



FEEDING HABITS OF THE COMMON TWO BANDED SEA BREAM, *DIPLODUS VULGARIS* (GEOFFROY SAINT-HILAIRE, 1817) (TELEOSTEI: SPARIDAE) IN AIN EL-GHAZALA LAGOON, EASTERN LIBYA

Hamad EL-Maremie^{1*}, Sarah Ali Abdalnabi² and Mohammad El-Mor^{2,3}

¹Marine Resources Department, Faculty Of Natural Resources And Environmental Science, Omar Al-Mokhtar University, P.O. Box 919 El-Bayda, Libya

²Zoology Department, Faculty of Science, Omar Al-Mokhtar University, P.O. Box 919 El-Bayda, Libya

³Marine Science Department, Faculty of Science, Suez Canal University, Egypt

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Abstract: The feeding habits of 500 specimens of *Diplodus vulgaris* (family: Sparidae), inhabiting Ain El-Ghazala Lagoon, were studied monthly from September 2013 till August 2014. The annual diet composition, monthly variations in the diet composition, the variations of diet with length and the intensity of feeding were studied. *Diplodus vulgaris* feed on a wide variety of prey types: crustaceans (33.5%), polychaetes (20.5%), green algae (20.1%), mollusks (6.1%), foraminifers (2.7%) and sediments (17.1%). The crustaceans, polychaetes, green algae, were the major food item all year round and it was found in all length groups. In the present study crustaceans, green algae and sediments increased as the size increased while polychaetes, mollusks and foraminifers decreased as the fish size increased. The feeding intensity was quite high during the autumn and spring.

Key words: Feeding habits, *Diplodus vulgaris*, eastern coast, Mediterranean Sea, Libya

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 *Diplodus vulgaris*, *Pagrus pagrus*, *Dentex dentex*, *Diplodus vulgaris*, *Lithognathus mormyrus*, *Oblada melanura*, *Sarpa salpa* and *Crenidens crenidens* (Al-Hassan and El-Silini, 1999). The common two banded sea bream 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, 1990), the fish had been characterized by high price value, a highly appreciated flesh and good market perspectives. Although the annular sea bream found in a wide variety of locations that range from Europe to the Caribbean, its status is considered endangered (Figueiredo *et al.*, 2002). From the available literature, it was found that few works have been published on the biology of Sparid fishes in the study area (Laith, 2003; Ben-Abdallah *et al.*, 2005 and Ekwella, 2008). Laith (2003) studied asymmetry in some morphological characters of four sparid fishes in Benghazi coast. Frogliia (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, mollusks 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, mollusks,

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, mollusks, 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.

This is the first study so far on the feeding habits of *Diplodus vulgaris* (family Sparidae) in Libyan eastern coast. *Diplodus vulgaris* 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 *Diplodus vulgaris* with other invertebrates and fishes in this area, in order to understand the dynamic of this regional ecosystem. Beside results from feeding habits of *Diplodus vulgaris* may have direct implications for aquaculture.

MATERIALS AND METHODS

Monthly samples of *Diplodus vulgaris* were collected during the period from September 2013 till August 2014 by using gill and trammel nets they were obtained from fish landing site at Ain El-Ghazala Lagoon, which is located along the eastern most stretch of the Libyan coastline on the Mediterranean Sea (Fig. 1). A total of 500 specimens of *Diplodus vulgaris* were sampled for studying the feeding habits.

*Corresponding Author:

Hamad EL-Maremie,

Marine Resources Department,
Faculty of Natural Resources and Environmental Science,
Omar Al Mokhtar University, p.o.box 919,
El-Bayda, Libya.



Feeding Habits of the two banded sea bream, *Diplodus vulgaris* (Geoffroy Saint-Hilaire, 1817) from Ain El-Ghazala lagoon, Libya. Annual diet composition, seasonal variations of diet, variations of diet with lengths and feeding intensity were estimated in this study. For each fish specimen total length measured to the nearest 0.1 cm. Each fish was dissected and the alimentary tract 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 (Hyslop, 1980 and Hynes, 1985). 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 *Diplodus vulgaris*.



Figure 1: Illustrated Ain El-Ghazala Lagoon in eastern of Libyan coast.

RESULTS

Annual Diet Composition

The variety of food items was large (Fig. 2). However, crustaceans supplemented by polychaetes and green algae formed the major food groups for *Diplodus vulgaris*. Crustaceans made up of 33.5% by volume composition of the bulk of the diet which represented by small prawns and crabs, whereas polychaetes (20.5%) coming in the second position of importance. Green alga (20.1%) which was mainly represented by *Ulva spp.*, *Enteromorpha spp.*, *Codium spp.*, *Chladophora spp.* and *Cheitomorpha spp.*, this following by mollusks (6.1%) were composed of bivalves and gastropods. Foraminifers constituting 2.7%, all of them with small quantities of sediments (Sand) constituting 17.1%.

Monthly Variations in Diet Composition

The food items crustaceans, polychaetes and green algae were occurred in all year round and constituted the major food items during the study (Table 1). Mollusks completely disappeared in January,

February, July and August. Foraminifers absent from the food list in December, February, May, July and August where sediments completely disappeared from the diet composition during January and August. Table (2) showed seasonally variations in diet composition for 500 specimens of *Diplodus vulgaris* in Ain El-Ghazala Lagoon during the study period, in winter the fish preferred crustaceans (36.4%), polychaetes (29.6%). Where the fish preferred green algae (28.8%) and sediments (20.1%) in summer. In spring the fish preferred mollusks (10.8%) and foraminifers (4.8%).

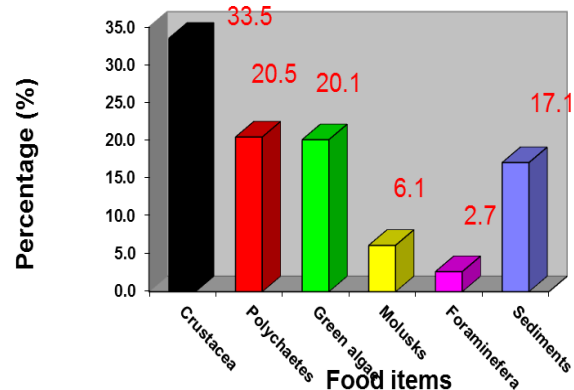


Figure 2: The diet composition of *Diplodus vulgaris* from Ain El-Ghazala Lagoon, eastern Libya during the period from September 2013 till August 2014.

Feeding habit in relation to fish size

The total length of *Diplodus vulgaris* population classified into 11 classes ranged from 12.5 cm to 34.4 cm with 1.9 cm interval (Table 3). Prey size differed between large size individuals, which had ingested the large size prey, whereas the small sized fish ingested the small size prey. Crustaceans, polychaetes, green algae, and sediments were found in all length groups of *D. vulgaris*. Crustaceans, green algae and sediments increased as the fish size increased while, polychaetes, mollusks and foraminifers decreased as the fish size increased. Crustaceans were found in all length groups *D. vulgaris*, they increased from 20.4% in size class (12.5-14.4 cm) to 47.7% in size class (32.5-34.4cm). Polychaetes decreased from 37.1% in size class (12.5-14.4cm) to 3.1% in size class (32.5-34.4cm), green algae increased from 13.1% in size class (12.5- 14.4cm) to 26.5% in size class (26.5-28.4cm), then decreased in the following length groups. Mollusks ingested in size class (12.5-14.4cm) by 13.1% decreased in the following length groups and recorded the lowest value 0.9% in size class (28.5-30.4cm), then completely disappeared in the following lengths. Foraminifera decreased from 10.8% in size class (12.5-14.4cm) to 4.4% in size class (24.5-26.4cm), then disappeared in the following length groups. Sediments were taken by 5.6% in small fish (12.5-14.4cm), and then increased with the increasing of fish size increased.

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 4). The feeding activities were quite high during autumn

82.5% and spring 68.0%. There are minimal rate of feeding intensity recorded in winter (28.3%) and summer (43.3%)(Table 5).

Table 1: Monthly variations in diet composition of 500 *Diplodus vulgaris* from Ain El-Ghazala Lagoon, eastern Libya during the period from September 2013 till August 2014

Months	No.	Crustaceans	Food items			Foraminifera	Sediments
			Polychaetes	Green algae	Mollusks		
Sep. (2013)	42	29.2	24.3	26.1	8.9	1.5	9.9
Oct.	42	22.5	27.7	15.7	11.9	3.2	18.9
Nov.	44	33.1	20.8	15.5	9.9	3.1	17.6
Dec.	45	35.2	22.5	19.9	2.4	A	20.1
Jan. (2014)	47	43.6	33.6	13.3	A	9.4	A
Feb.	47	30.3	32.7	17.9	A	A	19.1
Mar.	48	27.9	15.7	14.5	11.9	9.9	20.1
Apr.	38	36.3	13.3	15.8	10.1	4.6	19.8
May	36	39.2	14.9	16.2	10.5	A	19.1
Jun.	53	35.5	13.3	12.9	8.1	0.2	30.1
Jul.	25	36.1	15.2	18.5	A	A	30.2
Aug.	33	33.3	11.6	55.1	A	A	A
%	500	33.5	20.5	20.1	6.1	2.7	17.1

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

Table 2: Seasonally variations in diet composition of 500 *Diplodus vulgaris* from Ain El-Ghazala Lagoon, eastern Libya during the period from September 2013 till August 2014

Seasons	No. of fish	Crustaceans	Polychaetes	Green algae	Mollusks	Foraminifera	Sediments
Autumn	128	28.3	24.3	19.1	10.2	2.6	15.5
Winter	139	36.4	29.6	17.0	0.8	3.1	13.1
Spring	122	34.5	14.6	15.5	10.8	4.8	19.7
Summer	111	35.0	13.4	28.8	2.7	0.1	20.1

Remarks: Data expressed as percentage

Table 3: The diet composition of different size classes of *Diplodus vulgaris* from Ain El-Ghazala Lagoon, eastern Libya during the period from September 2013 till August 2014

Size groups (cm)	No.	Crustaceans	Food items			Foraminifera	Sediments
			Polychaetes	Green algae	Mollusks		
12.5-14.4	35	20.4	37.1	13.1	13.1	10.8	5.6
14.5-16.4	39	20.7	36.9	21.9	11.8	2.6	6.1
16.5-18.4	33	22.5	36.6	22.6	10.3	1.1	6.9
18.5-20.4	45	25.1	36.4	18.9	8.8	0.9	9.9
20.5-22.4	55	27.3	25.4	26.1	8.5	0.7	12.1
22.5-24.4	67	29.1	15.7	20.9	7.9	9.6	16.8
24.5-26.4	33	41.1	11.1	21.5	4.7	4.4	17.2
26.5-28.4	45	43.6	10.1	26.5	1.1	B	18.7
28.5-30.4	36	45.4	7.7	16.1	0.9	B	29.9
30.5-32.4	67	47.1	5.3	16.6	B	B	31.1
32.5-34.4	45	47.7	3.1	17.1	B	B	32.1

Remarks: Data expressed as percentage, (B) No food in class occurred

Table 4: Monthly variations in the intensity of feeding of 500 *Diplodus vulgaris* from Ain El-Ghazala Lagoon, eastern Libya during the period from September 2013 till August 2014

Months	No. of fish	The degree of distension of the stomach							
		Empty	Trace	1/4	a %	1/2	3/4	Full	b %
Sep. (2013)	42	11.4	A	A	11.4	13.1	48.3	27.2	88.6
Oct.	42	23.2	A	A	23.2	15.4	15.4	46.1	76.9
Nov.	44	6.0	30.1	39.9	76.0	13.9	10.1	A	24.0
Dec.	45	26.2	22.7	26.3	75.2	8.9	A	15.9	24.8
Jan. (2014)	47	26.0	21.1	16.8	63.9	16.0	2.0	18.0	36.0
Feb.	47	10.0	5.0	45.1	60.1	A	40.0	A	40.0
Mar.	48	10.0	10.0	15.0	35.0	25.0	14.1	25.9	65.0
Apr.	38	23.2	A	A	23.2	15.4	15.4	46.1	76.9
May	36	16.0	2.0	A	18.0	12.0	20.0	50.1	82.1
Jun.	53	10.0	4.0	44.0	58.0	20.0	22.0	A	42.0
Jul.	25	24.0	28.0	A	52.0	24.0	24.0	A	48.0
Aug.	33	20.0	10.0	8.0	38.0	10.0	26.0	26.0	62.0
Average					44.5±22.6				55.5±22.7

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

Table 5: Seasonally variations in the intensity of feeding of 500 *Diplodus vulgaris* from Ain El-Ghazala Lagoon, eastern Libya during the period from September 2013 till August 2014

Seasons	No. of fish	The Degree Of Distension Of The Stomach							
		Empty	Trace	1/4	%	1/2	3/4	Full	%
Autumn	128	16.9	0.7	0.0	17.5	13.5	27.9	41.1	82.5
Winter	139	19.4	24.6	27.7	71.7	12.9	4.0	11.3	28.3
Spring	122	17.7	6.7	7.7	32.1	16.8	18.5	32.7	68.0
Summer	111	14.7	12.3	29.7	56.7	14.7	28.7	0.0	43.3

Remarks: Data expressed as percentage

DISCUSSION

The food and feeding habits of sparid fishes have been studied by many authors (Blaber, 1974; Coetzee and Baird, 1981; Wassef and Eisawy, 1985 and Rosecchi, 1987). The common two banded sea bream, *Diplodus vulgaris* (family Sparidae) found over rock rubble or sand bottoms young frequently found on sea grasses beds and continual shelf, feeds on crustaceans, fishes and mollusks (Abdel-Rahman and Abdel-Barr, 2003). In the current study *Diplodus vulgaris* were found to consume a wide range of food items ranging from of crustaceans, supplemented by polychaetes, green algae with other food such as mollusks, foraminifers and sediments this is full agreement with Abdel-Rahman and Abdel-Barr, 2003 and Osman and Mahmoud, 2009. In the present work, in winter the fish preferred crustaceans (36.4%), polychaetes (29.6%). Where the fish preferred green algae (28.8%) and sediments (20.1%) in summer. In spring the fish preferred mollusks (10.8%) and foraminifers (4.8%). On the other hand, sediments completely disappeared from the diet composition during the winter months; this is full agreement with Abdel-Rahman and Abdel-Barr, 2003. Generally, the food extent demands and ability for food acquisition increase with fish development Osman and Mahmoud, 2009. Abdel Rahman and Abdel Barr, (2003), studied the feeding habits of the common two banded sea bream, *Diplodus vulgaris* in Alexandria waters on the Mediterranean Sea and they concluded that the numbers and size prey taxa increased with size of the common two banded sea bream due to the ability of

larger fishes to consume a wide range of prey sizes than smaller fishes, this phenomenon appeared to be done for the target species in present work. Crustaceans, polychaetes, green algae, and sediments were found in all length groups of *D. vulgaris*. Crustaceans, green algae and sediments increased as the fish size increased while, polychaetes, mollusks and foraminifers decreased as the fish size increased, which is in agreement with Osman and Mahmoud (2009). The monthly variation in the condition factors fish is affected by the feeding activity which may show there reflection on the body condition (Vassilopoulou, 1989), this phenomenon appears to be correct for species in the present work. The highest condition factor values (K_f and K_c) were recorded in autumn and spring; these results coincide with the degree of stomach fullness (Motaref, 2013). This supports observations describe in the Canary Island (Pajuelo et al., 2002), in Mediterranean waters off Alexandria, Egypt (Osman and Mahmoud, 2009) and coastal waters of Thracian Sea, Greece (Kallianiotis, et al., 2005).

CONCLUSIONS

Diplodus vulgaris feed on a wide variety of prey types such as: crustaceans (33.5%), polychaetes (20.5%), green algae (20.1%), Sediments (17.1%), mollusks (6.1%), foraminifers (2.7%). The Feeding intensity was quite high during the autumn and spring the present study is defining the trophic relationships between *Diplodus vulgaris* with other invertebrates and fishes in this area,

in order to understand the dynamic of this regional ecosystem. Beside results from feeding habits of *Diplodus vulgaris* may have direct implications for aquaculture.

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