FEEDING ECOLOGY OF *SQUALUS MEGALOPS* (MACLEAY, 1881) AND *S. BLAINVILLEI* (RISSO, 1827) (CHONDRICHTHYES: SQUALIDAE) IN THE GULF OF GABÈS (CENTRAL MEDITERRANEAN SEA)

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ABSTRACT
In this study, the diet of *S. megalops* and *S. blainvillei* in the Gulf of Gabès (Central Mediterranean Sea) was investigated between 2007 and 2009, by collecting monthly samples of these two species from local fishing vessels. In the stomachs of both species, teleosts were the dominant prey items, and crustaceans, molluscs, and annelids, were found in lower abundance. A three-factor multivariate analysis of variance (MANOVA) demonstrated significant differences in diet related to size, season and sex in *S. megalops* but not related to size in *S. blainvillei*.

RESUME
Le régime alimentaire de *S. megalops* et de *S. blainvillei* dans le golfe de Gabès (mer Méditerranée centrale) a été étudié de 2007 à 2009, en recueillant des échantillons mensuels de ces deux espèces sur des bateaux de pêche locaux. Dans l'estomac des deux espèces, les téléostéens étaient les proies dominantes, et les crustacés, les mollusques et les annélides étaient moins abondants. Une analyse de variance multivariée à trois facteurs (MANOVA) a révélé des différences significatives dans l'alimentation en fonction de la taille, de la saison et du sexe chez *S. megalops*, mais pas en rapport avec la taille chez *S. blainvillei*.

Keywords: *Squalus megalops*, *Squalus blainvillei*, feeding ecology, Gulf of Gabès, Tunisia, MED.

INTRODUCTION

The piked spurdog *Squalus megalops* (Macleay, 1881) and the longnose spurdog *S. blainvillei* (Risso, 1827) are two viviparous aplacental demersal sharks that occurred in the Gulf of Gabès (Tunisia) (Marouani *et al.*2012).

Feeding studies can provide researchers with important insights towards understanding potential fishery impacts on marine systems. Besides, knowing what a species eats can provide information about possible distribution and its position in food webs (Ebert *et al.* 1992).

Relatively little information is available on the feeding study of both species. Concerning the diet of *S. megalops*, scarce studies were carried out in the Australian waters (Braccini *et al.,* 2005) and in the West coast of South Africa (Ebert *et al*., 1992). Few studies on the feeding of *S. blainvillei* were undertaken off the Turkish waters (Kabasakal, 2002) and off the coast of Portugal (Martinho *et al.*, 2011).

To date no similar work has been reported from the Mediterranean Sea. This present study provides information concerning the diet of *S. megalops* and *S. blainvillei* from the Gulf of Gabès.

MATERIAL AND METHODS

Sampling was carried out from 17 stations located in the territorial waters of the Gulf of Gabès (Fig.1). A total of 630 specimens of *S. megalops* and 232 specimens *of S.blainvillei* were landed by the commercial trawlers operating over 70 m depth between January 2007 and May 2009.

All specimens were sexed, weighed and measured for total length (TL) to the nearest millimeter. Stomachs were dissected for analysis. Prey items were identified to the lowest possible taxonomic level, counted and weighed.

Vacuity index (VI) was calculated as the number of empty stomach divided by the total number of examined stomachs multiplied by 100. The variation in VI was tested using a chi-square test over a contingency table of the number of empty stomachs

The importance of each prey was determined by calculating the index of relative importance (IRI) (Pinkas *et al.* 1971). The IRI values were converted to a percentage to facilitate comparisons between prey items (Cortés, 1997). IRI% is the index of the relative importance:

$$\%IRI = 100 \times \mathrm{IRIi} / \sum_{i=1}^{n} \mathrm{IRIi}$$

Where %F, %N and %M are the percentage contributions of a prey category in terms of frequency of occurrence, number and mass, respectively, in the stomachs with food.

Dietary shifts with sex, predator’s size (TL) and season were evaluated using Multivariate analysis of variance (MANOVA). Statistical analyses were carried out considering the main prey categories: crustaceans, teleosts, cephalopods and annelids. In addition, according to Marouani (2013) three size classes were designated to assess a possible change in

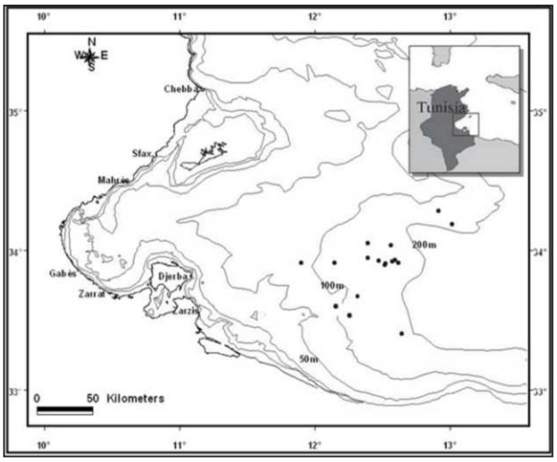

Fig.1. Map of the Gulf of Gabès (Tunisia, Central Mediterranean Sea) illustrating samples locations.

the diet with respect to length: class I (Juveniles): TL<40 cm; class II (Subadults): 40<TL<55cm and class III (Adults): TL>55cm for *S. megalops* and class I: TL<40 cm; class II: 40<TL<55cm and class III: TL>55cm for *S. blainvillei*.

The number of each prey category was considered and the dependent variables and seasons (winter, spring, summer and autumn); sex (F or M) and size class (I, II, III) were defined as factors. The multivariate F value (Wilks' lambda) based on a comparison of the error variance/covariance matrix and the effect variance/covariance matrix was applied to test differences in the diet. An ANOVA was further performed to identify the main prey groups responsible for the major differences among factors: sex, season and size class. The significance level adopted was 5%.

RESULTS

In total, 630 *S. megalops* specimens were measured in this study. Females (n= 307) ranged from 18.8 to 76.0 cm TL and 30.26 – 2870 g while males (n=323) ranged from 19.80 to 69.0 cm TL (42.61 ± 5.86 cm) and 35.0- 1570g. Of the 232 specimens of *S. blainvillei*, 108 males ranged from 23.20 to 83.40 cm TL and 42.40 – 2275g M; while 124 females ranged from 24.70 to 100.0 cm TL and 52.35 – 4520 g M.

Length–mass relationships were not significantly different between males and females of *S. megalops* (Student's *t*-test: *t*= 0.49; d.f =62, *P*> 0.05) (Sexes combined : $TM = 0.002\times TL^{3.13}$ (r^2 =0.98, *n* = 630), but significantly different between males and females of *S. blainvillei* (*t*-test = 4.11; d.f =232; P < 0.05) (Male: $M = 0.002\times TL^{3.08}$ (R^2 =0.99, SE = 0.03, n = 108); Female: $M = 0.003\times TL^{3.10}$ (R^2 =0.95, SE = 0.12, n = 124)).

The vacuity index of *S. megalops* was 30.63%. The VI of males (24.77%) and females (36.81%) were significantly different ($\chi2$ = 10.73, d.f. = 1, P <0.05). The proportion of empty stomachs differed significantly among size classes ($\chi2$ = 117.53, d.f. = 2, P <0.05) but did not varied over the year ($\chi2$ = 1.87, d.f. = 3, P>0.05).

The vacuity index of *S. blainvillei* was 26.72%. The VI was not significantly different between males (24.07%) and females (29.03%) ($\chi2$ = 10.73, d.f. = 1, P <0.05) and among the year ($\chi2$ = 1,69 ; dl=3 ; p<0,05) but differed significantly among size classes $\chi2$ = 68,63 ; dl=2 ; p<0,05).

Both species were found to prey on a wide variety of invertebrates and teleosts (Table 1). Prey items belonging to four major zoological groups were found in their stomachs (Table 1). The average number of prey and mass per stomach of *S. megalops* and *S. blainvillei* were 1.59 (±0.54) and 12.62 (±4.54) g and 0.53 (±0.51) and 3.62 (±3.38) g respectively. Teleosts were the most frequently observed prey in the diet of both species, constituting 80.32% of the total % IRI, followed by cephalopods (% IRI = 11.96) and crustaceans (%IRI = 7.68) while annelids (%IRI = 0.05) were minor components (Table 1), and 82.59% of the total % IRI followed by crustaceans (%IRI = 17.06) while cephalopods (% IRI = 0.34) and annelids (%IRI = 0.01) were minor components (Table 1) respectively in *S. megalops* and *S. blainvillei.* Among teleosts, Sparidae was the most numerous and frequently occurring family (Table 1).

The MANOVA results demonstrated the existence of differences in the diet of *S. megalops* according to size, season and sex (Table 2). The ANOVA performed for each dependent variable (group taxa) indicated that teleosts and crustaceans were responsible for the statistical difference just of size classes and sexes whereas cephalopods were responsible for the difference between size classes, sexes and seasons (Table 2). There is a significant difference on the crustacean intake through sex and season. The sex-size classes interaction was caused by teleosts. Moreover, all interactions were caused by cephalopods. Concerning the diet of *S. blainvillei*, it differs according to size but not according to season

Table 1. Diet composition of *Squalus megalops* and *S. blainvillei* off the Gulf of Gabès. %F, frequency of occurrence; %N, percentage in number; %M, percentage in weight; %IRI, index of relative importance of prey item.

	Squalus megalops				***Squalus blainvillei***			
	%F	**%N**	**%M**	**%IRI**	**%F**	**%N**	**%M**	**%IRI**
Crustacea	**26.32**	**23.39**	**6.77**	**7.68**	**42.94**	**38.20**	**14.16**	**17.06**
Penaeidae	18.54	16.36	5.22	14.97	31.18	29.44	9.52	32.75
Melicertus kerathurus (Forsskal, 1775)	2.75	3.59	1.73	0.85	5.88	4.51	1.77	3.58
Parapenaeus longirostris (Lucas, 1846)	1.37	1.29	0.42	0.14	5.29	4.77	2.08	3.52
Metapenaeus monoceros (Fabricius, 1798)	4.81	4.45	1.68	1.71	12.94	12.47	3.42	19.95
Trachypenaeus curvirostrus (Stimpson, 1860)	0.23	0.29	0.16	0.01	5.29	6.37	1.62	4.10
Unidentified	9.38	6.74	1.23	4.34	1.76	1.33	0.63	0.34
Sycioniidae	4.12	3.44	0.66	0.63	5.88	5.31	1.45	1.07
Sicyonia carinata(Brunnich, 1768)	4.12	3.44	0.66	0.98	5.88	5.31	1.45	3.85
Mysidacea	0.69	1.29	0.02	0.03	--	--	--	--
Unidentified	0.69	1.29	0.02	0.05	--	--	--	--
Amphipoda	0.23	0.29	0.00	0.00	--	--	--	--
Unidentified	0.23	0.29	0.00	0.00	--	--	--	--
Isopoda	0.23	0.14	0.00	0.00	--	--	--	--
Unidentified	0.23	0.14	0.00	0.00	--	--	--	--
Majidae	1.83	1.15	0.36	0.10	2.35	1.33	1.39	0.17
Maja verrucosa(Brünnich, 1772)	0.46	0.29	0.04	0.01	1.18	0.80	0.98	0.20
Maja squinado(Herbst, 1788)	0.69	0.43	0.22	0.03	0.59	0.27	0.21	0.03
Unidentified	0.69	0.43	0.10	0.02	0.59	0.27	0.20	0.03
Squillidae	0.92	0.72	0.50	0.04	4.12	2.12	1.81	0.44
Squilla mantis(Linnaeus, 1758)	0.92	0.72	0.50	0.06	4.12	2.12	1.81	1.57
Teleosts	**68.19**	**56.24**	**65.51**	**80.32**	**77.06**	**57.82**	**83.38**	**82.59**
Sparidae	12.81	10.76	17.77	13.69	21.18	17.51	31.50	27.98
Diplodus annularis(Linnaeus. 1758)	4.81	4.45	6.21	2.97	6.47	4.77	9.35	8.87
Diplodus vulgaris(Geoffroy Saint-Hilaire. 1817)	1.83	1.29	1.25	0.27	2.35	1.59	1.19	0.64
Diplodus sp	0.92	0.57	0.65	0.07	1.76	0.80	0.89	0.29
Pagellus erythrinus(Linnaeus. 1758)	2.29	1.87	3.84	0.76	6.47	3.18	8.35	7.24
Pagellus sp	1.83	1.15	3.29	0.47	0.59	0.53	0.46	0.06
Sarpa salpa(Linnaeus. 1758)	0.23	0.14	0.16	0.00	--	--	--	--
Boops boops(Linnaeus. 1758)	1.60	1.29	2.37	0.34	3.53	5.31	9.41	5.04
Dentex sp	--	--	--	--	0.59	1.06	1.59	0.15
Pagrus sp.	--	--	--	--	0.59	0.27	0.25	0.03
Centracanthidae	0.46	0.29	0.30	0.01	1.76	1.33	1.30	0.13
Spicara smaris(Linnaeus. 1758)	0.23	0.14	0.21	0.00	1.18	0.80	0.93	0.20
Spicarasp	0.23	0.14	0.09	0.00	0.59	0.53	0.38	0.05
Congridae	3.66	2.87	3.56	0.88	5.88	3.18	5.43	1.37
Conger conger(Linnaeus. 1758)	3.66	2.87	3.56	1.36	5.88	3.18	5.43	4.92
Serranidae	1.83	1.15	1.06	0.15	4.12	2.12	1.87	0.44
Serranus hepatus(Linnaeus. 1758)	0.92	0.57	0.34	0.05	1.18	0.53	0.37	0.10
Serranus scriba(Linnaeus. 1758)	0.46	0.29	0.49	0.02	1.76	1.06	1.28	0.40
Serranus sp	0.46	0.29	0.23	0.01	1.18	0.53	0.18	0.08

Table 1. Continued

Carangidae	4.81	4.73	8.10	2.31	6.47	3.71	9.63	2.33
Trachurustrachurus(Linnaeus. 1758)	2.97	3.01	5.70	1.50	4.12	2.65	6.89	3.81
Trachinusdraco(Linnaeus. 1758)	0.69	1.00	1.74	0.11	0.59	0.27	0.57	0.05
Trachurus sp	0.92	0.57	0.44	0.05	0.59	0.27	0.22	0.03
Caranx crysos (Mitchill. 1815)	0.23	0.14	0.22	0.00	1.18	0.53	1.95	0.28
Clupeidae	9.15	7.46	6.35	4.73	7.65	6.90	5.11	2.48
*Sardinella aurita*Valenciennes. 1847	4.58	4.02	4.22	2.18	4.71	4.77	3.44	3.75
Sardina pilchardus(Walbaum. 1792)	0.92	1.00	1.12	0.11	2.35	1.59	1.38	0.68
Unidentified	3.66	2.44	1.01	0.73	0.59	0.53	0.29	0.05
Mugildae	0.46	0.29	0.20	0.01	1.18	0.53	0.49	0.03
Liza aurata (Risso. 1810)	0.23	0.14	0.16	0.00	0.59	0.27	0.39	0.04
Unidentified	0.23	0.14	0.04	0.00	0.59	0.27	0.10	0.02
Mullidae	2.75	2.44	2.86	0.54	4.12	3.45	6.37	1.09
Mullus barbatus (Linnaeus. 1758)	0.69	0.43	0.25	0.03	1.18	1.06	1.00	0.24
M. surmuletus(Linnaeus. 1758)	1.60	1.72	2.21	0.36	2.94	2.39	5.37	2.21
Unidentified	0.46	0.29	0.40	0.02	--	--	--	--
Scorpaenidae	1.37	0.86	2.17	0.16	2.94	1.33	3.14	0.35
Scorpaena elongata Cadenat. 1943	1.37	0.86	2.17	0.24	2.94	1.33	3.14	1.28
Soleidae	0.46	0.29	0.36	0.01	3.53	1.59	2.30	0.37
Solea aegyptiaca(Linnaeus. 1758).	0.23	0.14	0.31	0.01	2.94	1.33	2.21	1.01
Unidentified	0.23	0.14	0.05	0.00	0.59	0.27	0.09	0.02
Scyliorinidae	0.23	0.14	0.26	0.00	--	--	--	--
Scyliorinussp	0.23	0.14	0.26	0.01	--	--	--	--
Merluccidae	2.06	1.87	4.58	0.50	3.53	2.12	4.99	0.68
Merluccius merluccius (Linnaeus. 1758)	2.06	1.87	4.58	0.77	3.53	2.12	4.99	2.44
Sciaenidae	0.23	0.14	0.82	0.01	--	--	--	--
Sciaenaumbra(Linnaeus. 1758)	0.23	0.14	0.82	0.01	--	--	--	--
Gobiidae	0.23	0.14	0.22	0.00	--	--	--	--
Gobius sp	0.23	0.14	0.22	0.00	--	--	--	--
Triglidae	0.23	0.14	0.15	0.00	--	--	--	--
Aspitrigla cuculus (Linnaeus. 1758)	0.23	0.14	0.15	0.00	--	--	--	--
Unidentifiedteleosts	32.95	22.67	16.76	48.65	28.82	14.06	11.23	19.65
Molluscs	**26.77**	**18.51**	**27.66**	**11.96**	**7.65**	**3.45**	**2.42**	**0.34**
Cephalopods	26.77	18.51	27.66	11.96	7.65	3.45	2.42	0.34
Octopodidae	6.86	4.73	14.99	5.07	11.76	6.37	13.43	6.28
Octopus vulgaris	4.58	3.16	13.64	4.45	6.47	3.45	9.50	8.13
Eledone moschata	2.29	1.58	1.35	0.39	5.29	2.92	3.93	3.52
Loligolinidae	6.18	4.59	5.50	2.34	5.29	3.18	5.23	1.20
Loligovulgaris	5.95	4.45	5.13	3.30	5.29	3.18	5.23	4.32
Sepiolidae	2.97	2.15	2.46	0.51	4.71	3.18	5.36	1.08
Sepia officinalis	2.75	2.01	2.32	0.69	3.53	2.39	4.22	2.26
Unidentified	0.23	0.14	0.14	0.00	1.18	0.80	1.14	0.22
Ommastrephidae	0.23	0.14	0.31	0.00	1.18	0.80	2.16	0.09
Illexcoindetti	0.23	0.14	0.31	0.01	1.18	0.80	2.16	0.34
Unidentifiedcephalopods	10.53	6.89	4.39	4.44	--	--	--	--
Annelids	**2.52**	**1.87**	**0.06**	**0.05**	**1.18**	**0.53**	**0.04**	**0.01**
Nereids	2.52	1.87	0.06	0.18	1.18	0.53	0.04	0.02
Nereis sp	2.52	1.87	0.06	0.28	1.18	0.53	0.04	0.07

Table 2. Multivariate analysis of variance (MANOVA) table of Wilks' lambda and group response to analysis of variance (ANOVA). (df, degrees of freedom; W. L, value of Wilks lambda; F, approximate F value; Sig, significant; crust: crustaceans; ceph: cephalopods;Ann: Annelids).

	Squalus megalops							***Squalus blainvillei***						
	MANOVA			**ANOVA**				**MANOVA**			**ANOVA**			
Effect	W.L	F	Sig.	Crust	Teleosts	Ceph	Ann	W.L	F	Sig.	Crust	Teleosts	Ceph	Ann
Season	0.94	3.04	0.00	0.99	0.43	0.00	0.44	0.88	1.61	0.09	0.24	0.13	0.86	0.07
Sex	0.88	18.93	$1.00\ 10^{-14}$	0.00	0.00	$2.01\ 10^{-06}$	0.84	0.97	1.02	0.40	0.11	0.77	0.93	0.25
TL	0.48	65.42	$4.18\ 10^{-89}$	0.00	$1.46\ 10^{-49}$	$4.08\ 10^{-25}$	0.06	0.74	5.98	0.00	0.84	0.00	0.78	0.32
Season * Sex	0.92	4.07	0.00	0.02	0.65	$2.38\ 10^{-06}$	0.79	0.94	0.75	0.70	0.60	0.20	0.95	0.48
Season * TL	0.90	2.64	0.00	0.77	0.05	0.00	0.15	0.90	0.66	0.89	0.22	0.98	0.97	0.50
Sex * TL	0.9	6.13	$8.93\ 10^{-08}$	0.08	0.02	0.00	0.77	0.93	1.34	0.22	0.11	0.80	0.44	0.13
Season * Sex * TL	0.89	2.78	$8.36\ 10^{-06}$	0.07	0.52	$4.03\ 10^{-06}$	0.97	0.89	0.91	0.58	0.60	0.40	0.98	0.09

and sex (Table 2). The ANOVA analysis showed that the ingestion of teleosts varies with size. On the other hand, there is no significant trend in ingestion of crustaceans and molluscs by combining all the dependent factors (Table 2).

DISCUSSION

The relatively low index of vacuity recorded for the Squalidae captured in the Gulf of Gabes has also been reported in other diet studies of same species(*S. megalops*: in the Australian waters (VI = 34.7 % , Braccini *et al.*, 2005) and off South African coasts (VI=39.77%, Ebert *et al.*, 2002); *S. blainvillei*: in the Aegean Sea (VI =26.6%, Kabasakal, 2002); in Portugal (VI = 21.6% (Martinho et al., 2011)). Moreover, the relatively small number of empty stomachs in both species suggests that those species are intermittent predators with an intense and continuous feeding activity. Therefore many shark species including *Squalus megalops* off Australia are considered intermittent predators having short periods of active feeding followed by longer periods of reduced predatory activity (Braccini *et al.*, 2005).

There was a wide range of food items in the stomachs of *S. megalops and S. megalops* off the Gulf of Gabes. But, their diet was dominated by teleosts representing more than 80% of the IRI% followed by cephalopods and crustaceans. Whereas annelids were of minor importance in stomachs contents and incidentally consumed. Our results are in agreement with data provided for specimens from other areas (Ebert *et al.*, 2002; Braccini *et al.*, 2005; Bass *et al.*, 1976; Kabasakal, 2002; Martinho *et al.*, 2011).

In the present study, the stomach contents indicate that those species are an active predators foraging mainly on demersal and benthic preys, while pelagic preys were also found occasionally. The occurrence of pelagic preys in the diet of benthic elasmobranch species may also be derived from scavenging on the discard of commercial fisheries (Kadri *et al.*, 2012). Sparidae was the most numerous and frequently occurring family.

A comparison of the diet between size classes indicated that *S. megalops* and *S. blainvillei* exhibited ontogenetic changes in diet, with crustaceans decreasing and cephalopods and teleosts increasing in importance with shark size. Braccini *et al.* (2005) reported similar ontogenetic dietary shifts in *S. megalops* off the Australian waters where large and small exploited different resources. In fact, diet shift with size is a pattern widely observed in elasmobranchs (Lucifora *et al.*, 2009). These ontogenetic differences may be attributed to morphological limitations of small sharks, better foraging ability of large fish, or food preference with growth and swimming capacities of the species (Ebert et al., 2002).

BIBLIOGRAPHY

Bass A.J., D'Aubrey J.D. et Kistnasamy N. 1976. Sharks of the east coast of southern Africa. VI. The families Oxynotidae, Squalidae, Dalatiidae and Echinorhinidae Invest. Rep. Oceanogr. Res. Inst. Durban 45: 1-103.

Braccini, J. M., Gillanders B. M. et Walker T.I., 2005. Sources of variation in the feeding ecology of the piked spurdog (*Squalus megalops*): implications for inferring predator-prey interactions from overall dietary composition. ICES J. Mar. Sci. 62:1076–1094.

Cortès E. 1997. A critical review of methods of studying fish feeding based on analysis of stomach contents: application to elasmobranch fishes. Can J Fish Aquat Sci, 54: 726-738.

Ebert D.A., Compagno L.J.V. et Cowley P.D. 1992. A preliminary investigation of the feeding ecology of Squaloid sharks off the west coast of the southern S. Afr. J. Mar. Sci., 12 601-609.

Ebert D.A., Cowley P.D. et Compagno L.J.V. 2002. First records of the longnose spiny dogfish *Squalus* blainvillei (Squalidae) and the deep-water stingray Plesiobatis daviesi (Urolophidae) from South African waters. S. Afr. J. Mar. Sci, 24: 355-357.

Kabasakal H. 2002. Stomach contents of the longnose spurdog *Squalus blainvillei* (Risso, 1826) from the North-Eastern Aegean Sea. Ann. Ser. Hist. Nat., 12(2): 161-166.

Kadri H., S. Marouani, B. Saidi, M. N. Bradaï, M. Ghorbel, Bouaïn A. et Morize E. 2012. Life history of *Raja miraletus* (Linnaeus, 1758) (Chondrichthyes: Rajidae) of the Gulf of Gabès (Central Mediterranean Sea). Mar. Biol. Res. 8: 309-317.

Lucifera L.O., Garcia V.B., Menni R.C., Escalante A.H., Hozbor N.M. (2009) Effects of body size, age and maturity stage on diet in a large shark: Ecologicla and applied implications. Ecological and applied implications. Ecology Research 24: 09-18.

Marouani S. (2013) Systematique et eco-biologie de *Squalus blainvillei* (Risso, 1827) et *S. megalops* (Macleay, 1881) (Chondrichtyens, Squalidae) du golfe de Gabes (Mediterranee centrale). PhD Thesis, University of Sfax.

Marouani S., Chaâba R., Kadri H., Saidi B., Bouain A., Maltagliati F., Last P., Séret B. et Bradai M.N. 2012. Taxonomic research on *Squalus megalops* (Macleay, 1881) and *S. blainvillei* (Risso, 1827) (Chondrichthyes: Squalidae) in Tunisian waters (Central Mediterranean Sea). Sci. Mar., 76(1): 97-109.

Martinho F., Sá C., Falcão J., Cabral H.N. et Pardal M. Â. 2011. Comparative feeding ecology of two elasmobranch species, *Squalus blainville* and *Scyliorhinus canicula*, off the coast of Portugal. Fish. Bull. 110: 71–84.

Pinkas L.M., Oliphant S., Iverson I.L.K. (1971). Food habits of albacore, bluefin tuna, and bonito in Californian waters. Califorian Fish Game. 152: 1-105.