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Observations on food and feeding habits of the common smooth hound shark, *Mustelus mustelus* in the Mediterranean Sea at Alexandria coast, Egypt

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ABSTRACT

The present study aimed to provide information on the food and feeding of common smoothhound shark, *Mustelus mustelus* in Egyptian Mediterranean waters at Alexandria, Egypt. A total of 306 specimens of *M. mustellus* were monthly collected from the commercial catch at Alexandria coast of Mediterranean Sea, during June 2020 - May 2021. Results revealed that the annual average of feeding activity of the whole population of *M. mustelus* constitutes 65.40% of the total examined stomachs. According to season, the highest recorded feeding activity was noted during summer (73.86%) and spring (71.01%), and the lowest value (55.56%) occurred during winter. According to life stages, the annual average value of heavy, good, and medium stomachs constitutes 64.77%, 71.57% and 60.92% of the total examined stomachs in juveniles, sub-adult and adult fish, respectively. Results showed that *M. mustelus* is essentially a predator shark, consumed a wide range of aquatic food. The major recorded animal foods are crustaceans and fish. The other minor items included Mollusca and Nemertia. In the whole population of *M. mustelus*, crustaceans were the most preferred food items (52.58%) followed by fishes (33.53%); they displayed seasonal fluctuation in fish's diet. The diet of the fish showed considerable variations in different-sized groups and during consecutive seasons within the same-sized group. This study concluded that *Mustelus mustelus* in the Egyptian Mediterranean waters at Alexandria is considered a moderately feeder active fish, with considerable differentiation in their diet during different life stages, and seasons.

INTRODUCTION

The catch of elasmobranchs was recorded every year by the general authority for fish resources development on the Mediterranean coast, it has been reduced from 3450 Tones during 2006 to 1292 Tones during 2018 **(GAFRD, 2018**) with no reference to sharks or other elasmobranchs and the identification to the lowest species taxa. In the Egyptian Mediterranean sea of Alexandria, order Carcharhiniformes comprised 13 species belonging to 4 families: Scyliorhinidae, Triakidae, Carcharhinidae, and Sphyrnidae. Family: Triakidae was represents by 3 species; *Galeorhinus galeus*, *Mustelus asterias*, and *Mustelus mustelus* **(El-Tabakh, 2019).**

Sharks, as apex predators, play a key role in forming marine ecosystems and managing prey population dynamics. Sharks, as dietary opportunists, eat on a diverse variety of accessible food, which is governed by their body size and the composition of the surrounding macrofauna. The food of coastal, medium-sized meso-predatory sharks of the genus *Mustelus* consists of crustaceans, mollusks, and small fish **(Lipej *et al.*, 2004).** *M. mustelus*' stomach contents suggested that it was an opportunistic predator, eating on a wide

range of prey items, including benthic invertebrates and fishes, as well as a wide range of prey sizes and morphologies. It feeds on crustaceans, gastropods, bivalves, cephalopods, echiurids, sipunculids, annelid worms, tunicates, various species of fishes, and other invertebrates using a small cusped tooth in multi-serial rows that is adapted for crushing hard-shelled prey; preying on crustaceans, gastropods, bivalves, cephalopods, **(Compagno, 1984; Cortés, 1999; Motta, 2004** and **Gerry *et al*., 2008).**

Understanding the eating patterns and nutritional requirements of the species requires knowledge of the natural diet of animals. Diet composition, which can identify the type of food preferred by each species of fish, is considered as an indicator of the availability of food in the region. The analysis of stomach contents to understand the diets and feeding habits of fish and other marine animals has become common practice **(Hyslop, 1980).** However, many authors have studied the taxonomy of sharks and other elasmobranchs in Egyptian Mediterranean water **(Moftah *et al*., 2011; Farrag *et al*., 2016; Akel & Karachle, 2017** and **Azab *et al*., 2019a & b).** But the biology of sharks is scarcity **(Hosny, 1981).**

Therefore, the present study aimed to provide information on the food composition and feeding habits of the common smoothhound shark (*M. mustelus*) in the Egyptian Mediterranean waters, at Alexandria.

MATERIALS AND METHODS

1. Collection sites:

Alexandria is roughly 223 kilometres north of Cairo and is located at 31°12'56.3"N & 29°57'18.97"E. Four fish land markets (El-Max, Anfushi, Abu-Qir, and Al-Maadia) were the primary locations for shark specimen gathering along Alexandria's waterfront **(Fig. 1).**

2. Samples collection:

A total of 306 specimens of the common smoothhound shark, *Mustelus mustelus* **(Fig. 2)** were monthly collected from the commercial catch at the fish land markets in Alexandria **(Fig. 1)** of the Mediterranean Sea, during the period from June 2020 to May 2021. Samples were kept in 10% formalin solution before transporting to the Marine Biology Laboratory, Zoology Department, Faculty of Science, Al-Azhar University, Nasr City, Cairo, Egypt, for further study. Sharks were identified in the laboratory using **FAO (2005)**, fork and total lengths were measured to the nearest millimetres. Sharks were also wet-weighted in grams and the following studies were carried out.

Fig. (1): Map showing the land fish markets in Alexandria coast of Egyptian Mediterranean Sea.

Fig. (2): Picture of female common smoothhound shark, *Mustelus mustelus*, collected from the commercial catch at the land fish market in Alexandria of Mediterranean Sea, during the period from June 2020 to May 2021.

3. Food and feeding habits:

To explore the feeding behavior, stomachs were dissected from individuals of the common smoothhound shark, *Mustelus mustelus*, ranging in total length from 38.6 to 117.5 cm. For the latter inspection, all of the investigated specimens were preserved in a 10% formalin solution.

3.1. Feeding activity:

To explore feeding intensity, all of the stomachs examined were initially evaluated. The assessment was based on a visual measurement of the stomach distension and the amount of food contained inside it. The investigated stomachs were divided into five groups using the procedure described by **Geevarghese (1976):**

1- **Heavy:** The stomach was gorged with food and the wall was fully distended.
2- **Good:** The stomach was almost full, and the distension of the wall was quite evident.
3- **Medium:** The stomach was nearly half full and the wall was slightly distended.
4- **Poor:** The stomach contained little food, but distension of the wall was not evident.

5- **Empty:** The stomach contained particularly nothing, and the wall was evident.

The investigated specimens tested for the intensity of feeding activity, nature of the diet, and the possible seasonal variations. To facilitate the comparison of their feeding habits, specimens were divided into three length groups, the first juvenile (< 60 cm), the second sub-adult (60.1 – 83 cm), and the third adult (83.1 < cm)**.** The percentage incidence of the five stomach groups in each length group was computed. To measure feeding activity, percentage incidence of heavy, good and medium stomachs that were actually representative of excellent condition were assessed the actively fed and the remainder stomachs were poorly fed.

3.2. Food composition:

The point assessment approach was used to study food composition. Each stomach was dissected, removed, cleansed with water, opened, and its contents were flushed into a Petri dish and inspected. Taxonomically, food items were recognized up to genera and divided into four major groups: Crustacea, fishes, Mollusca, and Nemertea. For the three-length groups, the percentage recurrence of each category was approximated and visually displayed.

RESULTS

1. Feeding activity:

1.1. Seasonal variations in feeding intensity of *Mustelus mustelus*:

Results showed that the annual average value of heavy, good, and medium stomachs constitutes 65.40% of the total examined stomachs. The highest values of feeding activity were recorded during summer (73.86%) and spring (71.01%), and the lowest value (55.56%) occurred during winter **(Table 1** and **Fig. 3)**.

Table (1): Seasonal variations in the feeding intensity of the whole population (38.6 – 117.5 cm) *Mustellus mustellus*, collected from Alexandria coast, Egypt, during the year, 2020 - 2021.

Feeding intensity	Seasons				Annual average
	Summer	Autumn	Winter	Spring	
Empty stomachs	10.23%	15.29%	17.46%	14.49%	14.37%
Poor stomachs	15.91%	23.53%	26.98%	14.49%	20.23%
Non actively fed	**26.14%**	**38.82%**	**44.44%**	**28.99%**	**34.60%**
Medium stomachs	114.81%	27.06%	26.98%	30.43%	49.82%
Good stomachs	30.68%	21.18%	15.87%	26.09%	23.45%
Heavy stomachs	7.95%	12.94%	12.70%	14.49%	12.02%
Actively fed	**73.86%**	**61.18%**	**55.56%**	**71.01%**	**65.40%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**

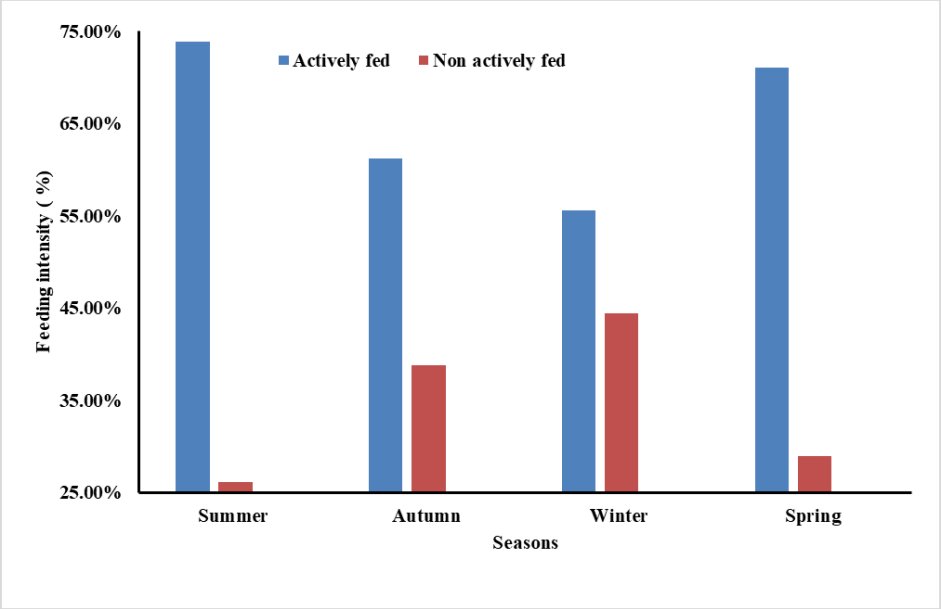

Fig. (3): Seasonal variations in feeding intensity of the whole population (38.6 – 117.5 cm) of *M. mustellus*, collected from Alexandria coast, Egypt, during the year, 2020 - 2021.

1.2. Feeding intensity variations according to size:

The annual average values of juvenile *M. mustelus* which have heavy, good and medium stomachs constitutes 64.77% of the total stomachs examined. The highest value of feeding activity was recorded during summer (74.24%) and spring (70.50%) and the lowest (58.19 and 56.14%) occurred during autumn and winter, respectively (**Table 2** and **Fig. 4).**

The annual average values of sub-adult *M. mustelus* which have heavy, good and medium stomachs constitutes 71.57% of the total stomachs examined. The lowest value (68.97%) of feeding activity was recorded during autumn. It increases gradually during winter (70%) and spring (72.32%) and reached the highest value (75%) occurred during summer **(Table 2** and **Fig. 4).**

The annual average values of adult *M. mustelus* which have heavy, good, and medium stomachs constitutes 60.92% of the total stomachs examined. The highest value of feeding activity (83%) was recorded during summer and the lowest (40%) occurred during winter (**Table 2** and **Fig. 4).**

The results of ANOVA showed no significant differences (P>0.05) between different stages, while the stomach status for juvenile stage was significantly varied (P<0.05).

Table (2): Seasonal variations in the feeding intensity of different stages of *M. mustelus*, collected from Alexandria coast, Egypt, during the year, 2020 - 2021.

Life stages	Feeding intensity	Seasons				Annual average
		Summer	Autumn	Winter	Spring	
Juvenile	**Actively fed**	74.24%	58.19%	56.14%	70.50%	**64.77%**
	Non actively fed	25.76%	41.81%	43.86%	29.50%	**35.23%**
Sub-adult	**Actively fed**	75%	68.97%	%٧٠	72.32%	**71.57%**
	Non actively fed	25%	31.03%	30%	27.68%	**28.43%**
Adult	**Actively fed**	83%	50%	40%	70.67%	**60.92%**
	Non actively fed	17%	50%	60%	29.33%	**39.08%**

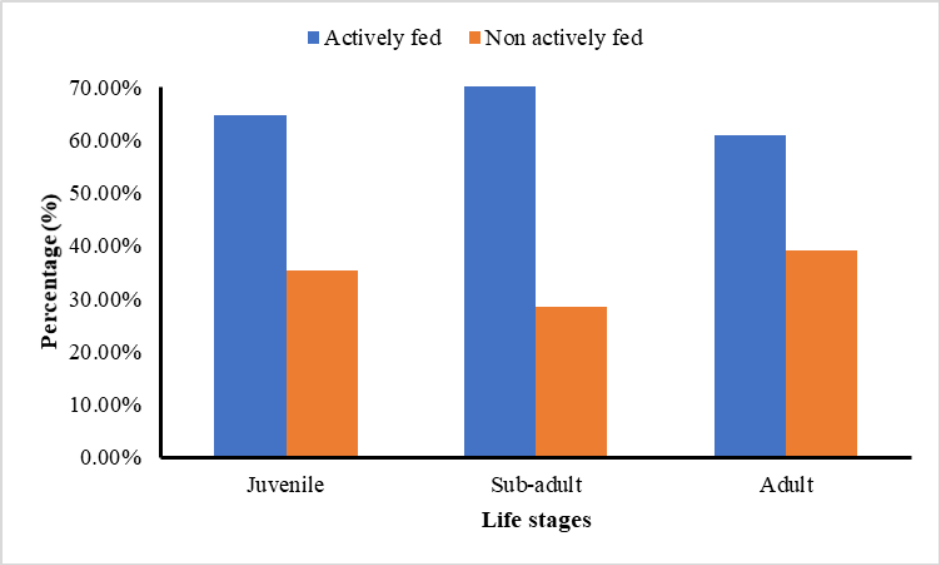

Fig. (4): Annual variations in the feeding intensity of different stages of *M. mustelus*, collected from Alexandria coast, Egypt, during the year, 2020 - 2021.

2. Food composition:

2.1. Seasonal variations in the food items:

The major animal foods recorded from the stomachs of the fish are crustaceans and fishes. The other minor items included Mollusca and Nemertia **(Fig. 5).**

In the whole population of *M. mustelus*, crustaceans were the most dominant and preferred food items group (52.58%) consumed by the fish. The highest value (78.73%) of crustacean food was recorded during winter and the lowest (29.70%) occurred during summer. *Squalla mantis*, *Maja squinado* and *Penaeus semisulcatus* were the main crustacean food items appeared in the stomach contents of this fish; representing 38%, 6.71% and 1.20% of the total food items, respectively. The minimum value of *S. mantis* (29.7%) was recorded during summer, followed by autumn (30%). It increased gradually during winter (42.3%) and reached to its maximum value (50%) during spring. The highest value of *M. squinado* (24.43%) was recorded during winter and the lowest (2.40%) occurred during spring. It was absent during summer and autumn. *P. semisulcatus* was recorded only during spring, being 4.80% of the total food items. The un-identified crustaceans represented 6.67% of the total food items; their maximum value (12%) was recorded during winter and their minimum (4.4%) occurred during spring. It was absent during summer **(Table 3** and **Figs. 6 & 7).**

Fish was the second important food items group (33.53%) consumed by *M. mustelus*. The highest value of fish items (53.10%) was recorded during summer. It decreased gradually during autumn (41.30%) and reached its lowest value (6.33%) during winter. *Sphyraena sphyraena*, *Sardinella aurita*, *Sparus aurata*, *Hippocampus* sp. were the main fish food consumed by this fish; representing 18.24%, 8.06%, 4.07% and 2.09% of the total food items, respectively. The maximum value of *Sphyraena sphyraena* (39.14%) was recorded during summer. It decreased gradually during autumn (18.98%) and reached its minimum value (5.43%) during winter. The highest value of *Sardinella aurita* (24%) was recorded during spring, it decreased to 7.36% during summer and it was absent during autumn. The maximum value of *Sparus aurata* (12.31%) was recorded during autumn. *Hippocampus* sp. was recorded only during autumn, being 8.39% of the total food items. The highest value of un-

identified fishes (4%) was recorded during spring and the lowest (1.62%) occurred during autumn **(Table 3** and **Figs. 6 & 7).**

Mollusca come in the third group of food items (10.20%) consumed by the fish and they displayed a seasonal fluctuation in the diet of fish. The maximum percentage of mollusk food (15.64%) was recorded during autumn and the minimum (2.73%) occurred during spring. *Sepia officinalis*, *Octopus vulgaris* and un-identified gastropods were the main mollusks food consumed by the fish, representing 6.88%, 2.75% and 0.57% of the total food items, respectively. The highest value of *Sepia officinalis* (10.56%) was recorded during summer. It decreased gradually during autumn (9.26%) and reached its lowest value (2.73%) during spring. The highest value of *Octopus vulgaris* (5.69%) was recorded during autumn and the lowest (1.69%) occurred in summer. It was absent during spring. Un-identified gastropods represented in stomachs of the fish by negligible amounts during summer, autumn and winter. It was absent during spring.

Nemertia was sporadically consumed by *M. mustellus*, being 3.69% of the total food items. The highest value of Nemertia (5.43%) was recorded during winter. It reached its lowest value (2.27%) during spring **(Table 3** and **Figs. 6 & 7).**

Table (3): Point assessment (%) of various categories of food items of the whole population *Mustellus mustellus,* collected from Alexandria coast, Egypt, during the year, 2020 - 2021.

Food items	Seasons				Annual average
	Summer	Autumn	Winter	Spring	
1. Crustaceans	**29.7**	**40.28**	**78.73**	**61.6**	**52.58**
Squalla mantis	29.7	30	42.30	50	38
Maja squinado	0	0	24.43	2.4	6.71
Penaeus semisulcatus	0	0	0	4.8	1.2
Un-id. Crustacea	0	10.28	12	4.4	6.67
2. Fishes	**53.1**	**41.3**	**6.33**	**33.4**	**33.53**
Sphyraena sphyraena	39.14	18.98	5.43	9.4	18.24
Sardinella aurita	7.36	0	0.9	24	8.06
Sparus aurata	3.96	12.31	0	0	4.07
Hippocampus sp.	0	8.39	0	0	2.09
Un-identified fishes	2.64	1.62	0	4	2.07
3. Mollusca	**12.91**	**15.64**	**9.51**	**2.73**	**10.2**
Sepia officinalis	10.56	9.26	4.99	2.73	6.88
Octopus vulgaris	1.69	5.69	3.62	0	2.75
Un-identified gastropods	0.66	0.69	0.9	0	0.57
4. Nemertea	**4.29**	**2.78**	**5.43**	**2.27**	**3.69**

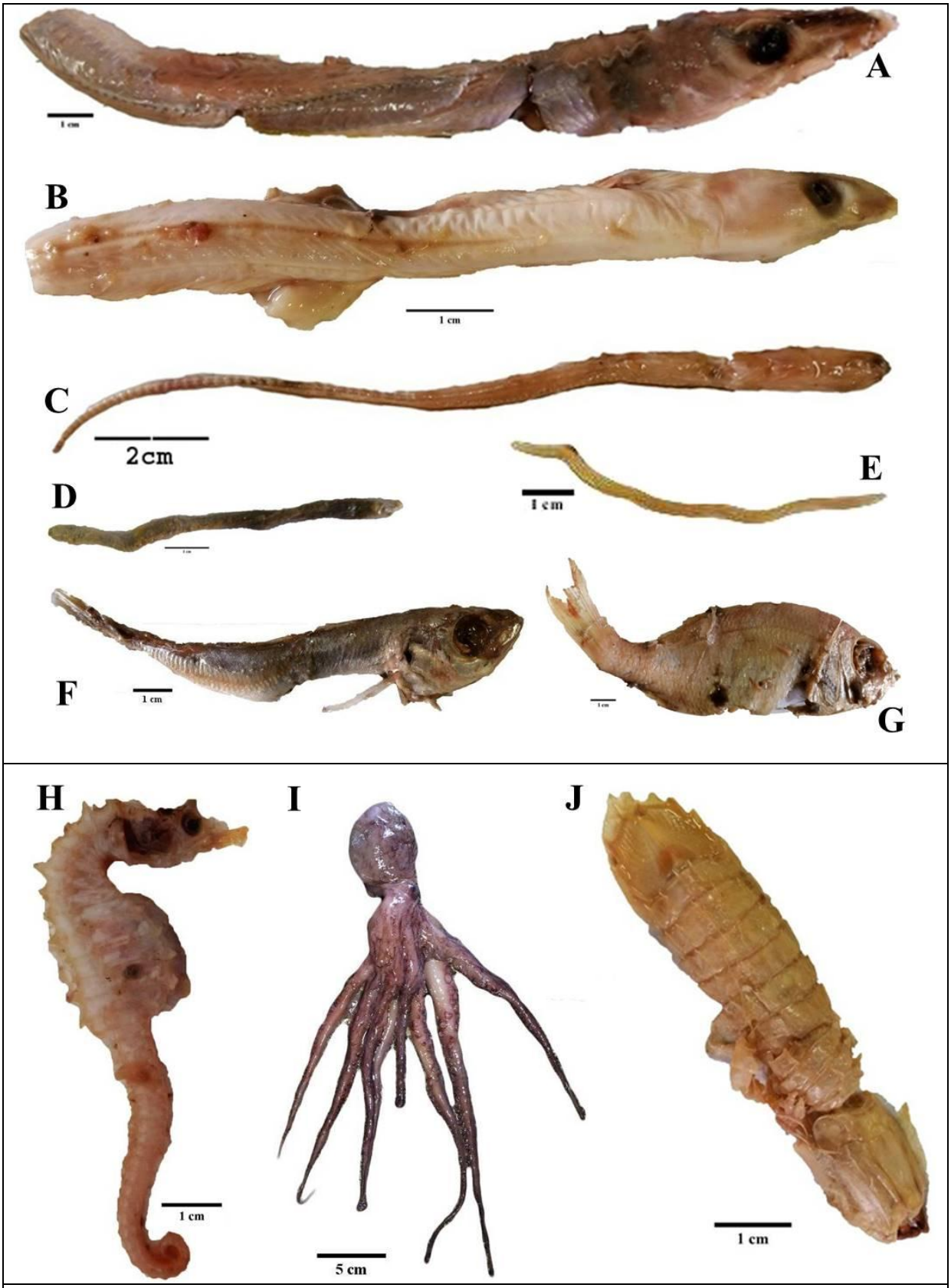

Fig. (5): Light photograph of examples from food items in the stomachs of different stages of *M. mustellus*, collected from Alexandria coast, Egypt, during the year, 2020 - 2021.
A & B: *Sphyreana* sp.**; C:** Muraenidae**; D & E:** Nemertea**; F:** *Sardinella* sp.**; G:** *Sparus aurata***;** **H:** *Hippocampus* sp.; **I:** *Octopus vulgaris*; **J:** *Squalla mantis*.

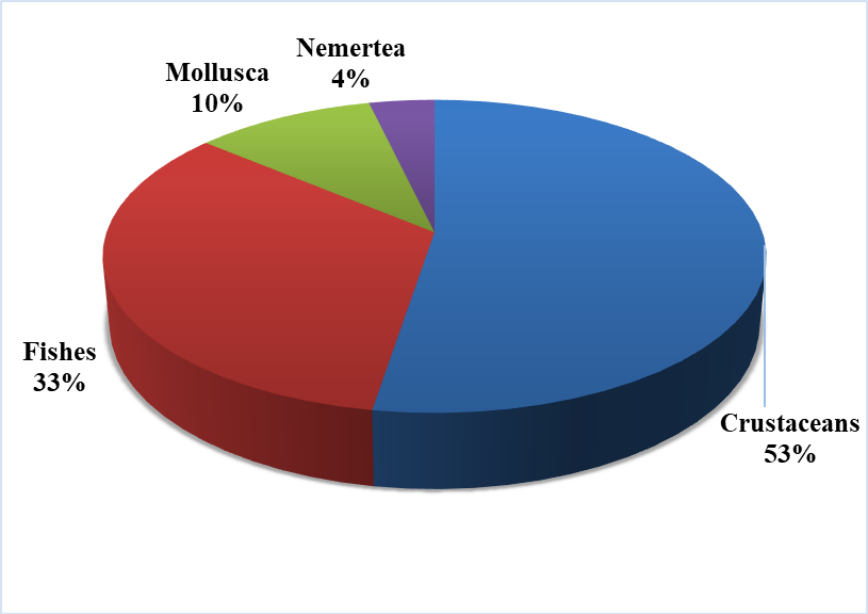

Fig. (6): Point assessment (%) of various categories of food items of the whole population *Mustellus mustellus* (38.6 – 117.5 cm), collected from Alexandria coast, Egypt, during the year, 2020 - 2021.

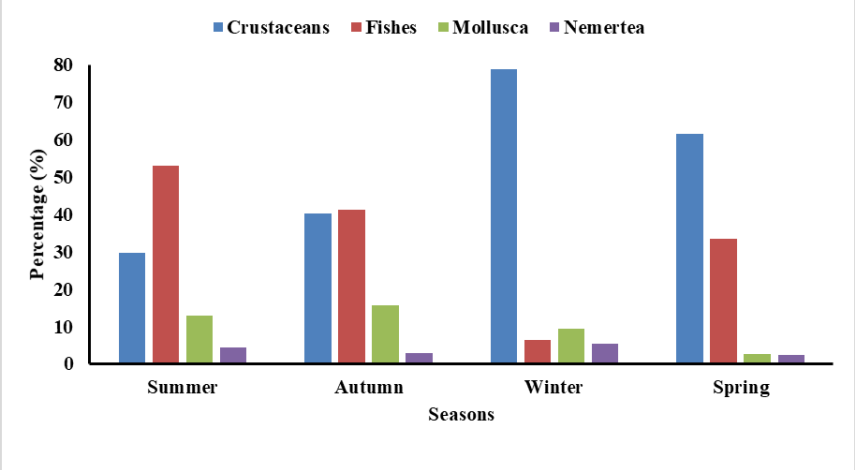

Fig. (7): Seasonal variations (%) of various categories of food items of the whole population *Mustellus mustellus* (38.6 – 117.5 cm), collected from Alexandria coast, Egypt, during the year, 2020 - 2021.

2.2. Variation of food composition according to size (life stages):

The diet of the fish showed considerable variations in different sized groups and of different seasons within the same sized group. Crustaceans decreases in the stomach content with the increasing length of the fish. Fishes increases in the stomach content with the increasing length of the fish. Mollusca and Nemertia were sporadically consumed **(Table 4** and **Fig. 8).**

In the juvenile of *M. mustelus*, crustaceans were by far the most dominant and preferred food item (71.63%) consumed by the juvenile fish. The highest value of crustacean food (82.76%) was recorded during winter, followed by spring (81.46%) and the lowest (52.47%) occurred during autumn. Fishes were the second importance of food items

(12.53%) consumed by *M. mustelus*. The highest value of fish (26.48%) was recorded during summer. It decreased gradually during autumn (17.49%) and reached its lowest value (6.17%) during spring. It was absent during winter. Mollusca come in the third importance of food items (8.50%) consumed by the fish and displayed seasonal fluctuation in the diet of the fish. The maximum percentage of mollusk food (11.64%) was recorded during autumn and the minimum (2.73%) occurred during spring. Nemertia are sporadically consumed, being 7.34%. It is represented in the stomachs of the fish by the small amounts of food in summer, autumn, winter and spring; represented 7.95%, 6.56%, 7.91% and 6.94% of the total food items in juvenile fishes (**Table 4** and **Fig. 8).**

In the sub-adult of *M. mustelus*, crustaceans and fishes were the most dominant and preferred food items consumed by the fish; being 40.90% and 41.03%, respectively. The highest value of crustacean food (21.30%) was recorded during summer. It increases gradually and reached its highest value (64.86%) during spring. The highest value of fish (53.10%) was recorded during summer. It decreased and reached its lowest value (33.40%) during spring. Mollusca (14.25%) come in the third rank of food items consumed by the fish and displayed seasonal fluctuation in the diet of the fish. The maximum percentage of Mollusca (21.62%) was recorded during spring and the minimum (16.81%) occurred during autumn. Nemertia appeared in the stomachs of the sub-adult fish during autumn season only and it is represented by 15.28% of the totalfood **(Table 4** and **Fig. 8).**

In the adult of *M. mustelus*, fishes were the most dominant and preferred food item (78.92%) consumed by this shark. The lowest value of fish was recorded during summer (73.10%). It increased gradually and reached its highest value (85.66%) during spring. Mollusca come in the second importance of food items (15.99%) consumed by the fish and displayed seasonal fluctuation in the diet of the fish. The maximum percentage of mollusk food (41.82%) was recorded during summer and the minimum (22.14%) occurred during winter. It was absent during autumn and spring. Crustacea is represented in the stomachs of the fish by the small amount of food during winter (8.24%) and spring (12.12%). It was absent during summer and autumn **(Table 4** and **Fig. 8).**

Table (4): Point assessment (%) of various categories of food items in the stomachs of *M. mustelus* (different life stages), collected from Alexandria coast, Egypt, during the year, 2020 - 2021.

Life stages	Food items	Seasons				Annual Average
		Summer	Autumn	Winter	Spring	
Juvenile	1. Crustacea	69.82	52.47	82.76	81.46	71.63
	2. Fishes	26.48	17.49	0	6.17	12.53
	3. Mollusca	10.14	11.64	9.51	2.73	8.5
	4. Nemertea	7.95	6.56	7.91	6.94	7.34
Sub-adult	1. Crustacea	21.3	30.9	46.55	64.86	40.9
	2. Fishes	53.1	41.3	36.33	33.4	41.03
	3. Mollusca	18.57	16.81	0	21.62	14.25
	4. Nemertea	0	15.28	0	0	3.82
Adult	1. Crustacea	0	0	8.24	12.12	5.09
	2. Fishes	73.1	76.6	80.33	85.66	78.92
	3. Mollusca	41.82	0	22.14	0	15.99
	4. Nemertea	0	0	0	0	0

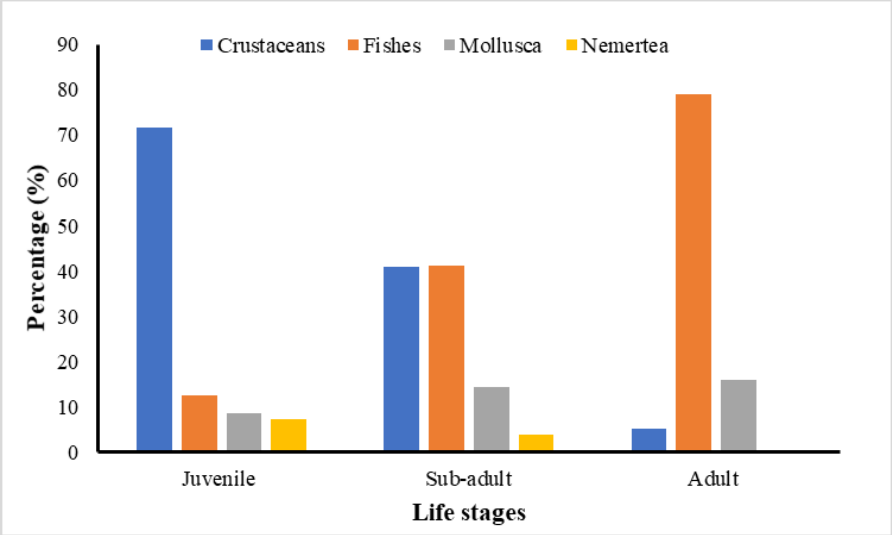

Fig. (8): Point assessment (%) of various categories in annual average of food items in the stomachs of different stages of *M. mustellus*, collected from Alexandria coast, Egypt, during the year, 2020 - 2021.

DISCUSSION

Understanding the eating patterns and nutritional requirements of the species requires knowledge of the natural diet of animals. Diet composition, which can identify the type of food preferred by each species of fish, is considered as an indicator of the availability of food in the region. The analysis of stomach contents to understand the diets and feeding habits of fish and other marine animals has become common practice **(Hyslop, 1980).**

In the running study, the annual average value of heavy, good, and medium stomachs constitutes 65.40% of the total stomachs examined. This result is lower than that recorded by **Jardas *et al.* (2007)** which said that the full stomach of *M. mustelus* in the Eastern Adriatic Sea is 82.8%. **Ozcan & Basusta (2016)** examined the stomach contents of *M. mustelus* in the northeastern Mediterranean and concluded that 97.5% were found to be full of the stomach.

The highest values of feeding activity of *M. mustelus* recorded during the present study were (73.86%) in summer and (71.01%) in spring, while the lowest value (55.56%) occurred during winter (reproductive season). This means that shark reproduction was strongly correlated with low feeding activity. This result was matching with the result obtained by **Cortés (1997).** He mentioned that the highest value of fullness index (19.30%) was recorded during the autumn, pre-spawning season and the lowest value (7.4 %) occurred during winter**.**

In the present study, the annual average value of heavy, good, and medium stomachs constitutes 64.77%, 71.57% and 60.92% of the total examined stomachs in juveniles, sub-adult and adult *M. mustelus*. This means that this shark is moderately feeding active during the different life stages.

Sharks, as apex predators, play a key role in forming marine ecosystems and managing prey population dynamics **(Lipej *et al.*, 2004)**. In the present study, *M. mustelus* is essentially a predator and consumes a wide range of animal food. The major animal foods recorded from the stomachs of the fish were crustaceans and fish. The other minor items included Mollusca and Nemertia. Similar results were detected in many studies **(Capape, 1975; Compagno, 1984; Cortés, 1999; Constantini *et al.*, 2000; Kabasakal, 2002; Motta,**

2004; Jardas *et al*., 2007; Gerry *et al*., 2008; Saidi *et al*., 2009; Gracan *et al*., 2014; Ozcan & Basusta, 2016 and **Kara *et al*., 2019).** They claimed that *M. mustelus* is an opportunistic predator that feeds on benthic crustaceans, mollusks, and pelagic and benthopelagic teleost fish. According to **Filiz (2009)**, *M. mustelus* in the Aegean Sea, Turkey, has molariform teeth, indicating the dominance of crustaceans in the smooth hound's diet. He concluded that *M. mustellus* is classified as a carnivore since it consumes big decapods, cephalopods, and fish (i.e., has a trophic level between 3.7 and 4.5).

In the whole population of *M. mustelus*, crustaceans (52.58%) were the most prevalent and favored food source ingested by the fish. These results were nearly like that obtained by some authors **(Compagno, 1984; Cortés, 1999; Motta, 2004; Gerry *et al*., 2008; Saidi *et al*., 2009** and **Ozcan &/ Basusta, 2016).** They mentioned that the decapods are the major components in the diet of *M. mustelus***.**

In the current study, the maximum value of crustacean food was recorded during winter (78.73 %) and the lowest value was reported during summer (29.70 %). This result is the opposite of that recorded by **Jardas *et al*. (1996)** and **Smale *et al*. (2001)**. They stated that decapod crustaceans dominated the food composition throughout year, especially in the summer. They explained that the increase in decapod intake throughout the summer corresponds with the season of many decapod species' recruits, which may be present in large quantities.

The range of prey items seen in the smooth-hound's diet suggests that it may be a generalist. Although crustaceans and fish are the major food groups for smooth-hounds, some bottom-dwelling species, such as *M. mustelus*, have teeth specialized for crushing hard-shelled invertebrate prey such as crabs and mollusks **(Stevens, 1987).**

Fishes were the second most important food item ingested by *M. mustelus* in the current study; it recorded the highest value (53.10 %) during the summer. It fell progressively during the autumn (41.30 %) and reached its lowest point during the winter (6.33 %). The increase in fish intake during summer correlate with the season of many fish species' recruits, which may be present in large quantities.

In the current study, Mollusca ranked the third group of food items ingested by fish and it showed seasonal variation in the fish's diet. The highest percentage (15.64 **%**) of mollusk food was found in autumn, while the lowest (2.73 **%**) was found in spring. The little cusped teeth (in multi-serial rows) in *M. mustelus* are designed for crushing hard-shelled prey, such as crustaceans, gastropods, bivalves, cephalopods, echiurids, sipunculids, annelid worms, tunicates, numerous types of teleosts, and other invertebrates **(Compagno, 1984; Cortés, 1999; Motta, 2004** and **Gerry *et al*., 2008).**

In the present study, the diet of the fish varied significantly in different-sized groups and throughout seasons within the same-sized group. The stomach content of crustaceans diminishes as the length of the fish increases. The stomach content of fish and mollusks increases with the increase of fish length. Similar outcomes were recorded by many authors **(Capape, 1975; Jardas *et al*., 2007; Saidi *et al*., 2009** and **Ozcan & Basusta, 2016)**. They mentioned that with *M. mustelus* growth, the proportion of decapods decreased whereas that of teleosts and cephalopods increased. According to **Pallaoro *et al*. (2005)**, *M. mustelus* is an opportunistic predator that feeds mostly on benthic crustaceans. In all seasons and in specimens up to 110 cm TL, decapods, cephalopods, and teleosts constitute the most significant prey. Furthermore, teleosts were the primary food source in bigger specimens.

Crustaceans were by far the most dominant and fishes were less dominant in the stomach contents of juvenile sharks, crustaceans and fishes were dominant in the stomach

contents of sub-adult sharks, and fishes were dominant, and crustaceans were less dominant in the stomach contents of adult *M. mustelus*. This suggests that this shark species was able to alter foods based on the requirement for energy and the availability of food in nature**. Lowe *et al*. (1996)** determined that *M. mustelus* swims close to the substrate, foraging for prey and changing diet as it becomes larger. *M. mustelus'* diet composition shifts dramatically as it grows, with smaller individuals consuming more bottom-living crustaceans and polychaetes and larger specimens switching to cephalopods and other fish.

M. mustellus is found on sandy bottoms, generally swimming no more than 50 meters from the bottom in quest of prey and moving via lateral undulation. Crustaceans become the primary prey component at depths of 50-100 m, whereas octopods dominate at depths greater than 100 m, but crustaceans are also significant. Scavenging might also explain the teleost component of the diet. In addition to the dietary shift with weight, another nutritional shift occurs with depth owing to species availability. There was a strong correlation between prey and fish size. Teleosts were discovered in stomachs at all levels, with deeper-water teleosts dominating at increasing depths **(Smale & Compagno, 1997; Heemstra & Heemstra, 2004** and **Da Silva, 2007).** This was also seen in the current investigation.

There is evidence that size disparities reflect shifting dietary choices with growth, as well as large individuals' capacity to acquire larger prey. To maximize energy per unit effort, mean prey size increases as predator size increases **(Ware, 1972; Ross, 1977** and **Stoner & Livingston, 1984).** Changes in dietary preferences associated with fish size may reduce intraspecific competition **(Langton, 1982)**.

According to **Bosh *et al*. (2013)**, *M. mustelus*' food has shifted from crustaceans and polychaetes to cephalopods as it has become older. This change in the sharks' food (an external factor) may be predicted to reflect differences in flesh composition, which should be seen when comparing the composition of small, medium, and large sharks. *M. mustelus* segregation by life-history stage may be a significant characteristic for minimizing intraspecific competition and allocating available food resources **(Saidi *et al*., 2009)**.

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الملخص العربي

ملاحظات حول العادات الغذائية والتغذية للقرش الأملس الشائع (*Mustelus mustelus*) في البحر الأبيض المتوسط في ساحل الإسكندرية، مصر

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تهدف هذه الدراسة إلى تقديم معلومات عن العادات الغذائية والتغذية لسمك القرش الأملس الشائع (*Mustelus mustelus*) من ساحل البحر المتوسط بالإسكندرية، مصر. تم التجميع بصورة شهرية لاجمالي ٣٠٦ عينة من أسماك القرش الأملس الشائع من ساحل الإسكندرية على البحر المتوسط ، خلال الفترة من يونيو ٢٠٢٠ إلى مايو ٢٠٢١.

أظهرت النتائج أن متوسط القيمة السنوية للنشاط الغذائى لسمك القرش الأملس الشائع (*Mustelus mustelus*) تشكل ٦٥.٤٠٪. وبحسب الموسم، سجلت أعلى قيم للنشاط الغذائى خلال الصيف (٧٣.٨٦٪) والربيع (٧١.٠١٪)، وأقل قيمة (٥٥.٥٦٪) خلال الشتاء. حسب مراحل العمر فإن المعدل السنوي للنشاط الغذائى يشكل ٦٤.٧٧٪ في صغار القروش و٧١.٥٧٪ في القروش شبه البالغة و٦٠.٩٢٪ في القروش البالغة.

يعتبر القرش الأملس الشائع من الأسماك المفترسة ويستهلك مجموعة واسعة من الأطعمة الحيوانية. أهم الأطعمة الحيوانية المسجلة فى معدة أسماك القرش هي القشريات والأسماك. وتشمل العناصر الثانوية الأخرى للغذاء الرخويات والديدان. أظهرت الاختلافات الموسمية في النظام الغذائي للأسماك أن القشريات هي العنصر الغذائي الأكثر وفرة والأكثر تفضيلًا (٥٢.٥٨٪) الذي تستهلكه الأسماك، سجلت أعلى قيمة لغذاء القشريات خلال الشتاء (**٧٨.٧٣**٪) وأدنى قيمه (٢٩.٧٠٪) خلال الصيف. احتلت الأسماك المرتبة الثانية (٣٣.٥٣٪) من حيث الأهمية للمواد الغذائية التي يستهلكها القرش. سجلت أعلى قيمة للأسماك (٥٣.١٠٪) خلال الصيف. وانخفض تدريجياً ووصل لأدنى مستوى (٦.٣٣٪) خلال الشتاء. تأتي الرخويات في المرتبة الثالثة (١٠.٢٠٪) من حيث الأهمية للمواد الغذائية التي تستهلكها أسماك القرش. ظهرت الديدان فى معدة الأسماك بنسب ضئيله (٣.٦٩٪). أظهر النظام الغذائي للأسماك اختلافات كبيرة في مجموعات الأحجام المختلفة وأيضًا في الفصول المختلفة داخل نفس المجموعة. سادت القشريات وقلت الأسماك في محتوى معدة أسماك القرش الصغيرة، سادت القشريات والأسماك في محتوى معدة أسماك القرش شبه البالغة، وكانت الأسماك هي السائدة والقشريات أقل شيوعًا في محتوى معدة أسماك القروش البالغة.

ونستخلص من هذه الدراسه أن القرش الأملس الشائع (*Mustelus mustelus*) يتغذى بشكل معتدل النشاط في مراحل الحياة المختلفة. يزداد نشاط التغذية لهذا القرش مع زيادة درجة الحرارة. يعتبر القرش الأملس الشائع من الأسماك المفترسة ويستهلك مجموعة واسعة من الأطعمة الحيوانية. أهم الأطعمة الحيوانية المسجلة فى معدة أسماك القرش هي القشريات والأسماك. تشمل العناصر الثانوية الأخرى الرخويات والديدان. تتناقص القشريات وتزداد الأسماك والرخويات في محتوى المعدة مع زيادة النمو.