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LENGTH-WEIGHT RELATIONSHIP, CONDITION FACTOR AND FOOD AND FEEDING HABITS OF SERIOLA DUMERILI (RISSO, 1810, CARANGIDAE) IN AL-HAMAMA, EASTERN LIBYA MEDITERRANEAN SEA

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ABSTRACT: *Stomachs of 235 pre-adult (PA) and 111 adult (A) Seriola dumerili obtained monthly from Al-Hamama (eastern Libya Mediterranean Sea) artisanal catch during November 2012 to October 2013 were examined to study food and feeding habits of the fish. The length-weight relationships of "PA" and "A" were* $W = 0.0437L^{2.819}$, $n = 235$, $R^2 = 0.99$ *and* $W = 0.019L^{2.873}$, $n = 111$, $R^2 = 0.99$, *indicating isometric growth. Annual ranges of monthly values of Fulton (*K_F*) and Clark (*K_C*) condition factors were 2.35 to 3.1 and 1.71 to 2.52 for "PA" and 0.98 to 1.44 and 0.69 to 1.22 for "A" in order. Relationships of both factors with fish length and months and seasons of the year were established. "PA"* K_F *and* K_C *recorded highest values in autumn and spring, which coincided with the period of highest degree of stomach fullness. "A"* K_F *and* K_C *recorded highest values in spring and summer, which coincided with the period of stomach fullness in spring and the spawning season in summer. Food items of "PA" according to order of importance were crustaceans, mollusks, polychaetes, sea grass and bony fish. Those of "A" were bony fish, mollusks, crustaceans, sea grass and polychaetes. Dependence of "PA" on crustaceans, mollusks and bony fish increased with increasing fish length while that on the other items decreased. Dependence of "A" on bony fish and mollusks increased with increasing fish length while dependence on the other items decreased. "PA" prefers feeding on crustaceans and sea grass in summer, on mollusks and bony fish in spring and on polychaetes in autumn. "A" prefers bony fish in autumn and summer, mollusks and polychaetes in spring, crustaceans in winter and sea grass in summer. Monthly and seasonal feeding intensity were established. The feeding intensity was high during autumn and spring for "PA" and moderate to high during all seasons for "A".*

KEYWORDS: Length-Weight Relationship, Condition Factor, Feeding Habits, Food

INTRODUCTION

The Family Carangidae contains 145 species inhabiting all tropical and temperate seas and oceans except in eastern Pacific Ocean and at all depth (Golani *et al*., 2006). There are 18 species in the Mediterranean of which 14 are in the eastern basin where they are considered of significant value for the artisanal and industrial fisheries (Cavaliere *et al*., 1989). The greater amberjack *Seriola dumerili* grows to a maximum total length of 1.9 m and maximum weight of 80.6 kg (Thompson *et al*., 1999; Kulbicki *et al*., 1993). It is found in subtropical regions throughout the globe, often associated with rocky reefs at depths ranging from less than 20 to 80 meters. The juveniles congregate in schools but the adults are basically solitary (Khalaf, 2004; Fischer *et al*., 1990). *S. dumerili* is an opportunistic predator that feeds on benthic invertebrates, small bony fish and sea grass (Andaloro and Pipitone, 1997; *Badalamenti et al., 1993*). The juveniles feed on plankton and small invertebrates, sea grass and small bony fishes (Feitoza *et al*., 2005). Little is known to date on the feeding ecology of the Mediterranean *S. dumerili*, excepting a preliminary report on the feeding habits (Mazzola *et al*., 1993).

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S. dumerili is one of the most popular Carangid fish in the Mediterranean region, Atlantic and Indopacific coasts (Bilecenoglu *et al*., 2002, Bauchot, 1987). Few works have been published on the biology of Carangid fishes in the Mediterranean Sea especially in the eastern basins (Bertolini *et al*., 1956; Bauchot, 1987; Cavaliere *et al*., 1989; Andaloro *et al*., 1992; Badalamenti et *al*., 1993 and Marino *et al*., 1995).

The objective of the present study is to establish food and feeding habits of *S. dumerili* in eastern Libya Mediterranean Sea. Results of the study are valuable for planning management policy of the fisheries of this species.

Procedures and methods

Collection of fish samples

Monthly samples totaling 235 pre-adult (PA) and 111 adult (A) Seriola dumerili were obtained from Al-Hamama (Fig. 1) artisanal catch during November 2012 to October 2013 for studding food and feeding habits of the fish. Al-Hamama is a small commercial and fishing port on eastern Libya Mediterranean Sea. PA is fish with total length ≤ 33.4 cm. A is ≥ 33.5 cm.

The morphological measurements

In the laboratory total length and corresponding weight of individual fish were measured to the nearest 0.1 cm and 0.1 gm. Then the abdominal cavity of each fish was cut open and the alimentary tract and the gonads were removed and preserved in formalin, then the gutted weight of the fish was measured to the nearest 0.1 gm.

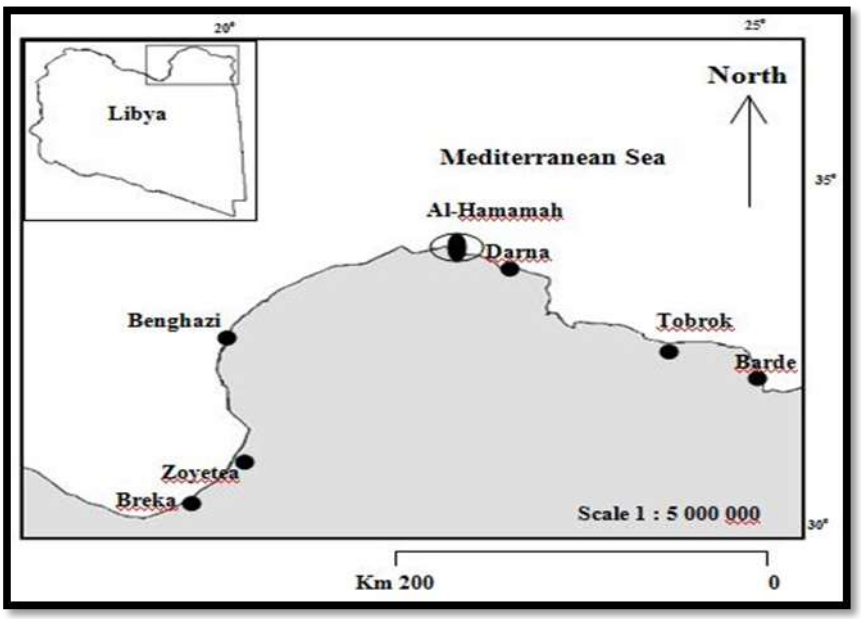

Fig. 1. Map showing Al-Hamama coast on the Mediterranean Sea, eastern Libya.

The length weight relationship

The length weight relationship was established according to Le-Cren 1951:

$W = a L^b$; where: W= total weight (gm), L= total fish length (cm) and “a” and ”b “ are constants of the power regression.

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The condition factors

Fulton, 1902, (K_F) and Clark, 1928, (K_C) condition factors were calculated from:

K_F =T.W / L3 * 100 and K_C = G.W / L3 * 100

Where T.W = total weight (gm), G.W = gutted weight (gm) and L = total length (cm).

The food and feeding habits

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 by Pillay, 1952.

Each stomach was cut opened longitudinally and its content scraped off and transferred into a small Petri dish containing a small amount of water. Food items were sorted out under a binocular microscope and identified down to their groups. A list of general diet composition was made. Food analyses were made by points of assessment (Hynes, 1950 and Hyslop, 1980).

RESULTS AND DISCUSSION

The length-weight relationship

The length-weight relationship of pre-adult *S. dumerili* (Table 1) was:

$W = 0.0437L^{2.8187}$, n = 235, $R^2 = 0.9947$

That of adult *S. dumerili* (Table 2) was:

$W = 0.019L^{2.8726}$, n = 111, $R^2 = 0.9957$

The total length range of pre-adult *S. dumerili* population was ranked into 11 classes ranging from 11.5 to 33.4 cm with 1.9 cm interval (Table 1). The total length range of adult *S. dumerili* population (33.5 to 165.4 cm) was treated similarly (11 classes with 11.9 cm intervals, Table 2). Table 1 and 2 show high agreement between the average observed weights and the corresponding weights calculated from the length-weight relationships of pre-adult and adult *S. dumerili*.

Table 1. Average observed and calculated weights and Fulton (K_F) and Clark (K_C) condition factors per length class of 235 pre-adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

Total fish length (cm)		No of fish	Corresponding fish weight (gm)		Condition factor	
Range	Average		Obser. weight ± S.D.	Calc. weight	K_F± S.D.	K_C± S.D.
11.5 - 13.4	12.3	18	57.7± 8.16	51.6	3.10 ± 0.94	2.52 ± 0.24
13.5 - 15.4	14.4	23	75.9 ± 12.71	80.5	2.54± 0.81	1.93± 0.61
15.5 - 17.4	16.3	12	101.8 ± 26.77	114.1	2.35± 0.76	1.76± 0.56

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17.5 - 19.4	18.2	14	150.2 ± 38.33	155.7	2.49 ± 0.78	1.88 ± 0.58
19.5 - 21.4	20.4	11	239.1 ± 33.11	214.8	2.82 ± 0.91	2.21 ± 0.71
21.5 - 23.4	22.3	25	270.9 ± 43.51	276.0	2.44 ± 0.63	1.84 ± 0.43
23.5 - 25.4	24.3	27	347.8 ±45.61	351.6	2.42 ± 0.57	1.81 ± 0.37
25.5 - 27.4	26.2	33	432.9 ± 49.76	434.8	2.41 ± 0.42	1.79 ± 0.22
27.5 - 29.4	28.3	24	541.7 ± 42.32	540.3	2.39 ± 0.39	1.77 ± 0.19
29.5 - 31.4	30.4	27	667.2 ±45.87	661.1	2.37 ± 0.28	1.74 ± 0.08
31.5 - 33.4	32.3	21	795.8 ± 58.34	784.3	2.36 ± 0.16	1.71 ± 0.06

Table 2. Average observed and calculated weights and Fulton (K_F) and Clark (K_C) condition factors per length class of 111 adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

Total fish length (cm)		**No. 0f fish**	**Corresponding fish weight (gm)**		**Condition factor**	
Range	**Average**		**Obser. weight ± S.D.**	**Calc. weight**	**K_F± S.D.**	**K_C± S.D.**
33.5 - 45.4	38.3	7	811.5± 68.17	670.9	1.44 ± 0.44	1.22 ± 0.21
45.5 - 57.4	51.4	9	1324.6 ± 112.73	1561.9	0.98 ± 0.13	0.76 ± 0.07
57.5 - 69.4	62.2	11	2599.2 ±126.79	2701.4	1.08 ± 0.28	0.91± 0.09
69.5 - 81.4	75.3	12	4360.7 ± 138.36	4677.7	1.02 ± 0.11	0.88 ± 0.08
81.5 - 93.4	86.3	15	6860.8 ± 133.15	6920.5	1.07 ± 0.15	0.90 ± 0.09
93.5 - 105.4	98.4	5	10157.4 ± 143.54	10088.6	1.06 ± 0.13	0.79 ± 0.07
105.5 - 117.4	111.3	7	14209.3 ±145.65	14371.9	1.03± 0.11	0.75± 0.06
117.5 - 129.4	123.3	9	19214.5 ± 149.79	19286.5	1.02 ± 0.09	0.73 ± 0.05
129.5 - 141.4	134.4	11	25168.9 ± 242.37	24705.5	1.04 ± 0.12	0.78 ± 0.08
141.5 - 153.4	146.3	14	32314.9 ±345.89	31523.5	1.03 ± 0.11	0.69 ± 0.03
153.5 - 165.4	157.2	11	49640.4 ± 558.36	38751.0	1.28 ± 0.41	1.13 ± 0.18

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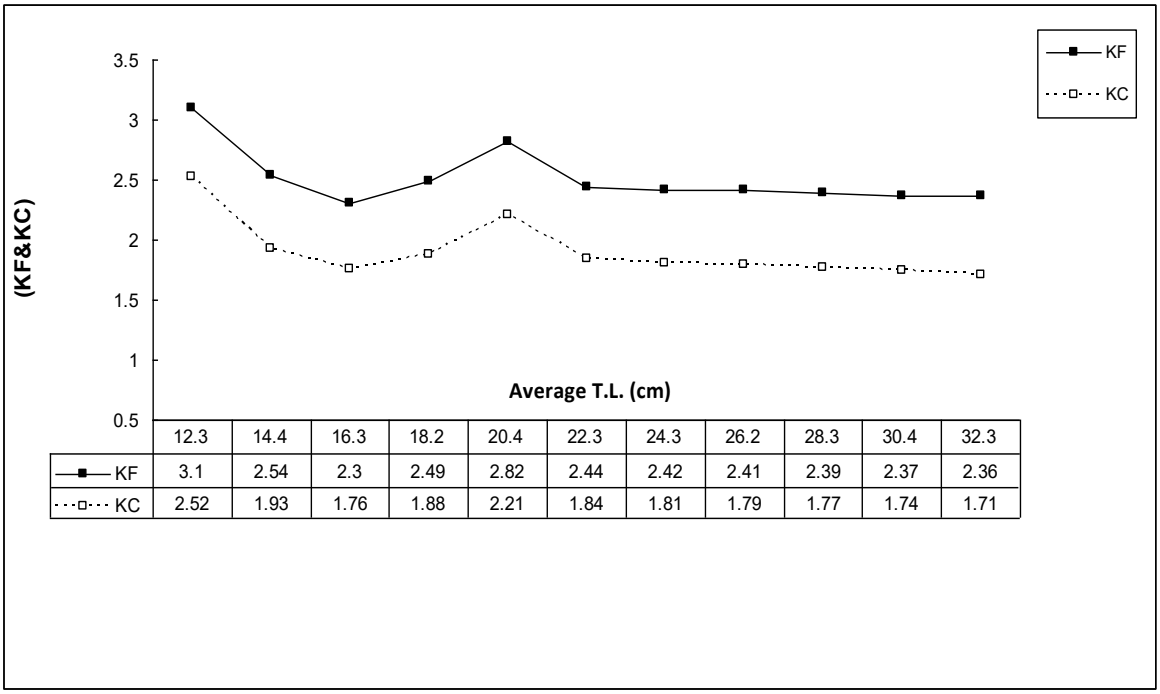
The condition factors

Relation of the condition factors with fish length

Pre-adult *S. dumerili* K_F and K_C condition factors were 3.10 and 2.52 in order in the size class 11.5-13.4 cm (Table 1 and Fig. 1). Their magnitude decreased to 2.44 and 1.84 in the size class 21.5-23.4 cm, and then decreased further to the lowest values of 2.36 and 1.71 in the size class 31.5-33.4 cm.

Adult *S. dumerili* K_F and K_C have lower magnitudes than those of the pre-adult. K_F and K_C were 1.44 and 1.22 in the size class 33.5-45.4 cm (Table 2 and Fig. 2); they stayed more or less constant in the following size classes and then increased to 1.28 and 1.13 in the size class 153.5-165.4 cm (Table 2 and Fig. 2).



	12.3	14.4	16.3	18.2	20.4	22.3	24.3	26.2	28.3	30.4	32.3
KF	3.1	2.54	2.3	2.49	2.82	2.44	2.42	2.41	2.39	2.37	2.36
KC	2.52	1.93	1.76	1.88	2.21	1.84	1.81	1.79	1.77	1.74	1.71

Fig. 1. The relation between average Fulton and Clark condition factors and total length of pre-adult *S. dumerili* from Al- Hamama coast during November 2012 to October 2013

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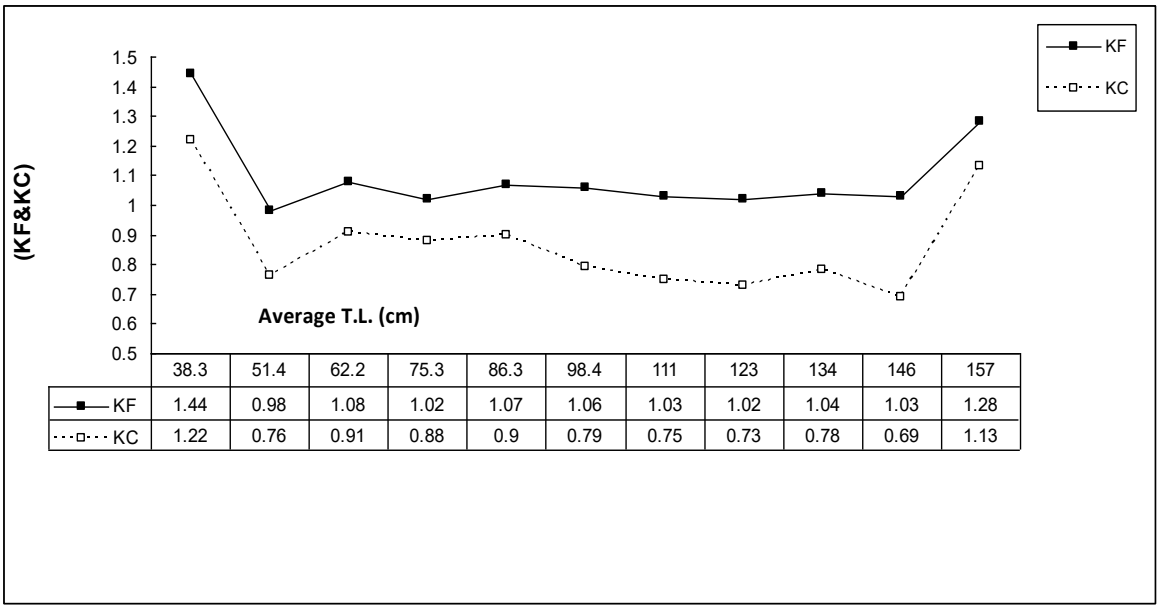

Fig. 2. The relation between Fulton and Clark average condition factors and total length of adult *S. dumerili* from Al- Hamama coast during November 2012 to October 2013

Relation of the condition factors with months of the year

Pre-adult condition factors recorded higher values during November 2012 and March, April, May, September and October 2013 (Table 3 and Fig. 3).

The condition factors of adult *S. dumerili* increased gradually during November 2012 to May 2013 and then decrease gradually henceforward (Table 4 and Fig. 4).

Table 3. Monthly variations in Fulton (K_F) and Clark (K_C) condition factors of pre-adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

		Condition factor	
Months	**No. of fish**	**K_F± S.D.**	**K_C± S.D.**
Nov. (2012)	12	3.07± 0.94	2.43± 0.41
Dec.	14	2.21± 0.41	1.89± 0.08
Jan. (2013)	30	2.29± 0.43	2.01± 0.11
Feb.	32	2.37± 0.45	2.12± 0.13
Mar.	33	3.15± 1.01	2.76± 0.26
Apr.	27	3.11± 0.96	2.71± 0.24
May	12	3.09± 0.95	2.54± 0.19
Jun.	14	2.44± 0.55	1.54± 0.07
Jul.	17	2.54± 0.61	1.76± 0.09
Aug.	20	2.64± 0.72	1.87± 0.13
Sep.	12	3.12± 1.03	2.71± 0.31

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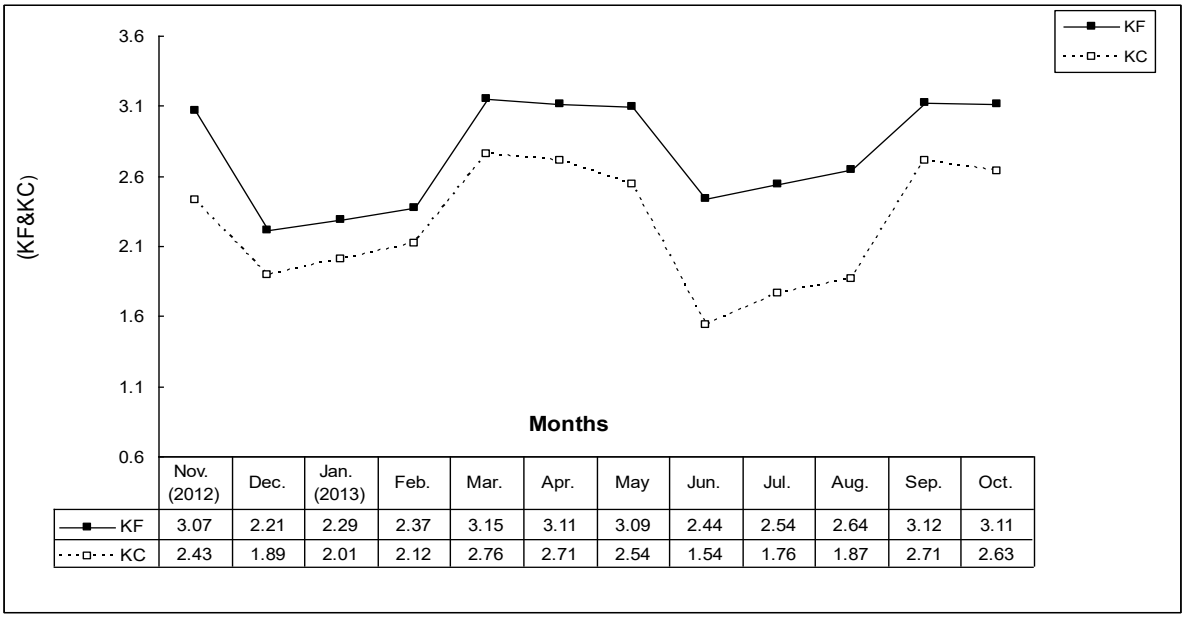

	Nov. (2012)	Dec.	Jan. (2013)	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
KF	3.07	2.21	2.29	2.37	3.15	3.11	3.09	2.44	2.54	2.64	3.12	3.11
KC	2.43	1.89	2.01	2.12	2.76	2.71	2.54	1.54	1.76	1.87	2.71	2.63

Fig. 3. Monthly variations in Fulton (K_F) and Clark (K_C) condition factors of pre-adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

Table 4. Monthly variations in Fulton (K_F) and Clark (K_C) condition factors of adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

		Condition factor	
Months	**No. of fish**	**K_F± S.D.**	**K_C± S.D.**
Nov. (2012)	5	1.05± 0.94	0.75± 0.04
Dec.	4	1.12± 0.41	0.82± 0.08
Jan. (2013)	6	1.21± 0.43	0.91± 0.09
Feb.	6	1.26± 0.45	0.96± 0.08
Mar.	12	1.33± 1.01	1.03± 0.11
Apr.	11	1.36± 0.96	1.06± 0.13
May	13	1.45± 0.95	1.15± 0.15
Jun.	16	1.47± 0.55	0.88± 0.05
Jul.	17	1.49± 0.61	0.91± 0.07
Aug.	10	1.39± 0.72	0.76± 0.04
Sep.	7	1.37± 1.03	1.07± 0.13
Oct.	4	1.35± 1.02	1.05± 0.11

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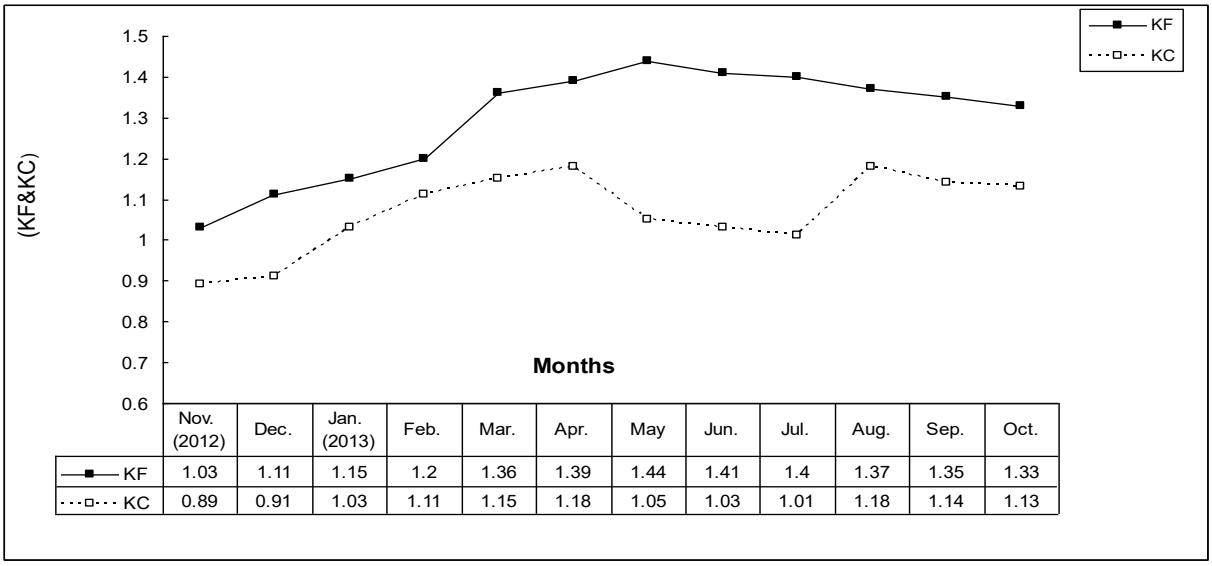

	Nov. (2012)	Dec.	Jan. (2013)	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
KF	1.03	1.11	1.15	1.2	1.36	1.39	1.44	1.41	1.4	1.37	1.35	1.33
KC	0.89	0.91	1.03	1.11	1.15	1.18	1.05	1.03	1.01	1.18	1.14	1.13

Fig. 4. Monthly variations in Fulton (K_F) and Clark (K_C) condition factors of adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

The food and feeding habits

Annual diet composition

Crustaceans represented mostly by copepods and isopods made up 48.6% by volume composition of the bulk of the diet of pre-adult *S. dumerili* (Fig. 5) whereas mollusks composed of *Sepia sp*., *Loligo sp.* and *Octobus vulgaris* came in the second position of importance (21.6%). The other food items were polychaetes (16.9%) followed by sea grass (8.1%) and bony fish (4.8%) composed of several species such as *Pagrus pagrus*, *Boops boopes*, *Trigla lyra* and *Mullus barbatus.*

Bony fish made up of 55.6% by volume composition of the bulk diet of adult *S. dumerili* (Fig. 6). They were represented by different species such as *Pagrus pagrus*, *Boops boopes*, *Trigla lyra, Mullus barbatus, Diplodus annularis, Lithognathus mormyrus, Symphodus tinca*, *Synodus sarus* and *Trachinus radiates*. Mollusks (*Sepia* sp. and *Octopus* sp.) constituting 20.4% came in the second position of importance. The other food items were crustaceans (15.5%) represented mostly by copepods, isopods and amphipods, sea grass (6.1%) and polychaetes (2.4%).

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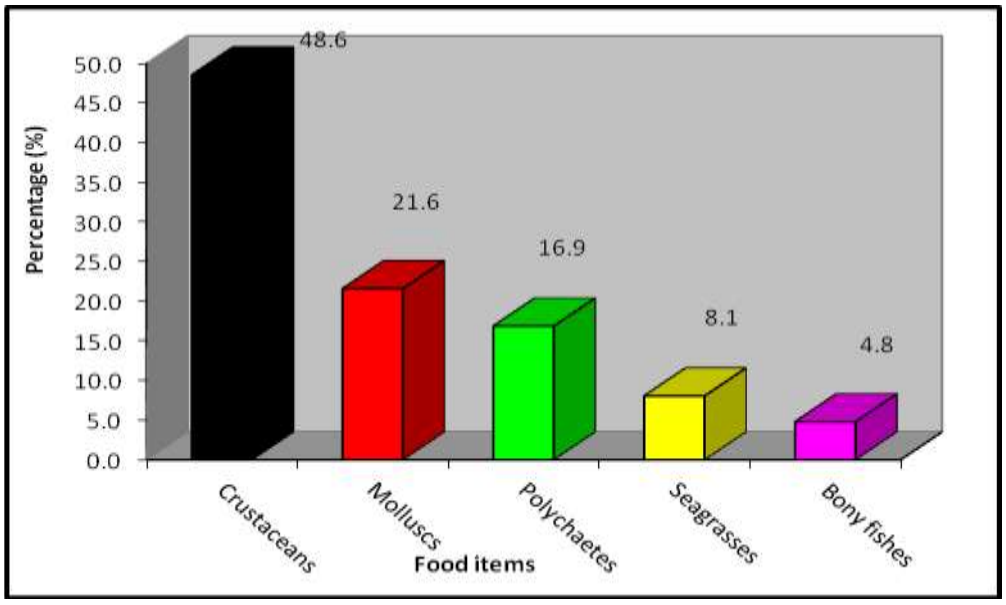
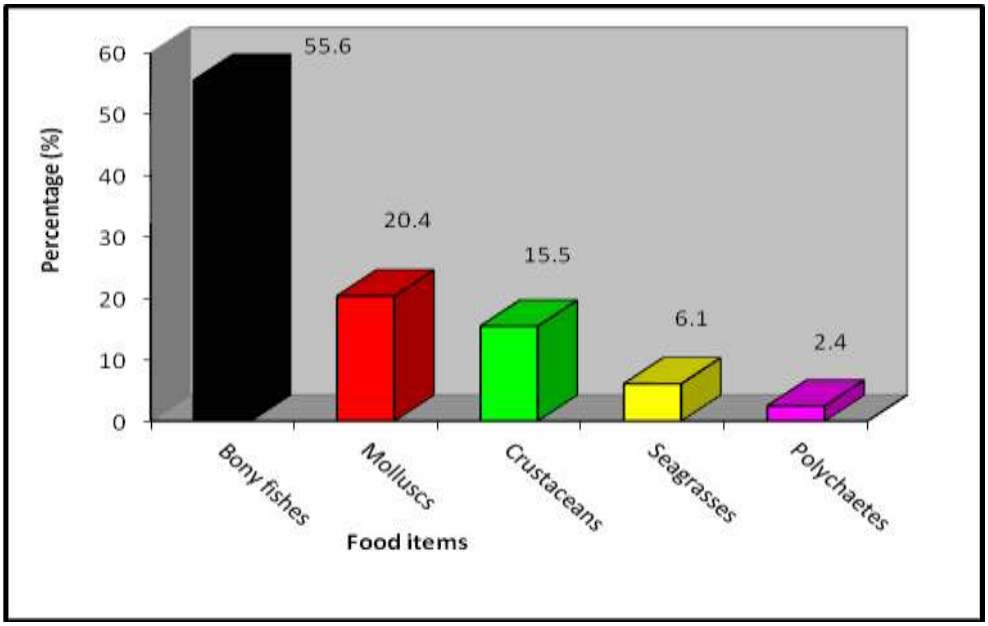


Fig. 5. The diet composition of pre-adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

Fig. 6. The diet composition of adult *S. dumerili* from Al-Hamama coast during November



2012 to October 2013

Monthly and seasonal variations in diet composition

Crustaceans, mollusks, polychaetes, sea grass and bony fish were represented in the menu of pre-adult *S. dumerili* at all months of the year (Table 5). Crustaceans, mollusks and polychaetes in order were the major food items during all seasons of the year (Table 6).

Bony fishes, mollusks and crustaceans in order constituted the major food items of adult *S. dumerili* in all months of the year (Table 7). Crustaceans completely disappeared from the

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menu during October. Sea grass disappeared during March, April, September and October. Polychaetes were absent during February, April, July, September and October. Bony fishes, mollusks crustaceans, sea grass and polychaetes in order of importance were consumed during all seasons of the year (Table 8).

Table 5. Monthly variations in diet composition (%) of pre-adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

Food items						
Months	**No.**	**Crustaceans**	**Mollusks**	**Polychaetes**	**Sea grass**	**Bony fishes**
Nov. (2012)	12	40.1	27.3	25.1	6.3	1.2
Dec.	14	46.4	28.7	14.7	6.6	3.6
Jan. (2013)	30	51.1	20.9	15.5	9.9	2.7
Feb.	32	44.2	21.5	19.9	5.6	8.8
Mar.	33	38.6	33.6	12.3	6.1	9.4
Apr.	27	28.3	30.7	18.8	11.6	10.7
May	12	47.9	15.7	14.5	11.9	9.9
Jun.	14	56.3	12.3	15.8	10.1	5.6
Jul.	17	59.2	14.1	13.2	12.5	1.1
Aug.	20	65.5	13.3	12.9	8.1	0.2
Sep.	12	61.1	16.4	17.2	2.9	2.4
Oct.	12	44.3	24.8	22.7	5.1	3.1
Total	**235**	**583.0**	**259.3**	**202.6**	**96.7**	**58.7**
%		**48.6**	**21.6**	**16.9**	**8.1**	**4.8**

Table 6. Seasonal variations in diet composition (%) of pre-adult *S. dumerili from* Al-Hamama coast during November 2012 to October 2013

Seasons	**No. of fish**	**Crustaceans**	**Mollusks**	**Polychaetes**	**Sea grass**	**Bony fishes**
Autumn	36	48.5	22.8	21.7	4.8	2.2
Winter	76	47.2	23.7	16.7	7.4	5.0
Spring	72	38.3	26.7	15.2	9.9	10.0
Summer	51	60.3	13.2	14.0	10.2	2.3

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Table 7. Monthly variations in diet composition (%) of adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

		Food items				
Months	**No. of fish**	**Bony fishes**	**Mollusks**	**Crustaceans**	**Sea grass**	**Polychaetes**
Nov. (2012)	5	39.2	24.3	26.1	8.9	1.4
Dec.	4	42.5	27.7	15.7	11.1	3.1
Jan. (2013)	6	53.1	20.8	15.5	9.9	0.7
Feb.	6	55.2	22.5	19.9	2.4	A
Mar.	12	43.6	33.6	13.3	A	9.4
Apr.	11	50.3	32.7	17.1	A	A
May	13	47.9	15.7	14.5	11.9	9.9
Jun.	16	56.3	13.3	15.8	10.1	4.6
Jul.	17	59.2	14.1	16.2	10.5	A
Aug.	10	65.5	13.3	12.9	8.1	0.2
Sep.	7	66.1	15.2	18.7	A	A
Oct.	4	88.3	11.6	A	A	A
Total	**111**	**667.2**	**244.8**	**185.7**	**72.9**	**29.3**
%		**55.6**	**20.4**	**15.5**	**6.1**	**2.4**

Remarks: (A) the food item was absent

Table 8. Seasonal variations in diet composition (%) of adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

Seasons	**No. of fish**	**Bony fishes**	**Mollusks**	**Crustaceans**	**Sea grass**	**Polychaetes**
Autumn	16	64.5	17.0	14.9	3.0	0.5
Winter	16	50.3	23.7	17.0	7.8	1.3
Spring	36	47.3	27.3	15.0	4.0	6.4
Summer	43	60.3	13.6	15.0	9.6	1.6

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Feeding habits in relation to fish size

Crustaceans, mollusks, polychaetes and sea grass were consumed by all length classes of pre-adult *S. dumerili* (Table 9). Consumption of crustaceans, mollusks and fish increased as S. *dumerili* size increased while that of polychaetes and sea grass decreased. Bony fish were not consumed by fish of lengths from 11.5 to 21.4 cm but were ingested in the following size classes.

Bony fishes, mollusks, and crustaceans were consumed by all length classes of adult *S. dumerili* (Table 10). Consumption of bony fish and mollusks increased as fish size increased while that of crustaceans, sea grass and polychaetes decreased. Sea grass and polychaetes were not consumed by fish larger than 141.5 and **117.5** cm in order.

Table 9. Diet composition (%) of different size classes of pre-adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

		Food items				
Size groups (cm)	**No. of fish**	**Crustaceans**	**Molluscs**	**Polychaetes**	**Sea grass**	**Bony fishes**
11.5 - 13.4	18	41.4	6.1	34.6	17.9	A
13.5 - 15.4	23	42.4	8.3	34.1	15.3	A
15.5 - 17.4	12	44.5	9.7	32.5	13.3	A
17.5 - 19.4	14	46.8	12.1	29.1	12.1	A
19.5 - 21.4	11	49.9	12.1	27.5	10.5	A
21.5 - 23.4	25	50.2	15.2	17.7	10.4	6.6
23.5 - 25.4	27	50.4	15.4	6.1	7.7	20.4
25.5 - 27.4	33	50.6	39.4	1.9	1.1	7.1
27.5 - 29.4	24	52.1	39.7	1.1	0.9	6.3
29.5 - 31.4	27	53.3	39.9	1.1	0.3	5.3
31.5 - 33.4	21	53.5	40.1	0.3	0.1	6.1

Remarks: (A) the food item was absent

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Table 10. Diet composition (%) of different size classes of pre-adult *S. dumerili* from Al-Hamama coast during November 2012 to October 2013

		Food items				
Size groups (cm)	**No. of fish**	Bony fishes	Molluscks	Crustaceans	Sea grass	Polychaetes
33.5 - 45.4	**7**	**37.4**	**2.1**	**34.6**	**13.1**	**12.8**
45.5 - 57.4	**9**	**46.7**	**5.3**	**34.1**	**11.3**	**2.6**
57.5 - 69.4	**11**	**48.5**	**7.7**	**32.5**	**10.3**	**1.1**
69.5 - 81.4	**12**	**51.1**	**10.1**	**29.1**	**8.8**	**0.9**
81.5 - 93.4	**15**	**57.3**	**11.1**	**22.5**	**8.5**	**0.7**
93.5 - 105.4	**5**	**59.1**	**15.7**	**7.7**	**7.9**	**9.6**
105.5 - 117.4	**7**	**59.4**	**25.4**	**6.1**	**4.7**	**4.4**
117.5 - 129.4	**9**	**60.6**	**36.4**	**1.9**	**1.1**	A
129.5 - 141.4	**11**	**61.4**	**36.6**	**1.1**	**0.9**	A
141.5 - 153.4	**14**	**62.1**	**36.9**	**1.1**	A	A
153.5 - 165.4	**11**	**62.6**	**37.1**	**0.3**	A	A

Remarks: (A) the food item was absent

The feeding intensity

Pre-adult fish with stomachs half full, 3/4 full and full of food were ranked b% (Table 11) whereas those with stomachs that were empty, with traces of food and quarter full were ranked a%. b% constituted 52.7% of all analyzed individual while a% represented 47.3%. The feeding activities were high during autumn 69.2% and spring 72.6% (Table 12), low during winter (24.9%) and moderate in summer (44.0%).

For adult fish, b% constituted 55.5% and a% 44.5% (Table 13). The feeding activities were moderate to high during all seasons: autumn 55.7%, winter 55.6%, spring 61.0% and summer 49.8% (Table 14).

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Table 11. Monthly variations in the intensity of feeding of pre-adult *S. dumerili* from Al-Hamama coast during April 2012 to March 2013

Degree of distention of stomach									
Months	**No. of fish**	**Empty**	**Trace**	**1/4**	**a %**	**1/2**	**3/4**	**Full**	**b %**
Nov. (2012)	12	17.4	A	1.9	**19.3**	12.5	48.3	19.9	**80.7**
Dec.	14	6.0	30.1	49.9	**86.0**	13.9	A	A	**13.9**
Jan. (2013)	30	26.0	21.1	16.8	**63.9**	16.0	2.0	18.0	**36.0**
Feb.	32	26.2	22.7	26.3	**75.2**	8.9	A	15.9	**24.8**
Mar.	33	23.2	A	A	**23.2**	13.3	15.3	48.2	**76.8**
Apr.	27	23.2	A	A	**23.2**	15.4	15.4	46.1	**76.9**
May	12	16.0	2.0	18.0	**36.0**	12.0	20.0	32.0	**64.0**
Jun.	14	10.0	5.0	43.0	**58.0**	1.9	40.0	A	**41.9**
Jul.	17	10.0	4.0	44.0	**58.0**	20.0	22.0	A	**42.0**
Aug.	20	24.0	28.0	A	**52.0**	24.0	24.0	A	**48.0**
Sep.	12	20.0	10.0	8.0	**38.0**	10.0	26.0	26.0	**62.0**
Oct.	12	10.0	10.0	15.0	**35.0**	25.0	14.1	25.9	**65.0**
Average					47.3				52.7

Remarks: (A) the food item was absent

Table 12. Seasonal variations in the intensity of feeding of pre-adult *S. dumerili* from Al-Hamama coast during April 2012 to March 2013

Degree of distention of stomach									
Seasons	**No. of fish**	**Empty**	**Trace**	**1/4**	**a%**	**1/2**	**3/4**	**Full**	**b%**
Autumn	36	15.8	6.7	8.3	**30.8**	15.8	29.5	23.9	**69.2**
Winter	76	19.4	24.6	31.0	**75.0**	12.9	0.7	11.3	**24.9**
Spring	72	20.8	0.7	6.0	**27.5**	13.6	16.9	42.1	**72.6**
Summer	51	14.7	12.3	29.0	**56.0**	15.3	28.7	0.0	**44.0**

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Table 13. Monthly variations in the intensity of feeding of adult *S. dumerili* from Al-Hamama coast during April 2012 to March 2013

Degree of distention of stomach									
Months	**No of fish**	**Empty**	**Trace**	**1/4**	**a %**	**1/2**	**3/4**	**Full**	**b %**
Nov. (2012)	5	10.0	5.0	45.1	**60.1**	A	40.0	A	**40.0**
Dec.	4	10.0	4.0	44.0	**58.0**	20.0	22.0	A	**42.0**
Jan. (2013)	6	24.0	28.0	A	**52.0**	24.0	24.0	A	**48.0**
Feb.	6	23.2	A	A	**23.2**	13.3	15.3	48.2	**76.8**
Mar.	12	23.2	A	A	**23.2**	15.4	15.4	46.1	**76.9**
Apr.	11	16.0	2.0	A	**18.0**	12.0	20.0	50.1	**82.1**
May	13	6.0	30.1	39.9	**76.0**	13.9	10.1	A	**24.0**
Jun.	16	26.0	21.1	16.8	**63.9**	16.0	2.0	18.0	**36.0**
Jul.	17	26.2	22.7	26.3	**75.2**	8.9	A	15.9	**24.8**
Aug.	10	11.4	A	A	**11.4**	13.1	48.3	27.2	**88.6**
Sep.	7	20.0	10.0	8.0	**38.0**	10.0	26.0	26.0	**62.0**
Oct.	4	10.0	10.0	15.0	**35.0**	25.0	14.1	25.9	**65.0**
Average					44.5				55.5

Remarks: (A) the food item was absent

Table 14. Seasonal variations in the intensity of feeding of adult *S. dumerili* from Al-Hamama coast during April 2012 to March 2013

Degree of distention of stomach									
Seasons	**No. of fish**	**Empty**	**Trace**	**1/4**	**a%**	**1/2**	**3/4**	**Full**	**b%**
Autumn	**16**	13.3	8.3	22.7	**44.4**	11.7	26.7	17.3	**55.7**
Winter	**16**	19.1	10.7	14.7	**44.4**	19.1	20.4	16.1	**55.6**
Spring	**36**	15.1	10.7	13.3	**39.1**	13.8	15.2	32.1	**61.0**
Summer	**43**	21.2	14.6	14.4	**50.2**	12.7	16.8	20.4	**49.8**

DISCUSSION

In the present study length-weight relationships of $W = 0.0437L^{2.819}$ and $W = 0.019L^{2.873}$ were obtained for pre-adult and adult *S. dumerili* in order. Similar "b" values were reported by Bilecenoglu *et al*., 2002, who stated that b equals 2.9881 for pre-adults and 2.8444 for adults (isometric growth) of the same species in Turkey (Mediterranean Sea). Kozul *et al*., 2008,

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stated that b equals 2.765 for pre-adult and 3.001 for adult *S. dumerili*. The value of b was 2.933 for *S. dumerili* in lagoon of New Caledonia, Naga (Kulbicki *et al*., 1993). A number of factors are known to influence the length weight relationship in fishes including growth phase, sex, size range, temperature and preservation techniques (Thompson *et al*., 1999). Beckman, 1948, mentioned that the coefficient of length-weight relationship differs not only between species but sometimes between stock of the same species due to sex ratio, spawning season and maturity stage.

In the present study the condition factors of both fish groups have tendency to decrease with increasing fish length. Adult *S. dumerili* condition factors were lower than those of the pre-adult. This supports observations described for south eastern Adriatic Sea (Kozul *et al*., 2008) and the Sargasso Sea, south west of Bermuda (David and Rooker, 2004). The monthly variation in the condition factors of fish are known to be affected by feeding activities (Niklosky, 1963; Roo *et al.*, 1999) and the spawning activities (Niklosky, 1963; Gillanders *et al*., 2010) which may show their refection on the body condition. In the present study the condition factors of pre-adult *S. Dumerili* recorded higher values in autumn and spring. This coincides with the period of high degree of stomach fullness. The condition factors of the adult fish recorded the highest values in spring and summer which coincides with the period of high degree of stomach fullness in spring and the spawning season in summer.

Little is known to date on the feeding ecology of the Mediterranean *S. dumerili*, excepting a preliminary report on the feeding habits (Mazzola *et al*., 1993). Feitoza *et al*., 2005, mentioned that juveniles of greater amberjacks feed on plankton such as decapods larvae, polychaetes, other small invertebrates, sea grass and bony fishes. In the current study pre-adult and adult *S. dumerili* were found to consume a wide range of food items: crustaceans, mollusks, polychaetes, sea grass and bony fishes. This is in agreement with Feitoza *et al*., 2005 and Badalamenti *et al*., 1993.

Generally, the food extent demands and ability for food acquisition increase with fish development (Honda, 1984). Andaloro and Pipitone, 1997, studied the feeding habits of *S. dumerili* in central Mediterranean Sea. They concluded that the numbers and size of the prey taxa increased with increase in size of the predator fish due to the ability of larger fishes to consume a wide range of prey sizes than smaller fishes. This phenomenon appears to be applying for the present study where consumption of the food items crustaceans, mollusks and bony fish by pre-adult *S. dumerili* increased as their size increased while that of polychaetes and sea grass decreased. For adult fishes, more bony fishes and mollusks and less crustaceans, sea grass and polychaetes were consumed as the fish size increased. This is in agreement with Cho *et al*., 2001. Matallanas *et al*., 2009, in Catalan Sea, western Mediterranean Sea, stated that uptake of the food items, fish parts and mollusks increased as the fish size increased while that of crustaceans decreased.

The feeding activity may affect the monthly variation in the condition factors of fish which may show their reflection on the body condition (Thompson *et al*., 1999). In the present study pre-adult, *S. dumerili* ingestion of crustaceans and sea grass recorded the highest values in summer while mollusks and bony fishes in spring but polychaetes in autumn, which is in agreement with Feitoza *et al*., 2005. For adult S. *dumerili* bony fishes ingestion was highest values in autumn, mollusks and polychaetes in spring, crustaceans in winter and sea grass in summer which is in agreement with Badalamenti *et al*., 1993.

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