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Some Aspects of The biology of Black Spot Sea Bream, *Pagellus bogaraveo* (Brunnich, 1768) in Umm al-Rizam Coast, Eastern Libya

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بعض الخصائص البيولوجية على سمكة المرجان ذو النقطة السوداء *Pagellus bogaraveo* (Brunnich 1768) في ساحل أم مرزم، شرق ليبيا

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Abstracts

Monthly samples of 600 specimens of *Pagellus bogaraveo* were collected from artisanal fishing on Umm al Rizam coast, eastern Libya in 2019. Total length ranged from 16.5 to 38.4 cm with average total weight ranging from 68.5-401.8 g. The length–weight relationship for all individuals was described by the following parameters: α= 0.008 and b= 3.0993. There were monthly variations in the sex ratio between males (245 fish= 40.8%) and females (355 fish= 59.2%). The overall sex ratio was 1:1.45 in favor of females. *Pagellus bogaraveo* feed on a wide variety of prey types: bony fish (41.2%), mollusks (22.9%), crustaceans (20.1%), polychaetes (7.5%), algae (4.4%), and echinoderms (3.9%). The feeding intensity was quite high during the summer (82.5%) and autumn (68.0%).

Keywords: Biology aspects, *Pagellus bogaraveo*, Umm al Rizam coast, Derna, Mediterranean Sea, Libya.

الملخص

تم جميع عينات شهرية حوالي 600 عينه اسماك من سمكة المرجان ذو النقطة السوداء من الصيادين لساحل ام مرزم شرق ليبيا المطل على البحر المتوسط خلال عام 2009، حيث كان معدل الطول الكلي لدي الاسماك يتراوح طولها ما بين 16.5– 4.38 سم، وتم دراسة العلاقة بين الاطوال والأوزان وكانت العلاقة مثالية النمو حيث ان قيمة α= 0.008 و b= 3.0993. وبدراسة الشق الجنسي للأسماك وجد أن الاناث هي السائدة طوال شهور التجميع خصوصا في شهور التكاثر، وكان الشق الجنسي العام بنسبة 1: 1.45، وبأوزان تتراوح ما بين 68.5– 401.8 جم. والسمكة كان لها قائمة غذائية كبيره تتكون من صغار الاسماك العظمية (41.2%) والرخويات من أحاديات وثنائيات المصرع (22.9%) والقشريات من الجمبري والكابوريا (20.1%) والديدان عديدة الاشواك (7.5%) والطحالب الخضراء (4.4%) والجلد شوكيات من نجوم البحر (3.9%)، وكانت السمكة شديدة الاغتذاء في الصيف والخريف.

الكلمات الدالة: الخصائص البيولوجية، سمكة المرجان ذو النقطة السوداء، ساحل ام مرزم، درنة، البحر الأبيض المتوسط، ليبيا.

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1. Introduction

Sparid fishes inhabit tropical and temperate coastal water. Fish individuals are swimming near the shore in shallow inlet and bays at moderate depth. Family Sparidae comprise about 22 genera in four subfamilies containing 41 species Bauchot and Smith (1983). 14 species were recorded in the Libyan coast, such as *Pagellus bogaraveo*, *Diplodus vulgaris, Pagrus pagrus, Diplodus puntazzo, Diplodus vulgaris, Lithognathus mormyrus, Oblada melanura, Sarpa salpa,* and *Crenidens crenidens* (Elbaraasi *et al*., 2019; and Al-Hassan and El-Silini, 1999). The black spot sea bream, *Pagellus bogaraveo* (Brunnich, 1768) is one of the fishes in family Sparidae, is one of the most popular sparid fish species in the Mediterranean region and the Atlantic coast (Bauchot and Hureau, 1986), the fish had been characterized by high price value, a highly appreciated flesh and good market perspectives. Although the black spot sea bream found in a wide variety of locations that range from Eastern Atlantic: Norway, Strait of Gibraltar to Cape Blanc in Mauritania, Madeira, Canary Islands, and western Mediterranean (rare beyond the Sicilian Strait), its status is considered endangered (Psomadakis *et al*., 2012; and Jonsson, 1992). From the available literature, it was found that few works have been published on the biology of Sparid fishes in the study area (Ekwella, 2008; Ben-Abdallah *et al*., 2005; and Laith, 2003). Laith (2003) studied asymmetry in some morphological characters of four sparid fishes in Benghazi coast. Froglia (1977) stated that feeding biology of Sparid fish *Lithognathus mormyrus* in Central Adriatic, he concluded that the species feed on a wide variety of prey types: crustacean, polychaetes, molluscs and echinoderms, also Jardas (1996) studied the feeding biology for the same previous species in the same previous area and he stated that the species feed on crustacean, polychaetes, molluscs, Echinoderms, fish parts, and sea grasses. Ali (2008) stated that feeding biology of Sparid fish *Pagrus pagrus* in Souse coast, eastern Libya; she concluded that the species feed on a wide variety of prey types: crustacean, polychaetes, molluscs, echinoderms, fish parts, sea grasses and foraminifera. El-Mor and El-Maremie (2008) studied feeding habits of the nockt Diplodus noct in southern Sinai, Gulf of Suez, Red Sea Egypt, they stated that the species feed on a wide variety of prey types, fish parts, crustacean, sea grasses, mollusks, algae and copepods. The target species inhabits rocky substrate often covered with vegetation. Found also in sea grass meadow to depth of 50 m. Young fish live in large schools in shallow waters. Omnivorous, feeds on shrimps, mollusks, worms and seaweeds (Golani *et al*., 2006). This is the first study so far on the biology of *Pagellus bogaraveo* (family Sparidae) in Libyan eastern coast. *Pagellus bogaraveo* position in the trophic structure of the Libyan eastern coast is poorly understood. So the aim of the present study is defining the trophic relationships between *Pagellus bogaraveo* with other invertebrates and fishes in this area, in order to understand the dynamic of this regional ecosystem. Beside results from feeding habits of *Pagellus bogaraveo* may have direct implications for aquaculture.

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2. Materials and Methods

A total of 600 specimens of *Pagelus bogaraveo* were collected from artisanal fishing in Umm al Rizam coast, eastern Libya 32°53′24″N 23°00′56″E (Figure.1) on the Mediterranean Sea during 2019. Umm al-Razm is a Libyan town within the province of Derna, located about 48 km east of the city of Derna, and about 125 km west of Tobruk , and it is administratively followed by several villages, which are Umm Ahfeen, Bemba, and Ras al-Teen.

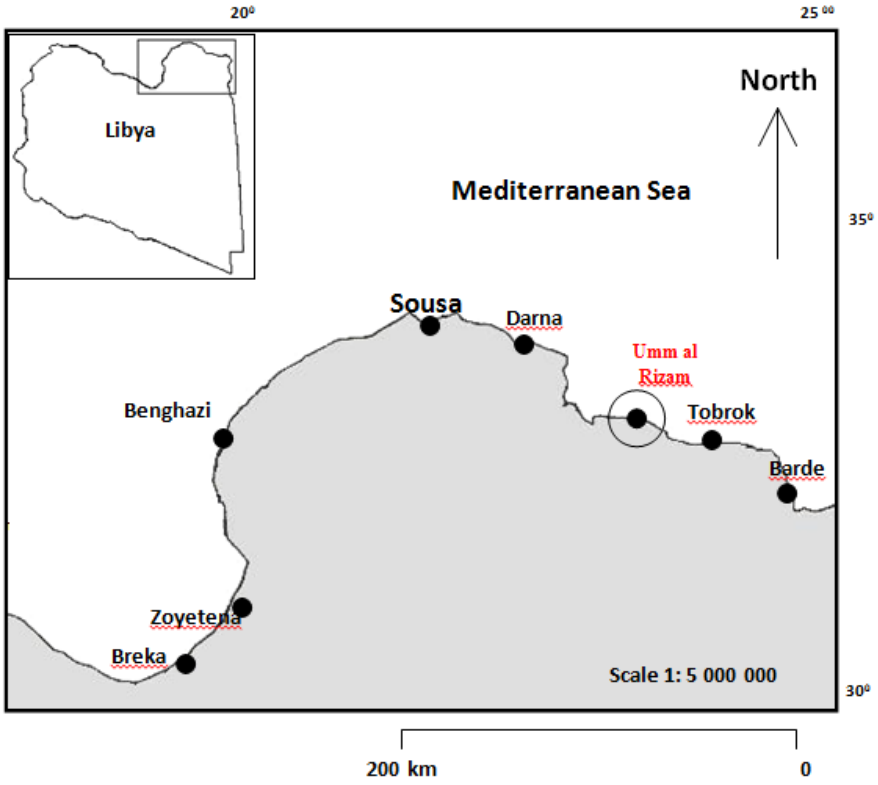

Figure 1. Map of Umm al-Rizam, on the Mediterranean Sea, eastern Libya

2.1. The morphological measurement

The fish length was taken using a ruler graduated in mm. each fish was wet weight (T.W) to nearest 0.1 g.

2.2. Length-weight relationship

The length weight relationship was described by the power relation based on (Le-Cren, 1951);

$$W = a \times L^b \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Where; W: Total weight (g), L: total length (cm), and a and b: are constants.

2.3. Food and feeding

Each fish was dissected and alimentary tract and gonads were removed from the body cavity, then measurement of gutted weight (G.W) to the nearest 0.1 g was achieved. Sex and feeding habits of *Pagellus bogaraveo* such as annual, diet composition and feeding intensity were estimated in this study. For each fish specimen was dissected and the alimentary tract

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removed and preserved in formalin. The degree of fullness of the stomach was assessed by visual estimation and classified as empty, trace, quarter full, half full, three quarters full and completely full respectively as described in Pillay (1952). Food items were identified to their groups. A list of general diet composition was made food analysis was made by points of assessment (Hynes, 1985; and Hyslop, 1980). The results were statistically analysis subjected to the further statistical treatment according to Godfriaux (1969) in order to give more precise information about food and feeding habits of *Pagellus bogaraveo*.

3. Results

3.1. Length weight relationship

Length-weight relationships for *Pagellus bogaraveo* were calculated for total population shown in Table (1) and represented by the following equation:

$$W = 0.008 \times L^{3.0993} \qquad n = 600 \qquad R^2 = 0.9257 \qquad \ldots\ldots\ldots\ldots \quad (2)$$

L : Total length (16.5-38.4 cm).
W: Total weight (68.5-401.8 g).

The result revealed that the equation show highly satisfactorily fit agreement between the averages observed and calculated weight for each length group (Figure 2). Also, the calculated slope "*b*" value for length weight relation was observed isometric growth (*b*= 3.0993).

Table 1. Average empirical, calculated weight per length groups of 600 *Pagellus bogaraveo* from Umm al-Rizam coast, eastern Libya during the period from January till December 2019.

length (cm)			Aver. Obser.	Cal.
Range	Average	No. of fishes	weight (g) ± S.D.	weight (g)
16.5-18.4	17.5	65	68.5±1.88	57.0
18.5-20.4	19.4	59	93.7±3.11	78.4
20.5-22.4	21.6	43	129.9±11.3	109.4
22.5-24.4	23.5	55	167.9±15.34	142.0
24.5-26.4	25.4	55	212.6±22.56	180.8
26.5-28.4	27.6	67	273.7±25.89	233.8
28.5-30.4	29.4	43	331.7±31.65	284.4
30.5-32.4	31.3	55	367.2±39.56	345.3
32.5-34.4	33.2	46	378.1±41.23	414.5
34.5-36.4	35.3	57	391.2±47.34	501.3
36.5-38.4	37.2	55	401.8±49.34	589.8

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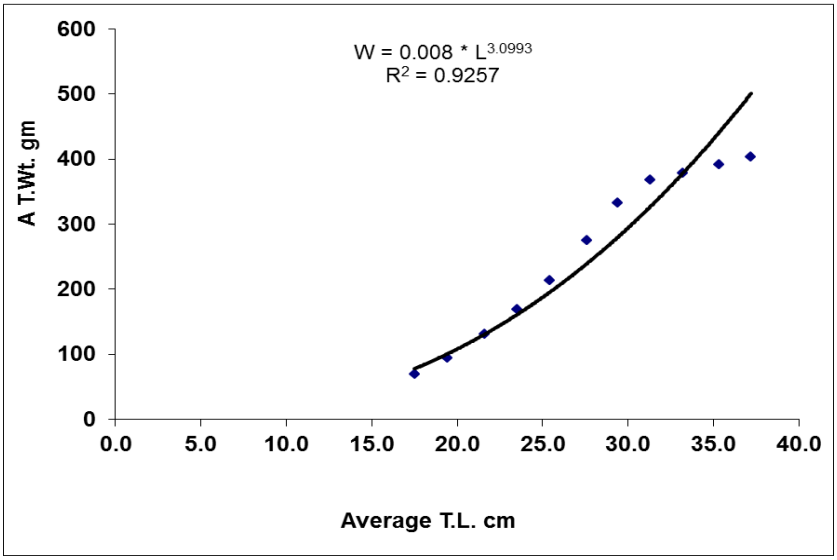

Figure 2. The relation between average total length (cm) and average total weight (g) for *Pagellus bogarave* from Umm al-Rizam coast, eastern Libya during the period from January till December 2019.

3.2. Sex Ratio

Generally, these is a tendency for more females (355 fish= 59.2%) than males (245 fish= 40.8%) for the whole population. Overall sex ratio was 1:1.45 for males to females (Table 2). The sex ratio was not constant throughout the different months; the numbers of females exceed males in all months. The maximum percentage of females was recorded in August (64.6%), September (68.4%), October (64.2%), November (64.0%), December (63.6 %), January (63.5%), and February (61.4 %).

Table 2. Monthly variations in sex ratio 600 *Pagellus bogaraveo* from Umm al-Rizam coast, eastern Libya during the period from January till December 2019.

		Males		Females		
Months	**No. of fish**	**No.**	**(%)**	**No.**	**(%)**	**Sex ratio**
Jan. (2019)	52	19	36.5	33	63.5	1 : 1.74
Feb.	57	22	38.6	35	61.4	0 :1.59
Mar.	54	23	42.6	31	57.4	1 : 1.35
Apr.	68	29	42.6	39	57.4	1 : 1.34
May	57	27	47.4	30	52.6	1 : 1.11
Jun.	57	28	49.1	29	50.9	1 : 1.04
Jul.	58	28	48.3	30	51.7	1 : 1.07
Aug.	48	17	35.4	31	64.6	1 : 1.82
Sep.	38	12	31.6	26	68.4	1 : 2.17
Oct.	53	19	35.8	34	64.2	1 : 1.79
Nov.	25	9	36.0	16	64.0	1 : 1.78
Dec.	33	12	36.4	21	63.6	1 : 1.75
Total	**600**	**245**	**40.8**	**355**	**59.2**	**1 : 1.45**

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3.3. Annual diet composition

The variety of food items was large as shown in Figure (3). However, bony fish supplemented by mollusks and crustaceans formed the major food groups for *Pagellus bogaraveo*. Bony fish (41.2%) such as; the juvenile of *Boops boops, Diplodus annularies,Diplodus sargus. Liza ramada* and *Mugil cephalus* formed the major food groups for *Pagellus bogaraveo*, mollusks made up of (22.9%) by volume composition of the bulk of the diet were represented by bivalve and gastropods, whereas crustaceans (20.1%) coming in the third position of the bulk of the diet such as shrimp and crabs. Polychaetes (7.5%) followed by green algae (4.4%) and echinoderms (3.9%) such as sea stars.

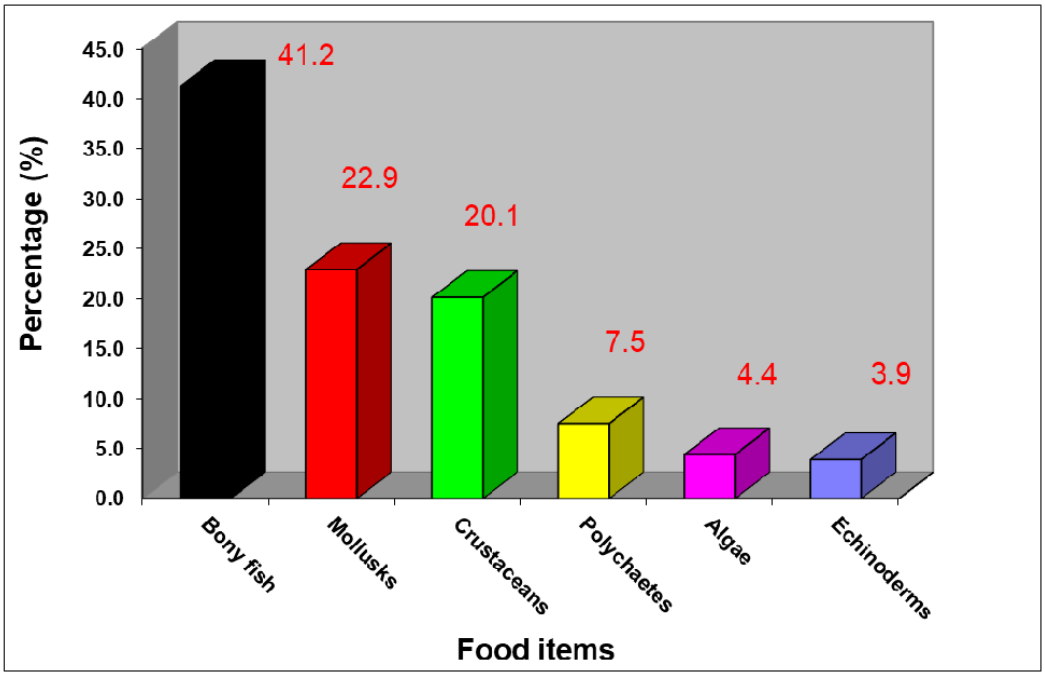

Figure 3. The diet composition of *Pagellus bogarave* from Umm al-Rizam coast, eastern Libya during the period from January till December 2019.

3.4. Feeding intensity

Fishes with stomach half full, almost full and full of food ranked b% constituted 55.5% of all analyzed individual, whereas those with stomach that were empty or with traces of food and quarter full ranked a% represented 44.5% of the total specimens (Table 3).The feeding activities were quite high during summer (82.5%) and autumn (68.0%). There are minimal rate of feeding intensity recorded in winter (28.3%) and spring (43.3%).

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Table 3. Seasonally variations in the intensity of feeding of 600 *Pagellus bogaraveo* from Umm al-Rizam coast, eastern Libya during the period from January till December 2019.

		The degree of distension of the stomach							
Seasons	**No. of fish**	**Empty**	**Trace**	**1/4**	**%**	**1/2**	**3/4**	**Full**	**%**
Winter	**189**	19.4	24.6	27.7	**71.7**	12.9	4.0	11.3	**28.3**
Spring	**134**	14.7	12.3	29.7	**56.7**	14.7	28.7	A	**43.3**
Summer	**89**	16.9	0.7	A	**17.5**	13.5	27.9	41.1	**82.5**
Autumn	**188**	17.7	6.7	7.7	**32.1**	16.8	18.5	32.7	**68.0**
Total average	**600**				**44.5**				**55.5**

Remarks: Data expressed as percentage (A)= No food in month occurred

4. Discussion

There are a few of published works on length-weight relationship of *Pagellus bogaraveo* (Giacalone *et al*., 2010; Chilari *et al*., 2006; and Campillo, 1992). A number of factors are known to influence the length weight relationship in fishes including growth phase, sex, size range, temperature and preservation techniques (Bilge *et al*., 2014). He mentioned that the coefficients of length-weight relationship were different not only between species but sometimes also between stock of the same species due to sex season and maturity stage. Chilari *et al*. (2006), stated that *b* =2.9339 (isometric growth), for the same species studied in the present work, in the Ionian Sea, Greece. Giacalone *et al*. (2010), stated that *b* =2.9910 (isometric growth), for the same species studied in the present work, in the coast of northern Sicily (central Mediterranean Sea). It was found that few works have been published on the reproductive biology of *Pagellus bogaraveo* in the Mediterranean Sea (Buxton and Garratt, 1990; and Dorel, 1986). A total of 600 specimens of *P. bogaraveo* were sampled for studying the sex ratio during the study period from January to December 2019. In the present work overall sex ratio was 1:1.45 for males to females these results are in agreement with those results of *P. bogaraveo* in Northeastern Mediterranean (Dorel, 1986). The sex ratio is not constant throughout the different months, particularly during the breeding season of each species (Perez *et al*., 1992). Females are dominant sex in Sparid populations (Buxton and Garratt, 1990). It is possible that the females are heavy and get caught in the gear in large numbers, resulting in an unbalanced sex ratio (Dorel, 1986). Unbalanced sex ratios are natural in fishes and are generally related to sexual differences in growth, mortality or reproduction (Marshall *et al*., 1998). Skewed sex ratios in favor of females are quite common in Sparid fishes with few exceptions especially during spawning months when males prevail (Bauchot

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and Hureau, 1986). The study of the food and feeding habits of fish species remains a subject on fish capture and culture (Oronsaye and Nakpodia, 2005). The stomach contents could provide useful information on positioning of the fishes in the food web of their environment and estimation of trophic levels (Pauly and Christensen, 2000; and Post *et al.*, 2000). In addition, the quality and quantity of food are among the most important exogenous factors directly affecting growth and indirectly, maturation and mortality of fish, thus being ultimately related to fitness (Wootton, 1990). *P. bogaraveo* being a commercially important fish needs special attention and the study of its food and feeding is important. This study provides more insights into the feeding habits of *P. bogaraveo* at Umm al-Rizam coast, eastern Libya which was observed from samples obtained during the four seasons of 2019. In the present work the feeding intensity was high during the summer and autumn which has been reported before and after the spawning season for *P. bogaraveo* in the Mediterranean (Bauchot and Hureau, 1986). This may be explained by the fact that during spawning, the fish had fully occupied abdominal cavity with the ripe gonads and empty stomach. The synchronization of the period of poor feeding activity with spawning season has been reported for other fish species (Shalloof and Khalifa, 2009). In the present work, diet composition of *P. bogaraveo* revealed that they usually feed on bony fish, mollusks, crustaceans, polychaetes, algae and echinoderms this is full agreement with Papaconstantinou *et al*. (1994) in Thermatikas Gulf and Thracian Sea, Greece and in report of (Gomes *et al*., 1998) in Azores, Portugal.

5. Conclusions

In the present study is defining some biological aspects from monthly samples of 600 specimens of *Pagellus bogaraveo* were collected from artisanal fishing in Umm al-Rizam coast, eastern Libya during 2019. Total length ranged from 16.5 to 38.4 cm with average total weight ranged from 68.5-401.8 g. The length–weight relationship for all individuals was isometric growth where the value *b*= 3.0993. The overall sex ratio was 1:1.45 in favor of females. *Pagellus bogaraveo* feed on a wide variety of prey types: bony fish, mollusks, crustaceans, polychaetes, algae and echinoderms. The feeding intensity was quite high during the summer and autumn.

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