FOOD AND FEEDING HABITS OF THE SHORT-JAW ANCHOVY, *THRISSINA BAELAMA* (FORSKAL), OF THE ANDAMAN SEA

R. MARICHAMY[1]

Central Marine Fisheries Research Institute; Unit, Port Blair, Andamans

ABSTRACT

Like many other anchovies *T. baelama* feeds mostly on large zooplanktonic organisms. Euphausiids were the most important item of food supplemented by copepods, megalopae, prawns and amphipods. These major items in the diet of the fish did not differ significantly from year to year although the relative importance of particular item may vary slightly between different months.

The smaller fish appeared to prefer smaller organisms like veligers, zoeae, *Oithona, Pseudodiaptomus* etc. while the adults preferred euphausiids, megalopae, prawns, amphipods and fish larvae.

The variations in the composition of the gut contents and feeding intensity are discussed in relation to environmental biota, size-groups and maturity of the fish.

INTRODUCTION

The anchovies constitute an important fishery in the inshore waters of Andaman Islands of which *Thrissina baelama* (Forskal) is the most important. Sadasivan (1953) while giving a brief account on the biology of this species has stressed the need for an intensive observation to obtain a fuller and satisfactory picture. The present account deals with the food and feeding habits of this species.

The food and feeding habits of anchovies and allied species have been widely studied. Bapat and Bal (1950) have made a comprehensive study on the food of some young clupeids including *Thrissocles kammalensis, T. hamiltonii, T. purava, T. dussumieri, Anchoviella commersonii* and *A. tri.* Mookerjee and Mookerjee (1950) have described the carnivorous feeding habits of *Engraulis hamiltonii.* Jones and Menon (1951) have studied the nutrition of

1. Present address: Central Marine Fisheries Research Institute; Sub-station, Tuticorin.

the Gangetic anchovy, *Setipinna phasa*. The food and feeding habits of *Thrissocles mystax* has been studied by Venkataraman (1956) and Ganapathi and Rao (1962). Basheeruddin and Nayar (1962) have briefly mentioned about the food of *T. mystax* and *T. setirostris*.

Material and Methods

Weekly samples of *T. baelama* for this study were collected from the fish market, where the catches from different fish-landing centres are sold. Shore-seines and cast nets were the two common gears used along this coast. All the samples were combined for the purpose of the study irrespective of the gears employed. 1,022 specimens of size range 57-134 mm (TL) were examined during 1968-70. Data on size, sex and stage of sexual maturity were recorded for each fish. Identification of gut inclusions upto genus and sometimes upto species level was possible, depending upon the state of digestion. The percentage composition of the various items of the gut contents were analysed by the numerical method (Pillay, 1952). Since the food consisted of zooplanktonic organisms this method was found to be more convenient. The different food items were counted and its relative abundance expressed as percentage of the total number of items in the gut contents. The prevalence of each item of food among different size groups was calculated by the occurrence method (Hynes, 1950). In this method, the number of occurrences of all items was summed and scaled down to a percentage basis. The extent of feeding was determined by the degree of distension of the stomach and also the amount of food it contained, the stomach being graded as empty, trace, ¼ full, ½ full, ¾ full and full. The percentage occurrence of these different categories of stomach was calculated from the total number of fish examined in a month. The volume of the gut content was measured by displacement method using a graduated cylinder.

The study reveals that *T. baelama* feeds mostly on zooplankton. Euphausiids, mainly represented by *Pseudoeuphausia* sp., were the chief food, being consumed in considerable quantities throughout the period of investigation except April 1969. The average percentage for the period 1968-69 and 1969-70 worked out to 44.0% and 26.4% respectively (Table 1.).

Copepods constituted a fairly good portion of the diet throughout the year. The percentage composition of copepods varied between 3.1 and 65.1%. The following 10 genera of copepods were noticed in the stomachs of *T. baelama*, 1. *Pontella*, 2. *Labidocera*, 3. *Pseudodiaptomus*, 4. *Temora*, 5. *Calanus*, 6. *Tortanus*, 7. *Corycaeus*, 8. *Oithona*, 9. *Anamalocera* and 10. *Sapphirina*. Of these the first three items were very common in the diet of the fish.

Prawns and shrimps occurred in the food in most of the months in small percentages, but were abundant during May and August 1968. *Acetes* spp.

were more common than *Penaeus indicus*. Amphipods occupied a secondary place, in November 1968.

A variety of larval forms represented by cypris, zoea, megalopa, veligers, alima and fish larvae were frequently observed in the stomach contents, of which megalopa were found in the guts almost throughout the year and occupied the first rank in the diet composition during November 1968 and March 1969.

VARIATIONS IN THE FOOD

The mean percentage composition of some important food items revealed that euphausiids (26.4-44.0%) were the most prevalent in the diet, the others in the order of importance being *Pontella* spp., (10.4-17.3%) megalopa, (9.1-13.4%) *Pseudodiaptomus* spp., (6.1-11.4%) and *Labidocera* spp., (2.1-6.4%).

The fluctuations in the percentage composition of the essential food items such as euphausiids, copepods, megalopae, prawns and amphipods have shown some similarities in the two years (Table 1).

Whenever the euphausiids formed the main bulk of food the other common items such as copepods, megalopae and prawns showed a decrease. Similarly, when the copepods constituted the chief diet, a fall in the percentage composition of the other forms was seen. It is probable that these fluctuations may be due to changes in the availability of the various organisms in a particular environment.

Cypris was present in the stomach contents during most of the months. It was maximum in April 1969 while in the corresponding month of the previous year it was absent. It appeared from the data that this item although represented in minor quantities was the one that was preferred by the fish almost throughout the year. Veligers were noticed in minor quantities in the food but more common during 1968-69 than in succeeding year. Zoeae ranked third in the diet during February '69 and constituted only a minor percentage of the food during 1969-70.

It is evident that the high feeding intensity generally coincided with the occurrence of eupausiids, megalopa or prawns or amphipods in appreciable percentages (March, September, November-December '68 and July-September 1969). A decrease in the feeding (0.1-0.3 ml) was observed to coincide when these items ranked either second or third in the diet and copepods were the dominant items in the gut as seen during June-July '68 and February, April-June '69 and December '69 to February '70. However the increase in the volume of food in May '68 and September '69 was due to the relative abundance of prawns and megalopae.

TABLE 1. *The percentage composition of different food items*

Months	1968 M	A	M	J	1969 J	A	S	O	N	D	J	F	Average for 68–69
No. of fish examined	20	18	10	52	69	39	60	39	41	53	42	56	
Euphausiids	78.6	82.4	9.7	21.2	20.3	12.5	83.6	59.2	19.6	82.7	41.2	17.6	44.0
Prawns and *Acetes*	4.0	4.4	23.6	1.3	3.0	19.0	2.9	4.2	3.9	1.1	0.4	1.5	5.8
Amphipods	1.1	..	1.8	2.5	1.3	4.5	0.7	4.2	32.3	2.8	..	..	4.3
Mysids	0.6	..	..	..	0.4	..	..	..	..	0.6	0.6	..	0.2
Lucifer	..	..	..	2.1	1.3	..	..	5.3	1.7	0.1	0.8	..	0.9
Pontella	6.2	..	3.5	11.0	30.3	30.4	2.5	6.0	0.8	4.7	17.5	11.8	10.4
Labidocera	1.1	..	3.5	10.6	3.7	..	..	2.1	0.8	3.2	..	..	2.1
Pseudodiaptomus	2.8	5.9	7.9	5.1	0.7	..	..	1.1	..	0.3	29.8	19.1	6.1
Temora	0.2	..	0.9	..	0.9	4.2	0.3	1.1	0.2	..	..	..	0.6
Calanus	1.9	1.5	..	..	1.1	..	0.3	1.1	..	0.1	0.9	..	0.6
Torvanus	0.2	..	..	0.4	..	..	..	..	..	..	0.6	..	0.1
Other copepods	1.0	2.9	35.0	11.9	3.8	4.3	..	1.0	1.8	0.9	5.2	13.2	6.8
Zoeae	..	..	..	13.6	5.9	3.8	2.3	2.1	0.6	..	..	16.2	3.7
Megalopae	1.1	2.9	10.5	14.0	12.9	10.5	3.6	4.9	34.6	2.0	0.8	11.8	9.1
Cypris	0.2	..	1.8	1.7	5.0	7.2	0.7	3.5	2.7	0.8	..	1.5	2.1
Veligers	0.2	..	..	3.4	2.0	1.5	1.8	3.5	..	0.2	0.9	7.3	1.7
Alima larvae	..	..	..	..	0.9	..	0.4	0.3	0.2	0.1	..	..	0.2
Fish eggs	0.2	..	..	..	0.2	1.2	0.4	..	..	0.1	0.9	..	0.3
Fish larvae	..	..	..	..	0.4	..	0.3	..	0.4	0.1	0.2	..	0.1
Crustacean remains	0.4	..	..	0.4	..	..	..	..	..	..	..	..	0.1
Pteropods	..	..	..	..	5.9	1.1	0.2	0.3	..	0.2	0.2	..	0.7
Miscellaneous	0.2	..	1.8	0.9	..	..	..	..	0.4	..	..	..	0.3

in the stomachs of T. baelama *during 1968–70*

1969								1970				
M	A	M	J	J	A	S	O	N	D	J	F	Average for 69–70
24	37	15	14	45	50	45	46	56	66	55	70	
22.1	..	18.2	25.0	65.5	40.6	5.4	46.2	49.0	5.2	14.5	25.6	26.4
2.7	..	6.8	..	1.3	14.6	2.3	4.8	0.9	3.0	2.0	1.4	3.3
2.1	..	..	..	..	3.0	0.9	3.0	2.3	4.4	1.3	5.2	1.8
0.9	..	4.5	..	..	..	..	..	..	0.7	..	..	0.5
0.9	..	..	..	..	1.6	1.6	..	..	..	..	..	0.3
17.0	..	15.9	43.7	11.2	5.2	25.2	22.2	21.0	11.1	11.2	20.7	17.3
..	..	11.4	..	10.5	4.7	32.4	4.3	7.7	..	5.3	..	6.4
11.2	36.4	4.5	..	..	0.9	..	..	..	42.2	28.9	12.6	11.4
0.6	..	..	..	..	..	..	..	..	..	..	..	0.05
3.0	..	..	..	..	..	..	..	..	..	..	0.4	0.3
..	..	..	..	..	..	0.6	..	..	..	2.0	0.9	0.3
3.6	..	9.1	..	..	4.7	2.6	..	2.8	10.4	17.7	15.7	5.5
0.9	..	..	..	..	0.3	0.2	0.3	0.6	..	1.3	1.2	0.4
27.0	27.2	15.9	12.5	6.3	13.2	18.4	9.3	4.1	14.1	4.6	8.7	13.4
3.9	18.2	4.5	12.5	2.7	0.3	6.5	5.5	9.4	3.0	5.3	2.9	6.2
0.9	..	..	..	..	0.9	2.9	2.8	..	..	..	0.4	0.6
..	..	..	..	0.7	0.3	..	..	..	..	..	..	0.1
..	18.2	2.3	..	..	0.3	..	..	..	0.7	1.3	..	1.9
..	..	..	6.3	0.5	0.9	0.6	0.3	0.4	..	..	..	0.7
3.0	..	6.8	..	1.3	8.5	0.6	1.3	1.4	..	2.6	3.6	2.4
0.3	..	..	..	..	..	0.2	..	0.4	..	..	..	0.1
..	..	..	..	..	..	0.5	..	..	5.2	2.0	0.7	0.7

TABLE 2. *Percentage occurrence of some major food items in various size groups*

	1968-69									1969-70					
Size group (mm.)	50-59	60-69	70-79	80-89	90-99	100-109	110-119	120-129	130-139	70-79	80-89	90-99	100-109	110-119	120-129
No. of fish examined	1	1	3	24	94	233	117	24	2	1	32	143	147	155	45
Cypris larvae	..	..	..	4.2	5.3	13.3	16.2	4.2	..	..	15.6	12.6	15.6	20.0	11.1
Veliger larvae	..	..	33.3	4.2	4.2	10.3	6.8	12.6	..	..	3.1	5.6	6.1	3.9	..
Zoeae	..	..	..	4.2	13.8	12.0	9.4	..	..	100.0	6.2	7.7	2.0	1.3	..
Pseudodiaptomus spp.	100.0	100.0	66.6	20.8	9.6	8.1	5.1	4.2	..	100.0	31.2	19.6	8.2	5.2	6.7
Labidocera spp.	..	..	33.3	8.3	7.4	8.6	6.0	..	..	..	18.7	10.5	12.9	12.9	15.5
Pontella spp.	..	..	..	4.2	8.5	24.9	26.5	25.0	..	..	21.9	15.4	20.4	23.4	17.8
Oithona spp.	..	..	66.6	..	..	..	0.8	..	..	..	3.1	0.7	..	..	..
Pteropods	..	..	..	..	..	3.0	11.1	4.2	..	..	..	..	2.7	..	..
Amphipods	..	..	..	..	5.3	9.4	11.1	12.6	..	..	3.1	6.3	4.7	7.8	6.7
Prawns	..	..	..	..	4.2	32.5	13.6	16.6	50.0	..	6.2	5.6	13.5	14.2	31.2
Megalopae	..	..	33.3	4.2	10.6	36.9	30.8	16.6	..	..	12.4	14.0	24.5	25.2	20.1
Euphausiids	..	..	..	4.2	10.6	31.8	36.0	41.6	50.0	..	15.6	12.6	22.4	32.3	31.0
Fish larvae	..	..	..	..	..	1.7	1.7	8.3	..	..	3.1	0.7	4.0	3.2	..

In relation to plankton

In pelagic feeders like clupeids a direct correlation between the distribution of plankton in the environment and its occurrence in the stomach contents can be expected. A comparison of food of the fish with the plankton collected at Port Blair during the corresponding period lead to the conclusion that the occurrence and the abundance of the food items in the stomachs of *T. baelama* have a relationship with their richness in the plankton in different months. The occurrence of *Pontella* spp., *Labidocera* spp., *Pseudodiaptomus* spp., *Oithona* spp., *Temora* spp., *Calanus* spp., *Tortanus* sp., *Corycaeus* spp. etc. in fairly high percentages in the stomach contents from May to August 1968, January-June, September 1969 and again during December '69 February 1970 coincided with its abundant occurrence in the coastal waters during the same period. It is significant to note that swarms of eupausiids observed on 27-8-'69 and 8-10-'69 and their abundance in August and October 1969 coincided with their high percentage of occurrence in the stomachs of *T. baelama*. Among the larval forms *cypris, veligers,* zoeae and megalopae have been observed in the plankton almost throughout the year and noticed in the stomach contents also in most of the period.

In relation to different size groups

As stated earlier the size range of *T. baelama* examined during the period of study was 57-134 mm. All the fish were grouped at 10 mm interval. The percentage occurrence of some important items of food in each size group was calculated and presented in Table III.

Copepods like *Pseudodiaptomus* spp., *Labidocera* sp., *Oithona* sp., were predominant in smaller individuals below 99 mm and occurred in very low percentages in the adults; while *Pontella* spp. megalopa, cypris larvae and pteropods were present in greater percentage in the fish of 100-129 mm size groups. *Euphausiids* occurred in relatively high percentages in the bigger individuals. There was a high percentage of fish larvae in size group 120-129 mm.

Thus, generally, the bigger organisms, such as euphausiids, megalopae, prawns, pteropods and fish larvae form the chief food of adult fish, while the young ones appear to feed mostly on small forms like veligers, zoea, *Pseudodiaptomus, Oithona* etc.

Intensity of Feeding

The state of the stomach in different degrees of fullness and the average volume of gut contents from March 1968 to February 1970 are given in Table IV. Fish labelled as full and ¾ full were considered to have fed actively while those with ½ full denoted moderate feeding and those with ¼ full and trace as poorly fed.

TABLE 3. *Percentage occurrence of the stomachs of* T. baelama *in various degrees of fullness and the volume of food during 1968–70*

Months	1968-69								1969-70							
	Condition of feed								Condition of feed							
	No. of fish	Empty	Trace	¼ full	½ full	¾ full	Full	Volume ml.	No. of fish	Empty	Trace	¼ full	½ full	¾ full	Full	Volume ml.
March	20	..	..	10.0	10.0	35.0	45.0	0.6	24	..	..	58.3	25.0	12.5	4.2	0.3
April	18	50.0	16.6	16.6	5.6	5.6	5.6	0.2	37	89.2	5.4	5.4	..	..	..	0.1
May	10	..	..	..	20.0	50.0	30.0	0.7	15	20.0	26.7	46.7	6.6	..	..	0.3
June	52	21.2	23.1	38.4	9.6	5.8	1.9	0.2	14	64.3	7.1	14.3	14.3	..	..	0.2
July	69	15.9	13.0	31.0	20.3	5.8	13.0	0.3	45	..	4.4	46.7	20.0	17.8	11.1	0.5
August	39	..	7.7	41.0	33.3	15.4	2.6	0.4	50	6.0	2.0	24.0	30.0	22.0	16.0	0.6
September	60	18.3	20.0	26.7	16.7	10.0	8.3	0.5	45	11.1	6.7	33.3	13.3	8.8	26.8	0.6
October	39	10.3	25.6	41.0	18.0	5.1	..	0.3	46	19.6	21.7	41.3	13.0	4.4	..	0.3
November	41	24.4	7.3	29.3	29.3	2.4	7.3	0.5	56	23.2	5.4	46.4	12.5	7.1	5.4	0.4
December	53	3.8	9.4	24.5	34.0	15.1	13.2	0.6	66	75.8	7.6	13.6	1.5	1.5	..	0.2
January	42	14.3	19.0	35.7	23.8	4.8	2.4	0.4	55	23.6	21.8	41.8	12.8	..	..	0.2
February	56	48.2	28.6	19.6	1.8	1.8	..	0.2	70	4.3	44.3	35.7	14.3	..	1.4	0.2

During the year 1968 a large percentage of fish were observed to feed actively during March and May and no empty guts were encountered in these months. In December 1968, besides the occurrence of such actively fed fish in appreciable numbers, a high percentage (34%) of specimens showed moderate feeding. Such condition was also noticed in the months August-September and November 1968.

The trend of feeding intensity was quite different in the subsequent year in which the active feeding was noticed during July-September '69. In the remaining period the condition of feed was poor and the occurrence of empty stomachs relatively high.

The variations in the feeding intensity were further assessed by measuring the actual volume of food. The volume of gut contents was high during March, May-September and again November-December '68, coinciding with the occurrence of high percentage of actively feeding fish. Similarly, the data for the subsequent year revealed that during those months when the percentage of actively fed fish was high the volume of the food was also high. Thus, the

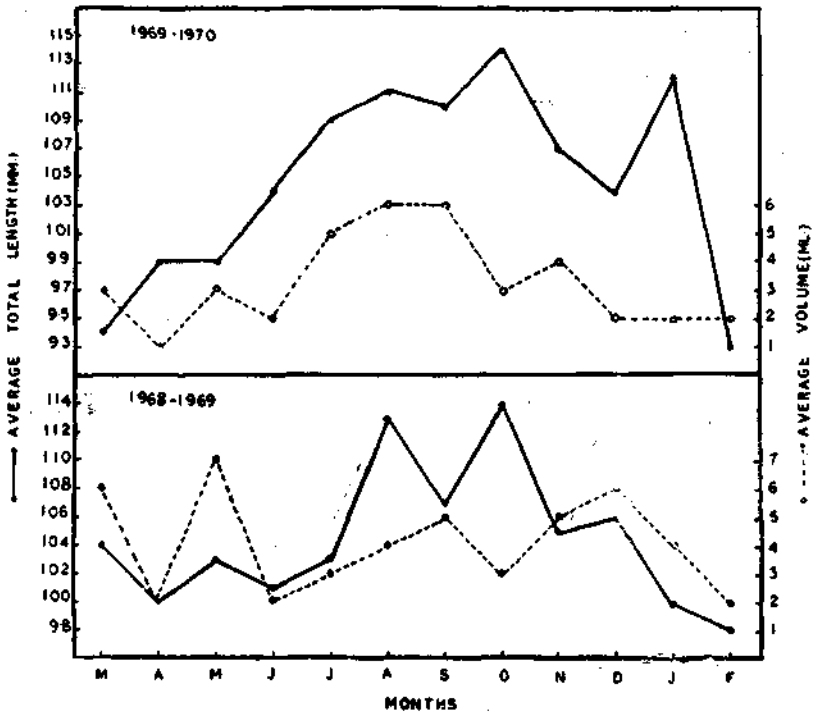

Fig. 1. Monthly average length of fish and average volume of gut contents in *T. baelama*.

feeding intensity varied considerably from month to month and the fish appeared to feed actively at irregular intervals.

In relation to size of fish

In Fig. 1 feeding intensity is plotted against the monthly average length of the samples examined. A study of the curves of these variables does not seem to indicate any consistent parallel correlation in their fluctuations, it may be inferred that the seasonal variations in the intensity of feeding was due to the variations in availability of the organisms in a particular environment.

In relation to sexual cycle

Though mature fish are seen throughout the year, a high percentage of mature fish is noticed only during July-August and again from November-January coinciding with the spawning seasons of the fish. Fish collected during July-September '69 had fed actively (table IV) coinciding with the first spawning activity of the fish. A rise in the feeding intensity was again noticed in November 1969 probably in relation with the second spawning. But feeding was poor during the succeeding months. The table for 1968-69 indicate a high degree of feeding only in March and May 1968 when the immature fish were predominant. However the active feeding as seen in November-December

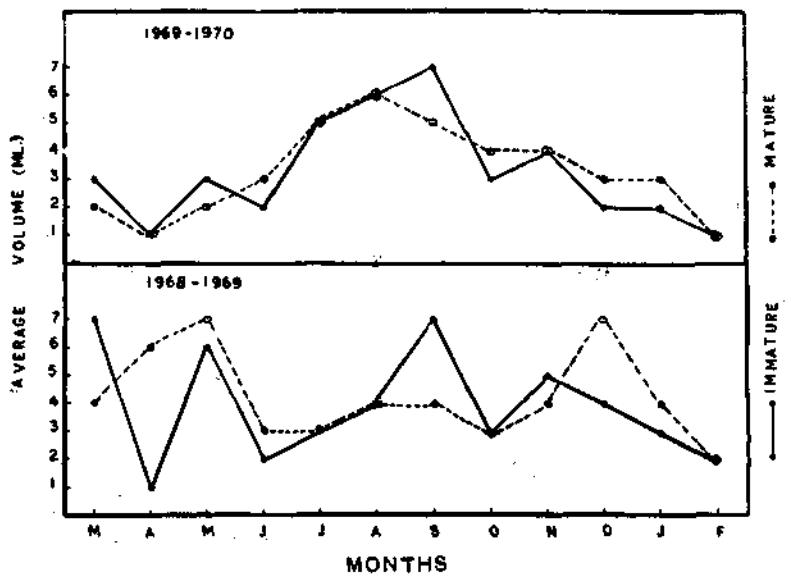

Fig. 2. Relationship between maturity and feeding intensity in *T. baelama*.

1968 coincided with the second spawning period of this species although poor feeding was noticed in December 1969.

To understand more clearly the relation between feeding activity and spawning all the material was sorted out into two arbitrary groups, Immature and Mature, and the results depicted in Fig. 2. It can be seen that the variations in the intensity of feeding between these two groups showed a uniform pattern in May-August, October-November 1968 and in January-February 1969. This trend was also noticed during 1969-70 and the values showed almost the same pattern of rise and fall even during the spawning season. Whereas an active feeding was noticed in mature fish during July-August 1969 (spawning period) the volume of food was less in the corresponding months of the year 1968. Similarly an active feeding (0.7 ml) was noticed during the second spawning i.e., in December 1968. But in the next year in the same months mature fish fed poorly.

As the fluctuations in the feeding intensity of mature fish had not strictly coincided with the spawning period, it would be rather difficult to conclude whether the fall in the feeding intensity was entirely due to the spawning activity of the fish.

Discussion

Variation in food and feeding habits among the different species of the same family is not uncommon. Earlier studies have revealed it among the anchovies. While fishes like *Thrissocles kammalensis* and *T. dussumierii* feed on both zooplankton and diatoms without any apparent discrimination, those like *T. purava, T. hamiltonii* and *Anchoviella commersonii* are carnivorous surface feeders, the main bulk of food being prawns and copepods (Bapat and Bal, 1950). Similarly, Venkataraman (1960) has noticed the varied feeding habits among the inshore anchovies of the Malabar Coast. He observed that *T. malabaricus, T. setirostris, T. purava* and *A. commersonii* appear to prefer zooplankton, chiefly the copepods and prawns, while in *T. dussumierii* and *Anchviella tri* the diet is also supplemented by diatoms, mostly *Coscinodiscus* sp., Carnivorous feeding habit in the allied species of anchovy has also been observed in *Setipinna phasa* and *T. mystax* by Jones and Menon (1951) and Venkataraman (1956) respectively. Basheeruddin and Nayar (1962) have found such tendency in *T. mystax* and *T. setirostris.* Srinivasa Rao (1964) has noticed this habit in *Anchoviella heterolobus* and *A. insularis.*

Sadasivan (1953), on the basis of limited data, observed a correlation between the increase in prawn larvae in the plankton and appearance of some clupeids of Andaman waters, including the common anchovies *Engraulis baelama* and *Stolephorus heterolobus.* He further stated that *E. baelama* appeared

to exercise selective faculties of feeding. The present study has revealed that euphausiids and copepods formed the predominant items of food in *T. baelama*.

This species show a marked change in feeding habit as the size of the fish increased. The percentage of copepods decreased and that of bigger organisms like euphausiids, prawns, amphipods and fish larvae increased as the fish grew bigger. Such differences in the feeding habits of juveniles and adults were noticed by Bapat and Bal (1950) in *T. hamiltonii* and *A. commersonii* and by Venkataraman (1956) in *T. mystax*. The variations in the diet composition of *T. baelama* showed a correlation with the environmental biota, as noticed in other anchovies by Srinivasa Rao (1964) and Venkataraman (1956, 1960).

Acknowledgements

The author is grateful to Dr. S. Z. Qasim, Director, Central Marine Fisheries Research Institute for his keen interest and encouragement in the work. He is thankful to Mr. K. Rangarajan for kindly going through the paper and offering constructive criticisms.

References

Bapat, S. V. and D. V. Bal. 1950. The food of some young clupeids. *Proc. Indian Acad. Sci.*, 32B(1):39-58.

Basheeruddin, S. and K. N. Nayar. 1962. A preliminary study of the juvenile fishes of the coastal waters off Madras city. *Indian J. Fish.*, 8(1):169-188.

Ganapathi, P. N. and K. S. Rao. 1962. Observation on the feeding and spawning of *Thrissocles mystax* (Schn.) off Waltair coast. *Proc. Ist All India Congr. Zool.* (Jabalpur), 1959, Pt. 2:321-323.

Hynes, H. B. N. 1950. The food of the fresh water stickleback (*Gasterosteus aculeatus* and *Psygosteus pungitius*) with a review of methods used in studies of the food of fishes. *J. Anim. Ecol.*, 19(1):35-58.

Jones, S. and P. M. G. Menon. 1951. Observations on the life history, bionomics and fishery of the Gangetic Anchovy, *Setipinna phasa* (Ham.) *J. zool. Soc. India*, 3(2):323-33.

Mookerjee, H. K. and P. S. Mookerjee. 1950. On some aspects of the natural history of *Engraulis hamiltonii* and *Engraulis telara*. *Proc. 37th Indian Science Congress*, Part 3, Abstracts, 251.

Pillay, T. V. R. 1952. A critique of the methods of study of food of fishes. *J. zool. Soc. India*, 4:185-200.

SADASIVAN, V. 1953. Preliminary observations on the biology of some clupeids occurring in the Andaman waters. *Proc. 40th Indian Sci. Congr.* (Lucknow) Pt. 3. Abstracts. 207.

SRINIVASA RAO, K. 1964. Food and feeding habits of fishes from trawl catches. *Indian J. Fish.*, 11(1):277-314.

VENKATARAMAN, G. 1956. Studies on some aspects of the biology of the common anchovy *Thrissocles mystax* (Bl. and Schn.) *Indian J. Fish.*, 3:311-333.

VENKATARAMAN, G. 1960. Studies on the food and feeding relationship of the inshore fisheries off Calicut on the Malabar Coast. *Indian J. Fish.*, 7(2):275-306.