Diet Composition of Gilthead Sea Bream *Sparus Aurata* from Bardawil Lagoon, North Sinai, Egypt

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ABSTRACT

The diet composition of 609 specimens of *Sparus aurata* respectively from Bardawil lagoon at three stations, were studied monthly from May 2017 to January 2018. The annual diet composition, monthly variations in the diet composition, the variations of the diet with lengths, and the intensity of feeding were studied. *Sparus aurata* feeds on a wide variety of prey types; crustacea, mollusks, polychaetes, algae, part of fish, undermined matter, and seagrasses. Crustaceans, mollusks, and polychaetes were the major food items in all months and were found in all length groups for *Sparus aurata*. Crustaceans and algae increased as the size increased, while mollusks and polychaetes decreased as the fish size increased. The feeding activities of *Sparus aurata* were quite high in September, December, and January at EL-Nasr, Tulul, and Igzwan stations respectively, and May at EL-Nasr. The finding result revealed that defining the relationships between *Sparus aurata* with other fishes in Bardawil lagoon, in order to understand the dynamic of this regional ecosystem.

INTRODUCTION

The Gilthead sea bream, *Sparus aurata* is an important species in the Egyptian coasts of Mediterranean Sea and the Bardawil lagoon fisheries. It was found in a wide variety of marine habitats, from rocky to sandy bottoms, at depths between 0 to 500 m, although it is usually more common at less than 150m deep, **Abecasis *et al.* (2008)**. Information on diet composition of *Sparus aurata* in local waters is of utmost value to provied optimum nursery requirments for successful rearing in fish farmes. The aim of this work was to anlyse the food taken and to examine the feeding in relation to fish size, habitats and month for both wild and reared fish. The aim of this work was to anlyse the food taken and to examine the feeding in relation to fish size, habitats and month for both wild and reared fish.

MATERIALS AND METHODS

The stomachs of (609) specimens of *Sparus aurata* were examined to study their feeding habits as a commercial catch (trammel nets) from three stations (EL- Nasr, Egswan and Tulul) from May 2017 to January 2018 in Bardawil lagoon.

Annual diet composition, seasonal variations of diet, variations of diet with length and feeding intensity of these species were estimated in the current study. For each fish specimen, total length was measured to the nearest 0.1 cm. Each fish was dissected and the alimentary tract removed by cutting at the point where the stomach entered the abdominal cavity and immediately before the anus. The degree of fullness of the stomach was assessed by visual estimation and classification as empty, half full and completely full respectively as described by **Pillay (1952)**. Then the stomach was cut, opened longitudinally, and its contents were scraped off and transferred into a small Petri dish containing a small amount of water. Food items were sorted out under a binocular microscope. They were identified down to their groups. A list of general diet composition was made. Food analysis was made by points of assessment (**Hynes, 1950; Hyslop, 1980**) then the results were subjected to further statistical evaluation according to **Godfriaux (1969)**, in order to givemore precise information about food and feeding habits of *Sparus aurata*.

RESULTS

1- Annual diet composition

A big variety of food items was found in the stomachs of the studied species and was represented in the Figure (1). Crustaceans were the main prey item in the diet of *S. auratu* (42.0%) followed by mollusks and polychaetes constituted 24.0% and 20.0%, respectively. Fish parts contributed about (4.0%) and algae (5.0%).Whereas, undetermined materials were those items that couldn't be identified and sediment (3.0%) and seagrassees (2.0%) were represented by the lowest percentage.
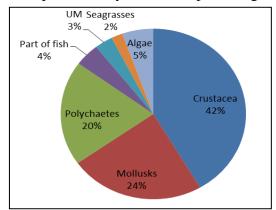

Fig. 1. The diet composition of *Sparus aurata* in Bardawil lagoon during 2017.

1-1-Monthly variation in diet composition

The monthly variation in food items are represented in Tables (1, 2 and 3). Food items occurred in all year round of the study. Crustaceans, mollusks and polychaetes were the major food items in all months, from May 2017 till January 2018 at the three studied

stations (EL- Nasr, Igzwan and Tulul) in Bardawil lagoon Tables (1, 2 and 3) and Figs. (2, 3 and 4).

Their contributions were 84.8%, 85.4 and 85.4% during 2017 at the three studied stations, respectively. The percentage of crustaceans attained the maximum value in September was 44.7% at El Nasr, 60.7% at Igzwan and 48% at Tulul during 2017. Also, the percentage of mollusks and polychaetes attained their maximum value from July to November at the three studied stations. Algae was occurred in all year round at El Nasr and Igzwan stations but absent during June and July at Tulul station.

On the other hand, part of fish reached their highest level of food items in October at Igzwan and Tulul station (10% and 8%) and September at EL-Nasr station (12.6%).

Undermined matter was frequently taken with the food items, occurred in all year round at Tulul and the maximum value in November was 6.3%. At the maximum value in June were 6.9 and 6% at El Nasr and Igzwan, respectively.

Whereas, seagrasses have been recorded the maximum value in July was (7.0%) at EL- Nasr station and disappeared in August, November and December. At Igzwan station, maximum value was recorded in August (12%). While at Tulul station, seagrasses were present in all year round and attained the maximum value in May (6.4%), and the minimum value in October (2.0%).
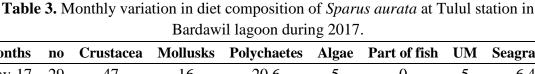
Table 1. Monthly variation in diet composition of *Sparus aurata* at EL- Nasr station in Bardawil lagoon during 2017.

Months	no	Crustacea	Mollusks	Polychaetes	Algae	Part of fish	UM	Seagrasses
May 17	26	40.7	27.0	20.0	3.7	4.0	0.6	4.0
Jun.	26	38.9	25.0	12.6	5.6	4.0	6.9	7.0
Jul.	30	37.5	32.5	16.5	6.0	0.0	2.5	5.0
Aug.	24	41.8	33.1	20.1	2.2	0.0	2.8	0.0
Sep.	22	44.7	20.0	16.4	0.0	12.6	2.0	4.3
Oct.	18	31.0	26.4	24.0	5.0	6.1	1.3	6.3
Nov.	19	30.0	30.0	26.7	5.0	5.3	3.0	0.0
Dec.	15	40.0	24.0	22.0	1.0	8.0	5.0	0.0
Jan. 18	15	37.7	24.0	20.3	7.0	4.0	4.0	3.0

Table 2. Monthly variation in diet composition of *Sparus aurata* at Igzwan station in Bardawil lagoon during 2017.

Months	no	Crustacea	Mollusks	Polychaetes	Algae	Part of fish	UM	Seagrasses
May-17	29	45	22	24	5	2	0	2
Jun.	28	46	24	15	6	1.5	6	1.5
Jul.	29	50	23.2	17	6.2	1.8	0	1.8
Aug.	21	35	23.5	12.5	5	12	0	12
Sep.	19	60.7	20	15.4	3.4	0	0.5	0
Oct.	19	40	15	25	0.5	10	1.5	8
Nov.	20	60.5	15	12.5	6	0	4	2
Dec.	20	40.4	18.7	22	6.2	4	3.9	4.8
Jan-18	22	37	25	24	5.7	1.4	5	1.9

Table 3. Monthly variation in diet composition of *Sparus aurata* at Tulul station in Bardawil lagoon during 2017.

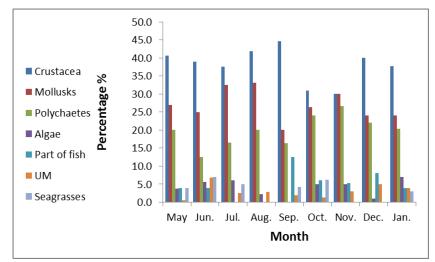| Months	no	Crustacea	Mollusks	Polychaetes	Algae	Part of fish	UM	Seagrasses
May-17	29	47	16	20.6	5	0	5	6.4
Jun.	28	45	22	21.9	0	0	5	6.1
Jul.	29	37.2	31.8	22	0	4	1	4
Aug.	21	37	23	22	6	5	2	5
Sep.	19	48	14.6	17.2	7	5	3.2	5
Oct.	19	30	28	23	6	8	3	2
Nov.	20	32	26	22	5	5.2	6.3	3.5
Dec.	20	33	24	22	6.5	4.5	6	4
Jan-18	22	36	26	20	5	4	3	6

Fig. 2. Monthly variation in diet composition of *Sparus aurata* at EL- Nasr station in Bardawil lagoon during 2017.
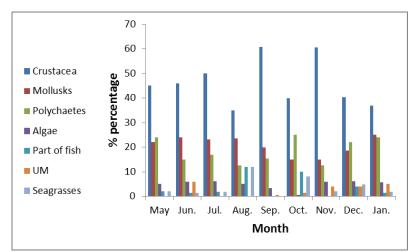

Fig. 3. Monthly variation in diet composition of *Sparus aurata* at Igzwan station in Bardawil lagoon during 2017.
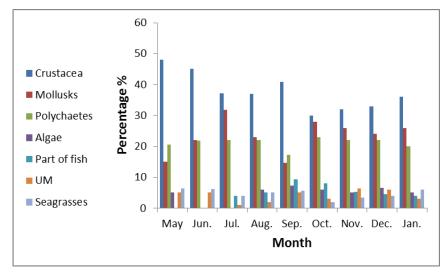
Fig. 4. Monthly variation in diet composition of *Sparus aurata* at Tulul station in Bardawil lagoon during 2017.

1-2-Diet composition in relation to fish size

The total length of *S. auratu* population was classified into 10 classes ranged from 13.5cm to 33.4cm with 1.9cm interval. The relation between diet composition and size of *S. auratus* is represented in tables (4, 5 and 6). Prey size differed with size individuals, where large sized fish ingested the large size prey and vice versa. Crustaceans, algae and undermined matter increased as the size increased while, mollusks and polychaetes decreased as the fish size increased.

Crustaceans, polychaetes and undermined matter were common in all length groups of *Sparus aurata*. It was found that the percentage of occurrence of crustaceans increased from 34.0, 31.0 and 35.0% in size class (13.5-15.4cm) to 63.0 and 55.2% in size class (31.4-33.4cm) and 53.3% in size class (27.4-29.4cm) at three stations (El Nasr, Igzwan and Tulul), respectively. On the other hand, the percentage of polychaetes decreased from (30.0, 28.5 and 30%) in size class (15.5- 17.4cm) to (11, 12.6 and 15.1%) in size class (31.4-33.4cm) and (27.5-29.4%) at the same three stations, respectively.

Mollusks was ingested in size class (15.5- 15.4cm) by 9%, increased in the following length groups and recorded the highest percentage value 17% in the two size classes (25.5- 27.4cm) and (27.5-29.4cm) at El Nasr, while decreased in the diet composition at the following size groups. At the two other stations, mollusks reached their highest level in food compostion at size class (25.5-27.4cm) by 23%.

Algae were found in the diet composition of most all sizes of *Sparus aurata* then disappeared in size class (21.5-23.4cm) and (25.5-27.4cm).

Table 4. The percentage of diet composition (%) of different size classes of *Sparus aurata* at EL-Nasr station in Bardawil lagoon during 2017.

Size groups (cm)	No.	Crustacea	Mollusks	Polychaetes	Algae	Part of fish	UM	Seagrasses
13.5-15.4	3	34	13	30	12	6	5	0
15.5-17.4	30	42.5	9	23	12.3	5.2	8	0
17.5-19.4	43	43	10.5	22	6	0	12.5	6
19.5-21.4	10	47	14	15	5.6	4	7.4	7
21.5-23.4	7	55	14	12	0	3	4	12
23.5- 25.4	6	56	16.8	11.7	4	0	4.3	7.2
25.5-27.4	9	61	17	11	2	0	6	3
27.5-29.4	6	61	17	6	2	7	5	2
29.5-31.4	2	62	11	10.5	5	5.5	3	3
31.5-33.4	2	63	10	11	6	2	4	4

Table 5. The percentage of diet composition (%) of different size classes of *Sparus aurata* at Igzwan station in Bardawil lagoon during 2017.

Size groups (cm)	No.	Crustacea	Mollusks	Polychaetes	Algae	Part of fish	UM	Seagrasses
13.5-15.4	62	31	20.1	28.5	6	5.4	9	0
15.5-17.4	36	35	21	23.7	1	6.3	9	4
17.5-19.4	61	43	13.3	22.7	2	4	9	6
19.5-21.4	28	43	10.6	13	5.2	10	9	9.2
21.5-23.4	18	50	15	14	8.4	0	5	7.6
23.5- 25.4	13	52	15	12	9	8	2.1	1.9
25.5-27.4	15	52	23	10	0	0	5.5	9.5
27.5-29.4	10	52.4	12.1	15.1	10	4.4	6	0
29.5-31.4	2	53	18	12.5	6.7	0	2.7	7.1
31.5-33.4	1	55.2	14.2	12.6	6.8	5.2	4	2

Table 6. The percentage of diet composition (%) of different size classes of *Sparus aurata* at Tulul station in Bardawil lagoon during 2017.

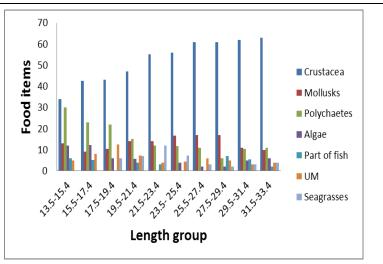| Size groups (cm)	No.	Crustacea	Mollusks	Polychaetes	Algae	Part of fish	UM	Seagrasses
13.5-15.4	62	35	14	30	6	5	10	0
15.5-17.4	36	36	18.6	24	1	8.3	8.1	4
17.5-19.4	61	41	13.3	22	2	8.7	8	5
19.5-21.4	28	43	10.6	15	5.2	10	9	7.2
21.5-23.4	18	45	16.6	14	8.4	0	5	11
23.5- 25.4	13	52	15	12	9	8	2.1	1.9
25.5-27.4	15	52	23	10	0	0	5.5	9.5
27.5-29.4	10	52.3	15	15.1	8.2	2	7.4	0
29.5-31.4								
31.5-33.4								

Fig. 5. The percentage of diet composition (%) of different size classes of *Sparus aurata* at EL-Nasr station in Bardawil lagoon during 2017.
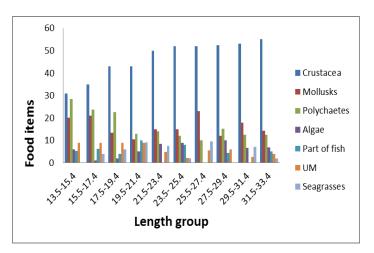

Fig. 6. The percentage of diet composition (%) different size classes of *Sparus aurata* at Igzwan station in Bardawil lagoon during 2017.
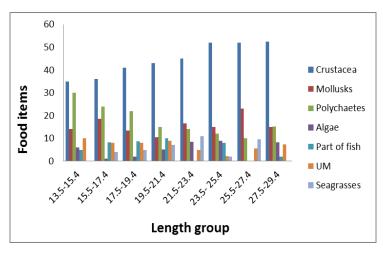
Fig. 7. The percentage of diet composition (%) of different size classes of *Sparus aurata* at Tulul station in Bardawil lagoon during 2017.

1-3-Feeding intensity

Stomach fullness has been categorized into three classes namely: empty, half and full. Generally, the intensity of feeding in *Sparus aurata* at three stations clearly indicates a low rate of feeding activity (Tables 6, 7 and 8). Fishes with stomach half full, and full of food constituted 53.57%, 53.21% and 50.48% of all analyzed individuals at the three studied stations (El Nasr, Igzwan and Tulul) during 2017, respectively. Whereas, those with stomachs that were empty or with traces of food represented 42.03%, 26.22% and 30.97% of the total specimens at the same stations, respectively.

When studying the monthly variation in intensity of feeding of *Sparus aurata*, it was noticed that the feeding activities were quite high during in September (91.67%), January (81.48%) and December (68.97%) at El Nasr, Igzwan and Tulul stations, respectively. There were minimal rate of feeding intensity in October (32.14% and 39.58%) El Nasr and Tulul. While the minimal rate of feeding intensity was clear in December (33.33%) at Igzwan station.

Table 7. Monthly variation in the intensity of feeding of *Sparus aurata* at El Nasr station in Bardawil lagoon during 2017.

Months	No	State of stomachs					
		Full	**%**	**Half**	**%**	**Empty**	**%**
May	60	26	43.33	5	8.33	30	50.00
Jun	47	26	55.32	7	14.89	14	29.79
July	61	30	49.18	4	6.56	27	44.26
Aug	28	24	85.71	1	3.57	3	10.71
Sep	24	22	91.67	2	8.33	A	A
Oct	56	18	32.14	8	14.29	30	53.57
Nov	43	19	44.19	4	9.30	20	46.51
Dec	27	15	55.56	3	11.11	9	33.33
Jan	40	15	37.50	5	12.50	20	50.00

Remarks : Data expressed as percentage   A = No food in class occurred.

Table 8. Monthly variation in the intensity of feeding of *Sparus aurata* from Igzwan station in Bardawil lagoon during 2017.

Months	No	State of stomachs					
		Full	%	Half	%	Empty	%
May	78	29	37.18	26	33.33	23	29.49
Jun	42	28	66.67	10	23.81	4	9.52
July	36	29	80.56	3	8.33	4	11.11
Aug	31	21	67.74	5	16.13	5	16.13
Sep	34	19	55.88	4	11.76	11	32.35
Oct	46	19	41.30	7	15.22	20	43.48
Nov	35	20	57.14	5	14.29	10	28.57
Dec	60	20	33.33	10	16.67	20	33.33
Jan	27	22	81.48	A	A	5	18.52

Remarks : Data expressed as percentage   A = No food in class occurred.

Table 9. Monthly variation in the intensity of feeding of *Sparus aurata* from Tulul station in Bardawil lagoon 2017.

Months	No	State of stomachs					
		Full	%	Half	%	Empty	%
May	59	29	49.15	18	30.51	12	20.34
Jun	72	28	39.89	23	30.94	21	29.17
July	47	29	61.70	A	A	18	38.30
Aug	37	21	56.76	7	18.92	9	24.32
Sep	46	19	41.30	8	17.39	19	41.30
Oct	48	19	39.58	6	12.50	23	47.92
Nov	34	20	58.82	4	11.76	10	29.41
Dec	29	20	68.97	3	10.34	6	20.69
Jan	38	22	57.89	7	18.42	9	23.68

Remarks : Data expressed as percentage   A = No food in class occurred.

DISCUSSION

The food and feeding habits of seabreams have been studied by many authors (**Blaber, 1974**; **Coetzee and Baird, 1981; Wassef and Eisawy, 1985; Rosecchi, 1987; Rosecchi and Nouaze, 1987; Papaconstantinou and Caragitsou, 1989; Harvath *et al.*, 1990; Buxton and Clarke, 1992; Abdel-Rahman and Abdel-Barr, 2003 and Osman and Mahmoud, 2009**).

Seabreams inhabit tropical and temperate coastal water. They found near the shore in shallow inlet and bays less often at moderate depths. Generally, seabreams are carnivorous feed on crustacean, mollusks and small fishes which they crush with their molar form teeth, but some species feed also on seagrasses and algae (**Bauchot and Smith, 1983**). Diet selection varies with species and environments, **Ellis *et al*. (1976).**

In the present study *Sparus aurata* were found to consume a wide range of food items ranging from of crustaceans (42.0%), mollusks and polychaetes constituted 24.0% and 20.0%, respectively. Fish parts contributed abou (4.0%), algae (5.0%), undetermined, sediment (3.0%) and seagrassees (2.0%) were represented by the lowest percentage, this is similar to **Golanei *et al.* (2006).**

In the present study crustaceans, mollusks and polychaetes formed the major food group this is agreement with (**Elham and Eisawy, 1985**) on studying the feeding habit of *Sparus aurata* in Med eastern Mediterranean Sea. On the other hand **Golani *et al.* (2006)** and **Hana and Elmor (2015**) found that crustaceans, supplemented by cephalopods and green algae formed the major food group for *Diplodus puntazzo.*

In the present study, In September the fish preferred crustaceans , algae Parts of fish, mollusks, polychaetes and undetermined In October and November. the fish preferred the sea grasses during the period from May to July, this is similar to **Abdel-Rahman and Abdel-Barr (2003)** and **Abou-Seedo *et al.* (1990**) on studying the feeding habit of *Diplodus noct* in Kuwait Bay, *Rhabdosargus haffara* in Suez Canal (**Al-Oraimi, 1996**), some Sparid fishes from Northern Sinai coasts of Red Sea (**Ahmed, 1999)** and *Diplodus annularis* in Benghazi coast on the Mediterranean Sea (**Buzaid, 2008**). Generally, the food extent demands and ability for food acquisition increase with fish development (**Honda, 1984**).

In the present study crustaceans and algae increased as the size increased while polychaetes decreased as the fish size increased. Crustaceans were found in all length groups of *S.aurata*, mollusks ingested in size class (15.5- 15.4 cm) by 13% increase in the following length groups and recorded the highest value 17 and 23% in size class (25.5-29.4cm), Algae were found in all length groups of *Sparus aurata*. Which is agreement with **Hana and Elmor (2015).**

In the present study intensity of feeding is subject to seasonal changes, activity being rather low during October and November than other time of the year. The decrease in feeding rate during October and November for immature and adult fish might be attributed to changes in water temperature and food availability rather than to the breeding of effect of fish in such months. **Mazzola and Rallo (1981)** recorded similar lower feeding activity of *Sparus aurata* in Italy during winter months. Also **Wassef and Abu EL Wafaa (1985)** proved that *Sparus aurata* farmed in Egypt feeds at a lower during winter, December to February, when water temperature was below $16\,^{\circ}$c.

CONCLUSION

Sparus aurata feed on a wide variety of prey types: crustaceans, mollusks, polychaetes, green algae, seagrasess, parts of fish and undermined matter. The crustaceans, mollusks and polychaetes,were the major food item all year round and it was found in all length groups.

In the present work is defining the relationships between *Sparus aurata* with other fishes in Bardawil lagoon, in order to understand the dynamic of this regional ecosystem. Beside results from diet composition of *Sparus aurata* may have direct implications for aquaculture.

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الملخص العربي

التركيب الغذائي لأسماك الدنيس *Sparus aurata* بمنخفض البردويل ــ شمال سيناء ــ مصر

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الملخص العربي

تم دراسة التركيب الغذائي لأسماك الدنيس *Sparus aurata* بمنخفض البردويل وتمت الدراسة على عدد (٦٠٩) عينة من أسماك الدنيس. والتى تم تجميعها شهريًا في الفترة من مايو ٢٠١٧ إلى يناير ٢٠١٨ بواسطة شباك الدبة. وتم دراسة العادات الغذائية وتغيراتها الشهرية والتغيرات الملحوظة في نوعية وكمية الغذاء بالنسبة للطول وشدة الاغتذاء، وقد أظهرت الدراسة أن شدة الاغتذاء منخفضة في الأسماك تحت الدراسة وتزيد شدة الاغتذاء في الدنيس في أشهر سبتمبر، وديسمبر ويناير لكلا من محطات النصر، والتلول واغزيوان على التوالى. كما وجد أن أسماك الدنيس فى بحيرة البردويل تتغذى على القشريات والرخويات والديدان الشوكية وأجزاء من الأسماك والأعشاب البحرية بالاضافة إلى الطحالب وجزء من تربة القاع غير معروف التصنيف. كما أظهرت الدراسة أن القشريات والرخويات والديدان الشوكية هي الغذاء الأساسي لأسماك الدنيس خلال شهور الدراسة وفى كل الأطوال. ولقد أوضحت الدراسة أيضًا أن نسبة القشريات والطحالب في أسماك الدنيس تزداد بزيادة الأطوال. بينما تقل نسبة التغذي على الديدان الشوكية والرخويات بزيادة الأطوال. والهدف من البحث هو تحديد العلاقة بين أسماك الدنيس بمنخفض البردويل والأسماك الأخرى وذلك من أجل فهم ديناميكية النظام البيئى.