

FOOD OF TWO ENGRAULIDS *THRYSSEA DUSSUMIERI* AND *T. VITRIROSTRIS*

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ABSTRACT

Feeding biology of *Thryssa dussumieri* and *T. vitrirostris* was studied for a period of one year (October, 1976 to September, 1977). *T. dussumieri* and *T. vitrirostris* are found to be carnivores with a preference for planktonic crustaceans in Parangipettai coastal waters. Polychaetes, molluscan larvae and juveniles of fish formed the supplementary food. Juveniles of both the species showed preference for *Lucifer* spp. and the adults mostly for *Acetes* spp., *Lucifer* spp., prawns, amphipod and crab larvae. No variation could be seen in the food of males and females in both the species. No seasonal variation in the food of adults of both species could also be noted. Percentage frequency of occurrence of 'actively fed' stomachs showed an inverse relationship with gonadosomatic index and relative condition factor whereas empty stomachs showed a direct relationship with gonadosomatic index and relative condition factor. Feeding intensities in both the species were less during the peak breeding season, but were more during rest of the period particularly just after the spawning. Well developed gill rakers and the presence of minute teeth on vomer and palatines indicate that these two species are adapted to feed mainly on planktonic organisms.

INTRODUCTION

THE DISTRIBUTION, occurrence and abundance of fish mainly depends on the availability of food. Gut content analysis and features of the alimentary system provide information on food, feeding habits and selective feeding, if any, in fishes. Studies on the food and feeding habits in glassnoses of India are those on *Thrissocles mystax* (= *Thryssa mystax*) from Calicut waters by Venkataraman (1956) and on *T. malabarica* off Bombay by Suseelan and Nair (1969). Other records are mostly casual observations on few specimens.

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MATERIAL AND METHODS

Random samples were collected twice a week, for a period of one year from October 1976 to September 1977 from commercial catches brought to the fish landing centre at Porto Novo. A total number of 1052 specimens of *T. dussumieri* (males — 356; females — 572; juveniles — 124) and 1187 specimens of *T. vitrirostris* (males — 482; females — 547; juveniles — 158) were examined. For each specimen the total length, sex, maturity stages and weight were noted in fresh condition. Feeding intensity was noted before opening the stomach. Percentage frequency of 'actively fed', 'moderately fed', 'poorly fed' and 'empty' stomachs were calculated from the total number of fishes examined in a month. Food items were identified upto the generic level wherever possible.

Though several methods have been followed by earlier workers to study the food of fishes, the 'Index of Preponderance' method (Natarajan and Jhingran, 1961) was followed presently, taking into consideration both the occurrence as well as the bulk of the food items. Volume of each food item was measured by displacement method.

RESULTS

Seasonal variation in food

Acetes spp. and *Lucifer* spp. formed the major food items for *T. dussumieri*, during most of the months (Table 1). *Acetes* spp. were consumed in larger amounts during all months except in February, July and August, when *Lucifer* spp. were predominant. Apparently, *Acetes* spp. formed the main bulk of food for *T. dussumieri* and when these items were scarce, *Lucifer* spp. were consumed. In addition, prawns, amphipods, crab larvae, mysids, copepods and veligers were also found in appreciable quantities. The larval forms of bivalves were seen only during February-September in meagre quantities, polychaetes in October, November and February, fishes in January and February and cumaceans only in January, as traces.

Acetes spp., *Lucifer* spp., prawns, amphipods, crab larvae, alima, prawn larvae, mysids and copepods were found to occur in the stomachs of *T. vitirostris* during all the months of the year (Table 2). Ostracods were recorded in lesser amounts during October, February, April and from June to September. Isopods occurred only in November. Among the molluscs, gastropod veligers were found in meagre quantities during all the months except in October, February and June. Bivalve veligers were represented only in August. Juveniles of fishes were found to be supplementary food items in November, January and February.

TABLE 1. Percentage index of food of *T. dussumieri*

Food items	October	November	December	January	February	March	April	May	June	July	August	September
Crustaceans												
<i>Acetes</i> spp.	37.37	48.32	83.15	72.51	15.25	75.02	73.57	49.54	38.80	27.46	7.62	54.48
<i>Lucifer</i> spp.	5.08	0.39	9.86	13.61	76.09	13.75	23.05	20.43	42.14	59.41	84.20	26.70
Prawns	14.04	19.33	0.65	0.03	0.13	3.42	0.51	18.51	10.50	7.38	0.30	16.46
Amphipods	23.26	27.53	0.99	3.76	4.39	1.44	0.15	4.72	1.47	1.83	2.20	0.10
Crab larvae	1.38	2.80	0.55	2.90	1.09	0.94	0.46	1.61	2.90	0.99	0.11	0.02
Alima	14.57	1.34	1.25	—	0.55	0.04	0.12	1.16	3.14	0.82	0.48	1.41
Mysids	2.64	—	0.01	4.28	—	—	0.02	1.60	0.08	0.04	0.06	0.19
Copepods	—	—	1.25	1.87	1.74	4.66	1.88	1.97	0.08	1.73	3.91	0.20
Prawn larvae	1.26	—	1.95	0.18	—	0.26	—	0.02	—	—	0.03	—
Ostracods	—	0.05	0.31	0.09	0.47	—	0.08	0.07	—	—	—	—
Cumaceans	—	—	—	0.07	—	—	—	—	—	0.05	—	—
Molluscs	—	—	—	—	—	—	—	—	—	—	—	—
Gastropod veligers	0.32	0.04	—	0.03	0.08	0.17	0.05	0.02	0.29	0.02	0.06	0.06
Bivalve veligers	—	—	—	—	0.05	0.27	0.11	0.35	0.60	0.28	1.03	0.07
Polychaetes	0.08	0.19	—	—	0.03	—	—	—	—	—	—	—
Fishes	—	—	—	0.63	0.13	—	—	—	—	—	—	—
Diatoms	—	0.01	0.03	0.04	—	0.03	—	—	—	—	—	—

TABLE 2. Percentage index of food of *T. vitreostriis*

Food items	October	November	December	January	February	March	April	May	June	July	August	September
Crustaceans	18.26	68.23	74.74	89.95	73.36	54.07	58.27	80.34	80.60	89.72	27.62	46.53
<i>Acetes</i> spp.	38.81	20.97	19.28	3.60	8.99	22.25	27.46	10.91	14.50	4.30	39.78	34.32
<i>Lucifer</i> spp.	6.15	3.60	4.33	4.44	9.28	7.68	10.83	7.94	4.15	5.23	24.30	5.58
Prawns	35.76	4.88	0.20	2.24	2.95	0.53	0.89	0.04	0.17	0.08	2.95	12.00
Amphipods	0.31	1.36	0.07	2.57	1.81	10.72	0.40	0.10	0.22	0.07	0.90	0.95
Crab larvae	0.01	0.14	0.06	0.15	1.52	0.06	0.08	0.15	0.04	0.04	0.16	0.35
Alima	—	0.57	1.00	0.71	1.50	2.76	0.98	0.10	0.02	0.22	3.52	0.13
Copepods	0.08	0.04	0.04	0.04	0.10	0.76	0.51	0.22	0.08	0.22	0.33	0.11
Prawn larvae	0.08	0.07	0.26	0.05	—	1.09	0.15	0.15	0.15	0.10	0.05	—
Mysids	0.54	—	—	—	0.17	—	0.18	—	0.07	0.01	0.02	0.02
Ostracods	—	0.03	—	—	—	—	—	—	—	—	—	—
Isopods	—	—	—	—	—	—	—	—	—	—	—	—
Molluscs	—	0.01	0.02	0.13	—	0.03	0.25	0.05	—	0.01	0.22	0.01
Gastropod veligers	—	—	—	—	—	—	—	—	—	—	0.15	—
Bivalve veligers	—	—	—	0.05	0.26	0.05	—	—	—	—	—	—
Polychaetes	—	0.03	—	0.06	0.01	—	—	—	—	—	—	—
Fishes	—	0.07	—	0.01	0.05	—	—	—	—	—	—	—
Diatoms	—	—	—	—	—	—	—	—	—	—	—	—

Variations between the food of juveniles and adults

It is apparent from Table 3 that juveniles of *T. dussumieri* mainly feed on *Lucifer* spp. though other crustaceans like *Acetes* spp., amphipods, copepods, crab larvae and alima also constituted their food. The diatom, *Coscinodiscus* spp., prawn larvae, and veligers of bivalves and gastropods were also encountered in stomachs in meagre quantities. No

TABLE 3. Percentage index of food of juveniles, male and females of *T. dussumieri*

Food items	Juvenile	Male	Female
Crustaceans			
<i>Acetes</i> spp.	1.76	39.00	58.17
<i>Lucifer</i> spp.	78.77	38.84	23.61
Prawns	0.17	7.67	7.54
Amphipods	3.35	9.44	4.57
Crab larvae	2.75	1.19	1.44
Alima	5.26	0.87	1.09
Mysids	0.03	0.77	0.72
Copepods	5.67	1.45	1.75
Prawn larvae	1.32	0.37	0.29
Ostracods	0.04	0.08	0.13
Cumaceans	—	0.01	—
Molluscs			
Gastropod veligers	0.38	0.08	0.12
Bivalve veligers	0.50	0.22	0.25
Polychaetes	—	—	0.20
Fishes	—	—	0.12
Diatoms	—	0.01	—

variation in the food of males and females could be noted. Among crustaceans, *Acetes* spp., *Lucifer* spp., prawns, amphipods and mysids formed the major food items. Other crustaceans, copepods, ostracods, cumaceans and larval forms of crabs, prawns and stomatopods, gastropods and bivalves were also recorded. Polychaetes and fishes were also found occasionally.

Obviously, the juveniles prey mainly on *Lucifer* spp. while the adult fishes seem to

prefer *Acetes* spp., though *Lucifer* spp., prawns, amphipods and crab larvae were also taken. Polychaetes and fishes were taken in lesser quantities by the adults.

Juveniles of *T. vitrirostris* were found to feed exclusively on *Lucifer* spp. (Table 4). Other crustaceans encountered include *Acetes* spp., prawns, copepods and amphipods. Crab larvae and mysids were represented in meagre quantities. No significant variation in the food

TABLE 4. Percentage index of food of juveniles, males and females of *T. vitrirostris*

Food items	Juvenile	Male	Female
Crustaceans			
<i>Acetes</i> spp.	14.12	64.09	62.85
<i>Lucifer</i> spp.	54.22	20.92	19.93
Prawns	1.73	8.24	6.68
Amphipods	11.86	2.00	8.44
Crab larvae	0.14	2.42	0.80
Alima	—	0.35	0.11
Copepods	9.54	1.22	0.68
Prawn larvae	—	0.22	0.20
Mysids	8.39	0.23	0.12
Ostracods	—	0.12	0.04
Isopods	—	0.01	—
Molluscs			
Gastropod veligers	—	0.05	0.07
Bivalve veligers	—	0.02	—
Polychaetes	—	0.09	0.06
Fishes	—	0.01	0.02
Diatoms	—	0.01	—

of males and females could be seen. Crustaceans formed the major food items, *Acetes* spp., and *Lucifer* spp. forming the main bulk. Prawns, amphipods and crab larvae were preferred next. Other crustaceans, alima, copepods, prawn larvae, mysids, ostracods and isopods were found only as supplementary items. Molluscan veligers, polychaetes and fishes were recorded in lesser quantities.

Evidently the juveniles prefer *Lucifer* spp., as their staple food, while adults feed on *Acetes*

spp. *Lucifer* spp., prawns, amphipods, crab larvae and copepods. Adult specimens, in addition, feed on polychaetes, molluscan larvae and fishes.

Feeding intensity

a. *Feeding intensity in relation to breeding cycle*: The percentage frequency feeding intensity is shown in Fig. 1 a for *T. dussumieri*. The percentage occurrence of 'actively fed' stomachs and 'moderately fed' stomachs were found to be more from October to January when more of immature and, spent and recovering individuals were found in the samples. Percentage occurrence of 'poorly fed' and 'empty' stomachs were found to be high from February to August when mature fishes were mostly collected. The minimum percentage of occurrence of 'actively fed' and 'moderately fed' stomachs were noted in June and July, the peak spawning period for this species. Spent specimens were available more in August and September when the feeding intensity was also found to be more. Though 'empty' stomachs were recorded during all the months, many such cases were found in June and July coinciding with the peak spawning period.

The percentage frequency of feeding intensity for *T. vitrirostris* is shown in Fig. 1 b. Percentage occurrence of 'actively fed' and 'moderately fed' stomachs were found to be more from October to January when immature and spent recovering specimens occurred more in the samples. Decrease in feeding intensity was associated with the occurrence of mature and ripe gonads. Similarly, a gradual increase in the number of specimens, with 'actively fed' and 'moderately fed' stomachs, from July onwards, was recorded when spent specimens started feeding voraciously and actively, after spawning. Eventhough empty stomach occurred in every month of the year, their percentage frequency was found to be more during the breeding season (maximum from April to June).

b. Relationship between feeding intensity, gonadosomatic index and relative condition factors ('Kn'): The indices revealed some

somatic index and relative condition factor. Such relationships were more pronounced during the peak spawning period.

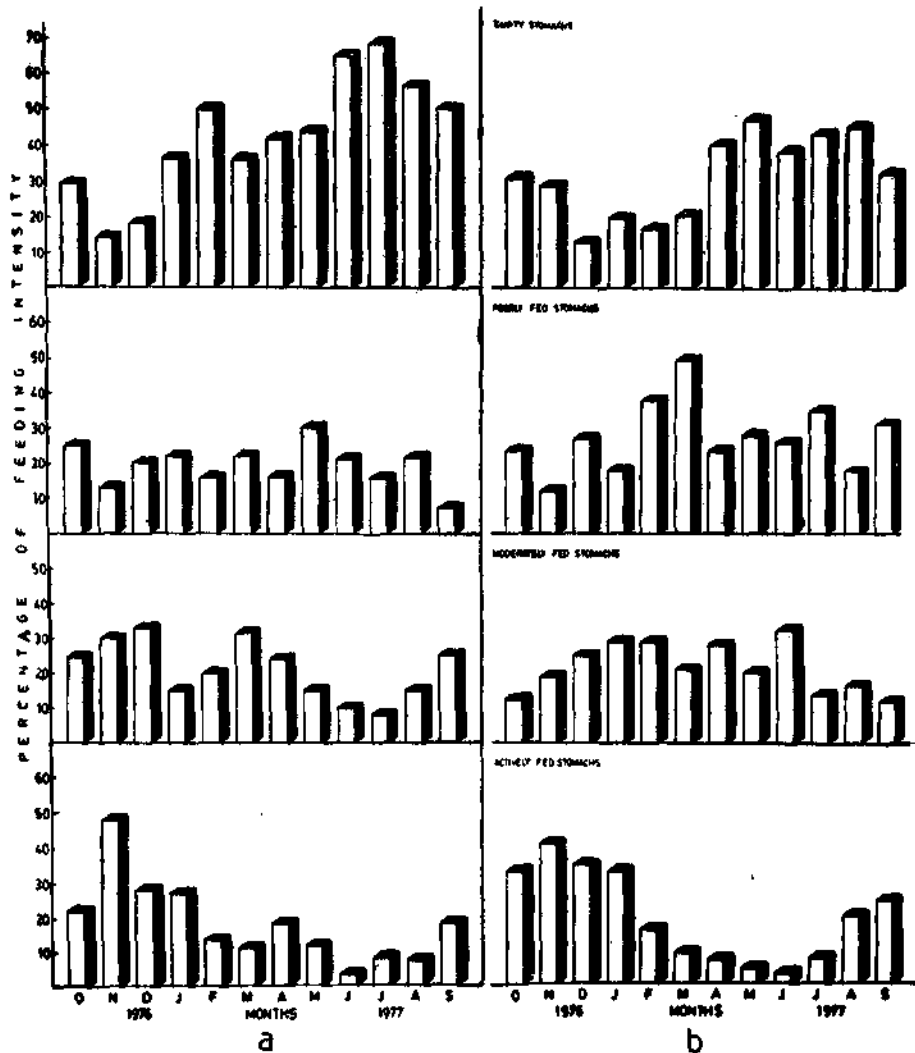


FIG. 1. The percentage frequency of feeding intensity for a. *T. dussumieri* and b. *T. vitirostris*

interesting relationships (Fig. 2). The rise and fall in gonadosomatic index was followed by a similar trend in relative condition factor and percentage of 'empty' stomachs, indicating positive correlations between them. The percentage frequency of 'actively fed' stomachs showed an inverse relationship with gonado-

Feeding habits

Both species were found to feed on a variety of organisms and selectivity in food should be noticed because of the frequent occurrence of these food items. Teeth on pharyngeal bones are well developed and serve as efficient masticatory organs due to which the appendages of

the food items were found missing sometimes in the gut contents.

DISCUSSION

From the above observations it can be stated that both species are carnivorous, feeding mainly on planktonic crustaceans. Adults

Differences in feeding habits of juveniles and adults were noted in both the species. *Lucifer* spp. were recorded from the stomachs of juveniles and *Acetes* spp., *Lucifer* spp., prawns, amphipods and crab larvae, from those of the adults. Such differences were also observed by Venkataraman (1956) in *Thrissocles mystax* where the juveniles showed a marked preference for *Lucifer* spp., *Acetes* spp., larval

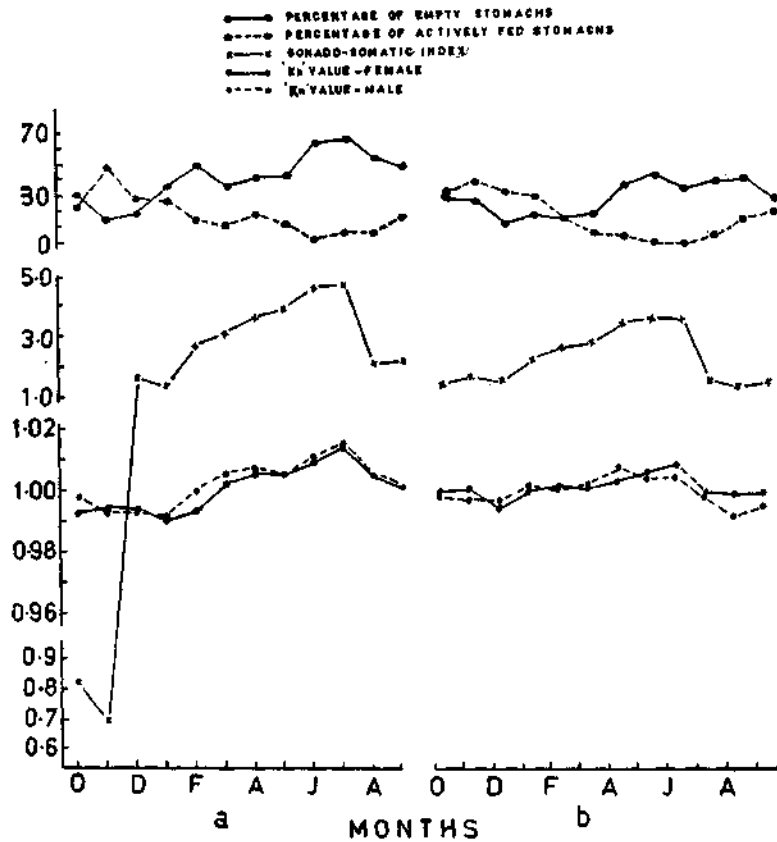


FIG. 2. Relationship between feeding intensity and gonadosomatic index in: a. *T. dussumieri* and b. *T. vitirostris*.

prefer polychaetes, molluscan larvae and juvenile fishes as supplementary food items. Similar carnivorous habit, with crustaceans forming the major food item, has been observed in all the engraulids investigated so far in Indian waters.

penaeids and fish larvae while adult specimens preferred prawns, fish and polychaetes. Similar observations were made also by Bapat and Bal (1950) in *T. hamiltonii* and *A. commersonii* and by Marichamy (1972) in *T. baelama* in Indian waters.

The frequency of occurrence of empty stomachs suggest that enormously bulged ripe ovaries may exert pressure on the walls of the stomach so as to induce 'empty' or 'poorly fed' conditions as explained by Thomas (1969). Similarly, 'actively fed' and 'moderately fed' stomachs appear in good percentages when, immature, spent and recovering specimens occur commonly.

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