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Komposisi Makanan Ikan Tuna Kecil *Euthynnus alletteratus* (Rafinesque,1810) di Perairan Laut Lattakia – Syria

Food Composition of Little Tunny *Euthynnus alletteratus* (Rafinesque,1810) in the Marine Waters of Lattakia – Syria

Mohamad Galiya[1], Hussam Eddin Laika[2], Zouher Almajid[3], and Ranim Othman[4*]

[1]Department of Zoology, Faculty of Sciences, Tishreen University, Lattakia, Syria
[2]High Institute of Marine Research, Tishreen University, Lattakia, Syria
[3]Department of Zoology, Faculty of Sciences, Tishreen University, Lattakia, Syria
[4*]Department of Zoology, Faculty of Sciences, Tishreen University, Lattakia, Syria

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Koresponding:
Ranim Othman, Department of Zoology, Faculty of Sciences, Tishreen University, Lattakia, Syria

E-mail:
ranimmohammadothman@tishreen.edu.sy

Abstrak

Penelitian ini bertujuan untuk mempelajari pola makan 275 ekor ikan *Euthynnus alletteratus* yang ditangkap di perairan laut Provinsi Lattakia selama dua tahun (19/10/2021 - 29/9/2023), menggunakan metode penangkapan ikan lokal (jaring insang, jaring lingkar, jaring tetap, dan long line). Hasil spektrum makanan menunjukkan adanya kesamaan dalam kebiasaan makan dan perilaku ikan tersebut, karena ikan tersebut merupakan ikan karnivora. Spektrum makanan terdiri dari empat kelompok taksonomi: Ikan, Crustacea, Moluska, dan Annelida. Spesies *E. alletteratus* memakan 18 unsur makanan selama tahun pertama (2021-2022) dan 28 unsur makanan pada tahun kedua (2022-2023). Ikan pada penelitian ini membentuk kelompok pertama dengan tujuh spesies pada tahun pertama dan 17 spesies pada tahun kedua. Diketahui terdapat Crustacea dalam 5 kelompok taksonomi: (Amphipoda, Decapoda, Stomatopoda, Euphausidae, Isopoda), Moluska, dan Polychaete. Individu *E. alletteratus* merespons perubahan musiman dalam ketersediaan makanan, yang mencerminkan kemampuan adaptasi mereka untuk memakan spesies yang paling melimpah di lingkungan. Crustacea diketahui sebagai mangsa utama di musim gugur (90%) dan musim dingin (97%), ikan di musim semi (67%) dan musim panas (69%), sedangkan Moluska dan Annelida meningkatkan pola makan mereka. Hal ini mencerminkan buruknya basis makanan untuk ikan di lingkungan laut.

Kata kunci: *E. alletteratus*, ikan laut Syria, spectrum makanan

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Abstract

The current research aims to study the diet of 275 individuals from *Euthynnus alletteratus*, caught in the marine waters of Lattakia Governorate for two years (19/10/2021 - 29/9/2023), using local fishing methods (gill nets, purse nets, fixed nets, and long lines). The results of the food spectrum showed a similarity in their feeding habits and behaviors, as they are carnivorous fish. The food spectrum consists of four taxonomic groups: Fish, Crustaceans, Molluscs, and Annelids. The species *E. alletteratus* fed on 18 food elements during the first year (2021-2022) and 28 food elements in the second year (2022-2023). Fish formed the first group, with seven species in the first year and 17 species in the second year. It is known that there were Crustaceans in 5 taxonomic groups: (Amphipoda, Decapoda, Stomatopoda, Euphausidae, Isopoda), Molluscs, and Polychaete. It has been also observed that individuals of *E. alletteratus* respond to seasonal changes in food availability, which reflect their adaptation ability to feed on the most abundant species in the environment. They fed on Crustaceans as their main prey in the Autumn (90%) and winter (97%), followed by fish in the Spring (67%) and Summer (69%), while Molluscs and Annelid enhanced their diet. This reflects the poor food base for fish in our marine environment.

Key words: *E. alletteratus*, food spectrum, Syrian marine fish

1. Introduction

The family Scombridae are highly migratory fishes with at least 54 species belonging to 15 genera worldwide (Collette *et al.,* 2001; Eschmeyer and Fong, 2015) and 11 species in the Eastern Mediterranean (Golanii *et al.,* 2006); Where 11 fish species belonging to 7 genera were recorded in Syrian marine waters (Galiya *et al.,* 2024). Most of them are Epipelagic and are widely distributed throughout the Tropical, Subtropical, and Temperate waters of the world's Oceans (Collette and Nauen, 1983; Nakamura, 1985; Sayskan, 1988). The *E. alletteratus* is the only member of the genus Euthynnus, belongs to Scombridae and aggregates in large schools with other scombrid species such as *Auxis* sp., *Sarda sarda* of similar size (Marchal, 1963; Collette and Nauen, 1983).

The biology of this species was studied by many others in the Mediterranean Sea especially: Turkey (Kahraman, 2005; Kahraman and Oray, 2001), Egypt (Hussain *et al.,* 2014), Tunisia (Hattour, 2009 and Hajjej *et al.,* 2016, 2018), Spain (Valeiras *et al*., 2008), Algeria (Ansel, 2019; Labidi, 2020) but no food biology study about *E. alletteratus* was conducted in Syria. Therefore, this study aims to provide more detailed information on the dietary composition and feeding strategy of *E. alletteratus* in the Ras Albasit region for conservation of its stocks, as the species is an economically and ecologically valuable fishery resource in Syrian waters.

2. Materials and Methods

Between October 2021 and September 2023, 275 specimens of Scombrid fish species *E. alletteratus* (Figure 1) were collected once a month from Ras Al-Basit – Eastern Mediterranean (Figure 2) using local fishing methods (gill nets, purse nets, fixed nets and long lines), All fish were measured to the nearest 1 mm fork length (FL), weighed to the nearest 0.1 g and their stomachs were extracted and fixed in 7% formalin solution for later analysis.

Figure 1. *E. alletteratus*: Tw: 580 g; Tl: 36.4 cm was caught from Ras albasit 11/ 11/ 2022

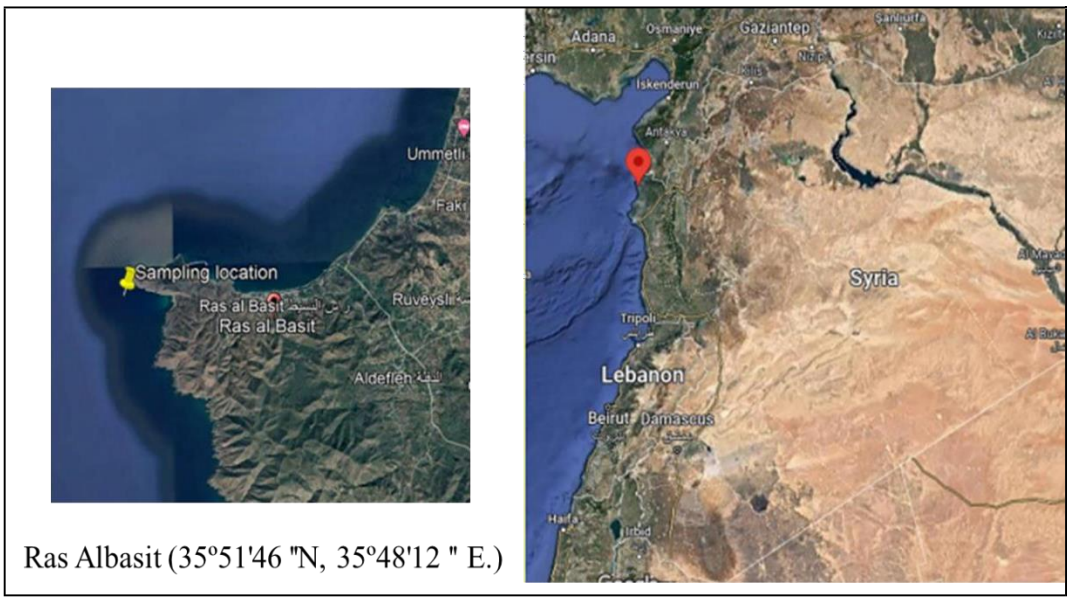

Figure 2. Sampling location (Source: Google Earth, 2024)

In the laboratory, prey items were identified to the lowest possible taxon and counted. Analyzing stomach contents is one of the most direct ways to check the fish's diet (Hynes and Bernard, 1950; Windell, 1971; Wootton, 1994). The diet was studied in two ways, qualitative and quantitative analysis. Qualitative analysis was conducted by examining the content of the digestive tube to determine the quality of the food, and the food spectrum. It included identifying the species and genera involved in feeding *E. alletteratus* using the following taxonomic keys (Gosner, 1971; Borutskii, 1974; Fisher *et al*., 1987; Hass and Knorr, 1979). The frequency occurrence coefficient of the food item (prey) was calculated and expressed in the percentage of occurrence of a food item in the digestive tube of the studied fish (Pravdin, 1966) as follows:

F = N x 100/P ..... (1)

F: frequency of the food item,
N: number of times the food item was encountered,
P: number of individuals studied.

Quantitative analysis was studied by the numerical method, i.e., counting the individuals of each food item in all the equipment examined, and the gravimetric method, i.e., weighing the total number of individuals of each food item using an accurate, sensitive balance (0.01 g). The parameters enumerated as follows; 1) Relative numerical importance of the food element (INE), 2) Relative weight importance of the food element (IWE), 3) Feeding index (Ff). Each of the following parameters was also calculated according to (Borutskii,1974; Bagnal, 1978).

INE = NE x 100/TNE ..... (2)

NE: the number of members of the food element,
TNE: total number of food elements.

IWE = WE x 100/TWE ..... (3)

WE: Weight of the item,
TWE: Total weight of the item.

Ff = IWE% x INE ..... (4)

3. Results and Discussion

a. The qualitative composition of nutritional components of E. Alleiterate

The food spectrum of *E. alletteratus* caught from the Ras Al-Basit was studied, which ranged in length (28.3-52.3 cm) average (40.71±5.94) and weight (350-2050 g) average (1074.99 g) (Table 1). The *E. alletteratus* is a predatory pelagic fish, of economic and ecological importance, and is considered to

specialize in its diet on small pelagic fish (Campo *et al.,* 2006; Falautano *et al.,* 2007; García and Posada, 2013 and Navarro *et al.,* 2017), but they are prey to several predators, including whale sharks that feed on their eggs (Hoffmayer *et al.,* 2007; De la Parra-Venegas *et al.,* 2011), seabirds (Hensley and Hensley, 1995), and fish. other tunas (Dragovich and Potthoff, 1972; Karakulak *et al*., 2009) and Carnivorous marine mammals such as Dolphins and Seals (Manooch III and Hogarth, 1983).

Therefore, knowledge of their diet is essential to determine their role in the Pelagian food web, and contributes to a better understanding of trophic dynamics (Pauly *et al.,* 2000), as exploitation of marine resources such as overfishing has a major impact on changing Pelagian ecosystems (Myers and Worm*,* 2003) affected by predators.

Table 1. Fork length and Total weight (Mean±SD) of *E. alletteratus* caught from the Ras Al Basit area during the research period 2021-2023

Adjective / Months		All Individuals		
		N	Weight (g)	Fork Length (Cm)
2021 - 2022	October	14	454.64	31.33±1.41
	November	9	1317.78	42.33±4.62
	December	10	1287	43.37±3.67
	January	11	1072.73	41.48±4.09
	February	8	535.5	33.54±1.71
	March	11	1300.82	44.65±2.21
	April	11	1110.73	41.37±3.48
	May	15	1106	41.47±3.55
	June	7	1559.14	46.73±2.34
	July	6	1581.33	47.12±1.54
	August	16	739.75	35.55±7.55
	September	14	783.28	37.45±2.74
2022 - 2023	October	15	888.27	4.50±38.32
	November	16	1095.62	40.86±4.59
	December	15	1043.33	40.77±4.61
	January	12	1163.83	43.4±2.82
	February	8	928.25	39.77±4.93
	March	11	1039.82	41.1±4.04
	April	10	1344.8	44.05±4.56
	May	8	1417.75	44.31±2.80
	June	9	1528.44	46.46±2.51
	July	11	1692.54	48.03±1.93
	August	11	1292	43.32±9.81
	September	17	670.70	35.06±4.23
		275	1074.99	40.71±5.94

The food spectrum of *E. alletteratus* consisted during the first year (2021-2022) from 18 food elements, belonging to 4 taxonomic groups: Fish, Crustaceans, Molluscs, and Polychaetes (Table 2). It was noted that there was diversity in the composition of its food components, as fish occu pied the first place among them with /9/ species: *B. boops*, *S. somber sp*, *S. rubrum*, *B.nectabanus*, *A. lacunosus*, *S. Pilchardus*, *S. cabrilla*, fish larvae with a frequency rate of 27.81%, in addition to individuals of the Clupeidae, *S. aurita* occupied the first place with 6.72%. It was followed by Crustaceans including 4 taxonomic groups: Amphipoda, Stomatopoda, Decapoda, Euphausidae with a frequency rate of 66.11% distinguished by 7 species, in which

Portunus puber belonging to Decapoda occupied the first place with a frequency rate of 21.21%, then mollusks and annelids with only one species for each and a frequency rate of 0.76%; 1.51%, respectively.

Table 2. Monthly changes in the qualitative composition and frequency occurrence of food components of *E. alletteratus* during the period 2021-2022 in the Ras Al-Basit.

Month / Food element	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	% F
Fishes	**57.13**	**222.22**	**10**	**94.27**	**-**	**154.54**	**127.27**	**3466.67**	**142.85**	**200**	**3681.25**	**2071.4**	**27.81**
S.aurita	-	-	-	36.36	-	-	100	20	-	33.33	25	-	6.82
S. pilchardus	-	-	-	-	-	-	-	6.67	-	50	6.25	-	2.27
Fish of Clupeidae	7.14	211.11	10	-	-	-	27.27	-	14.28	-	-	-	3.79
Boops boops	-	-	-	-	-	-	-	106.67	-	-	-	-	1.51
A. lacunosus	28.57	-	-	72.73	-	-	-	-	-	-	6.25	-	2.27
S. rubrum	-	-	-	-	-	-	-	-	-	-	1481.25	21.43	3.03
S.japanicus	-	-	-	-	-	-	-	-	-	-	6.25	-	0.76
Serranus cabrilla	14.28	-	-	-	-	-	-	-	-	-	-	-	0.76
B.nectabanus	-	-	-	-	-	-	-	960	-	-	-	-	4.54
Fish larvae	-	-	-	-	-	-	-	413.33	-	-	231.25	2042.8	6.06
Non-identified Fish	7.14	11.11	-	18.18	-	154.54	-	1960	128.57	116.67	1925	7.14	21.97
Crustacean	**10928.5**	**8411.1**	**4110**	**1554.54**	**2412.5**	**318.18**	**-**	**886.67**	**-**	**21250**	**731.25**	**1321.4**	**66.11**
Stomatopoda	**-**	**-**	**360**	**-**	**-**	**-**	**-**	**6.67**	**-**	**13700**	**-**	**114.28**	**6.82**
Decapoda	**5221.43**	**44.44**	**50**	**18.18**	**1850**	**-**	**-**	**-**	**-**	**983.33**	**731.25**	**542.85**	**24.24**
Portunus puber	3121.43	44.44	50	18.18	1850	-	-	-	-	983.33	731.25	542.85	21.21
Nike edulis	2100	-	-	-	-	-	-	-	-	-	-	-	3.03
Amphipoda	**-**	**-**	**30**	**81.81**	**25**	**9.09**	**-**	**180**	**-**	**-**	**-**	**-**	**8.32**
Hyperia sp.	-	-	30	27.27	12.5	-	-	180	-	-	-	-	5.30
Themisto sp.	-	-	-	54.54	-	-	-	-	-	-	-	-	1.51
Vibilia armata	-	-	-	-	12.5	9.09	-	-	-	-	-	-	1.51
Euphausiacea *M. norvegica*	**-**	**2411.1**	**2180**	**90.91**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3.03**
Non-identified Crustacean	**5707.14**	**5955.5**	**1490**	**1363.64**	**537.5**	**309.09**	**-**	**700**	**-**	**6566.6**	**-**	**657.14**	**24.24**
Mollusca: Gastropoda	**-**	**22.22**	**-**	**-**	**25**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.51**
O. keraudreni											-		
Polychaeta	**14.28**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.76**
Digested food	**7.14**	**6.31**	**50**	**18.18**	**25**	**27.27**	**72.73**	**33.33**	**28.57**	**16.67**	**37.5**	**-**	**-**

While a clear difference was observed in the composition of its food components when studying it in the second year (2022-2023), it included more diversity in food elements, as its food spectrum consisted of 28 food elements belonging to 4 main taxonomic groups (Table 3). Fish, which ranked first among them with 17 species, including *B. nectabanus*, Juvenile (*A. rochei*, *Thynnus thynnus*), *B. boops*, *S. rivulatus*, *S. rubrum*, *A. djedaba*, etc. Fish larvae with a repetition rate of 101.40%, in addition to individuals from the Clupeidae appeared with a frequency rate of 37.77% including 4 species, in which *E. encrasicholus* ranked first with a frequency rate of 13.29%, followed by *S. aurita* 11.89%. Followed by Crustaceans including 5 taxonomic groups with a frequency of 58.04%. Amphipoda, Stomatopoda, Decapoda, Isopoda, Euphausidae are distinguished by 8 species, the most frequently encountered of which is Stomatopoda with a frequency of 18.18%, then molluscs represented by two species with a frequency of 2.80%, followed by polychaete annelids with only one species with a frequency of 0.70%.

Table 3. Monthly changes in the qualitative composition and frequency occurrence of food components of *E. alletteratus* during the period 2022-2023 in the Ras Al-Basit.

Month / Food element	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	%F
Fishes	**5540**	**778.28**	**560**	**41.67**	**12.5**	**1572.71**	**140**	**887.5**	**177.77**	**954.55**	**172.72**	**1552.9**	**101.40**
S. aurita	-	-	13.33	-	-	-	110	-	-	263.64	36.36	123.53	11.89
E. encrasicholus	486.67	-	86.67	16.67	-	18.18	-	-	-	9.09	-	252.94	13.29
H. puncatatus	-	-	-	-	-	-	-	-	-	45.45	-	-	0.70
E. golanii	-	-	-	-	-	-	-	-	22.22	-	-	-	1.40
Fish of Clupeidae	-	-	460	-	-	-	30	12.5	-	281.82	-	88.23	10.49
E. denticulatus	33.33	25	-	-	-	-	-	-	-	-	-	-	4.19
S. rubrum	6.67	5.26	-	-	-	-	-	-	-	-	-	11.76	2.10
B.nectabanus	-	5.26	-	-	-	-	-	-	-	-	-	-	0.70
B. boops	-	-	-	-	-	-	-	-	-	9.09	9.09	-	1.40
A. lacunosus	6.67	5.26	-	-	-	-	-	-	-	-	-	5.88	2.10
S. indicus	-	-	-	-	-	-	-	-	11.11	-	-	-	0.70
Scomber sp	-	-	-	-	-	127.27	-	-	-	-	-	-	0.70
A. djedaba	13.33	-	-	-	-	-	-	-	-	-	-	-	0.70
S. rivulatus	-	-	-	-	-	-	-	-	11.11	263.64	9.09	-	4.19
M. scolopax	-	-	-	-	-	54.54	-	-	-	-	-	-	1.40
A. rochei	6.67	-	-	-	-	-	-	-	-	-	-	-	0.70
Thynnus thynnus	-	-	-	-	-	-	-	-	-	9.09	-	-	0.70
Fish larvae	4373.3	412.5	-	-	-	427.27	-	787.5	-	-	-	100	8.39
Non-identified fish	613.33	325	-	25	12.5	945.45	-	87.5	133.33	72.72	118.18	970.59	35.66
Crustacean	**640**	**2286.51**	**173.34**	**1833.3**	**-**	**6509.08**	**320**	**262.5**	**11.11**	**-**	**272.72**	**382.35**	**58.04**
Stomatopoda	**106.67**	**243.75**	**126.67**	**1116.6**	**-**	**1872.73**	**60**	**262.5**	**-**	**-**	**245.45**	**123.53**	**18.88**
Decapoda	**533.33**	**1335.26**	**40**	**-**	**-**	**18.18**	**-**	**-**	**11.11**	**-**	**9.09**	**258.82**	**18.18**
Portunus puber	520	1081.25	40	175	-	18.18	-	-	11.11	-	9.09	258.82	16.08
Nike edulis	13.33	268.75	-	-	-	-	-	-	-	-	-	-	1.40
Palaemon elegans	-	5.26	-	-	-	-	-	-	-	-	-	-	0.70
Amphipoda	**-**	**181.25**	**6.67**	**58.33**	**-**	**2145.45**	**-**	**-**	**-**	**-**	**18.18**	**-**	**8.39**
Hyperia sp	-	162.5	6.67	33.33	-	2136.36	-	-	-	-	18.18	-	5.59
Vibilia armata	-	18.75	-	25	-	9.09	-	-	-	-	-	-	2.80
Euphausiacea *M.norvegica*	**-**	**-**	**-**	**141.67**	**-**	**36.36**	**-**	**-**	**-**	**-**	**-**	**-**	**1.40**
Isopoda	**-**	**43.75**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.40**
Non-identified Crustacean	**-**	**462.5**	**-**	**341.67**	**-**	**2436.36**	**250**	**-**	**-**	**-**	**-**	**-**	**9.79**
Mollusca	**-**	**-**	**-**	**-**	**-**	**9.09**	**-**	**-**	**-**	**9.09**	**9.09**	**-**	**2.80**
O. keraudreni	-	-	-	-	-	9.09	-	-	-	-	-	-	1.40
S. lessoniana	-	-	-	-	-	-	-	-	-	9.09	9.09	-	1.40
Polychaeta	**6.67**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.70**
Digested food	**-**	**25**	**66.67**	**58.33**	**100**	**-**	**70**	**37.5**	**22.22**	**18.18**	**45.45**	**29.41**	**-**
Non-identified item	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**9.09**	**-**	**1.40**

The results of the study of the qualitative composition of food components of *E. alletteratus* caught from the Ras Al-Basit area showed that it has a Carnivorous diet and its diet is mainly based on fish, specifically fish of the Clupeidae family, and Crustaceans as preferred species, accompanied by Molluscs and Polychaetes as supplementary (occasional) species. These results are consistent with many studies, such as in Venezuela, Etchevers (1976) reported that *Sardinella aurita* is an important component of its diet. Manooch III *et al.* (1985) found in the south-eastern coasts of the United States of America 23 species of fish as part of its diet, but *S. aurita* is its favorite, with a group of invertebrates recorded as a complementary component of its diet. In the waters of the Caribbean-Colombia, Moreno (1986) recorded 11 species of fish Clupeidae (*Harengula* sp.; *Sardinella* sp.; *Ophistonema oglinum*), Carangid

(*Decapterus* sp.) as major food items, in addition to Squid and Shrimp.

As shown by Campagnuolo *et al.* (1998) in the Strait of Sicily, it is mainly Piscivorous with a marginal addition of Crustaceans, Cephalopods and Plant remains in its diet. Similar results confirming the dominance of fish prey and the occasional occurrence of Crustaceans were obtained after stomach content analysis of fish samples from the Aegean and Ionian Seas (Zaboukas *et al*., 2001). Its diet, according to Bahou *et al*. (2007) in the Continental Shelf waters of Ivory Coast, West Africa: 23 species of prey, belonging to 15 families were identified as 19 Fish species, three Crustacean species in addition to one species of Squid, where fish are the dominant prey in their diet with the two species *Priacanthus arenatus*, *Trichiurus lepturus* followed by Crustaceans, While Faulatano *et al*. (2007) reported in the central Mediterranean, South of the Tyrrhenian Sea: 59 species of prey, mainly fish represented by the species *Maurolicus muelleri* and species of the Clupeidae family (*Sardinella aurita*, *Sardina pilchardus*, *Engraulis encresicolus*), followed by Crustaceans represented by Amphipoda, Isopoda, Stomatopoda, and Molluscs were also found, represented mainly by Cephalopods and occasionally by Gastropods.

Puigarnau-Benitez (2019) noted during an examination of its diet over 5 years (2012-2017) on the coast of Tarragona (northwestern Mediterranean) that it consisted of 33 food elements within four taxonomic groups, in which fish occupied the first place with 27 species, specifically *Engraulis encrasicolus*, *Sardina pilchardus*, followed by Crustaceans, Molluscs, and Polychaetes, while the food content of *E. alletteratus* according to the study of Ansel (2019) on the coast of Mostaganem, Algeria showed that it consisted of three food elements: fish represented by *Sardinella aurita*, *Sardina pilchardus* followed by Molluscs and Crustaceans. The diet also consisted according to the study of Labidi (2020) of 29 food elements belonging to three taxonomic groups: Fish occupied the first place among them with 17 species, Followed by Crustaceans and Molluscs.

The variation in fish species encountered and recorded in the equipment of *E. alletteratus* fish examined in the present study with the study of Bahou *et al.* (2007) and Faulatano *et al.* (2007) can be attributed either to the wide availability of these fish species in the studied area considering their absence from the Syrian marine waters or to overfishing and the poor natural food base which negatively affects marine resources, forcing fish to consume the available food and search for other food sources (alternatives).

Small fish in pelagic, especially Sardines (with high energy content), provide high energy for *E. alletteratus* without the need to prey on more marine resources (Albo-Puigserver *et al*. 2017), and the stress of searching for new prey affects the body condition, health and population dynamics of *E. alletteratus* (Lloret *et al.,* 2013). Cannibalism, confirmed by Postel (1954) in the tropical Atlantic, was not observed during this study, and was characterized by the consumption of Scombridae in relatively large quantities during the summer, in addition to the study by Klawe (1961) and Bahou *et al*. (2007) in which small *E. alletteratus* appeared as prey for larger specimens.

b. Quantitative composition of food spectrum elements

Table (4) shows the quantitative composition of the food spectrum elements that the *E. alletteratus* feeds on in the Syrian marine waters - Ras al-Basit area. From its data, it is known that *E. alletteratus* feeds mainly on small Fish and Crustaceans. Fish and Crustaceans dominated the occurrence of the two preferred food groups for *E. alletteratus* during the seasons in both study years in the Ras al-Basit area, but they showed differences in their importance, with occasional occurrences of Molluscs and Polychaetes.

The total number of food elements that the *E. alletteratus* fish fed on during the research period (2021-2022) in Ras

Al-Basit amounted to 6,356 food elements, and their approximate weight was 683.31 g, led by individuals of the species belonging to the order Decapoda such as the species *Portunus puber* with 919 individuals with a relative numerical importance 14.46% and a low relative weight importance 0.92%, followed by Stomatopoda crustaceans with relative numerical importance 13.77% and relative weight importance (3.29%). As for the relative weight importance of all nutritional elements in the examined equipment, it was occupied by *Sardinella aurita* (24 individuals), at a rate of 9.82%, while in terms of the relative numerical importance of fish nutritional elements, fish larvae (385 individuals) at a rate of 6.06% occupied the first place among them, followed by *S. rubrum* (240 individuals) at a rate of 3.78%, then *B. nectabenus* (44 individuals) at a rate of 2.26%, while the rest of the fish species appeared with very close weight and numerical percentages, while Molluscs and Annelids occupied a very low relative numerical and weight importance.

As we notice from the data in Table (4), Crustaceans occupied the first place among them in terms of the nutritional index (3813.89), followed by Fish (1176.41), then Polychaetes (0.0003) and Molluscs (0.0006). As for the quantitative composition of the food elements included in the food spectrum of the studied *E. alletteratus* fish during the second year of the current research (2022-2023), a clear difference was observed, as their total number reached 3,259 food elements with an approximate weight of 866.85 g, led by fish larvae (848 individuals) with a relative numerical importance of 26.02%, but the *Sardinella aurita* (67 individuals) ranked first with a relative weight importance of 25.61%, followed by *Engraulis encrasicholus* (134 individuals) with a relative weight importance of 10.86%, while the rest of the fish species had a close relative numerical and weight importance. As for Crustaceans, Stomatopoda (483 individuals) occupied the first place among them in terms of relative numerical importance of 14.82%, followed by Decapoda with the species *Portunus puber* (326 individuals) with relative numerical importance of 10.01%. We note from the data in Table (4) that Fish occupied the first place among them in terms of the food index (5009.87), followed by Crustaceans with a food index very low compared to what was observed in the first year (159.47), followed by Molluscs (0.11), then Polychaetes (0.000003).

Table 4. Quantitative composition of food spectrum in *E. alletteratus* during 2021-2023

Year of study	2021-2022					2022 -2023				
Adjective / Food Element	Number of element	% INE	Total weight of element	%IWE	Ff	Number of element	% INE	Total weight of element	% IWE	Ff
Fishes	**1494**	**23.50**	**342.05**	**50.06**	**1176.4**	**1708**	**52.41**	**828.62**	**95.59**	**5009.87**
Sardinella aurita	**24**	**0.38**	**67.07**	**9.82**	**3.73**	**67**	**2.06**	**223.73**	**25.81**	**53.17**
Sardina pilchardus	**4**	**0.06**	**24.31**	**3.56**	**0.21**	**-**	**-**	**-**	**-**	**-**
Engraulis encrasicholus	**-**	**-**	**-**	**-**	**-**	**134**	**4.11**	**94.13**	**10.86**	**44.63**
Herklotsichthys puncatatus	**-**	**-**	**-**	**-**	**-**	**5**	**0.15**	**15.58**	**1.80**	**0.27**
Etrumeus golanii	**-**	**-**	**-**	**-**	**-**	**2**	**0.06**	**18.86**	**2.18**	**0.13**
Unspecified speciesClupeidae	**25**	**0.39**	**31.81**	**4.66**	**1.82**	**119**	**3.65**	**106.30**	**12.26**	**44.75**
Bregmaceros nectabanus	**144**	**2.26**	**17.58**	**2.57**	**5.81**	**1**	**0.03**	**0.19**	**0.02**	**0.0006**
Boops boops	**16**	**0.25**	**4.01**	**0.59**	**0.15**	**2**	**0.06**	**11.62**	**1.34**	**0.08**
Atherinomorus lacunosus	**13**	**0.20**	**13.24**	**1.94**	**0.39**	**3**	**0.09**	**10.39**	**1.20**	**0.11**
Sargocentron rubrum	**240**	**3.78**	**21.33**	**3.12**	**11.79**	**4**	**0.12**	**1.48**	**0.17**	**0.02**
Scomber japonicus	**1**	**0.02**	**32.63**	**4.77**	**0.09**	**-**	**-**	**-**	**-**	**-**
Scomber indicus	**-**	**-**	**-**	**-**	**-**	**1**	**0.03**	**6.14**	**0.71**	**0.02**
Scomber sp	**-**	**-**	**-**	**-**	**-**	**14**	**0.43**	**11.92**	**1.37**	**0.59**
Serranus cabrilla	**2**	**0.03**	**0.79**	**0.11**	**0.003**	**-**	**-**	**-**	**-**	**-**

Year of study	2021-2022					2022-2023				
Adjective / Food element	Number of element	% INE	Total weight of element	%IWE	Ff	Number of element	% INE	Total weight of element	% IWE	Ff
Alepes djedaba	-	-	-	-	-	2	0.06	17.61	2.03	0.12
Siganus rivulatus	-	-	-	-	-	31	0.95	10.55	1.22	1.16
Macrorhamphosus scolopax	-	-	-	-	-	6	0.19	3.35	0.39	0.07
Auxis rochei	-	-	-	-	-	1	0.03	1.90	0.02	0.0006
Thynnus thynnus	-	-	-	-	-	1	0.03	18.06	2.08	0.06
Epigonus denticulatus	-	-	-	-	-	9	0.28	10.69	1.23	0.34
Fish larvae	385	6.06	44.48	6.51	39.45	848	26.02	78.74	9.08	236.26
Non – identified fish	640	10.07	84.80	12.41	124.97	458	14.05	187.38	21.62	303.76
Crustacea	4856	76.40	341.14	49.92	3813.8	1542	47.32	292.29	3.37	159.47
Stomatopoda	875	13.77	22.46	3.29	45.30	483	14.82	135.8	1.57	23.27
Decapoda	1213	19.09	297.08	43.47	829.84	372	11.42	22.26	0.26	2.97
Portunus puber	919	14.46	6.32	0.92	13.30	326	10.01	7.96	0.09	0.90
Nike edulis	294	4.63	290.76	42.55	197.01	45	1.38	6.8	0.08	0.11
Palaemon elegans	-	-	-	-	-	1	0.03	7.5	0.09	0.003
Amphipoda	42	0.66	0.93	0.14	0.09	275	8.44	104.72	1.20	10.13
Hyperia sp	34	0.53	0.87	0.13	0.07	268	8.22	104.41	1.20	9.86
Themisto sp	6	0.09	0.03	0.004	0.0003	-	-	-	-	-
Vibilia armata	2	0.03	0.03	0.004	0.0001	7	0.21	0.31	0.003	0.0006
Euphausiacea *Meganyctiphanes norvegica*	445	7.00	2.13	0.31	2.17	21	0.64	0.12	0.001	0.0006
Isopoda *Eurydice pulchra*	-	-	-	-	-	7	0.22	0.3	0.003	0.0007
Non – identified Crustaceans	2281	35.89	18.54	2.71	97.26	384	11.78	29.21	0.34	4.01
Mollusca	4	0.06	0.08	0.01	0.0006	4	0.12	80.4	0.93	0.11
O. keraudreni	4	0.06	0.08	0.01	0.0006	2	0.06	2.9	0.03	0.002
Sepioteuthis lessoniana	-	-	-	-	-	2	0.06	77.5	0.89	0.05
Polychaeta	2	0.03	0.04	0.01	0.0003	1	0.03	66.7	0.0001	0.000003
Non – identified items	-	-	-	-	-	4	0.12	9.6	0.11	0.02
Total number of food elements	6356	100	683.31	100	-	3259	100	866.85	100	-

The results of the current research showed a difference in the relative numerical and weight importance of the food elements (Fish and Crustaceans) that *E. alletteratus* fish fed on between the individuals that were collected and studied in the first year (2021-2022) and the second year (2022-2023). It also appeared that their diversity was less in the first year than in the second year, perhaps due to the impact of the oil spill that occurred in August 2021 on the Syrian coast on the nutritional elements in the environment, causing their lack of presence in the area affected by the spill and even their death.

The results of the current research were compared with previous studies, and there was a convergence, as fish have a high-frequency rate. The study of Bahou *et al.* (2007) on the diet of this fish species in Côte d'Ivoire showed that fish dominated its diet with a frequency rate (88.44%) and a high relative weight importance (94.63%), followed by Crustaceans with a frequency rate (11.83%) and a high relative numerical importance, with a small contribution from Cephalopoda with a frequency rate of 5.38%), and Gastropoda with a frequency rate of 0.36%.

This is consistent with the study of Falautano *et al*. (2007), where it appeared that this fish species feeds mainly on fish, the occurrence rate of which reached (90.48%) with a relative numerical importance (86.91%) and a relative weight importance (92.01%), where *M. mulleri*

fish ranked first among them in terms of occurrence rate (20.41%) with a relative numerical importance (23.11%) and a relative weight importance (36.33%), followed by fish of the Clupeidae with a frequency rate (29.24%) including three species: *S. aurita*, *S. pilchardus*, *E. encrasiocolus,* followed by Crustaceans (38.09%) distinguished by the Hyperidae, then Molluscs (14.97%). While its diet according to Moore's (2014) study in the southeastern Florida coast included a low diversity of predators, with bony fishes being relatively important (88.7%), Cephalopods (1.5%), Isopods (7.9%), and Decapods (0.1%).

In the quantitative analysis of food elements conducted by Labidi (2020) on *E. alletteratus* in the Algerian coast, Fish constituted the preferred prey with a frequency rate of 92.81%, with a relative weight importance of 95.93% and a numerical value of 68.58%, and the coincidence index occupied a value of 152.69, followed by Crustaceans with a frequency rate of 37.25%, with a relative weight importance of 3.43% and a numerical value of 29.15% and a frequency occurrence of (12.12%), then Molluscs as an incidental prey with a frequency rate of 5.88% and a frequency occurrence of (0.11%), and the list of prey swallowed by the *E. alletteratus* in the coast of Mostaganem-Algeria showed that it has a wide food range represented by 1639 prey weighing 6036 g, consisting of fish that appeared with a frequency rate of 77.91% represented by *S. aurita* with a repetition rate of 21.14%, a numerical rate of 22.94%, and a weight rate of 25.28%, followed by *S. pilchardus* with a repetition rate of 20.67%, a numerical rate of 20.93%, and a weight rate of 29.04%, in addition to Molluscs, whose repetition rate reached 5.45%, followed by the occasional appearance of crustaceans 1.42% according to the study by Ansel (2019).

c. Seasonal changes in the qualitative composition of food components

Fish and Crustaceans dominated the occurrence of the two preferred food groups for *E. alletteratus* during the seasons in both study years (Figure 3) in the Ras al-Basit area, but they showed differences in their importance, with occasional occurrences of Molluscs and Polychaetes. During the Autumn, the species *E. alletteratus* showed a tendency to devour crustacean food items that appeared at a high rate (90%) with their diversity limited to Stomatopoda, Decapoda, and Euphausiid. As for fish, they constituted a low rate (10%) of the food items devoured, in addition to the appearance of Molluscs and Polychaetes at a very low rate during the first year. However, a clear difference was observed in the second year, where fish dominated at a rate of (70%), distinguished by the fish species: *S. aurita*, *E. encrasicholus*, *S. rubrum*, *B. nectabanus*, and *A. djedaba* , in addition to the appearance of Crustaceans at a low rate of (30%), including in their diversity Stomatopoda, Isopoda & Decapoda occupying the high rate among them, in addition to the very low appearance of Polychaetes. In Winter, this fish species showed, in both years of the study, its Food dependence on Crustaceans, which appeared at a very high rate (97%), (83%) respectively, with a noticeable decrease in Fish elements (2%), (17%), limited to fish species from the Clupeidae family (*S. aurita*, *E. encrasicholus*).

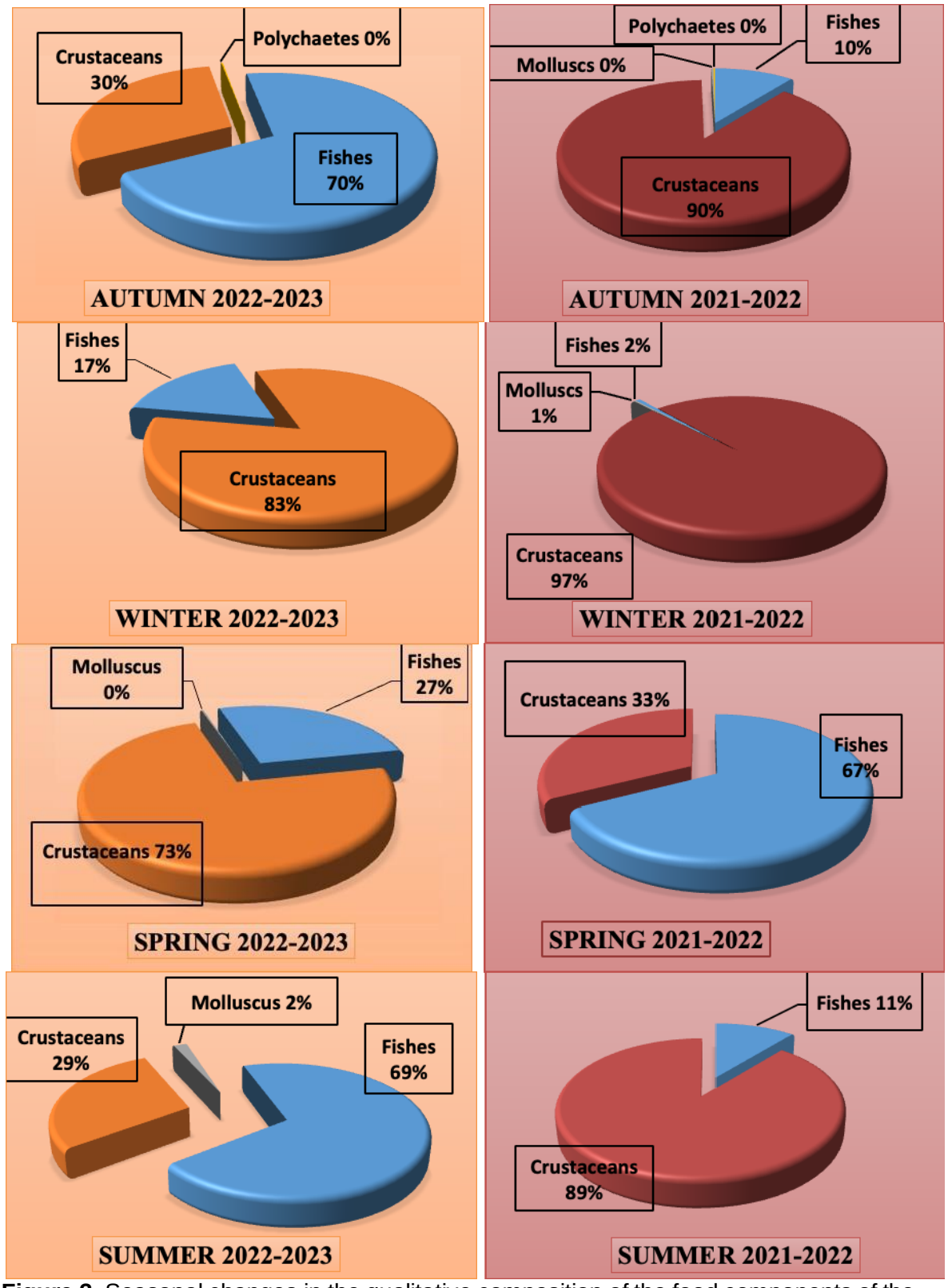

Figure 3. Seasonal changes in the qualitative composition of the food components of the *E. alletteratus* in the Ras Al-Bassit region during 2021-2023.

During the Spring, unlike the previous seasons of the first year, an increase in the percentage of Fish appearance (67%) and a decrease in the percentage of Crustaceans appearance (33%) was observed, unlike what was observed in the second year, where Crustaceans dominated the diet (73%), and the percentage of Fish appearance decreased to constitute (27%), with its diversity limited to Fish of the Clupeidae family and fish larvae, with a slight appearance of Molluscs.

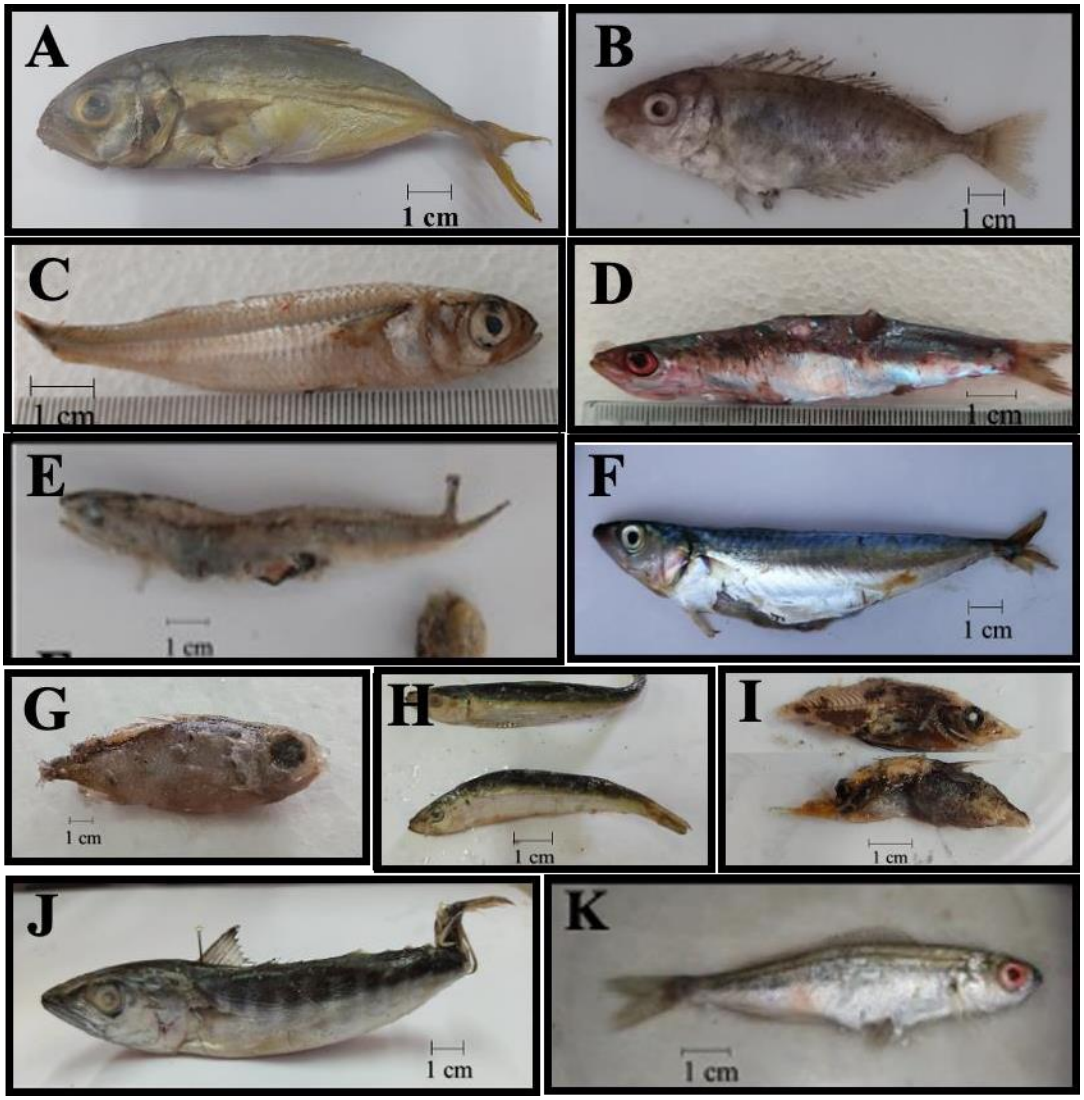

Figure 4. Examples of fish prey recorded in the stomachs of caught *E. alletteratus* during (2021-2023). A) *Alepes djedaba,* B) *Siganus rivulatus,* C) *Atherinomorus lacunosus,* D) *Sardina pilchardus,* E) *Engraulis encrasicholus,* F) *Scomber indicus,* G) *Sargocentron rubrum***,** H) *Sardinella aurita***,** I) *Macrorhamphosus scolopax***,** J)*Thynnus thynnus,* K) *Boops boops*

During the Summer, the nutritional components of *E. alletteratus* changed, with Crustaceans dominating (89%), while fish consumption decreased (11%). This is different from the second year, where Fish consumption increased to (94%), limited to Clupeidae and S. rivulatus, with Crustaceans decreasing to (26%), but Molluscs were recorded at (2%). The *E. alletteratus* respond to seasonal changes in food availability, reflecting their potential dietary adaptation and opportunistic behavior towards the most abundant species in the environment. The results of

the present study showed that they tend to rely on fish and crustaceans as their main prey, although they exploit Molluscs and Polychaetes to supplement their diet, which is consistent with the study of Bahou *et al.* (2007) in Côte d'Ivoire, West Africa.

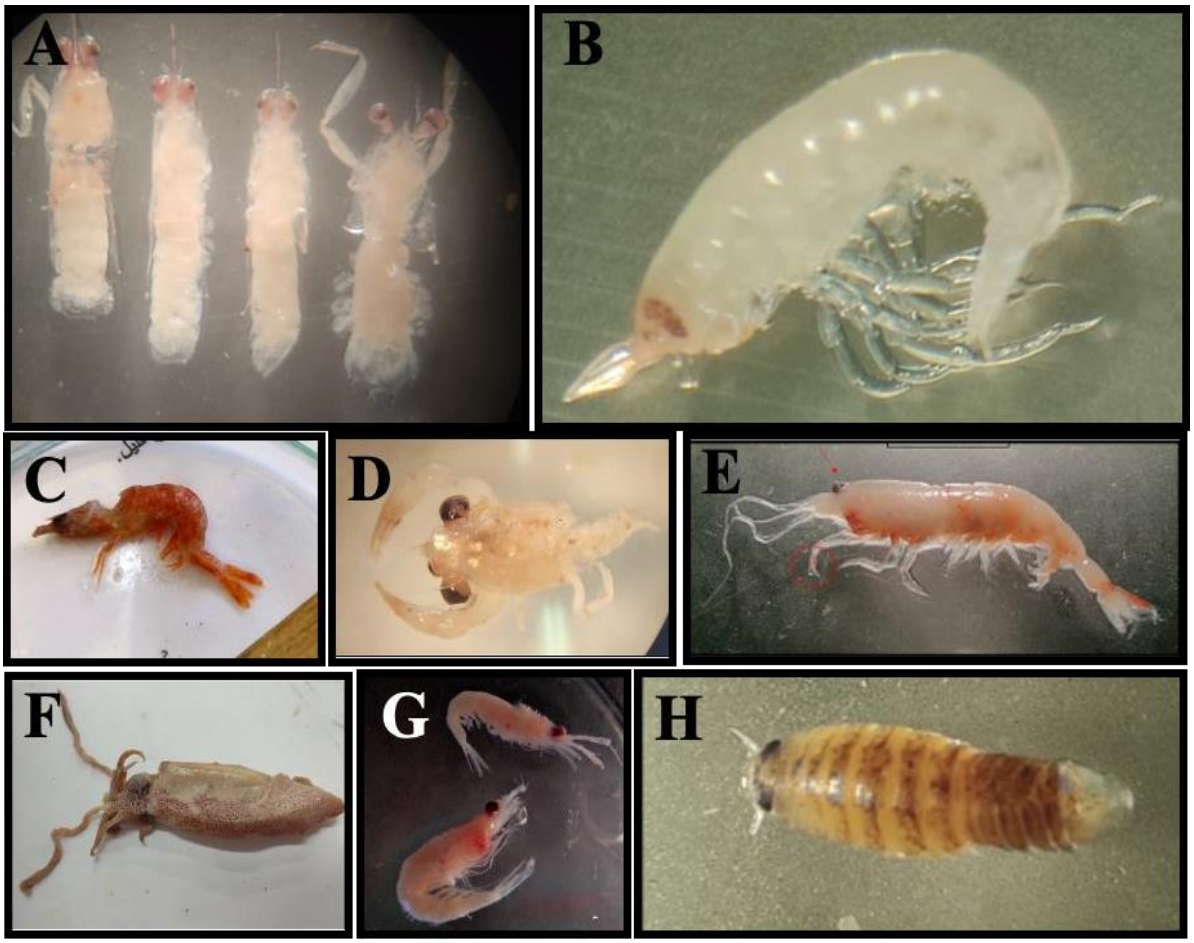

Figure 5. Examples of prey recorded in the stomachs of caught *E. alletteratus* during (2021-2023). A) **Stomatopoda**, B) **Amphipoda:** *Vibilia armata*, C) **Decapoda:** *Palaemon elegans*, D) **Decapoda**: *Portunus puber*, E) **Decapoda**: *Nike edulis*, F) *Sepioteuthis lessoniana*, G) **Euphausiacea:** *Meganyctiphanes norvegica*, H) **Isopoda:** *Eurydice pulchra*

4. Conclusion

This study was noted that *E. alletteratus* are carnivorous fish from the diet observation with their individuals fed on four taxonomic groups (fish, crustaceans, molluscs, annelids). Fish and crustaceans were the preferred prey, but Molluscs and Polychaetes were supplement of their diet. *E. alletteratus* responds to seasonal changes in nutrient availability, reflecting their dietary adaptation towards the most abundant species in the environment. They feed on crustaceans (Autumn and Winter) and fish (Spring and Summer).

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Conflict of Interest

Author declares no financial or commercial conflict of interest.

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