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Stomach Content Analysis of Suez pufferfish (Lagocephalus suezensis) in Derna coast, Libya (Mediterranean Sea) and Hurghada coast, Egypt (Red Sea)

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ABSTRACT

This study provides a comparative analysis of the stomach contents of the Lessepsian migrant pufferfish, *Lagocephalus suezensis* (family Tetraodontidae), across two distinct populations: the native population along the Hurghada coast (Red Sea, Egypt) and the migrant population along the Derna coast (Eastern Libyan Mediterranean Sea). A total of 283 specimens were collected monthly between January and December 2022 using trawl nets at depths ranging from 15 to 50 meters. The investigation focused on annual and monthly diet compositions, ontogenetic shifts in feeding habits related to fish length, and overall feeding intensity. The results indicate that *L. suezensis* is a generalist carnivore with a preference for benthic invertebrates, though diet composition varied significantly between the two locations. Along the Derna coast (n=133), crustaceans were the predominant prey group (55.7%), followed by bony fish (22.3%), marine worms (14.4%), mollusks (4.4%), and foraminifera (3.2%). Conversely, the Hurghada population (n=150) primarily consumed mollusks (41.3%), supplemented by crustaceans (26.4%), bony fish (17.9%), echinoderms (11.3%), and incidental sediments (3.1%). While mollusks, crustaceans, and bony fish were present in the diet throughout the year and across all size classes at both stations, clear ontogenetic shifts were observed. The consumption of mollusks, marine worms, foraminifera, and echinoderms decreased as fish size increased, whereas the preference for larger prey, such as crustaceans and bony fish, showed a positive correlation with fish length. Feeding intensity also exhibited seasonal fluctuations: in Derna, peak activities were recorded during spring (82.3%) and autumn (68.9%), while the Hurghada population reached its maximal feeding rate in autumn (82.4%). These findings highlight the adaptability of *L. suezensis* to different environments and its potential impact on local benthic communities.

KEYWORDS: *Lagocephalus suezensis*, Derna coast, Mediterranean Sea, Hurghada coast, Egypt, Stomach Content Analysis.

1. INTRODUCTION

The Mediterranean Sea is currently recognized as a significant hotspot for marine bio-invasions, impacting nearly all marine taxonomic groups [29]. The continuous influx of Red Sea biota into the Mediterranean, a phenomenon observed since the opening of the Suez Canal, has consistently drawn the attention of the scientific community [15, 16, 19]. Invasive alien species are substantial contributors to anthropogenic environmental changes within the Mediterranean ecosystem [31]. Numerous species exert detrimental socioeconomic effects on the region. For instance, *Lagocephalus suezensis*, a pufferfish species, possesses no commercial value. Its substantial populations are primarily sustained by intensive feeding on native commercial fish and invertebrate stocks, such as cephalopods, which are economically significant for fisheries and locally exploited. Although Lessepsian species may lack direct commercial importance, they consume vast quantities of fish, macrophytes, and benthic invertebrates, all of which are crucial components of the marine food chain. The proliferation of pufferfish species has increased following their recent migration through the Suez Canal into the Mediterranean Sea. Currently, ten migratory and native species of the family Tetraodontidae are found in the Mediterranean. However, studies specifically addressing this issue along Libya's eastern coast remain limited [1, 17, 35]. *Lagocephalus suezensis*, a species of pufferfish belonging to the family Tetraodontidae, is indigenous to the western Indian Ocean. Its presence in the Mediterranean Sea was first recorded in 1977, and it has since expanded its distribution throughout the Eastern Mediterranean Basin. This species can reach a total length of 18 cm and typically inhabits sandy and muddy bottoms at depths up to 40 meters [39]. It significantly impacts the surrounding ecology and is presently considered one of the most detrimental invasive species in the Mediterranean Sea, also posing considerable inconvenience to fisheries [41]. In Libya, *L. suezensis* has become a major concern for artisanal fisheries due to its large population and its capacity to damage fishing gear with its powerful tetragons and attack fish caught in nets and lines. Furthermore, *L. suezensis* contains tetrodotoxin (TTX), a potent neurotoxin that can be lethal to humans, thereby presenting a significant risk to consumers [1, 27]. Previous studies have documented a total of 83 native fish species, 4 species endemic to the Mediterranean, 20 non-indigenous species of Lessepsian origin, and two expanding taxa from Gibraltar [7].

High abundances of certain pufferfish species have been observed in the Gulf of Bomba [5]. Additionally, research indicates a correlation between the descriptive morphological measurements of the skeletal structure and the swimming and locomotor patterns of the silver-cheeked toadfish [6]. This study represents the first investigation into the diet and feeding habits of *Lagocephalus suezensis* along the coasts of Hurghada in the Red Sea, Egypt, and Derna in the Mediterranean Sea, Libya.

2 .MATERIALS AND METHODS

2.1 Derna coast

Derna, a city and harbor, served as one of the primary sites for sample collection. It is geographically situated at Latitude 32° 16′ North and Longitude 22° 39′ East (Fig. 1), approximately 146 km west of Tobruk and 91 km east of Al-Baida city. The harbor, with a depth of 35 meters, provides modern facilities and robust protection along an otherwise exposed coastline. It features numerous berths and quays across various sections, accommodating commercial shipping, fishing vessels, and sport fishing boats. The target species, *Lagocephalus suezensis*, was captured using trawling nets, trammel nets, and longlines.

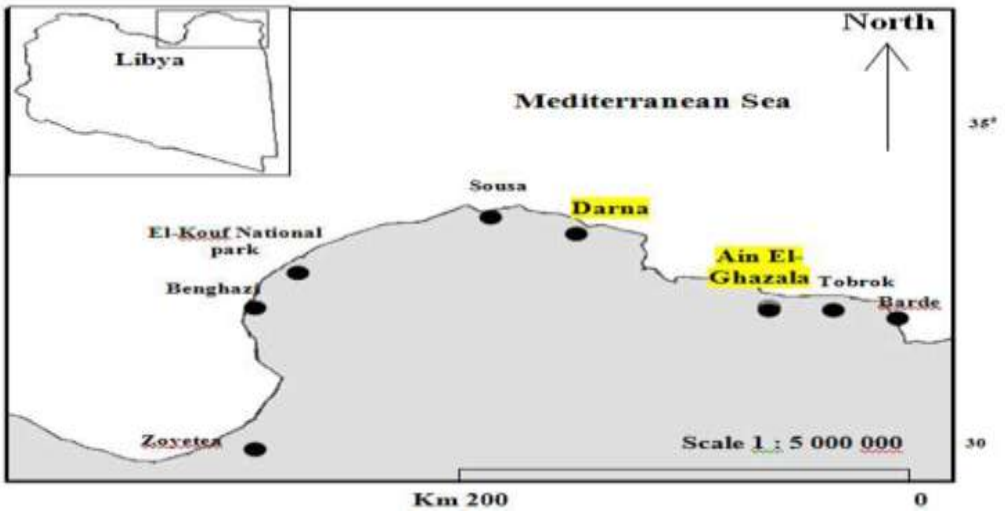

Fig. (1). **Derna coast site, Mediterranean Sea, eastern Libya**

2.2 Hurghada coast

The Hurghada coast, extending approximately 36 kilometers (22 miles) along the Red Sea, was the second sampling location. Its coordinates are

27°15′28″N 33°48′42″E (Fig. 2). Fishing operations in this area are typically conducted using artisanal longlines, gillnets, and trammel nets at depths ranging from 1 to 10 meters. It is important to distinguish between gillnets and trammel nets: a gillnet consists of a single mesh panel, whereas a trammel net comprises three mesh panels—a central panel of small mesh size flanked by two outer panels of larger mesh sizes.

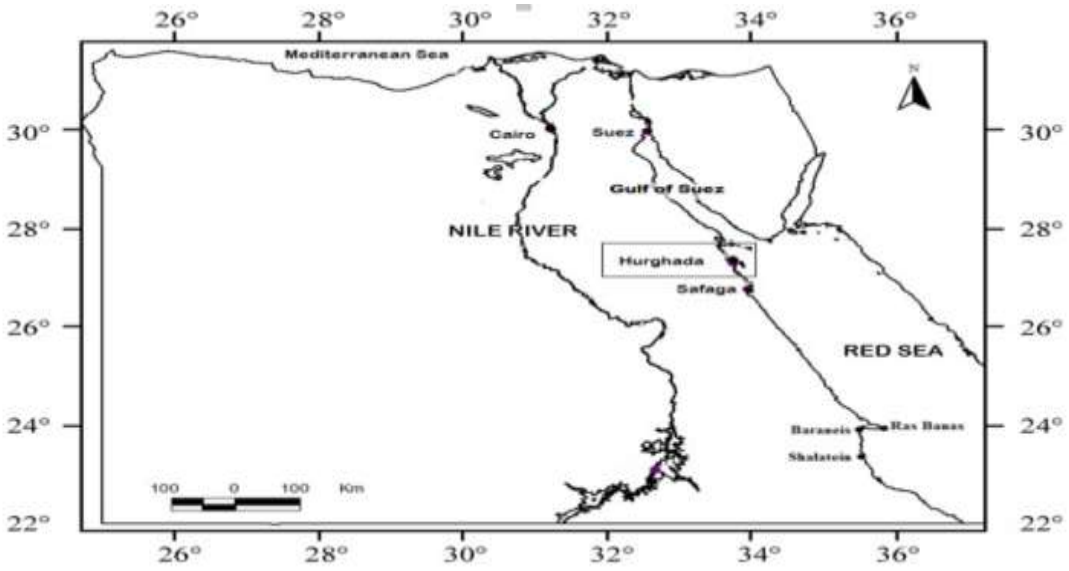

Fig. (2). Hurghada coast site northern Egyptian Red Sea

2.3 Collection of Samples

Monthly samples of pufferfish specimens were collected randomly from both the Derna and Hurghada coasts over a 12-month period in 2022. Samples obtained from Derna, Libya, were transported to the Fish Biology Laboratory at the Faculty of Sciences in Derna. Conversely, samples collected from Hurghada, Egypt, were transferred to the Fish Biology Laboratory, Department of Marine Sciences, Faculty of Science, Suez Canal University.

2.4 Methodology

For each specimen, total length (TL) was recorded to the nearest centimeter, and total weight was measured to the nearest gram. This was performed for 133 fish samples from the Derna coast and approximately 150 specimens from the Hurghada coast. Each stomach was longitudinally incised, and its contents were carefully scraped into a small Petri dish containing a minimal amount of water. The degree of stomach fullness was visually estimated and categorized into six levels: empty, trace, quarter full,

half full, three-quarters full, and completely full, as described by Hyslop [28]. Diet composition and feeding intensity were analyzed in relation to months and seasons throughout the study period. The stomach contents of fresh specimens were meticulously examined under a binocular microscope. Prey items were sorted and identified to the lowest possible taxonomic level using established keys and field guides [12, 13, 17]. To analyze the food and feeding habits of the two species, the percentage of numerical abundance (%N) was calculated using the formula: %N = (number of prey / total number of prey) × 100 [28].

3 . Results :

3.1 Annual diet composition

The variety of food items was large. However, crustaceans supplemented by bony fish, marine warms, mollusks, foraminifera, echinoderms and sediments. formed the major food groups for *Lagocephalus suezensis* in both stations (Fig. 3). In Derna coast crustaceans made up of 55.7% by volume composition of the bulk of the diet which represented by shrimps, crabs, isopods whereas bony fish (22.3%) coming in the second position of importance such as *Siganus rivulatus*, *Mullus surmulatus*, *Mullus barbatus*, *Liza ramada*, *Liza aurata* and *lithognathus mormyrus*. Marine warms (14.4%) such as polychaeta and oligochaeta followed by mollusks (4.4%) which represented by cephalopods, bivalves and gastropods and small amount of foraminifera (3.2%). In Hurghada coast mollusks made up of 41.3% by volume composition of the bulk of the diet which represented by cephalopods and bivalves whereas crustaceans (26.4%) coming in the second position of importance such as shrimp, crab, lobster and amphipods. Bony fish (17.9%) such as *Abudefduf sexfasciatus*, *Acanturus nigrofuscu*, *Amphiprion bicinctu*, *Atherinomorus lacunou*, *Bothus pantherinu*, *Caranx sexfasciatus*, *Cephopholis miniata*, *Chaetodon lineolatus*, *Siganus lurids* and *Liza caranita*. Echinoderms (11.3%) followed by small amount of sediments (3.1%) (Fig. 3).

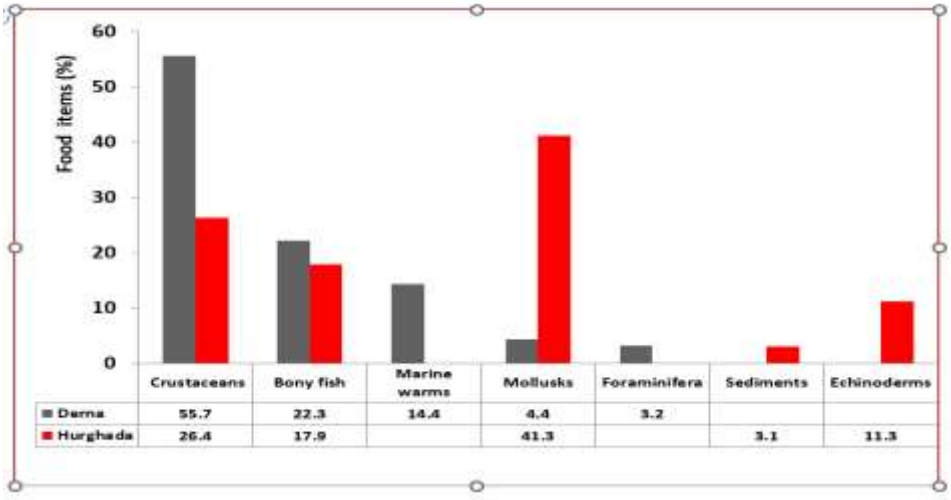

Fig. (3): The diet composition of *Lagocephalus suezensis* in Derna, and Hurghada coasts during the period from January till December 2022.

3.2 Monthly Variations in Diet Composition

During the current study, food items happened throughout the year. Throughout the year, the main food sources for *Lagocephalus suezensis* were crustaceans, bony fish and mollusks (82.4% in Derna and 85.6% in Hurghada) (Table 1&2). Throughout the study period, Table 1 displayed monthly changes in the food content of 133 *Lagocephalus suezensis* fish' stomachs on the Derna shore. In January and February marine warms was not present while foraminifera was absent in November and December. Crustaceans had the highest nutritional content (67.9%) in January. Bony fish are most abundant in May and June (32.3% and 34.4%, respectively). February is when mollusks have the highest values (9.4%).

Table (1). Monthly variations in diet composition of 133 *Lagocephalus suezensis* in Derna coast during the period from January till December 2022

		Food Items				
Months	No.	Crustaceans	Bony fish	Marine warms	Mollusks	Foraminifera
Jan. (2022)	9	67.9	20.8	A	2.2	9.1
Feb.	11	57.8	22.9	A	9.4	9.9
Mar.	10	52.7	17.4	21.1	3.1	5.8
Apr.	12	48.6	17.1	21.1	8.6	4.7
May	13	46.7	32.3	10.7	8.4	2.1
Jun.	10	50.1	34.4	13.3	1.1	1.1
Jul.	12	54.3	23.2	15.9	4.8	1.8
Aug.	10	51.6	25.3	17.5	4.4	1.2
Sep.	15	60.7	21.3	13.1	3.4	1.5
Oct.	10	59.7	16.9	19.8	2.3	1.3
Nov.	11	61.7	15.1	20.1	3.1	A
Dec.	10	55.7	21.6	20.6	2.1	A
%	133	**55.7**	**22.3**	**14.4**	**4.4**	**3.2**

Table 2 displayed monthly changes in the diet composition for 150 *Lagocephalus suezensis* stomach specimens on the coast of Hurghada over the course of the study. November and December did not have any echinoderms. Sediments was absent in January and February. Mollusks had the highest nutritional content (51.2%) in January. Crustaceans are most abundant in May and June (30.6% and 35.8%, respectively). Bony fish have the greatest values (25.6%) in December. Echinoderms (15.7%) in October. March saw the first appearance of sediments (5.8%).

Table (2). Monthly variations in diet composition of 150 *Lagocephalus suezensis* in Hurghada coast during the period from January till December 2022

		Food items				
Months	No.	Mollusks	Crustaceans	Bony fish	Echinoderms	Sediments
Jan. (2022)	14	51.2	24.5	9.6	14.8	A
Feb.	12	46.3	17.7	22.1	13.9	A
Mar.	11	38.1	19.4	21.1	15.6	5.8
Apr.	13	29.7	29.9	21.1	14.5	4.7
May	13	39.4	30.6	14.9	12.7	2.4
Jun.	12	39.1	35.8	12.9	11.1	1.1
Jul.	11	42.3	25.2	15.9	11.8	4.8
Aug.	12	34.6	28.1	22.1	12.1	3.1
Sep.	14	44.5	26.3	13.1	13.7	2.4
Oct.	12	40.1	21.9	19.9	15.7	2.5
Nov.	16	47.4	25.1	20.4	A	7.1
Dec.	10	40.7	29.6	25.6	A	4.1
%	150	**41.3**	**26.4**	**17.9**	**11.3**	**3.1**

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

3.3 Feeding habit in relation to fish size :

The total length of *Lagocephalus suezensis* population classified into 6 classes ranged from 10.5cm to 22.4 cm with 1.9 cm interval in Derna coast (Table 3). Prey size differed between large size individuals, which had ingested the large size prey, whereas the small sized fish ingested the small size prey. Crustaceans, bony fish and mollusks, were found in all length groups for *Lagocephalus suezensis*. In the present study marine warms, mollusks, foraminifera and echinoderms decreased as the size increased while crustaceans and bony fish increased as the fish size increased. The percentage of crustaceans in food items grew from 47.6% in the length group of 10.5 to 12.4 cm to 64.8% in the next length group, which was the biggest, in the 20.5-22.4 cm group. Bony fish had the highest percentage (31.9%) in the 20.5-22.4 cm length category. Marine warms recorded 14.1% in length groups 10.5–12.4 cm, dropped to 3.6% in length groups 14.5–16.4 cm, and subsequently vanished in the subsequent length groups. Mollusks in the length group of 10.5–12.4 cm had the highest value (19.1%). Foraminifera initially appeared in length groups 14.4–16.4 cm by 6.5%, but in length groups 20.5-22.4 cm, they dropped to 1.6% (Table, 3).

Table (3). The diet composition of different size classes of 133 *Lagocephalus suezensis* in Derna coast during the period from January till December 2022

Size groups (cm)	No.	Food items				
		Crustaceans	Bony fish	Marine warms	Mollusks	Foraminifera
10.5–12.4	22	47.6	19.2	14.1	19.1	B
12.5–14.4	25	53.9	20.3	12.5	13.3	B
14.5–16.4	21	54.4	22.3	3.6	13.3	6.5
16.5–18.4	20	59.5	28.2	B	9.8	2.5
18.5–20.4	22	62.9	29.9	B	5.5	1.7
20.5–22.4	23	64.8	31.9	B	1.7	1.6

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

The total length of *Lagocephalus suezensis* population classified into 8 classes ranged from 4.5cm to 20.4 cm with 1.9 cm interval in Hurghada coast (Table 4). Crustaceans, bony fish and mollusks, were found in all length groups for *Lagocephalus suezensis*. In the present study mollusks

and echinoderms decreased as the size increased while crustaceans and bony fish increased as the fish size increased. Sediments appears for the first time in the longitudinal group 10.5-12.4cm at a rate of 2.5%, then decreases to record the lowest rates 0.1% in the length group 18.5-20.4cm. Echinoderms recorded 12.2% in length group 4.5-6.4cm then decreased to 5.4% in 10.5-12.4cm and disappears completely from the food list in the following length groups (Table 4).

Table (4). The diet composition of different size classes of 150 *Lagocephalus suezensis* in Hurghada coast during the period from January till December 2022.

Size groups (cm)	No.	Food items				
		Mollusks	Crustaceans	Bony fish	Echinoderms	Sediments
4.5-6.4	31	54.6	19.2	14.1	12.2	B
6.5-8.4	27	53.5	27.9	18.5	`11.5	B
8.5-10.4	22	42.5	28.3	19.6	9.7	B
10.5-12.4	17	23.8	38.2	30.2	5.4	2.5
12.5-14.4	10	21.3	46.2	30.8	B	1.7
14.5-16.4	12	13.7	51.9	32.9	B	1.6
16.5-18.4	15	11.0	53.3	35.4	B	0.3
18.5-20.4	16	7.5	54.7	37.7	B	0.1

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

3.4 Feeding intensity:

In Derna coast, *Lagocephalus suezensis* specimens with stomach half full, almost full and full of food ranked b% constituted 56.7% of all analyzed individual, whereas those with stomach that were empty or with traces of food and quarter full ranked a% represented 43.3% of the total specimens (Table 5). The feeding activities were quite high during spring (82.3%) and autumn (68.9%). There are minimal rate of feeding intensity recorded in winter (41.8%) and summer (33.8%) (Table 6).

Table (5). Monthly variations in the intensity of feeding of 133 *Lagocephalus suezensis* in Derna coast during the period from January till December 2022

Months	No.of fish	The degree of distension of the stomach							
		Empty	Trace	1/4	a %	1/2	3/4	Full	b %
Jan. (2022)	9	22.3	21.1	16.8	60.2	16.0	10.2	13.6	39.8
Feb.	11	9.3	5.0	44.2	58.5	1.5	40.0	A	41.5
Mar.	10	25.5	A	A	25.5	24.0	27.1	23.3	74.4
Apr.	12	15.9	A	A	15.9	13.9	20.0	50.1	84.0
May	13	11.4	A	A	11.4	13.1	48.3	27.2	88.6
Jun.	10	33.1	22.6	11.6	67.3	32.8	A	A	32.8
Jul.	12	5.3	22.4	33.5	61.2	13.9	10.1	14.8	38.8
Aug.	10	21.2	22.7	26.3	70.2	8.7	A	21.1	29.8
Sep.	15	23.2	2.2	A	25.4	15.4	15.1	44.1	74.6
Oct.	10	20.0	12.0	2.3	34.3	11.3	11.2	43.2	65.7
Nov.	11	22.1	11.7	A	33.8	12.8	24.4	29.1	66.3
Dec.	10	20.1	12.5	23.3	55.9	10.3	11.4	22.4	44.1
Average	133				43.3±12.3				56.7±13.5

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

Table (6). Seasonally variations in the intensity of feeding of 133 *Lagocephalus suezensis* in Derna coast during the period from January till December 2022

Seasons	No. of fish	Empty	Trace	1/4	%	1/2	3/4	Full	%
Winter	30	17.2	12.9	28.1	58.2	9.3	20.5	12.0	41.8
Spring	35	17.6	B	B	17.6	17.0	31.8	33.5	82.3
Summer	32	19.9	22.6	23.8	66.2	18.5	3.4	12.0	33.8
Autumn	36	21.8	8.6	0.8	31.2	13.2	16.9	38.8	68.9

Remarks : Data expressed as percentage (B) = No food in season occurred

In Hurghada coast, *Lagocephalus suezensis* specimens with stomach half full, almost full and full of food ranked b% constituted 50.1% of all

analyzed individual, whereas those with stomach that were empty or with traces of food and quarter full ranked a% represented 49.9% of the total specimens (Table 7). The feeding activities were quite high during autumn (82.4%). There are minimal rate of feeding intensity recorded in winter (43.9%), spring (33.8%) and summer (40.2%) (Table 8).

Table (7). Monthly variations in the intensity of feeding of 150 *Lagocephalus suezensis* in Hurghada coast during the period from January till December 2022.

Months	No.of fish	The degree of distension of the stomach							
		Empty	Trace	1/4	a %	1/2	3/4	Full	b %
Jan. (2022)	12	5.1	22.2	31.5	58.8	14.2	11.4	15.6	41.2
Feb.	13	5.9	24.4	39.5	69.8	10.3	5.5	14.4	30.2
Mar.	11	33.1	22.6	11.6	67.3	32.8	A	A	32.8
Apr.	14	5.3	22.4	33.5	61.2	13.9	10.1	14.8	38.8
May	15	21.2	22.7	26.3	70.2	8.7	A	21.1	29.8
Jun.	11	5.3	22.4	33.5	61.2	13.9	10.1	14.8	38.8
Jul.	12	22.3	21.1	16.8	60.2	16.0	10.2	13.6	39.8
Aug.	11	10.9	6.5	40.6	58.0	1.9	40.1	A	42.0
Sep.	15	15.9	A	A	15.9	13.9	20.0	50.2	84.0
Oct.	11	11.4	A	A	11.4	13.1	48.3	27.2	88.6
Nov.	12	23.2	2.2	A	25.4	15.4	15.1	44.1	74.6
Dec.	13	16.0	10.2	13.6	39.8	22.3	21.1	16.8	60.2
Average	150				49.9±10.7				50.1±9.5

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

Table (8). Seasonally variations in the intensity of feeding of 150 *Lagocephalus suezensis* in Hurghada coast during the period from January till December 2022

Seasons	No. of fish	The degree of distension of the stomach							
		Empty	Trace	1/4	%	1/2	3/4	Full	%
Winter	38	9.0	18.9	28.2	56.1	15.6	12.7	15.6	43.9
Spring	40	19.9	22.6	23.8	66.2	18.5	3.4	12.0	33.8
Summer	34	12.8	16.7	30.3	59.8	10.6	20.1	9.5	40.2
Autumn	38	16.8	0.7	B	17.6	14.1	27.8	40.5	82.4

Remarks : Data expressed as percentage (B) = No food in season occurred

4 .Discussion

The food and feeding habits of family Tetraodontidae have been studied by many authors [2, 25,35]. This study indicates that different trends are present between the two populations in terms of the main preferred food item nearly the same nutrients, with different percentages, are in the stomach of each. *Lagocephalus suezensis* feed on a wide variety of prey types: In Derna coast, feed on crustaceans supplemented by bony fish, marine warms, mollusks and foraminifera. this agrees with the findings of [17, 19, 23]. In the current study, the nutritional list was consistent with some previous studies, such as a study in Island of Crete, southern Greece [21]. In Hurghada feed mainly on mollusks supplemented by crustaceans, bony fish, echinoderms and sediments this agrees with the findings of [4, 20, 35]. In gulf of Suez the target species feed on cephalopods such as squids and cuttle fishes, crustaceans particularly crabs and several species of bony fish [33]. Also, past studies indicate that the diet of *L. suezensis* is highly variable, but mostly carnivorous, as reported for several other Tetraodontidae species [17,18,26,38] Generally, the food extent demands and ability for food acquisition increase with fish development [21]. Analysis of *L. suezensis* diet in Turkey's Mediterranean Sea showed that the fish is carnivorous and crustaceans are its major food items [2], the numbers and size prey taxa increased with size of the *L. suezensis* due to the ability of larger fish to consume a wider range of prey sizes than smaller fishes, this phenomenon appeared to be true for *L. suezensis* of the present study. The feeding intensity of *L. suezensis* showed a significant difference in both stations. In Derna, the feeding activities were quite high during spring and autumn for *L. suezensis* before and after the spawning season [24]. While in Hurghada the activities were high during autumn this coincide with the spawning season in the end of spring and summer [35] and in agreement with observations carried out on the target species from the Gulf of Suez , Egypt by [4]. During spawning time, fish need more energy input in order to meet the reproduction requirements [32].

5. Conclusion

The present study has demonstrated that *L. suezensis* exhibit some degree of selectivity in their feeding habits since they exploit, almost exclusively, crustacean, bony fish, marine warms, mollusks, foraminifera, echinoderms and sediments. Therefore, the two population of *Lagocephalus suezensis* in Derna coast, Mediterranean Sea, Libya, and Hurghada coast, Red Sea, Egypt waters are specialist carnivorous especially on benthic invertebr.

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تحليل محتوي الغذاء لسمكة ابونفاخ السويسي(*Lagocephalus suezensis* (Clark & Gohar, 1953 في ساحل درنة علي البحر المتوسط وفي ساحل الغردقة علي البحر الأحمر .

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الملخص :
أجريت دراسة حول تحليل محتوي معدة لسمكة ابونفاخ السويسي (L. suezensis) من عائلة (family Tetraodontidae)
المهاجرة في مجموعتين مختلفتين ، حيث المجموعة الاولي من ساحل درنة علي البحر المتوسط ، والأخرى علي ساحل الغردقة علي البحر الأحمر. تم جمع ما مجموعه 283 عينة شهرياً بين يناير وديسمبر 2022 باستخدام شباك الجر على أعماق تتراوح بين 15 و50 متراً. ركز البحث على دراسة التركيب الغذائي السنوي والشهري، في تركيبة النظام الغذائي، وتغيرات النظام الغذائي مع الطول، وكثافة التغذية. على مجموعة متنوعة من الفرائس، وخاصة اللافقاريات القاعية. . فعلى طول ساحل درنة (العدد=133)، كانت القشريات هي مجموعة الفرائس السائدة بنسبة (55.7%)، تليها الأسماك العظمية (22.3%)، والديدان البحرية (14.4%)، والرخويات (4.4%)، والمثقبات (3.2%). وفي المقابل، في ساحل الغردقة (العدد=150) الرخويات بشكل أساسي بنسبة (41.3%)، مكملة بالقشريات (26.4%)، والأسماك العظمية (17.9%)، وشوكيات الجلد (11.3%)، والرواسب (3.1%) . وبينما تواجدت الرخويات والقشريات والأسماك العظمية في النظام الغذائي طوال العام وعبر جميع فئات الحجم في كلا المحطتين، لوحظت تحولات تطورية واضحة؛ حيث انخفض استهلاك الرخويات والديدان البحرية والمنخربات وشوكيات الجلد مع زيادة حجم الأسماك، في حين أظهر تفضيل الفرائس الأكبر حجماً، مثل القشريات والأسماك العظمية، ارتباطاً إيجابياً بطول السمكة. كما أظهرت كثافة التغذية تقلبات موسمية؛ ففي درنة، سُجلت ذروة النشاط خلال فصلي الربيع (82.3%) والخريف (68.9%)، بينما وصل مجتمع الغردقة إلى أقصى معدل تغذية له في على التكيف مع البيئات فصل الخريف (82.4%). تسلط هذه النتائج تسلط الضوء على القدرة العالية لسمكة المختلفة وتأثيرها المحتمل على أنواع الأسماك القاعية .

الكلمات الافتتاحية : تحليل محتوى الغذاء ، سمكة ابونفاخ السويسي ، علي ساحل درنة ، علي البحر المتوسط ، ساحل الغردقة ، علي البحر الأحمر .