RESEARCH ARTICLE

THE LENGTH AND WEIGHT RELATIONSHIP OF RED PORGY *PAGRUS PAGRUS* FROM EASTERN COAST OF LIBYA

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ARTICLE INFO

ABSTRACT

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. The number of sample collected for the study was 254 fish: males 81 and females 143. The sex ratio male to female was 1:1.8.The length-weight relationships for males, females, and both sex were found significant ($p < 0.001$) in all groups. In all months except December, April, June and July b equal 3(isometric relationship). For December, April, June and July the relationship was positive allometric growth (b between 2.804, and 2.77).

INTRODUCTION

Length-weight relationships are very useful for fisheries research because they: (a) allow the conversion of growth-in-length equations to growth-in-weight for use in stock assessment models; (b) allow the estimation of biomass from length observations; (c) allow an estimate of the condition of the fish; and (d) are useful for between region comparisons of life histories of certain species (Goncalves *et al*. 1996, Froese and Pauly 1998, Moutopoulos and Stergiou 2002, Stergiou and Moutopoulos, 2001). Many studied carried out describing the relation between length and weight of *P. pagrus*. Ibrahim in 2013, mentioned the length weight relationship of *P.pagrus* in Ain El-Ghazala Gulf of eastern Libya. Ismen, *et al* in 2013, studied the weight length relationship of red porgy in Saros Bay (North Aegean sea). The relation between the weight of fish and the length wasin use before 1930, it was first described by the cubic parabola, then after that another equation was used instead of cubic parabola called general parabola, it gives better results. The values of a and b differ between species, through the year and through the spawning season (Ahemed, 1987). When the values of b equal 3, the growth is called isometric, if it is less or more than 3 it is called allometric growth. Due to the commercial importance of this species (*P.pagrus*) in the eastern rejoin of the Libyan

coast, we studied the monthly relationship between the total Length and total Weight of this species in eastern coast.

MATERIAL AND METHODS

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' Figure 1. The coast line is characterized by lagoon marshes and sand dunes (Al-Hassan and Sllini, 1999). Monthly samples of *P.pagrus* 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. 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. The relationships between body weight and total length for the species was established following Gulland (1985), for the whole and monthly period, and by sexes. The sample of the species *P.pagrus* were taken randomly during 2015. The constants "a" and "b" were obtained from the equation:

$$W(i) = a*L(i)^{b}$$

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Where W (i) is the body weight, L(i) is the total length "a" and "b" are constants. The exponential equation was converted into a linear one by logarithmic transformation.

Ln W(i) = ln a + b*ln L(i)

General linear model was performed to determine the effects of the sex of fish and the month of captured using SPSS computer software (2012), release 20. Duncan Multiple Range Test was used to estimate the differences between means.

RESULTS

The number of sample collected was 254 fish: male 81 and female 143. The sex ratio male to female was 1:1.8. From Tables 1 and 2. It is clear that the maximum observed mean length was in April: 21.2 cm at weight 115.2g, and the minimum observed mean length during December was 15.5 cm at weight 49.5g. For males the observed mean length was 20.1 cm at weight 97.7g, while for female observed mean length was 18.3cm at weight 83.0g.
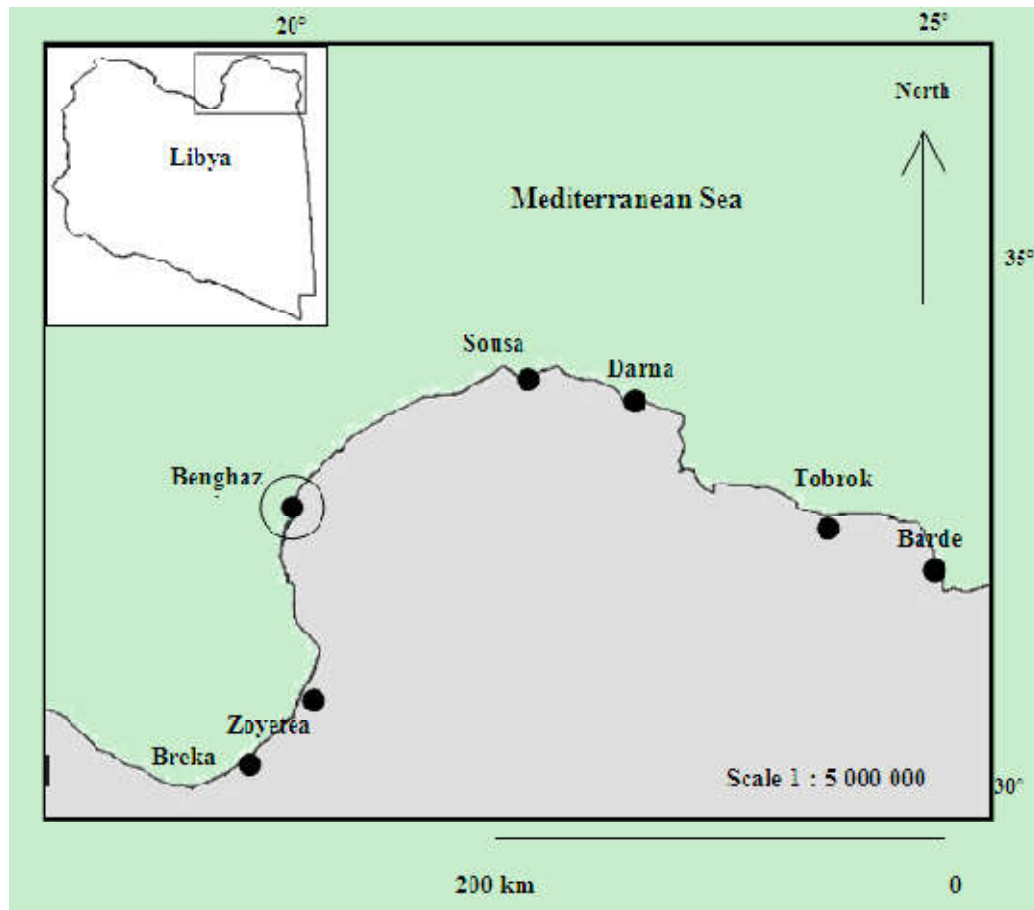

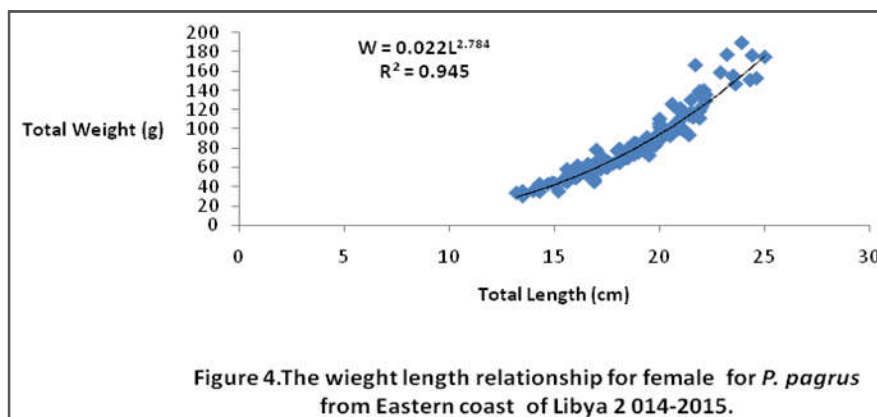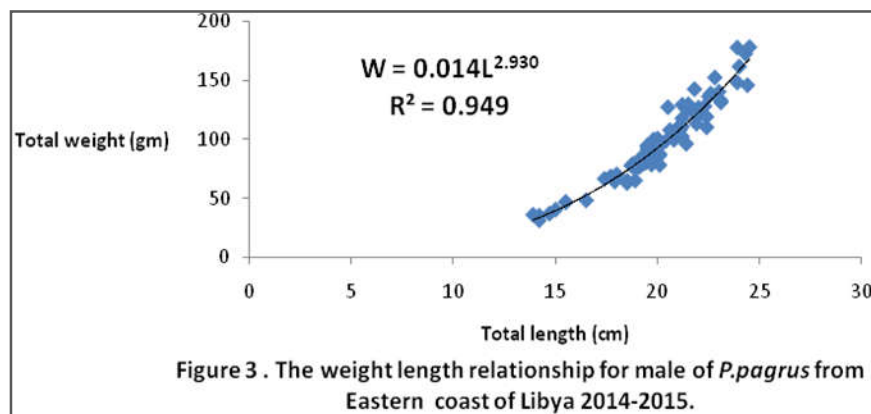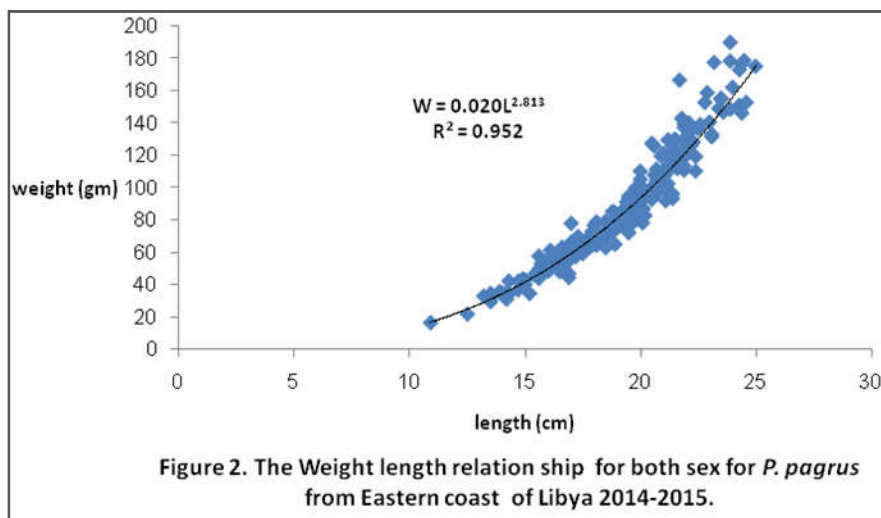**Figure 1. Showed the studied area (Eastern coast of Libya)**

Table.1. The observed mean length, weight and calculated length and weight for *P. pagrus* from Eastern coast of Libya 2014-2015

Month	Measured Mean length±SD (cm)	Measured Mean weight±SD (gm)	Calculated mean weight (gm)	Calculated mean length(cm)	Number of fishes
	Effect of months				
December	15.49±1.2[a]	49.58±48.6[a]	40.39	16.141	29
January	20.0±2.1[def]	102.2±38.9[ede]	90.35	20.898	18
February	18.12±2.2[b]	77.88±1.1[b]	68.57	18.96	28
March	18.845±3.3[cde]	88.36±97.1[cd]	76.51	19.84	27
April	21.2±1.3[f]	115.2±112.6[e]	106.39	21.814	27
May	19.9±1.7[cdef]	100.7±99.9[ede]	89.12	20.79	22
June	20.8±1.3[ef]	97.02±92.0[ede]	100.87	20.513	18
July	20.3±1.9[def]	91.7±89.1[bcd]	94.31	20.12	17
August	19.0±1.9[cd]	80.0±77.8[bc]	79.45	15.16	16
September	20.5±2.4[def]	104.4±101.8[de]	97.25	21.1	15
October	18.5±3.1[bc]	80.7±84.6[bc]	73.14	19.21	21
November	19.7±1.7[cdef]	91.7±86.6[bcd]	87.63	20.11	16
Effect of sex					
Male	20.1±2.68[a]	97.78±39.03[a]	91.65181	20.57	81
Female	18.76±2.5[a]	83.23±33.2[a]	75.55166	19.42	143
Whole	19.12±2.62	88.01±35.78	79.79836	19.8	254

Within columns, means with different superscripts differed significantly (p<0.05)

Table 2. The equation of weight-length relationship, the value of a, b, and the regression R, for the *P. pagrus* from Eastern coast of Libya2014-2015

Months	Number of fishes sample	Equation	A	b	R	Significant
December	29	Y=2.856x-1.711	1.711	2.9	0.922	p<0.001
January	18	Y=3.401x-2.436	2.436	3.4	0.977	p<0.001
February	28	Y=2.958x-1.855	1.855	3	0.983	p<0.001
March	27	Y=2.973x-1.888	1.888	3	0.924	p<0.001
April	27	Y=2.907x-1.800	1.800	2.9	0.805	p<0.001
May	22	Y=30121x-2.064	2.064	3.1	0.871	p<0.001
June	18	Y=2.710x-1.59	1.59	2.7	0.877	p<0.001
July	17	Y=2.891x-1.830	1.830	2.9	0.961	p<0.001
August	16	Y=3.236x-2.253	2.253	3.3	0.953	p<0.001
September	15	Y=3.066x-2.023	2.023	3.0	0.977	p<0.001
October	21	Y=2.946x-1.860	1.860	3	0.98	p<0.001
november	16	y = 2.572x - 1.378	1.378	2.6	0.951	p<0.001
Male	81	Y=2.93x-1.845	1.845	2.93	0.949	p<0.001
Female	143	Y=2.771x-1.631	1.631	2.771	0.944	p<0.001
Whole sample	254	Y=2.804x-1.675	1.675	2.804	0.947	p<0.001

$$W = 0.020L^{2.813}$$
$$R^2 = 0.952$$

Figure 2. The Weight length relation ship for both sex for *P. pagrus* from Eastern coast of Libya 2014-2015.

$$W = 0.014L^{2.930}$$
$$R^2 = 0.949$$

Figure 3 . The weight length relationship for male of *P.pagrus* from Eastern coast of Libya 2014-2015.

$$W = 0.022L^{2.784}$$
$$R^2 = 0.945$$

Figure 4.The wieght length relationship for female for *P. pagrus* from Eastern coast of Libya 2 014-2015.

For the both sex the observed mean length was 19.1cm at weight 88.0g. Length-weight regression parameters estimated for all months, males, females and the both sex sample are presented in table 2 and figures 2,3 and 4. The length-weight relationships were found significant (p < 0.001) in all groups. In all months except December, April, June and July b equal 3 for male, females, i.e. the growth is isometric. For December, April, June and July relationship slightly positive allometric relationship were seen. The analysis of variance (Table 2) indicated a high significant effects of months on both total length and total weight, while the sex had no significant effects on the bellow mentioned traits. The general equation for the weight – length relationship for both sex was:

$W = 0.020568L^{2.8}$
For male:
$W = 0.014L^{2.9}$
For female:
$W = 0.022L^{2.8}$

DISCUSSION

In the present study, length-weight regression parameters estimated for all months, males, females and the both sex sample are presented in Table 2 and Figures 2, 3 and 4. The length-weight relationships were found significant (p < 0.001) in all groups. In all months except December, April, June and July b equal 3 for male, females, and both sex. In December, April, June and July b showed slightly positive allometric relationship. There were no statistically significant differences in slopes or intercepts between males and females. The values of b in this study were 2.804 for both sexes, 2.930 for males and 2.77 for females. These results showed variation in values of b during the months, sex, and with that of the previous studies providing length-weight relationships for *P. pagrus* in different locations. Ismen *et al*., 2013 from Saros bay (north Aegean sea) Turkey, b was found to be 2.885, Morey *et al*,. 2003 from Mediterranean sea was 2.803, and Ozaydin*et al*,. 2007 from Mediterranean sea was 2.57. The length ranges covered for red porgy should be considered when using parameters of length-weight relationships, as to some extent the smallest specimens may change the parameters (Goodyear, 1993). The differences between b values are due to one or more factors: the season and effects of areas of origin, sex, and the food availability. Differences in the sampling design may also affect the relationships, as the numbers of specimens and length ranges of the species were distinct among localities (Tesch, 1971; Moutopoulos and Stergiou, 2002, Elawad, 2009). In the present study percentage of male to female red porgy landed off Benghazi coast Eastern Libya was not 1:1 but actually 1:1.8, these compared with Patrick and John, 1997, value of the ratio of male to female landed off North Carolina and South Carolina 1:2.1. The percentage of males to females varied with size of fish and also by season (month) (Sadovy and Shapiro. 1987).

REFERENCES

Ahemed, A. H. 1987. Fish biology, University of El Basra: pp. 279.

AL-Hassan L.A.J. and EL-Silini O.A. 1999. Check-list of bony fishes collected from the Mediterranean coast of Benghazi, Libya. Revista de Biologia Marina y Oceanografia 34: 291-301.

Chester, A.J., Huntsman, G.R., Tester, P.A. and Manooch, C.S. 1984. South Atlantic Bight reef fish communities as represented in hook-and-line catches. *Bulletin of Marine Science* 34: 267-279.

D'Ancona, U. 1949. II differentziamentodellagonade e l'inversionesessualedegli Sparidae. Arch. Oceanogr. Limnol. 6:97-163. 1950. Determination et differenciation du sexe chez les poissons. Arch. Anat. Microsc. Morphol. Exp. 39(3):27429.

Elawad, A. N. 2009. Some characteristics of trawling fishery in Sudanese Red Sea Coast. Ph.D. thesis. Sudan Academy of Sciences. Khartoum. Sudan.

Froese, R. and D. Pauly. 1998. FishBase 1998: Concepts, design and data sources. Manila, ICLARM. 293 p.

Gonçalves, J.M.S., L. Bentes, P.G. Lino, J.Ribeiro, A.V.M. Canario, and K. Erzini. 1996. Weight–length relationships for selected fish species of the small-scale demersal fisheries of the south and south-west coast of Portugal. Fish. Res. 30: 253-256.

Goodyear, C.P. and Thompson, N.B. 1993. An evaluation of data on size and catch limits of red porgy in the Gulf of Mexico . Contribution report MIA-92/93-67. National Marine Fisheries Service, Southeast Fisheries Center, Miami, Florida.

Gulland, J. A. 1985. Fish stock Assessment. A manual of basic methods. Marine resources service. Rome, Italy, p. 293.

Hood, P.B. and Johnson, A.K. 2000. Age, growth, mortality, and reproduction of red porgy, *Pagruspagrus, from the eastern Gulf of Mexico. Fishery Bulletin 98: 723-735.*

Ibrahim, 2013. Study, characterization and biolical study on some species of famlySparidae in Ain El-Ghazala Gulf of eastern Libya. M.Sc. thesis.

Ismen, A. Arslan, M. Gul, G. Yigin, C. G., 2013. Otolith morphometry and population parameters of red porgy, Pagruspagrus in Saros Bay (North Aegean sea). *Ege. J. fish Agua. Sci.* 30(1): 31:35 p.

Kokokiris, L., Bruslé, S., Kentouri, M. and Fostier, A. 1999. Sexual maturity and hermaphroditism of the red porgy *Pagruspagrus* (Teleostei: Sparidae). *Marine Biology* 134(4): 621-629.

Manooch, C. S. 1976. Reproductive cycle, fecundity, and sex ratios of the red porgy, *Pagruspagrus,* (Pisces: Sparidael in North Carolina. *Fish. Bull.* 74:775-781.

Morey, G., Moranta, J., Massut, E., Grau, A., Linde, M., Riera, F., Morales-Nin, B., 2003. Weight–length relationships of littoral to lower slope fishes from the western Mediterranean. *Fisheries Research*, 62:89-96. doi: 10.1016/S0165-7836(02)00250-3

Moutopoulos, D.K., Stergiou, K.I., 2002. Lenght-weight and lenght-lenght relationship of fish species from the Aegean Sea (Greece). *Journal of Applied Ichthyolgy*, 18 (3): 200-203. doi: 10.1046/j.1439-0426.2002.00281.x

Ozaydın, O., Uçkun, D., Akalın, S., Leblebici, S., Tosunoğlu, Z., 2007. Length–weight relationships of fishes captured from Izmir Bay, Central Aegean Sea. *Journal of Applied Ichthyolgy*, 23 (6): 695-696. doi: 10.1111/j.1439-0426.2007.00853.x

Sadovy, Y., and D. Y. Shapiro. 1987. Criteria for the diagnosis of hermaphroditism in fishes. Copeia 1987:136-156.

Stergious, K. I. and Moutopoulos, D. K. 2001. A Review of Length-Weight Relationship of Fishes from Greek marine

waters. Naga, the ICLARM. Quartarly (Vol. 24, Nos. 1 and 2. 23-39p.

Tesch, F. W., 1971. Age and growth. In: Methods for assessment of fish production in fresh waters. W. E. Ricker (Ed). Blackwell Scientific Publications, Oxford, pp. 98-130.

Vassilopoulou, V., and C. Papaconstantinou. 1992. Age, growth, and mortality of the red porgy, *Pagruspagrus,* in the eastern Mediterranean Sea (Dodecanese, Greece I. Vie Milieu 42:51-55.

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