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Feeding of *Trigla cuculus* on the coast of Lattakia, Syria

R.H. Alshikh Rasheed[1*], Z.W. AL-Hosne[2], Z.A. Almajid[3]

[1,2,3]Department of Zoology, Faculty of Sciences, Tishreen University, Lattakia, Syria

[*]*Corresponding Author rmrom29rm@gmail.com, Tel.: +963934131636*

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***Abstract*—** The study included 124 *Trigla cuculus* fish caught from Syrian marine waters from two sites, Burj Islam and Al Raml Al Janoubi, during the period between 16/6/2017 and 22/5/2018 using the bottom shelf. The research used the mathematical treatments used globally to study the food of fish, and the results showed that the fish species *Trigla cuculus* is a predatory fish, and it feeds on deciduous crustaceans, fish, mollusks, and gastropods. Through research, the cancer *Ethusa mascarone* was identified in the stomach of a fish, and it was recorded for the first time in Syria.

Keywords— Trigla cuculus, Syria, food spectrum

I. INTRODUCTION

The study of the food spectrum of fish is very important, as it sheds light on the food chains in the Syrian marine waters and their relationship to the studied species, as well as knowing the food that fish feed on is important for the proper management of fish wealth by preserving fish food in their homes and places of fishing and protection from emigration or starvation by securing adequate food for them.

One of the important economic fish in Syria is the species *T.cuculus*, figure (1), which belongs to the family *Triglidae* of the genus *Trigla*. Morphological description: Large head, without deep nuchal groove, first dorsal fin with nine to ten spines, second dorsal fin with seventeen to eighteen rays.

The pectoral fin has eleven and three free rays, the scales of the lateral line are plate-shaped and extend vertically. Between the top of the scale and the rays of the fin is an area between 25-50% of most of the scales.

The chest and the anterior region of the abdomen have scales, and the spine consists of (thirty-six, thirty-seven) vertebrae in addition to (thirteen to fourteen vertebrae in front of the caudal and twenty-two, twenty-three vertebrae caudal), and the number of gills in the gill arch is seven to eleven

Colour: The color is bright red from above, while it is paler from below, the dorsal fins are pink, the anal fins have milky white edges, the pectoral and dorsal fins are yellowish.

Height: may reach fifteen cm, usually twenty-five cm. Environment: It lives on silt, sand, gravel, rubble, and rock bottoms between 30 and 250 m depth.

Behavior: May exist in groups. Reproduction: It lays its eggs in spring and summer (from April to August).

Geographical distribution: the eastern Atlantic Ocean from the islands of Britain to Mauritania, the Azores, Madeira, rarely in the western seas: the Mediterranean, [1]

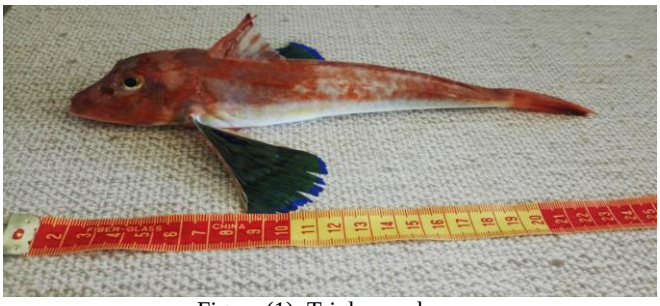

Figure (1): Trigla cuculus

II. METHODOLOGY

Field study (sampling collection)

The research was conducted on *T. cuculus* fish caught from the marine waters of Lattakia Governorate (Burj Islam, Al Raml Al Janoubi) during the period from 16/6/2017 until 22/5/2018. Samples were collected twice a month, using local bottom trawling methods, and the total number of studied fish was 124 individuals.

Working methods:

The fish were transferred immediately after being caught to the graduate laboratory in the College of Science. They were studied immediately after collection, where they were classified using the taxonomic key [1]. The morphological measurements required for each individual were taken, according to [2]:

- Total length (TL) to the nearest mm.
- Standard length (SL) to the nearest mm.
- The total weight (TW) to the nearest 0.01 mg

Then the fish were dissected, the stomach was removed, and its contents were examined with the help of a light microscope and magnifying glass, then they were preserved in absolute alcohol in containers with the sample number, species, date, and place of collecting the sample [2]. Food was classified at the species level only using the taxonomic key [3], while the incomplete body parts that were countable, such as the eyes of crustaceans, were counted.

Food study:
Food is processed in two ways:
qualitative study:
The stomach content was examined to find out the qualitative composition of the food spectrum at the three species using:
Coincidence evidence for the food component: It is expressed as the percentage of fish in the studied sample in which a food component is repeated, and fish with an empty stomach is not included in the calculation process. [2]:
F=N*100/P F: Frequency of the food item.
N: The number of times a food item is encountered.
P: the number of studied individuals.

Quantitative study:
The quantitative analysis was studied using the gravimetric method, that is, the weight of the total individuals of each food item using an accurate sensitive scale. Each of the following transactions was calculated according to [4]:
1- General Stomach Fullness Factor:

Applying the relationship:

$$GSFF = \frac{Wf \times 10000}{W}$$ W: weight of fish (mg).

Wf: weight of food mass (mg).

2- Numerical Relative Importance (INE):

$$INE = \frac{NE \times 100}{TNE}$$

NE: The number of members of the element.
TNE: The total number of elements.

3- The relative weight of the element (IWE):

$$IWE = \frac{WE \times 100}{TWE}$$ WE: Item weight.

TWE: The weight of the items as a whole.

4- Feeding factor (Borutskii, 1974):

$$Ff = IWE\% \times INE\%$$

N: the total number of stomachs examined.

The importance of nutrients in the food spectrum has been determined in two ways:
1- The method [5], which determines the importance of nutrients according to the value of the Nutritional Index Ff where:

- Ff > 200means that the nutrients are preferred by the studied fish species.
- 20< Ff < 200 means the nutrients are secondary.
- Ff < 20 means nutrients are scarce.

2- The method [6], which determines the importance of nutrients according to the value of the coefficients Ff and F at the same time, where the nutrients are divided into:

- Ff >100, F > 30% means that nutrients are preferred.
- 10 < Ff <100, F > 10%That is, the nutrients are secondary.
- Ff <10, F < 10% meaning that nutrients are scarce.

statistical analysis:
Using two Excel charting programs, all data were processed and calculated (mean, standard deviation, and correlation coefficient).

III. RESULTS AND DISCUSSION

The qualitativ composition of nutritional components in the stomach of *Trigla cuculus:*
The food spectrum of *Trigla cuculus* fish in the research consists of 7 main nutrients belonging to 3 taxonomic groups: crustaceans of the order *Decapoda* represented by 5 genera of crabs and shrimp (*Penaeidae*), and bony fish group represented by one genus in addition to *Gastropoda*

Table (1) shows the taxonomic position to which the food components belong within the stomachs of *Trigla cuculus*, and according to the frequency of the food component (chance F)

Crabs of the genus *Ocypode* ranked first with a rate of 5.65%, followed by crabs of the genus *Lio Carsinus* with a rate of 4.84%, then *eels* with a rate of 3.23%, while the rest of the genera were less by chance as shown in Figure (2).

Table (1): The qualitative composition of the nutritional components of Trigla cuculus members during the research period.

Species	Family	order	class	Phylum
	Penaeoidae	***Decapoda***	***Malacostraca***	
Ocypode	***Ocypodidae***			
Charybdis sp.	***Potunidae***			
Lio Carsinus				
E.mascarone	***Ethusidae***			
Anguilla	***Anguillidae***	***Anguilliformes***	***Actinopterygii***	***Chordata***
			Gastropoda	***Mollusca***

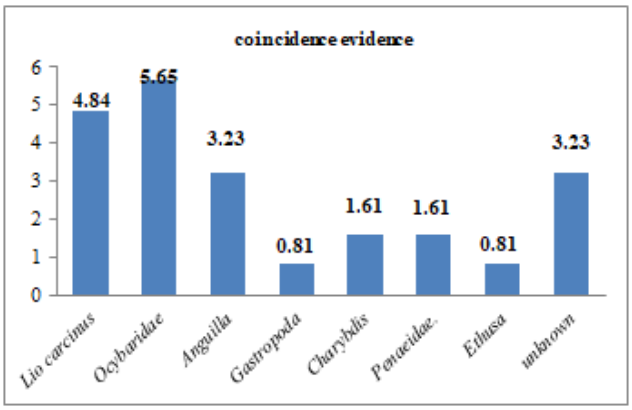

Figure (2): Evidence of coincidence among individuals of the species *Trigla cuculus* during the research period.

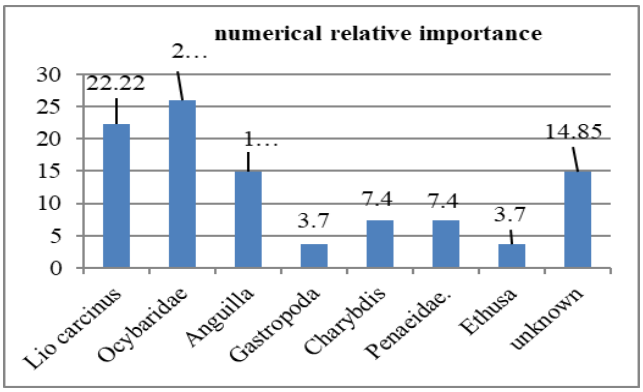

Figure (3): the relative numerical importance of individuals of the species *Trigla cuculus* during the research period

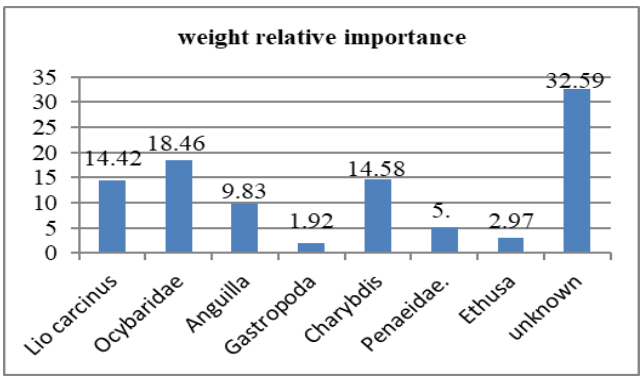

Figure (4): weight relative importance for individuals of the species *Trigla cuculus* during the research

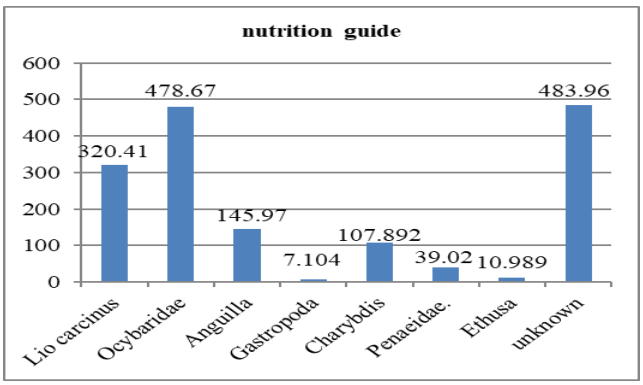

Figure (5): a nutritional guide for individuals of the species *Trigla cuculus* during the research period

T.acuculus fish is a carnivorous fish that feeds on deciduous crustaceans, fish, and mollusks *Gastropoda*. In terms of relative numerical importance, *Ocypode* crabs ranked first with 25.93%, followed by *Lio Carsinus* crabs by 22.22%, then *Anguilla* fish by 15.38% *Charybdis* sp. *Shrimp* with 7.40%, *E. mascarone* crabs, and *Gastropoda* mollusks with 3.70% (Fig. 3).

While in terms of weight relative importance, *Ocypode* carcinomas were also ranked first with a rate of 18.46%, then *Charybdis* sp. 14.85%, *Lio Carsinus* crabs 14.12%, *eels* 10.13%, *prawns* 5.21%, *E. mascarone* crabs 2.97%, and finally *Gastropoda* mollusks 1.92%. Figure (4).

The nutritional index gave the highest value in *Ocypode* crabs (478.67), followed by *Lio Carsinus* crabs (320.41), then *eels* (145.97), then *Charybdis* sp. With a percentage of (107.89), followed by chrysalis with a percentage of (39.02), then *E. mascarone* with a percentage of (10.99), and finally *Gastropoda* mollusks with a percentage of (7.10). Figure (5).

As for the unknown and unclassifiable elements, they gave relatively high values, their relative numerical importance was (14.85), the highest weighted relative importance was (32.59), the highest nutritional index was (482.96) and coincidence evidence (3.23).

Table (2) The relative importance of nutrients in *Trigla cuculus* fish in the marine waters of Lattakia Governorate during the research period according to (Hureau, 1970) and (Geistoderfer, 1975).

Analysis method	***Arrange of nutrients***	***Nature of nutrients***
(Hureau,1970)	***Favorite nutrients***	***Ocypode Lio carcinus***
	Secondary nutrients	***Charybdis sp. Penaeidae. Anguilla***
	Rare nutrients	***Gastropoda E.mascarone***
(Geistoderfer,1975)	**Favorite nutrients**	
	Secondary nutrients	
	Rare nutrients	***Lio carcinus Ocypode Charybdis sp. Penaeidae. Anguilla Gastropoda E.mascarone***

According to the coefficient [5], *Ocypode* and *Lio Carsinus* crabs were a preferred food for *T.cuculus* fish and *Charybdis* sp.
Shrimp and *eels* are secondary food, while *Gastropoda* and *E. mascarone* mollusks are also secondary foods.

Whereas, according to the coefficient of [6], all the aforementioned nutrients were considered scarce food. Table (2). These results are consistent with research conducted in the Mediterranean, where [7] found that crustaceans and fish constitute the main food of this species along the Catalan coast (northwest of the Mediterranean), while [8] studied the food of *T.cuculus*.

In the Swansea Bay of the North Atlantic Ocean and noting that *crustaceans* are the most important food, [9] investigated the dietary habits of *T. cuculus* in the eastern Mediterranean (Greece) where deciduous crustaceans dominated the diet

Also studied by [10] The food habits of *T. cuculus* fish in the northern Adriatic Mediterranean and showed that crustaceans are the preferred food for *T. cuculus* and that it specializes in feeding specifically on benthic invertebrates. And [11] examined the stomach contents of *T. cuculus* in the Mediterranean (Adriatic) and it was found that crustaceans, especially *Decapods*, represent the staple food for all sizes and age groups.

General stomach fullness factor:
The results showed that *T.cuculus* did not appear in fishing during the spring and summer seasons from May to August, while it appeared in the fall and winter seasons. This may be because the breeding period of the fish species is in the summer, or to the inefficiency of fishing, or the changes taking place in the Syrian coastal waters. The general fullness index gave the highest value in February (65.1).

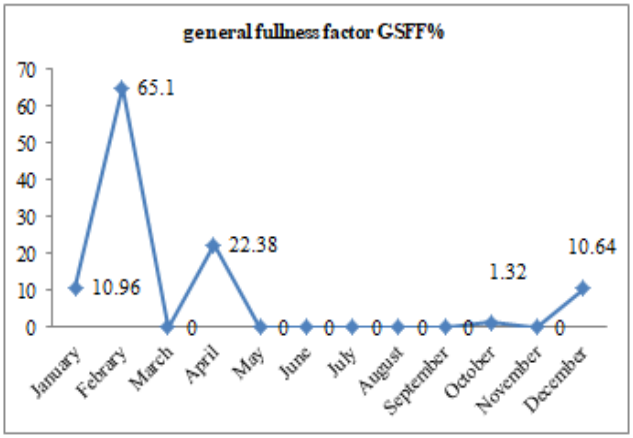

Figure (6): General stomach fullness factor for individuals of the species *Trigla cuculus* during the research period

Seasonal changes in *Trigla cuculus*:
T.cuculus fish appeared in three seasons of the year, autumn, winter, and spring. All nutrients were generally few and varied. Winter was the most diverse season of the year with the following percentages: *Ocypode* crabs 31%, *Lio carcinus* crabs 26%, *shrimp* 22% and fish Soybeans 17% and *E.mascarone* crabs 4%, while the autumn season was dominated by two food components equally: *Lio carcinus* crabs 50% and *Charybdis* sp.
50%, while in the spring, only two nutrients predominated, *Charybdis* sp. 50%
Shrimp 50%. As shown in figure (7).

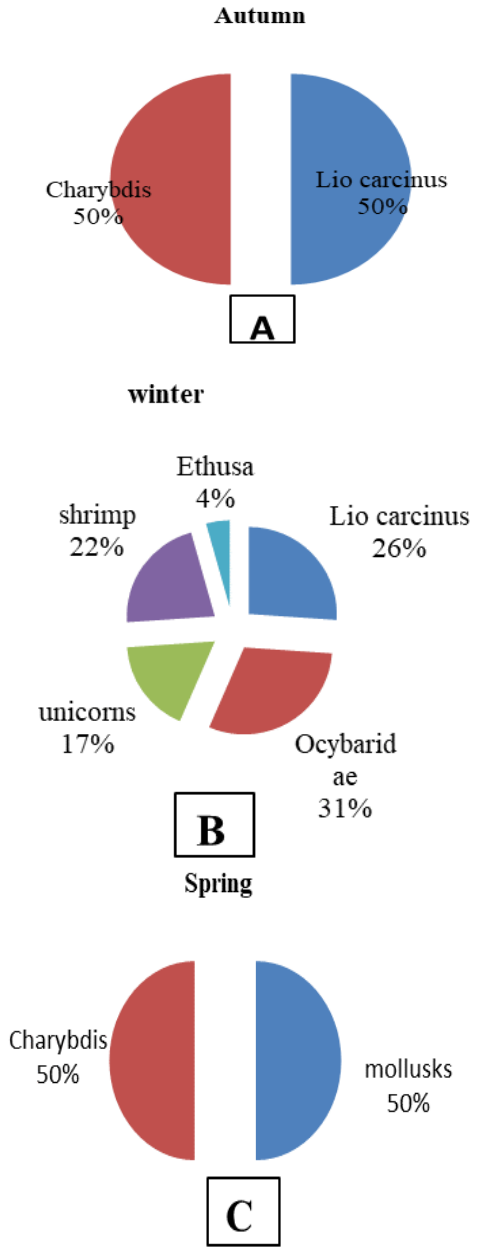

Figure (7): (A, B, C) Seasonal changes in *Trigla cuculus* during the research period.

Discussion:
- *T.cuculus* is a benthic species and is a carnivorous predator.
- The studied species feed on benthic and near-bottom invertebrates. The prey they feed on belonged to three main groups: *Crustacea*, fish, and *Gastropoda* mollusks.

● The food spectrum does not change in quality during the seasons, while it changes significantly in terms of quantity.

IV. CONCLUSION AND FUTURE SCOPE

● Follow-up of the biological study of *T.cuculus* in terms of age, growth, and reproduction.
● Better management of fishing and prevention of fishing by methods that cause disruption or collapse in the seabed ecosystems.

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AUTHORS PROFILE

R.H. Alshikh Rasheed, Doctoral student in Hydrobiology. Faculty of sciences -Tishreen university (Lattakia- Syria)
I published one article in the journal: Mediterranean marine science, and one article in Tishreen University Journal for Research and Scientific studies, they are also available online.
e-mail: rmrom92rm@gmail.com

Z.W.Alhosni, Doctor, Department of Zoology, Faculty of Sciences, Tishreen University, Lattakia, Syria.
e-mail: zinahalhosni@gmail.com

Z.A.Almajid, Professor, Department of Zoology, Faculty of Sciences, Tishreen University, Lattakia, Syria.
e-mail: zouher.almajid@gmail.com

