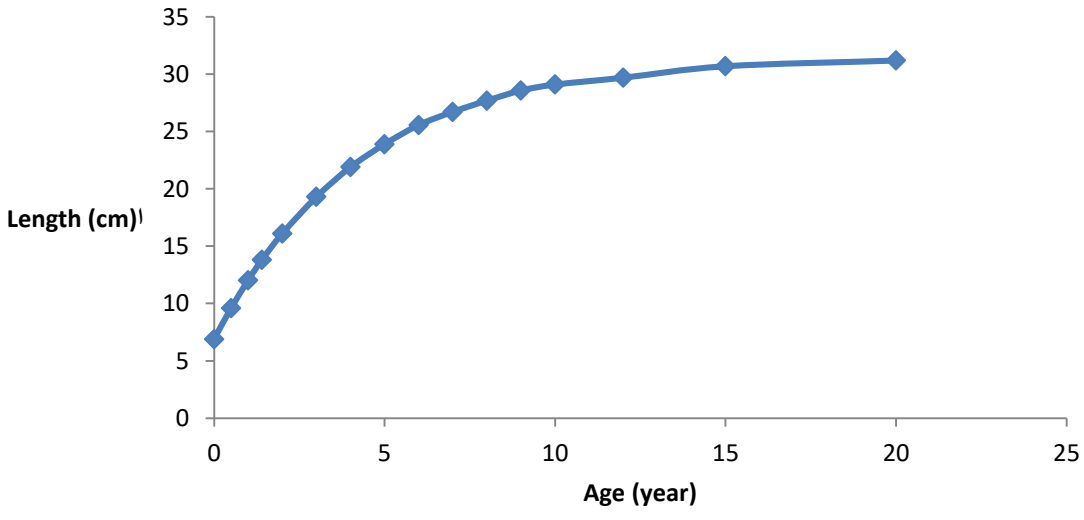

Figure 2.Growth curve for whole sample of *P. pagrus* from Benghazi coast 2014-2015

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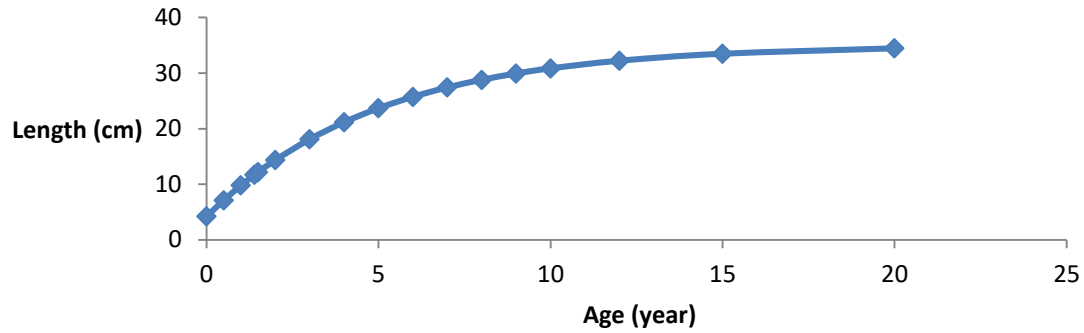

Figure 3. Von Bertalanffy growth curve for male of *P. pagrus* from Benghazi coast 2014-2015.

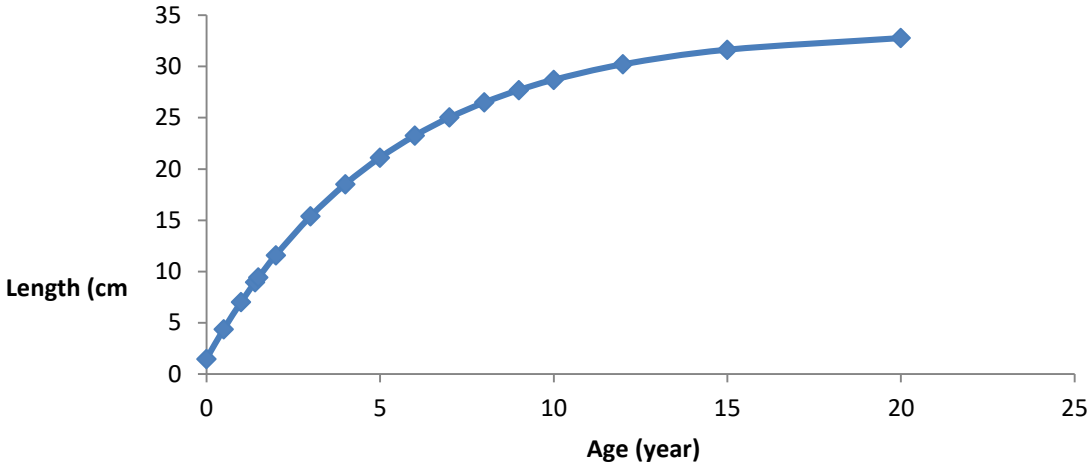

Figure 4. Von Bertalanffy growth cueve for female of *P. pagrus* from Benghazi coast 2014-2015.

DISCUSSION

Bottom trawls, traps, and hook-line are used to capture Red porgy, which are usually described as a slow growing and have a relatively long life span, and frequently attained an age of 15 yr or older (Manooch and Huntsman 1977).

The results of the present study indicated that the age composition of *P. pagrus*ranged between 1+ to 4+ year, The most abundant age groups were age group 2 (44.9%) at length group 17-20 cm, and age groups 3 (26.4%) at length group 20-23 cm. These results compare with Manooch, 1975 who reported that 13,000 red porgy landed by recreational fishermen fishing from North Carolina andSouth Carolina head boats, fish age range between 1 to 15 years and aged 5 to 8 year were common in the catch, also our results compare with the results of Ismen*et al*,. 2013, from Saros Bay in Turkey, he mentioned 1 to 9 years, and Potts and Monooch, 2002, they recognized 1 to 18 year, the oldest age class reported in the literature was 18 and 17 years (Potts and Monooch , 2002; Jarzhombek, 2007). Manooch and Huntsman, 1977,

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mentioned that variation in results of age composition due to Gear selectivity, rather than relative abundance of any age group, this is particularly true with hook and line where smaller individuals are completely or selectively excluded from the catch. Also the number of fishes collected, types of populations examined, different levels of exploitation and different structures were effecting in age structure(Collins and Sedberry. 1991,Francis, 1990 and Ball, *et al* 2007).

Also the parameters of the Von Bertalanffy growth equation were estimated in the present study, for male were 35.04 cm, 0.2 per year, -0.643 year and 2.4, for female 33.5 cm, 0.19 per year, 2.3 and -0.237, for both sex individuals were estimated at 31.4 cm, 0.237 per year, -1.04 years and 2.1 for $L\infty$, k, t_0,and φ', respectively. These parameters results were compared with Manooch and Huntsman (1977) from Southwestern U.S.A.($L\infty$76.3 cm, k 0.10), and Vassilopoulou and Papaconstanfinous (1992) from Eastern Mediterranean sea ($L\infty$ 63.9 cm and k 0.19), the present study showed some agreement and disagreement with these two studies. In the present study k quit equal 0.2, indicating that the rate of growth was high than those of Manooch and Huntsman (1977) in U.S.A, mean that this species attained the maximum length in Mediterranean sea faster than those in U.S.A. sea. Value of k results obtained by Vassilopoulou and Papaconstanfinou (1992) from Mediterranean sea (Dodecanese,Greece), was equal the value of k from the present study from Libyan coast (0.2 per year). Indicate that the growth rate of this species were the same, mean that they attained the maximum length at the same time. These differences in results may be attributed to many reasons.Ahemed (1987) and Gulland (1985) mentioned that the growth mode of fishes is controlled and affected by many factors, such as places, food availability and supply, environmental factors, and so on. The red porgy is rather long-lived and shows a slow, steady rate of growth, reflecting not only its genetic capabilities but also the type of environment in which it occurs. *P. pagrus*, which are relatively sedentary and live in a stable environment, therefore are able to expend more energy on growth than species which migrate extensively and must compensate for physiological stresses produced by salinity and temperature changes or seasonal availability of food (Wallace and Selman, 1981, and Pavlidis, *et al*, 2002). .

Total mortality (Z), fishing Mortality (F) and natural mortality (M), survival rate (s) and exploitation rate (E) were estimated, 0.9 per year, 0.6 per year, 0.3 per year, 0.4 and 0.7, respectively. The results indicated that total and fishing mortalities were high in ages +2 , while it is lower in other remaining age, survival rate was 0.4 and exploitation rate was high0.7 high than optimum level 0.5, also the natural mortality was moderate 0.3, these may be due to the lower growth rang k which 0.2 per year, (PerSpare, 1992 and Davis and Berkson, 2006), mention that fish species with high growth rate have high natural mortality and with lower growth have lower natural mortality. These results seem very logical for many reasons, in spite of no more heavy practicing on fishing activities due to the security and conflict of war in most of coast of Benghazi, but there were small area facing extensive fishing activities practicing there, so selectivity appear among catch and limitation of occurring of all size structure. So that, exploitation rate was high and survival rate was lower. Fishing activities and fisheries area and gears used effect in exploitation ratio (Davis and Berkson, 2006, Elawad, 2002 and Rudeshausen*et al*, 2008).

The value of Yield per recruit equal 29.8 gm at fishing mortality 0.6 per year. Length and age at first capture (Lc and tc) as obtained in the present study were found to be 13.9 cm and 1.4 year, while length at recruitment (Lr) was 9.6 cm and the corresponding age at recruitment (tr) was 0.5 year. By testing various (F) fishing mortality values ranging from F=0 to F =3, it was

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occurred that F =0.5 gives the maximum value of Y/R, the "Maximum Sustainable Yield per Recruit" (MSY/R = 30.23 gm, while F found in this study was 0.6, meaning that for better management of fisheries for this species reduction on fishing mortality will be done. Generally this species *P.pagrus* is commercially very important in fisheries in most parts of its range, also listed in red list of IUCN (2012), as threatened species in their habitats, IUCN in 2012, Proposed protected area to conserved these species from threaten decline. There have been significant population declines in parts of its range; these declines are well documented in many areas,as in this study, also as in the southeastern stock of the United States, Significant reductions in fishing mortality will be needed for rebuilding the stock in this region (Vaughan and Prager 2002). Also In the Mediterranean coast of Turkey, and in the Pacific sea in habitat with Red Porgy (Schobernd and Sedberry 2009), declined in catch were appear, best mange for that was reduction in effort used in fishing, so same suggested by and (Cerino*et al.* 2013 and Haimovici, 1998).

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