



ISSN: 0976-3376

Available Online at <http://www.journalajst.com>

ASIAN JOURNAL OF
SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol. 09, Issue, 09, pp.8581-8584, September, 2018

RESEARCH ARTICLE

LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF THREE COMMERCIAL FISHES FROM EASTERN LIBYA MEDITERRANEAN SEA

¹Maree S. Abuajaila, ¹Ramadan A. S. Ali, ^{1,*}Sayed M. Ali and ²Abdalla N. Elawad

¹Zoology Department, Omer Al-Mukhtar University, Albaida, Libya

²Fisheries Research Center, Khartoum, Sudan

ARTICLE INFO

Article History:

Received 17th June, 2018

Received in revised form

26th July, 2018

Accepted 19th August, 2018

Published online 30th September, 2018

Key words:

Definition of digital divide, Information Communication Technologies (ICT), disabled people.

ABSTRACT

Fresh samples of 15 *Seriola dumerili* (grade one fish), 15 *Pagrus pagrus* (second grade) and 15 *Liza ramada* (third grade) were collected randomly from the artisanal catch of Al-Hamama fishing area, eastern Libya, during summer (a total of 45 sample) and winter (a total of 45 sample) of 2015. Total Length (TL), Total Weight (TW) and Gutted Weight (GW) were measured for each fish to the nearest 0.1 cm and 0.1 g. Average total length of *S. dumerili* was 32.31 and 36.26 cm in summer and winter in order (corresponding weights: 968.31 and 1180.79 g), that of *P. pagrus* was 29.30 and 29.34 cm (329.09 and 322.13 g) and that of *L. ramada* was 26.12 and 15.75 cm (288.17 and 131.27 g). The Length-weight relationships in summer and winter were $TW = 0.0385 TL^{2.8552}$, $n = 15$, $R^2 = 0.9638$ and $TW = 0.0029 TL^{3.5575}$, $n = 15$, $R^2 = 0.9181$ in order for *S. dumerili*, $TW = 0.0532 TL^{2.5513}$, $n = 15$, $R^2 = 0.9793$ and $TW = 0.114 TL^{2.3304}$, $n = 15$, $R^2 = 0.9729$ for *P. Pagrus* and $TW = 0.3712 TL^{2.0169}$, $n = 15$, $R^2 = 0.9476$ and $TW = 0.2763 TL^{2.1804}$, $n = 15$, $R^2 = 0.9539$ for *L. Ramada*. *L. Ramada* had the highest condition factor (Table 2) in winter (K_F 3.16, K_C 2.79), followed by *S. Dumerili* in summer (K_F 2.37, K_C 2.03) and winter (K_F 2.16, K_C 1.93). *P. Pagrus* had the least condition factor in both seasons (summer: K_F 1.20, K_C 1.10, and winter K_F 1.23, K_C 1.17). Differences between summer and winter K_F and K_C values were not significant for *S. Dumerili* and *P. Pagrus* but were significant for *L. Ramada*. K_F and K_C values were significantly different between the three species except for *P. Pagrus* in winter and *L. Ramada* in summer.

Copyright © 2018, Maree Abuajaila et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

The length-weight relationship of fish has been used since 1930 (Bond, 1986), first this relation was described by the cubic parabola $W = aL^3$ but later by the general parabola $W = aL^b$. The constant b generally ranges from 2 to 4. When it is 3, the growth is called isometric meaning that weight and length increase at the same rate. If it is less than 3 the growth is negative allometric meaning that weight increase at a lesser rate than length. If it is more than 3 the growth is positive allometric, weight increases faster than length. *Seriola dumerili* (Carangidae, Risso, 1810), *Pagrus pagrus* (Sparidae, Linnaeus, 1758) and *Liza ramada* (Mugilidae, Risso, 1826) are common fishes in the artisanal catch of Libya (Ali, 2008; Ibrahim, 2013; Mohamed, 2015; Mohamed et al., 2016 and Buzaid, 2017). According to retailers of fish markets of Libya the greater amberjack *S. dumerili* is a first class fish, the sea bream *P. pagrus* is second class and the thin-lipped grey mullet *L. ramada* is third class. The objective of the present study is, establish length-weight relationship and condition factor for the three fishes in two seasons: summer and winter.

METHODS

Collection of fish samples

Fresh samples of 15 *Pagrus pagrus*, 15 *Seriola dumerili* and 15 *Liza ramada* were collected randomly from the artisanal catch of Al-Hamama fishing area (Fig. 1) during summer (a total of 45 sample) and winter (a total of 45 sample) of 2015.

The study area

Al-Hamama is a small town, fishing ground and fisheries harbor that is located in eastern Libya Mediterranean Sea (Fig. 1). Estimated average depth of the shore water is about 2 m and a maximum depth of 50 m (Reynolds et al. 1995).

Obtained data

Total Length (TL), Total Weight (TW) and Gutted Weight (GW) of individual fish of the three species were measured to the nearest 0.1 cm and 0.1 gram. The Length-weight relationships of the three species were established according to Le-Cren (1951), Ricker (1975) and Letourneur et al. (1998) as:

$$TW = aTL^b$$

*Corresponding author: Sayed M. Ali,

Zoology Department, Omer Al-Mukhtar University, Albaida, Libya.

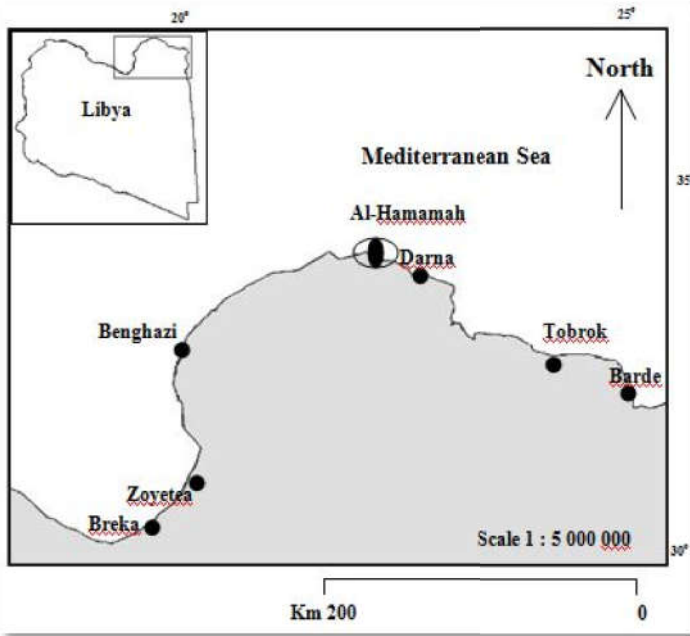


Fig. 1. Al-Hamama, the site from which the study fish were collected

Fulton and Clark condition factors (K_F and K_C) were calculated as:

- $K_F = 100 * W / L^3$ (Fulton, 1902)
- $K_C = 100 * GW / L^3$ (Clark, 1928)

RESULTS

The Length-weight relationship: The Length-weight relationship of the three fishes in summer and winter is shown in (Table 1 and Figs. 2 to 7). The relationship of *S. dumerili* was isometric in summer (2.8552) and positively allometric in winter ($b = 3.5975$). Those of *P. Pagrus* and *L. Ramada* in summer (2.5513, 2.0169) and winter (2.3304, 2.1804) were negatively allometric. All relationships were strong; R^2 ranged between 0.9181 and 0.9793.

Table 1. Length-weight relationship of the three fish species in summer and winter

Species	Summer	Winter
<i>S. dumerili</i>	$Y = 0.0385X^{2.8552}$, $R^2 = 0.9638$	$Y = 0.0029X^{3.5575}$, $R^2 = 0.9181$
<i>P. pagrus</i>	$Y = 0.0532X^{2.5513}$, $R^2 = 0.979$	$Y = 0.114X^{2.3304}$, $R^2 = 0.973$
<i>L. ramada</i>	$Y = 0.3712X^{2.0169}$, $R^2 = 0.9476$	$Y = 0.2763X^{2.1804}$, $R^2 = 0.954$

The condition factor: *L. ramada* had the highest condition factor (Table 2) in winter (K_F 3.16, K_C 2.79), followed by *S. dumerili* in summer (K_F 2.37, K_C 2.03) and winter (K_F 2.16, K_C 1.93). *P. pagrus* had the least condition factor in both seasons (summer: K_F 1.20, K_C 1.10, and winter K_F 1.23, K_C 1.17). Differences between summer and winter K_F and K_C values were not significant for *S. dumerili* and *P. pagrus* but were significant for *L. ramada*. K_F and K_C values were significantly different between the three species except for *P. pagrus* in winter and *L. ramada* in summer.

Species and season effect on the condition factors, and their interactions: The species effect (Table 3) on Fulton and Clark condition factors was significant between *S. dumerili* and *L. ramada* on one side and *P. pagrus* on the other hand.

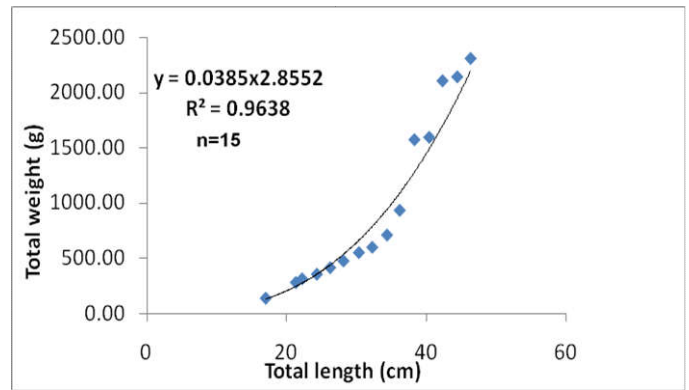


Fig. 2. Length-Weight relationship of *S. dumerili* in summer

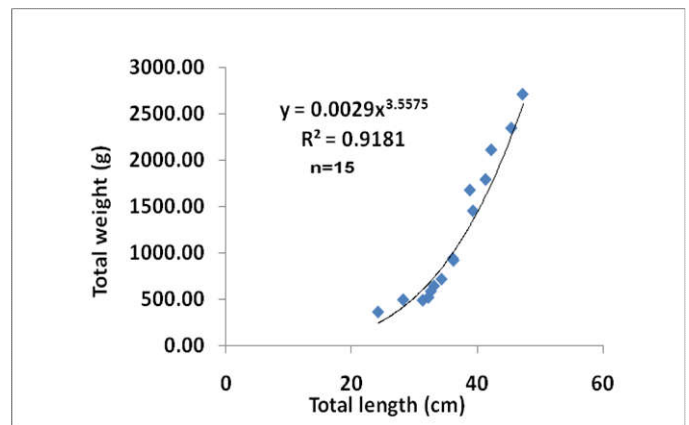


Fig. 3. Length-Weight relationship of *S. dumerili* in winter

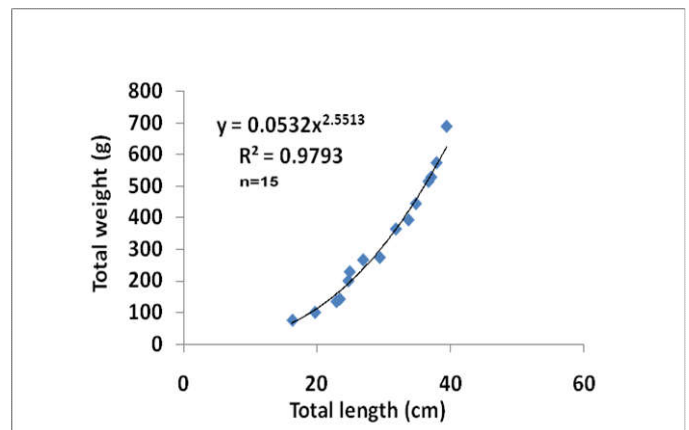


Fig. 4. Length-Weight relationship of *P. pagrus* in summer

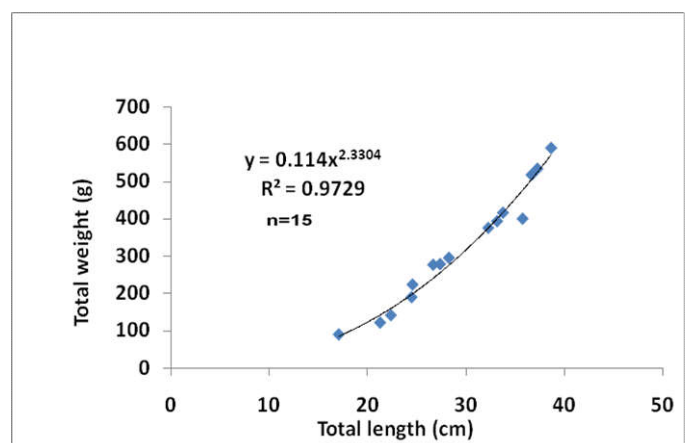


Fig. 5. Length-Weight relationship of *P. pagrus* in winter

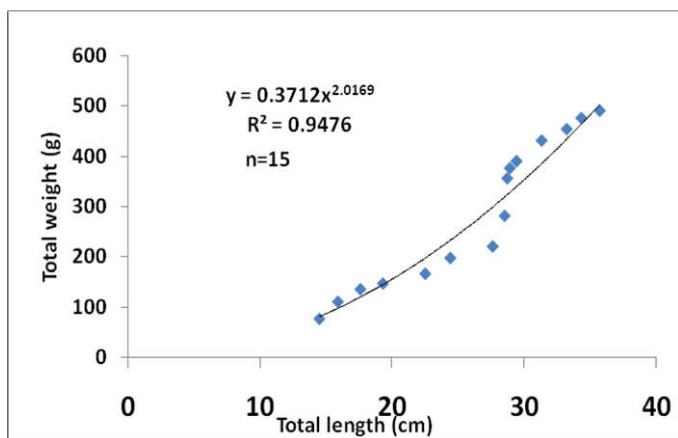


Fig. 6. Length-Weight relationship of *L. ramada* in summer

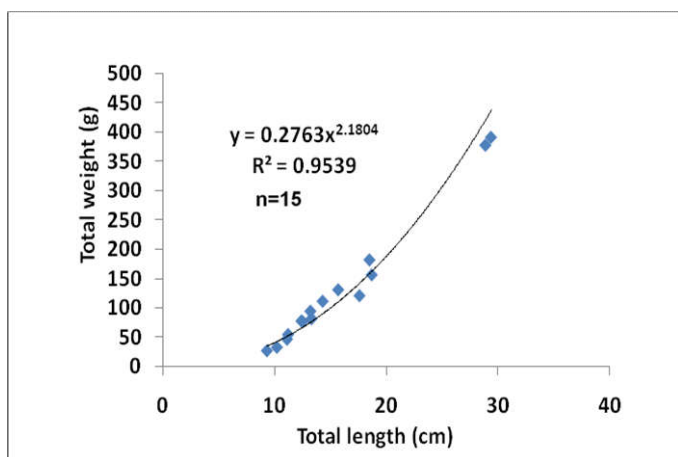


Fig. 7. Length-Weight relationship of *L. ramada* in winter

Table 2. Values of Fulton (K_F) and Clark (K_C) condition factors of the three species in summer and winter

Species	Season	No	K_F	K_C
<i>S. Dumerili</i>	Sum.	15	2.37±0.10 ^c	2.03±0.082 ^c
	Win.	15	2.16±0.12 ^c	1.93±0.097 ^c
<i>P. Pagrus</i>	Sum.	15	1.20±0.05 ^a	1.10±0.031 ^a
	Win.	15	1.23±0.06 ^a	1.17±0.07 ^{ab}
<i>L. Ramada</i>	Sum.	15	1.63±0.14 ^b	1.43±0.11 ^b
	Win.	15	3.16±0.223 ^d	2.79±0.174 ^d

Means within columns carrying different superscripts differed significantly ($p < 0.5$)

Table 3. Effect of species on morphometric traits

Species	No. of fish	Species effect	
		K_F	K_C
<i>S. dumerili</i>	30	2.26±0.08 ^a	1.98±0.06 ^a
<i>P. pagrus</i>	30	1.21±0.04 ^b	1.14±0.04 ^b
<i>L. ramada</i>	30	2.40±0.19 ^a	2.11±0.16 ^a

Means within columns carrying different superscripts differed significantly ($p < 0.5$)

Table 4. Effect of season on morphometric traits

Season	No. of fish	Season effect	
		K_F	K_C
Summer	45	1.73 ±0.09 ^b	1.52 ±0.07 ^b
Winter	45	2.18 ±0.15 ^a	1.96 ±0.12 ^a

Means within columns carrying different superscripts differed significantly ($p < 0.5$)

Table 5. Interaction between species and season on morphometric traits

Source of variation	K_F	K_C
Species*season	**	**

Traits	K_F	K_C
TL cm	.560**	.997**
TW g	.230*	.761**
GW g	-.678**	-.490**

** = Significant at the 0.01 level

** : Correlation is significant at the 0.01 levels

*: Correlation is significant at the 0.05

The season effect (Table 4) on both condition factors was significant. The interaction (Table 5) between the species and the season effects was highly significant.

Correlations between traits: K_F and K_C correlated positively significantly with TL and TW and negatively with GW at various magnitude of the correlation coefficient (Table 6).

DISCUSSION

S. dumerili of the present study had the highest length and weight among the three fishes. Its length and weight ranged from 17.1 to 47.3 cm corresponding to 137.60 and 2713.80 g. *P. pagrus* length range was 16.3 to 39.4 cm corresponding to 74.5 to 691.4g. *L. ramada* length ranged from 11.1 to 29.4 cm corresponding to 47.3 to 391.2 g. The length-weight relationship obtained in the present study for *Seriola dumerili* was $W = 0.0385L^{2.8552}$ and $W = 0.0029L^{3.5575}$ in summer and winter reflecting isometric and positively allometric growth in order. That obtained for the same species from Al-hamama coast, eastern Libya by Mohamed, 2015, was $W = 0.019*L^{2.8726}$. Kozul *et al.*, 2008, studied the relation between length and weight in south eastern Adriatic Sea. They stated that $b = 2.765$ and $b = 3.001$ for pre-adult and adult *Seriola dumerili*. Similar result ($b = 2.933$) was reported for *Seriola dumerili* in lagoon of New Caledonia by Kulbicki *et al.*, 1993. The characteristic high growth rate common to this species was also pointed out as making it suitable for both open sea and inland aquaculture (Cavaliere *et al.* 1989 and Greco, 1993). Fulton and Clark condition factors reflect the healthiness of fish. The higher their value the healthier the fish is. The value of these two factors obtained for *Seriola dumerili* in the present study were 2.37 and 2.03 in summer and 2.16 and 1.93 in winter in order. Mohamed, 2015, in a one year study obtained a range of Fulton and Clark condition factors for pre-adult *Seriola dumerili* as 2.21-3.15 and 1.54-2.76 consecutively, and 1.03-1.44 and 0.89-1.18 for adult *Seriola dumerili*. The variation in the condition factors of fish is affected by locality, season and feeding activities (Niklosky, 1963; Roo *et al.* 1999; Gillanders *et al.* 2010). The length-weight relationship of *P. pagrus* of the present study was $y = 0.0532x^{2.5513}$ and $0.114x^{2.3304}$ in summer and winter reflecting negative allometric growth. The length-weight relationship established for the same species from SUSA coast, eastern Libya, by Ali, 2008, was $W = 0.0228L^{2.7946}$ indicating negative allometric growth. Ibrahim, 2013, reported similar relationship of $W = 0.0237L^{2.7718}$ for the same species from Ain El-Ghazala, eastern Libya. Ali, 2008, reported that ranges of Fulton and Clark condition factors for *P. pagrus* were 0.6-3.73 and 0.57-3.64. Ibrahim, 2013, reported the following values for

the same species: K_F : 0.99-1.44, K_C : 0.89-1.35. In the present study, the constant b of the length-weight relationship of *L. ramada* was 2.01 in summer and 2.18 in winter reflecting negative allometric growth in both seasons. Khaleefi, 2016, obtained b values for the same species from Benghazi coast, eastern Libya Mediterranean Sea, ranging from 2.16 to 3.34 for the same species during December 2014 to November 2015. Mohamed *et al.*, 2016, reported $W=0.016L^{2.847}$ from Ain El-Ghazala lagoon, eastern Libya Mediterranean Sea. Mehanna, 2006, mentioned that for *L. ramada* from lake Bardwil, Egypt, the exponent b was 3.13. It is known that the values of the constants a and b differ between species, through the year, through the spawning season and according to the degree of fullness of the stomach (Ahemed, 1987). The condition factors obtained in the present study for *L. ramada* were K_F 1.63 and 3.16 in summer and winter, while that for K_C was 1.43 and 2.97. Similar results were obtained by Khaleefi, 2016, who reported that *L. ramada* condition factor was high during summer (1.1152) and low during winter (0.9993).

REFERENCES

- Ahemed, A. H. 1987. Fish biology. University of El Basra: pp. 279.
- Ali, Randa Rajab. 2008. biological studies on *Pagrus pagrus* from sosa (El-Gabal El-Akadar), Libya. M Sc Thesis. Department of Marine Resources Faculty of Natural Resources and Environmental Sciences, University of Omar Al Mukhtar. Albaida, Libya.
- Bond, K.I. 1986. Fish life. University of Organ, pp.475
- Buzaid, Esam M. K, Sayed Mohamed Ali, Mohamed E. Elmor. 2017. Characteristics of bottom trawling by catch in Benghazi coastal area, eastern Libya Mediterranean Sea. *Journal of Gold Scientific Research*, 2 (2017) 24-34
- Cavaliere, A., Crisaf, E., Faranda, F, Greco, G., Manganaro, A. and Mazzola, A. 1989. Collection of fingerling and rearing of *Seriola dumerili* in tanks. Aquaculture. A biotechnology in progress. De Pauw. Jaspers E. Ackefors H., Wilkins N. EDS. European Aquaculture Society. I-II:119-123.
- Clark, F. N. 1928. The weight length relationship of the California saerdine (*Sardina coarulea*) at San-Pedro. Division of fish and game of California. Fish bull.no.12-59.
- Fulton, F. 1902. Rate of growth of sea fishes. Scient.Invest fish. Div. Scot Rep. 20.
- Gillanders, B. M., Ferrell, D. J. and Andrew N. L. 2010. Size at maturity and seasonal changes in gonad activity of yellowtail kingfish (*Seriola lalandi*; Carangidae) in New South Wales, Australia. *Mar Aqu cult.* 22:457-468.
- Greco, S., Caridi, D., Cammaroto, S. And Genovese, L. 1993. Preliminary studies on artificial feeding of amberjack fingerlings. Production Environment and quality. Bordeaux Aquaculture G. Barnabe and P. Kesemond Eds EAS Special Publ. N. 18:247-254.
- Ibrahim, S. M. 2013. Characterization and biological study on some species of Family Sparidae in Ain El-Ghazala Gulf of eastern Libya. M.Sc., Faculty of Science, Omar Al-Mukhtar university, Albaida, Libya.
- Khaleefi, Manal M., (2016. A study of some population dynamic characteristics of *Liza ramada* (Risso, 1826) in Benghazi coast, Libya. M Sc. Thesis, Omar Al-Mukhtar University, Albaida, Libya.
- Kožul, A., Skaramuca, C., Kraljević, K., Dulčić, A. and Glamuzina, (2008. Age, growth and mortality of the Mediterranean amberjack *Seriola dumerili* (Risso 1810) from the south-eastern Adriatic Sea. *Journal of Applied Ichthyology*, 17, (3): 134-141.
- Kulbicki, M., G. Mou Tham, P. Thollot and L. Wantiez, 1993. Length-weight relationships of fish from the lagoon of New Caledonia. *Naga ICLARM Q.* 16(2-3):26-29.
- Le-Cren, E. D. 1951. The length – weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *J. Anim. Ecol.*, 20:201 – 219.
- Letourneur, Y.; Kulbicki, M. and Labrosse, P. 1998. Length-weight relationships of fish from coral reefs and lagoons of New Caledonia, southwestern Pacific Ocean: an update. *Naga ICLARM Q.* 21(4):39-46.
- Mehana, F. S. 2006. Fisheries management of the thinlip grey mullet *Liza ramada* and golden grey mullet *L. aurata* from lake Bardail, *J. Aquat. Bioi & fish.*, Voi 10, No.2:33-53 (2006) EGYPT.
- Mohamed, Nesma Idres, (2015. Biological study on *Seriola dumerili* from Al-Hamama coast, Eastern Libya. M.Sc., Faculty of Science, Omar Al-Mukhtar university, Albaida, Libya.
- Mohammed, Amena A., Lutfi M. A. Musa, Ramadan A. S. Ali. Abdalla N. Elawad and Sayed M. Ali. 2016) The length weight relationship and condition factors of the thinlip mullet *Liza ramada* and the flathed grey mullet *Mugil cephalus* (Mugilidae) fishes from Ain El-Ghazala lagoon, eastern Libya. *International journal information research and review*, June, 2016. Vol.03, issu, 06,pp. 2504-2507, June, 2016.
- Niklosky, G. V. 1963. The ecology of fishes. Academic press London, New York, 352pp.
- Reynolds, J. E., Haddoud, D. A., Vallet, F., (1995. Prospects for aquaculture development in Libya, Lib. fish field documents N 9. Tripoli / Rome, FAO. FAO. 94p. Fl: DP/LIB/88/009 - Fl: GCP/LIB/021/lsDB, Field Document 9 (En).
- Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of fisheries research board of Canada 191. 382 pp.
- Roo, F. J. Scorro, M, S. Izquierdo, M. J. Caballero, C. M. Hernandez-Cruz, Fernandez and Palaccios, H. F. 1999. Development of red porgy *Pagrus pagrus* visual system in the digestive tract and larval feeding habits. *Aquaculture* 179: 499-512.
