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FOOD AND FEEDING HABITS OF GURNARDS, *TRIGLA LUCERNA* Linnaeus, 1758 AND *TRIGLOPORUS LASTOVISA* (Brünnich, 1768) IN THE EGYPTIAN MEDITERRANEAN WATERS

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ABSTRACT

Stomach contents of the two gurnards, ***Trigla lucerna*** L. and ***Trigloporus lastovisa*** *(Brün.)* captured by bottom trawlers from the Egyptian Mediterranean waters during the period from October, 1994 to September, 1995 were analyzed. Small fishes and shrimps were the major food items in the diet of ***T. lucerna*** whereas small-sized crustaceans (shrimp and crab) were preferred by ***T. lastovisa***. The food composition and feeding intensity were subjected to seasonal changes. The feeding intensity was higher during February-April period for ***T. lucerna*** while it had no apparent trend for ***T. lastovisa***. Statistical analysis of trophic niche suggested no competition for food resources between the two species.

INTRODUCTION

Gurnards are marine demersal fishes, mainly captured by bottom trawlers and constitute a considerable portion representing 3.4-4.5% of their catches (Hashem, 1972; Rizkalla, 1992 and Faltas, 1993). In the present study, only four species, ***Trigla lucerna, Trigloporus lastovisa, Lepidotrigla cavillone*** and ***Aspitrigla obscura*** were found in the Egyptian Mediterranean waters, off

Alexandria constituting 26, 28, 37 & 9% of the total trigilids respectively. The two former species are the most commercially important species whereas ***L. cavillone*** is classified as a non economic trash fish, characterizing by small size and hard skeleton.

The literature pertaining to the food and feeding habits of these species has been cited by Nouvel (1950); Collignon & Aloncle (1960); Collignon (1968 & 1979); Fischer (1973); Azouz (1974); Hureau (1986) and Fischer ***et al.*** (1987).

The aim of the present work is to give information on the diet of these triglids as well as the variations of their diets according to season and fish size.

MATERIALS AND METHODS

Specimens of triglids were monthly sampled from the commercial catch of the trawlers at landing centers of Alexandria during the period from October, 1994 to September, 1995. A total of 272 ***T. lucerna*** and 225 ***T. lastovisa*** stomachs were examined. The total fish length varied from 12 to 28 cm for ***T. lucerna*** and from 11 to 24 cm for ***T. lastovisa***. At the laboratory, the total length and gutted weight were recorded. The stomachs were extracted and preserved in 5% formalin solution. The stomach contents were wet weighed and identified to their lowest possible taxon. The wet weight and the number of each food item were recorded.

According to Windell & Bowen (1978) for the quantitative analysis of the diets, the following indices have been used: Percentage frequency of occurrence 0% (Percentage of stomachs with a certain food item in relation to total number of non-empty stomachs examined); numerical abundance percentage N% (Percentage number of each food item in relation to total number of all food items) and gravimetric percentage G% (Percentage weight of each food item in relation to total weight of all food items).

The importance of each food item was judged by using the index of relative importance (IRI%) of the formula given by Rosecchi & Nouaze (1987) :

$$\mathbf{IRI\% = 100\ IRI / \sum_{1}^{n} IRI}$$

where IRI = O% (N% + G%)

Statistic (G) of Sokal & Rohlf (Crow, 1981) was used to test the differences in the proportions of prey species in the diets of the predators:

$$G = 2 \, sum_{ij} \, X_{ij} \ln \left(X_{ij} / \frac{X_i X_j}{N} \right)$$

where X_{ij} is the number of prey of i^{th} prey category eaten by predators in the j^{th} category, X_i is the total number of prey of i^{th} prey category eaten by all predators, X_j is the total number of prey eaten by predators in the j^{th} predatory category, and N is the total number of prey eaten by all predators, G is distributed as chi-square random variable with (R - 1) (C - 1) degrees of freedom.

Stomach fullness index (FI) is expressed as percentage weight of stomach content to the gutted weight of specimen (Berhaut, 1973).

RESULTS

- Food pattern

Table (1) shows that the food items of ***T. lucerna*** and ***T. lastovisa*** are quite different. Pisces and decapods (shrimps) constituted the main diet of the former species while for the latter, small crustaceans including mainly shrimps and crabs made mostly its diet.

For *T. lucerna* :

Pisces constituted the most important food item occurring in more than half of the stomachs examined and made about 60% of the food bulk by weight. Also it had higher relative importance index (62.5%). Small gobies and anchovies represented the main contributor of this food item. Other fish such as apodes, gurnards and cabrilla seabass were rarely encountered in the diet. The sizes of these prey varied from 5 to 7 cm, except the apodes (***Conger conger***) that reached 20 cm total length which was folded and swallowed.

Crustacea came next in importance, decapods (shrimp, mantis shrimp and small crab) were members of this category. Shrimps occurred in two fifths of the stomachs and comprised 36% of the total number representing 27% of all diet weight.The value of relative importance index of shrimps (33%) showed

Table (1):Occurrence percentage (O%), Numerical percentage (N%), Gravimetric percentage (G%) and Relative importance percentage (IRI%) of food items in the diet of ***T. lucerna*** & ***T. lastovisa***, captured from Egyptian Mediterranean off Alexandria.

Food items	*O%*	*N%*	*G%*	*IRI%*
T. lucerna (272 fish)				
A- Pisces	**52.32**	**38.26**	**59.54**	**62.48**
B- Crustacea	**53.64**	**58.33**	**39.88**	**37.46**
Decapoda				
Shrimp	43.05	35.98	26.58	32.88
Mantis shrimp	10.60	8.71	10.47	2.48
Crab	13.25	9.09	2.67	1.90
Megalopa	3.31	4.55	0.16	0.20
C- Mollusca	**4.64**	**2.66**	**0.45**	**0.06**
Cephalopoda	1.99	1.14	0.30	0.04
Lamellibranchiata	1.32	0.76	0.09	0.01
Gastropoda	1.32	0.76	0.06	0.01
D- Annelida	**0.66**	**0.76**	**0.03**	**0.01**
T. lastovisa (225 fish)				
A- Crustacea	**98.59**	**93.66**	**84.91**	**98.96**
Decapoda	(95.70)	(73.24)	(81.96)	(95.30)
Shrimp	56.34	40.85	52.99	77.25
Shrimp larvae	9.86	7.04	0.81	1.13
Crab	23.94	19.01	24.76	15.31
Megalopa	11.27	6.34	3.40	1.61
Amphipoda	15.49	9.86	1.92	2.66
Isopoda	7.04	8.45	0.89	0.96
Ostracoda	1.41	1.41	0.07	0.03
Cladocera	1.41	0.70	0.07	0.01
B- Mollusca	**4.23**	**2.11**	**10.35**	**0.48**
Cephalopoda	2.82	1.41	10.05	0.47
Lamellibranchiata	1.41	0.70	0.30	0.01
C- Annelida	**4.23**	**4.23**	**4.73**	**0.56**

that it was situated in the second rank of importance in the diet of ***T. lucerna***. The main identified shrimps were ***Trachypenaeus curvirostris*** and ***Parapenaeus longirostris***. Red Sea mantis shrimp (***Oratosquilla massavensis***) and crabs constituted another important crustacean food items. Each occurred in more than 10% of stomachs examined making up about 9% of the total number and 10.5% & 2.5% of the bulk food weight respectively. Megalopa larvae were rarely found (3%) representing a negligible gravimetric percentage (0.16%) and relative importance index (0.2%).

Mollusca included cephalopods, bivalves and gastropods, they were of minor importance. Each occurred in less than 2% of stomachs examined and their relative importance indices had insignificant percentages (0.01-0.04%). Also, Annelida contributed a negligible portion of stomach content (IRI= 0.01%).

For *T. lastovisa*

They mainly fed on small-sized crustaceans with shrimp and crab which were the most important food items. These two items made up more than 75% of the total food weight consumed and had relative importance indices of 77 & 15% respectively. Shrimp that could be identified was ***Lysmata seticaudata***. Other crustaceans such as amphipods and isopods were found in about 15 & 7% of stomachs examined comprising by number 10 & 8% of food items respectively. Ostracods and cladocerans were very marginal in the diet.

Each of cephalopods and annelids accounted for 10 & 5% of food by weight respectively, although they had minor relative importance indices of about 0.5%.

It would appear that the food items eaten by the two species are qualitatively differentiated as indicated from the high significant difference in their stomach contents ($G= 203.72$, $df= 13$, $P<0.005$). Food items, fish ($G=86.95$), amphipods ($G= 29.40$), isopods ($G= 25.20$), shrimp larvae ($G=21.00$) and mantis shrimp ($G= 19.79$) were the source of that difference.

- Seasonal variation of food patterns

Table (2) shows seasonal variation in the composition of the diet. ***T. lucerna*** fed exclusively on fish during spring and summer where they were found in

Table (2): Seasonal variation of food items in the diet of *T. lucerna* & *T. lastovisa* (O% = Occurrence ~~percentage~~, N% = Numerical percentage, G% = Gravimetric percentage, IRI% = Relative importance percentage) in Egyptian Mediterranean off Alexandria .

Food item	Autumn				Winter				Spring				Summer			
	O%	N%	G%	IRI%	O%	N%	G%	IRI%	O%	N%	G%	IRI%	O%	N%	G%	IRI%
T. lucerna																
A- Pisces	**42.86**	**27.78**	**27.96**	**28.31**	**44.12**	**35.48**	**47.74**	**31.73**	**67.65**	**48.44**	**72.36**	**75.13**	**54.17**	**42.42**	**77.63**	**78.34**
B- Crustacea	**57.14**	**66.67**	**71.42**	**71.49**	**79.41**	**61.29**	**51.98**	**68.18**	**67.65**	**51.56**	**27.65**	**24.87**	**52.08**	**53.02**	**20.41**	**21.17**
Decapoda																
Shrimp	48.57	52.78	63.88	67.13	76.47	51.61	50.26	67.31	17.65	12.50	0.82	2.16	33.33	25.75	16.43	16.94
Mantis shrimp	5.71	2.78	1.43	0.28					41.18	32.81	24.82	21.82				
Crab	20.00	11.11	6.11	4.08	8.82	9.68	1.72	0.87	11.76	6.25	2.01	0.89	12.50	9.09	2.95	1.82
Megalopa													10.42	18.18	1.03	2.41
C- Mollusca	**5.71**	**2.78**	**0.50**	**0.11**	**5.88**	**3.22**	**0.28**	**0.08**					**6.25**	**4.55**	**1.96**	**0.49**
Cephalopoda													6.25	4.55	1.96	0.49
Lamellibranchiata	2.86	1.39	0.47	0.06	2.94	1.61	0.08	0.04								
Gastropoda	2.86	1.39	0.03	0.05	2.94	1.61	0.20	0.04								
D- Annelida	**2.86**	**2.78**	**0.13**	**0.09**												
T. lastovisa																
A- Crustacea	**100.00**	**95.66**	**98.34**	**99.62**	**100.00**	**96.66**	**99.76**	**99.85**	**100.00**	**100.00**	**100.00**	**100.00**	**92.86**	**70.84**	**47.07**	**76.07**
Decapoda	100.00	86.96	94.17	97.99	90.48	83.33	98.27	97.94	100.00	64.61	93.37	83.42	92.86	70.84	47.07	76.07
Shrimp	58.82	47.83	53.33	64.25	76.19	66.67	67.99	92.46	47.37	29.23	54.22	60.99	35.71	33.33	35.90	49.90
Shrimp larvae	5.88	4.35	0.42	0.30					10.53	7.69	0.90	1.39	28.57	16.67	1.86	10.68
Crab	41.18	34.78	40.42	33.44	14.29	13.33	27.05	5.20	15.79	16.92	28.61	11.09	28.57	16.67	9.04	14.84
Megalopa					4.76	3.33	3.23	0.28	31.58	10.77	9.64	9.95	7.14	4.17	0.27	0.65
Amphipoda	11.76	8.70	4.17	1.63	14.29	13.33	1.49	1.91	31.58	12.31	2.42	7.17				
Isopoda									26.32	18.46	3.61	8.98				
Ostracoda									5.26	3.08	0.30	0.28				
Cladocera									5.26	1.54	0.30	0.15				
B- Mollusca	**5.88**	**4.35**	**1.67**	**0.38**	**4.76**	**3.33**	**0.25**	**0.15**					**7.14**	**4.17**	**35.90**	**5.77**
Cephalopoda					4.76	3.33	0.25	0.15					7.14	4.17	35.90	5.77
Lamellibranchiata	5.88	4.35	1.67	0.38												
C- Annelida													**21.43**	**25.00**	**17.02**	**18.17**

more than half of the stomachs examined representing over 70% of the food by weight having IRI >75%. On the contrary, they intensively fed on shrimp in autumn and winter having the same relative importance (67%).

On the other hand, ***T. lastovisa*** consumed mostly shrimp in winter (IRI= 92%) compared with summer (IRI= 50%). Crabs were less occurred in food in winter (14%) having low relative importance of 5% compared with autumn (33%). The spring season was characterized by relatively increasing importance of amphipods (IRI= 7%) and isopods (IRI= 9%) in the diet of this species.

Concerning the seasonality of food pattern, it was found that there was a strong seasonality in the abundance of food items for the two species (G=132.40, df=24, P<0.005 for ***T. lucerna*** and G=80.30, df=30, P<0.005 for ***T. lastovisa***). For ***T. lucerna***, the differences arose from food items, mantis shrimp (G=51.08) and megalopa (G=33.28), which were only represented in spring & autumn for the first item and in summer for the second item respectively. While in case of ***T. lastovisa***, the difference arose from Isopoda (G=18.77) which was only represented in spring. Separate tests showed only homogeneous food patterns in autumn and winter for both species (G=5.68, df=6, P>0.05 for ***T. lucerna*** and G=6.25, df=6, P>0.05 for ***T. lastovisa***).

- Food variation with fish length

The specimens were divided into three size groups for ***T. lucerna*** and two size groups for ***T. lastovisa***. From Fig. (1), small fish (< 15 cm) and large ones (≥20 cm) of ***T. lucerna*** fed widely on fish (IRI= 73 - 75%) and to less extent on shrimp (IRI=13 - 19%), followed by mantis shrimp (IRI= 5-6%). While medium fish size (15-19 cm) fed rather equally on fish (IRI=48%) and shrimp (IRI= 49%).

On the other hand, small fish of ***T. lastovisa*** (<15 cm) fed mainly on shrimp (IRI=93.7%) beside crab (IRI=5.9%). While large fish (≥15 cm) had wide trophic niche feeding mainly on shrimp (IRI= 76%) in addition to crab (IRI= 12%) and Amphipoda (IRI=5%).

Testing the differences among different size groups showed significant differences among them (G=44.02, df=16, P<0.005 for ***T. lucerna*** & G= 30.60, df= 10, P< 0.005 for ***T. lastovisa***). Megalopa in the diet of ***T. lucerna*** was the

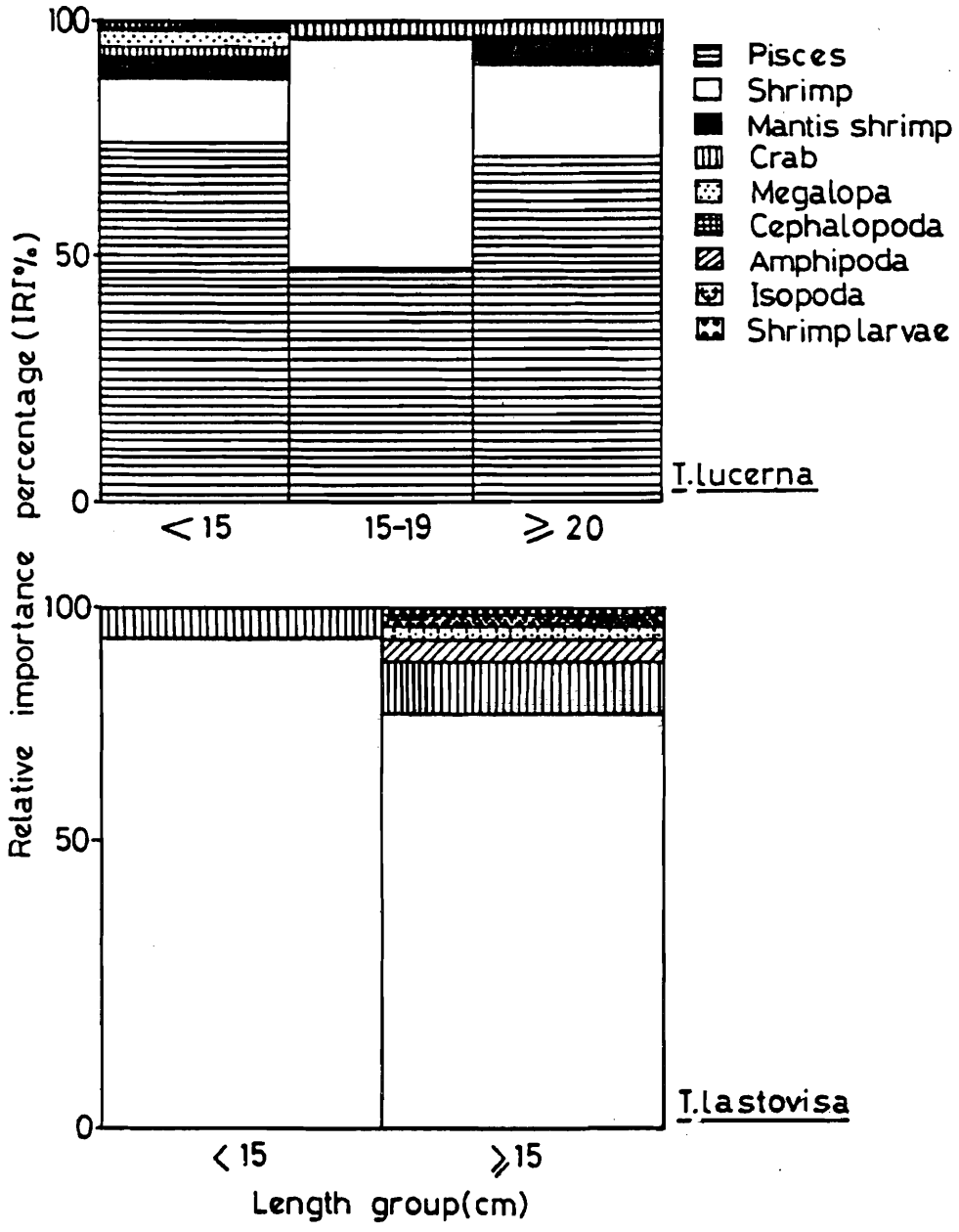

Fig. (1): Variation of food items in the diet of *T. lucerna* & *T. lastovisa* according to fish size. (Food item sharing IRI < 1% not included)

source of difference (G= 16.80) and it was over represented in smaller fish sizes. Amphipoda (G=5.42) and Isopoda (G=4.64) were also another source of difference in ***T. latovisa's*** diet. A separate analysis of food items for medium and large fish sizes of ***T. lucerna*** showed smaller significant difference with respect to size among these fishes (G= 19.92, df= 8, P<0.05), but larger significant differences were existed between small and both medium (G= 23.80, df= 8, P<0.005) & large fish (G= 19.44, df= 6, P<0.005).

- Feeding intensity

It was represented by fullness index (FI). Fullness index of ***T. lucerna*** began to increase from 1.25 in December and reached higher values during the period from February to April climaxing in March (FI= 7.35), thereafter it tended to decrease in the following months recording minimum values in September (0.63) & October (0.75). While for ***T. lastovisa***, there was no apparent trend in stomach fullness with time of year, it had values ranging from 0.02 in January to 0.95 in June (Fig. 2).

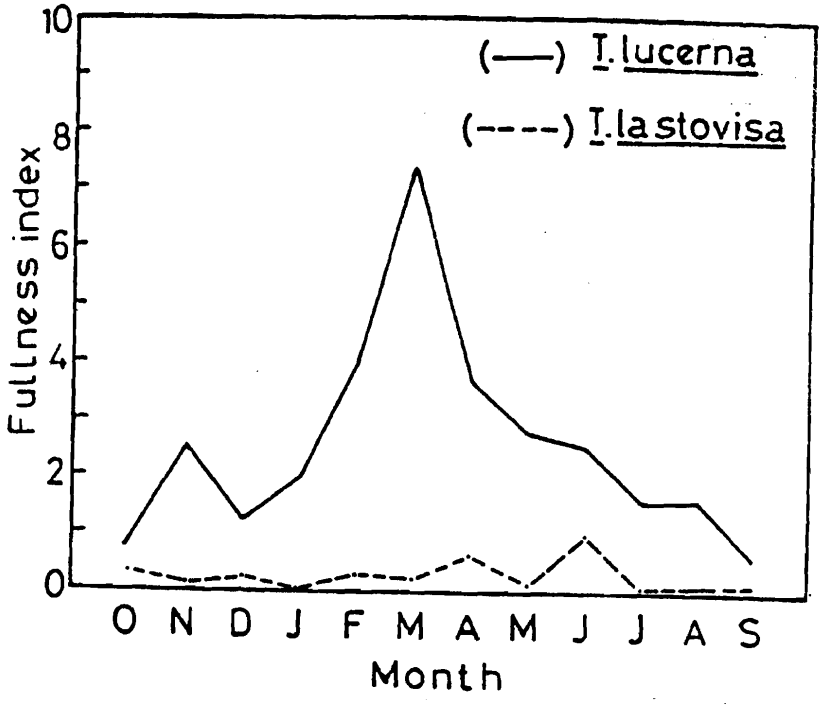

Fig. (2): Monthly variation in the fullness index for *T. lucerna* & *T. lastovisa.*

DISCUSSION

The present study reveals that ***T. lucerna*** and ***T. lastovisa*** are macrophagic and microphagic carnivores respectively . Triglids feed on the bottom or slightly above using free pectoral rays for searching food (Hureau, 1986).

Stomach contents of the two species under consideration mainly include Pisces & shrimps for ***T. lucerna*** and small crustaceans for ***T. lastovisa***. Such food items have been reported by previous workers on the same species (Fischer, 1973; Azouz, 1974; Hureau, 1986 and Fischer ***et al.***, 1987). Azouz (1974) mentioned that Pisces in addition to crustaceans were included in the diet of ***T. lastovisa*** in the Tunisian Mediterranean waters. Collignon & Aloncle (1960) and Collignon (1968 & 1979) found benthic crustaceans (shrimps & crabs) occupied superior position and importance in the diet of ***T. lucerna*** from the Moroccan Mediterranean waters adding that Pisces constituted one fifth of the total food items by number but in the present study Pisces formed two fifths of food items which occupied most important food item in accordance of relative importance index (62%) as compared to crustaceans (37%). Also Collignon and Aloncle (1960) reported that amphipods had important part representing about 50% of the total number of food items and no Mollusca was found in the diet of ***T. lucerna*** from Moroccan waters. The reverse was the case for ***T. lucerna*** in the present study where Amphipoda was absolutely lacking and Mollusca was rarely found in its diet. These variabilities may be attributed to the different abundance of these prey in various habitats (Nikolsky, 1963).

There is no doubt that seasonal variations in the composition of the food organisms and their availability have a great influence on the diet composition. In the present work, ***T. lucerna*** fed exclusively on Pisces (gobies & anchovy) during spring & summer as these species dominated the catch (Al-Kholy & El-Wakeel, 1975 and Faltas, 1983) and shrimp (***T. curvirostris*** & ***P. longirostris***) in autumn & winter where they were prevailed (Al-Kholy & El-Wakeel, 1975). While ***T. lastovisa*** fed mostly on shrimp throughout the year.

In the present study, the food pattern of triglids shows apparent difference among various size groups. This finding agrees with that given by Nikolsky (1963) who mentioned that changes in food selectivity were observed among

fishes having different size ranges. This fish size differentiation in exploitation degree of a range of food resources is of immense advantage in the reduction of intra-specific competition in the population (Nwadiaro & Okorie, 1987). The change in the diet associated with increase in fish size has been reported for ***T. lucerna*** in Moroccan Mediterranean (Collignon, 1968) who found excess cephalopods in the diet of fishes having lengths greater than 22 cm.

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