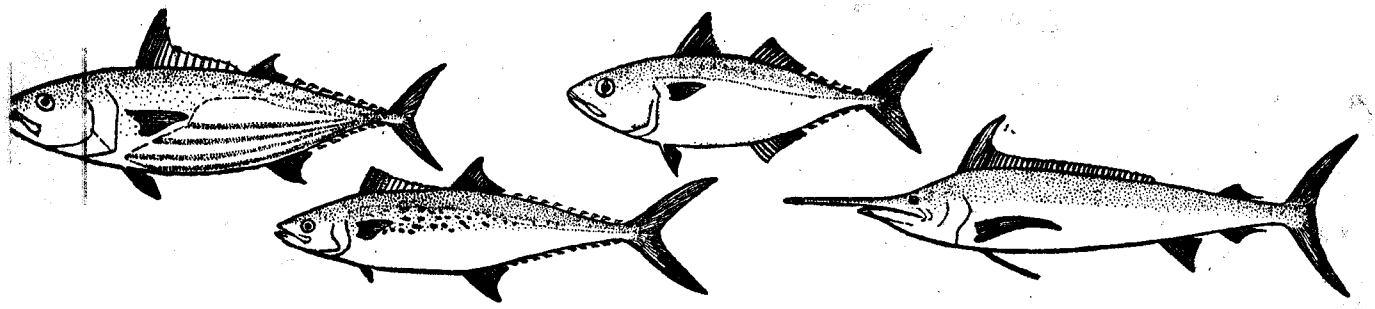
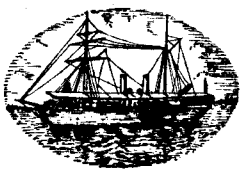


SYMPOSIUM ON SCOMBROID FISHES

PART II



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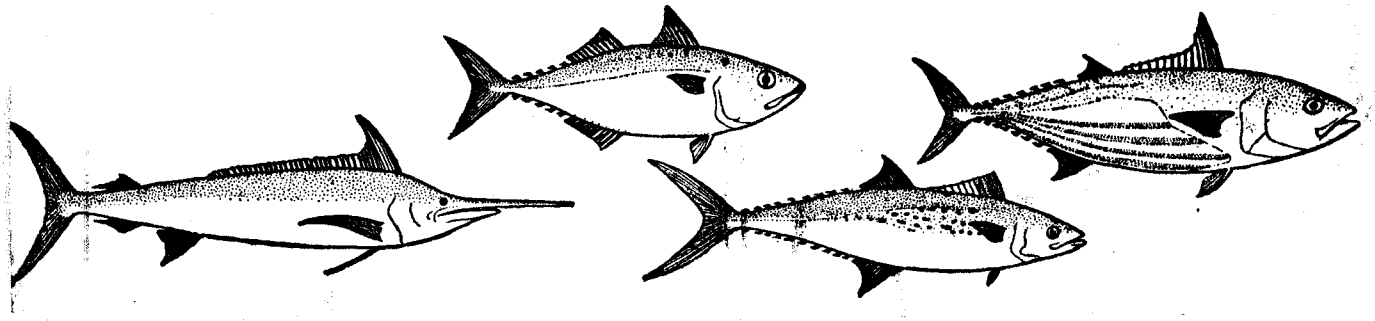
S. INDIA

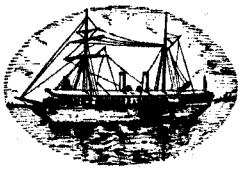


PROCEEDINGS OF THE

SYMPOSIUM
ON
SCOMBROID FISHES

HELD AT MANDAPAM CAMP FROM JAN. 12-15, 1962

PART II



SYMPOSIUM SERIES I

MARINE BIOLOGICAL ASSOCIATION OF INDIA

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OBSERVATIONS ON THE FOOD AND FEEDING HABITS OF *SCOMBEROMORUS GUTTATUS* (BLOCH & SCHNEIDER) AND JUVENILES OF *S. LINEOLATUS* (CUVIER & VALENCIENNES) AND *S. COMMERSON* (LACÉPÈDE) FROM THE WALTAIR COAST *

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INTRODUCTION

OUR knowledge of the biology of *Scomberomorus* spp. which constitute a valuable fishery along the East Coast of India is very meagre. Investigations on the biology of these fish were initiated by a few workers since the beginning of the last decade. On the East Coast, Vijayaraghavan (1955) gave an account of the life-history of *Scomberomorus guttatus* from Madras ; Krishnamoorthy (1958) studied the fluctuations in the fishery and maturity of the same species from the Gulf of Mannar area; and Kuthalingam (1959) made a brief mention of the food and feeding habits of post larvae, juveniles, and adults of *S. lineolatus*. On the west coast, Venkataraman (1960) gave an account of the food and feeding relationships of some inshore fishes which also included a short account of the food of *S. guttatus*, *S. commerson* and *Cybium interruptum*. Kumaran (1962) recorded the food of the juveniles of *S. commerson* and *S. guttatus* of the South Kerala Coast.

During the period 1957-'59, investigations on the biology of *S. guttatus* which contributed to a fifth of the total fish landings at Lawson's Bay, were undertaken. The aspects covered were the seasonal fluctuations of the fishery, length frequency distribution, maturity and spawning, and food and feeding habits. In the present communication, only food and feeding habits of the species have been reported. An account of the stomach analyses of juveniles of *S. lineolatus* and *S. commerson* has been also included.

MATERIAL AND METHODS

Material for the present study was collected at the Lawson's Bay fish landing centre. Juveniles upto the size of 150 mm. were mostly caught in the shore seines, those from 150 mm. to 300 mm. in the boat seines, and fish above 300 mm. generally by the hooks and lines.

The total and standard lengths were measured. The standard length only has been considered in the present study. The stomachs of fish above 300 mm. were removed at the landing place and preserved in 6% formalin.

For analysis of the food items, each stomach was considered as a unit. The amount of feeding was noted, based on the degree of distension of the stomachs. If the stomach was half full (eye estimation) 0.5 points, if it was quarter full, 0.25 points etc., were allotted. The stomach contents were examined both qualitatively and quantitatively. The volume of each food item was measured by the displacement method. Empty stomachs were omitted in the calculation of the average percentage composition and in the percentage frequency of the occurrence of the various items.

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Juveniles of the three species were observed in the shore seine catches from the end of February to the middle of May and in the boat seine catches from the middle of May to the middle of September. A total of 361 juveniles of *S. guttatus*, 50 of *S. lineolatus* and 177 of *S. commerson* were examined during the present study. The fish examined were classified into 50 mm. size intervals and the average percentage composition of the various food items in the different size groups was calculated (Table 1) in preference to the analysis of food items monthwise, as the former was found to be more significant.

S. guttatus :

For all the size groups combined, on an average, teleosts constituted 91.84% and crustaceans 4.38%, of the total food. Among the teleosts *Anchoviella* sp. (40.4%) was very important, besides which *Sardinella* sp. (1.4%) and *Dussumieria* sp. (0.68%) were also observed. *Acetes* sp. (3.58%) was the important crustacean item, which constituted 12.8% and 4.8% of the total food in the size groups of 50 to 100 mm. and 100 to 150 mm., respectively.

S. lineolatus :

Teleost remains (96.9%) were mostly in an advanced state of digestion. *Sciaena* sp. (8.9%), *Saurida* sp. (8.3%) and *Anchoviella* sp. (1.46%) were the only fish items that could be identified. *Acetes* sp. (1.4%) was also observed.

S. commerson :

The food of this species was mainly made up of teleosts (99.5%) comprising a variety of fish, like *Anchoviella* sp. (29.7%), *Sardinella* sp. (13.7%), and *Trichiurus* sp. (2.5%), besides *Sphyraena* sp., *Thrissocles* sp., *Sciaena* sp., *Saurida* sp., and *Dussumieria* sp., in the order of their abundance.

Stomach Contents of Adult *Scomberomorus guttatus*

Adult *S. guttatus* was observed to have fed mainly on teleosts (70.0%), which were mostly in an advanced state of digestion. Of those that could be identified *Anchoviella* sp. (11.9%), *Sardinella* sp. (6.0%), and *Trichiurus* sp. (5.7%) were important. *Anchoviella* sp. was observed in almost all the months, while *Trichiurus* sp. was noticed only from June to October period (Table 2). The other teleostean items were *Acanthurus* sp. (1.1%), Percoids (1.2%), *Pellona* sp. (0.75%) Diodontids (0.7%), *Thrissocles* sp. (0.7%), *Leiognathus* sp. (0.48%), *Mene maculata* (0.45%), *Rastrelliger kanagurta* (0.35%), *Lactarius lactarius* (0.18%), *Upenoides* sp. (0.15%), Squamipinnid (0.15%), eel larva (0.12%), *Chirocentrus* sp. (0.12%), *Ostracion* sp. (0.06%), and *Monacanthus* sp. (0.02%).

Crustaceans (24.6%) were mainly represented by *Alima* larvae (20.8%) and *Acetes* sp. (3.85%) in the stomach contents, besides Megalopa larvae, Zoaea larvae, crabs, *Hippa*, amphipods and isopods. The percentage composition of *Alima* larvae was observed to be significantly high from August to February (Table 2).

A few cephalopods and gastropods were also observed in the stomach contents, occasionally.

Considering the frequency of occurrence of these food items, *Alima* larva was found in 41.0% of the total number of stomachs with food, while *Anchoviella* sp., *Sardinella* sp., and *Trichiurus* sp. which were the important teleostean food items were noticed only in 15.8%, 9.0%, and 8.5%, respectively. During the months of September and January, that is, at the commencement and closing of the seerfish fishery, *Alima* larvae occurred in nearly 70.0% of the stomachs.

General Observations

The principal mode of capture of the seerfish is by hooks and lines, which yielded 99.0% of the total catch at Lawson's Bay, during the period under study. The baits employed were, sardines, whitebait, and ribbonfish, besides which articles carved in the shape of fish were also used. This method of capture appears to take advantage of the habit of the fish, namely, chasing and capturing the prey by sight. The presence of juvenile sardines, whitebait, and ribbonfish in the stomach contents constituting 23.6% of the total food items corroborates the above statement.

Juveniles of the three species below 50 mm. size were observed to be feeding more actively than the bigger size groups. The amount of feeding gradually decreased with increase in size (Table 1).

The period of intensive feeding of *S. guttatus* was from June to December (Fig. 1).

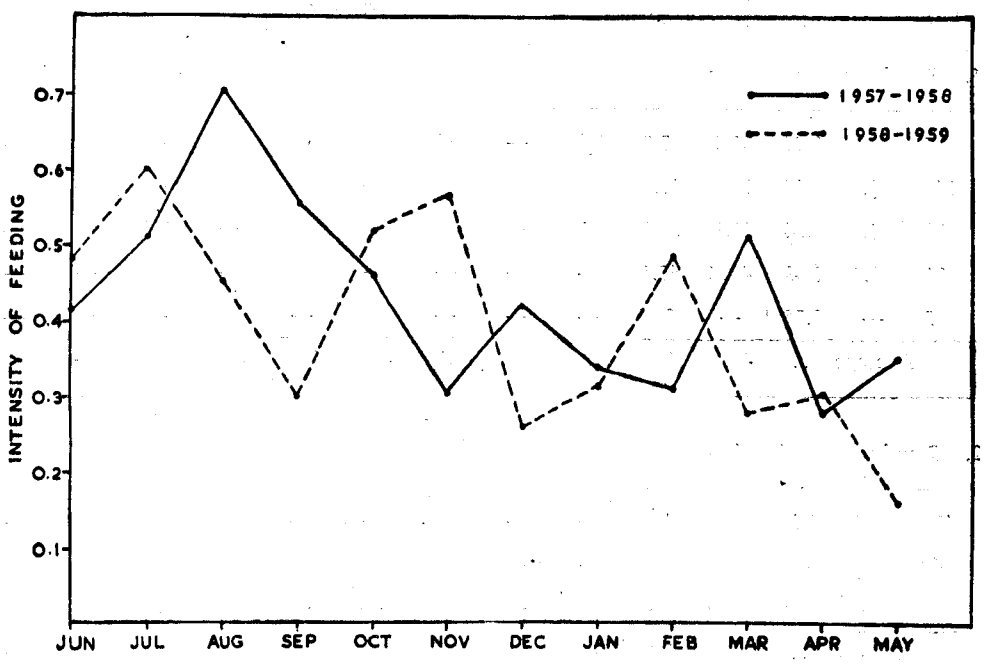

Fig. 1. Monthly Variation in the Intensity of Feeding of *S. guttatus*.

A perusal of Table 2 would reveal that the teleosts constituted the highest percentage of the food inclusions and this shows their importance in the dietary of the fish. However, it is of interest to note, that the *Alima* larvae exhibited the highest frequency of occurrence in the stomach contents as compared to any other organism. This and the fact that they constituted a high percentage of food inclusions next only to teleosts appear to indicate that the *Alima* larvae also form an important food item of *S. guttatus*.

Vijayaraghavan (1955), followed by Kuthalingam (1959), who worked on *S. guttatus* and *S. lineolatus* respectively from Madras waters observed that planktonic organisms like copepods and diatoms were the dominant food items upto a size of 150 mm. Vijayaraghavan further stated that even the adults (living in the inshore waters) were feeding on copepods and diatoms

TABLE

Showing the percentage composition of the food items in the

Size group in mm.	Number of fish examined	Percentage of empty stomachs	Average amount of feeding	Teleost remains	*Anchoviella* sp.	*Sardinella* sp.	*Trichiurus* sp.	*Sciaena* sp.	*Dussumieria* sp.	*Platycephalus* sp.	*Leiognathus* sp.	*Bregmaceros atripinnis*	*Lactarius lactarius*	*Thrissocles* sp.	*Sphyraena* sp.
															Food
1. *Scomberomorus guttatus*															
0— 50	107	6.54	0.77	82.4	7.2	2.0	—	0.7	3.4	0.2	—	—	—	—	—
50—100	148	5.4	0.68	73.0	10.7	0.6	0.3	—	—	0.1	0.1	—	—	—	—
100—150	83	31.3	0.54	37.3	37.0	5.3	—	—	—	—	—	0.2	—	—	—
150—200	21	19.0	0.43	48. 2	47.1	—	—	—	—	—	—	—	—	—	—
200—250	2	—	0.75	—	100.0	—	—	—	—	—	—	—	—	—	—
	Average ..			48.2	40.4	1.4	0.06	0.14	0.68	0.06	0.02	0.04	—		—
2. *Scomberomorus lineolatus*															
0— 50	42	7.1	0.84	90.5	4.4	—	—	—	—	—	—	—	—	—	—
50—100	6	50.0	0.31	73.3	—	—	—	26.6	—	—	—	—	—	—	—
100—150	2	—	1.0	70.9	—	—	—	—	—	—	—	—	—	—	—
	Average ..			78.2	1.46	—	—	8.9	—	—	—	—	—	—	—
3. *Scomberomorus commerson*															
0— 50	60	6.7	0.9	54.4	19.1	0.8	10.0	2.1	1.6	—	0.5	—	0.6	—	3.4
50—100	62	9.7	0.9	41.2	29.7	4.7	—	2.3	—	—	—	—	3.2	6.0	4.8
100—150	52	19.2	0.8	20.4	25.6	49.2	—	—	—	—	0.3	—	—	—	—
150—200	3	—	0.45	55.3	44.4	—	—	—	—	—	—	—	—	—	—
	Average ..			42.8	29.7	13.7	2.5	1.1	0.4	—	0.2	—	0.95	1.5	2.05

1

different size groups of juvenile *S. guttatus*, *S. lineolatus* and *S. commerson*

items																
Saurida sp.	*Ambassis* sp.	*Scomberomorus commerson*	*Raconda* sp.	Carangid	Clupeid	Serranid	Percoid	Crustacean remains	*Acetes* sp.	Carid prawn	*Mysis*	*Alima* larva	Decapod remains	Digested and mucous matter	Total teleost component	Total crustacean component
—	—	—	—	0.2	0.8	—	0.2	—	—	—	—	—	—	3.0	97.1	—
—	—	—	—	0.5	—	—	0.8	—	0.3	0.3	0.4	—	0.6	12.0	86.1	1.6
—	—	—	—	—	0.9	—	—	1.8	12.8	0.9	—	0.01	—	4.0	80.7	15.5
—	—	—	—	—	—	—	—	4.8	—	—	—	—	—	—	95.3	4.8
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	100.0	—
—	—	—	—	0.14	0.34	—	0.2	0.36	3.58	0.24	0.08	0.0	0.12	3.8	91.84	4.38
—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.0	94.9	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	99.9	—
25.0	—	—	—	—	—	—	—	—	4.1	—	—	—	—	—	95.9	4.1
8.3	—	—	—	—	—	—	—	—	1.4	—	—	—	—	1.3	96.86	1.46
—	—	—	—	1.8	2.7	—	3.0	—	—	—	—	—	—	—	100.0	—
1.9	—	—	—	—	3.2	1.0	0.5	—	0.9	—	—	—	0.6	—	98.5	1.5
—	1.0	1.0	2.4	—	—	—	—	—	0.07	—	—	—	—	—	99.9	0.07
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	99.7	—
0.47	—	—	—	0.5	1.5	0.25	0.9	—	—	0.24	—	—	0.15	—	99.5	0.4

TABLE 2

Monthly variation in the percentage composition of food items of adult *S. guttatus* during the year 1957–58

Food items	Months												Average
	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	
1. Teleost remains ..	55.9	33.2	29.7	26.1	23.1	25.6	30.0	36.2	60.1	57.1	67.0	69.9	42.8
2. *Anchoviella* sp. ..	—	2.4	1.7	5.7	16.3	17.3	0.9	8.3	—	15.6	5.8	23.0	8.1
3. *Sardinella* sp. ..	6.3	4.8	7.9	—	—	9.6	—	5.0	—	—	—	—	2.8
4. *Trichiurus* sp. ..	—	11.8	31.6	13.9	18.2	—	—	0.8	—	—	—	—	6.4
5. Percoids ..	—	6.4	—	—	—	6.5	0.2	—	0.5	0.1	9.1	2.7	2.1
6. *Thrissocles* sp. ..	—	—	3.1	—	—	—	—	—	—	5.0	—	—	0.7
7. *Leiognathus* sp. ..	—	—	2.0	4.1	—	—	—	0.4	—	—	—	1.9	0.7
8. *Caranx* sp. ..	2.1	—	—	0.4	—	—	28.0	2.9	—	—	—	—	2.8
9. Eel larva ..	—	—	—	—	—	—	0.6	—	—	—	—	—	0.05
10. Diodontid ..	3.2	—	10.8	—	—	—	—	—	—	—	—	—	1.2
11. *Lactarius* sp. ..	—	—	—	—	—	4.2	—	—	—	—	—	—	0.4
12. Clupeid remains..	—	2.8	—	—	—	—	—	—	—	—	—	—	0.2
13. *Upenoides* sp. ..	—	—	—	—	3.7	—	—	—	—	—	—	—	0.3
14. Squamipinnid ..	—	—	—	2.0	—	—	—	—	—	—	—	—	0.2
15. *Monacanthus* sp...	—	—	—	—	—	0.1	—	0.3	—	—	—	—	0.03
16. *Ostracion* sp. ..	—	—	—	—	—	1.4	—	—	—	—	—	—	0.1
Teleosts ..	67.5	61.4	86.8	52.2	61.3	64.7	59.7	53.9	60.6	77.8	81.9	97.5	68.8
17. Crustacean remains ..	—	—	—	—	—	—	—	2.0	—	—	2.0	—	0.3
18. *Alima* larva ..	3.8	15.2	2.4	28.8	32.4	32.2	39.7	39.0	37.4	13.3	11.1	1.6	21.4
19. *Acetes* sp. ..	6.1	8.5	1.0	14.9	6.3	—	—	—	0.1	—	3.0	0.8	3.4
20. Megalopa ..	—	—	—	—	—	4.0	—	1.6	1.7	0.4	1.2	—	0.7
21. Decapod remains.	0.1	—	—	0.1	—	—	0.4	3.7	—	—	1.3	—	0.5
22. Crab ..	—	—	—	—	—	—	—	—	0.1	—	—	—	0.01
23. Zoaea ..	—	—	—	—	—	—	—	—	0.1	—	—	—	0.01
24. *Hippa* ..	—	—	—	—	—	—	—	—	0.5	—	—	—	0.04
Crustaceans ..	10.0	23.7	3.4	43.8	38.7	36.2	40.1	46.3	39.9	13.7	18.6	2.4	26.36
25. Cephalopod ..	—	—	3.3	—	—	0.3	—	—	—	7.9	—	—	1.0
26. Gastropod ..	—	—	—	—	—	—	0.1	—	—	0.4	—	—	0.04
27. Digested and mucous matter ..	22.5	15.0	7.5	4.0	—	—	—	—	—	—	—	—	3.8

in almost the same quantities as teleost eggs and larvae. On the other hand Venkataraman (1960) and Kumaran (1962) have noted a predominantly piscivorous tendency in adults as well as juveniles, in conformity with the present observations. During the present study the author noticed copepods, only in the stomachs of those plankton feeding fish which fell prey to *S. guttatus* and were incidentally observed in their stomach contents. In this connection it might be interesting to recall that the primary requisite of plankton feeding fish is an efficient filtering mechanism in the form of numerous, close set, long gill rakers on the gill arches. But the gill rakers of all *Scomberomorus* spp. are rudimentary and few in number thus forcing the fish to resort to larger organisms like fish larvae, *Alima* etc., for its food, even at an early stage in their life.

TABLE 2 (*Contd.*)

Monthly variation in the percentage composition of food items of adult *S. guttatus* during the year 1958-59

Food items	Months												Average
	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	
1. Teleost remains ..	50.6	30.6	21.9	47.5	35.5	31.5	46.4	39.2	23.2	18.3	18.0	44.6	33.9
2. *Anchoviella* sp. ..	29.2	21.3	23.8	6.5	23.5	9.3	6.7	4.9	30.2	22.2	5.5	3.7	15.6
3. *Sardinella* sp. ..	—	—	4.7	—	1.7	30.7	12.6	5.4	22.0	12.1	20.0	—	9.1
4. *Trichiurus* sp. ..	9.3	28.8	13.9	8.7	0.1	—	—	—	—	—	—	—	5.1
5. *Rastrelliger* sp. ..	—	—	0.5	2.9	2.2	2.3	—	—	—	—	—	—	0.7
6. Percoid ..	—	0.5	0.1	—	—	0.2	—	—	—	—	1.7	—	0.2
7. *Acathurus* sp. ..	4.0	—	—	—	—	—	—	—	—	22.2	—	—	2.2
8. *Thrissocles* sp. ..	—	6.0	—	—	—	—	—	—	—	—	—	2.6	0.7
9. *Mene maculata* ..	—	2.7	1.0	—	—	—	1.6	—	—	4.4	—	0.9	0.9
10. *Leiognathus* sp. ..	—	0.4	—	—	—	2.7	—	—	—	—	—	—	0.3
11. *Caranx* sp. ..	—	—	3.0	—	1.2	—	—	—	—	—	—	—	0.3
12. *Chirocentrus* sp. ..	—	—	2.9	—	—	—	—	—	—	—	—	—	0.2
13. Eel larva ..	—	—	—	—	0.1	0.1	—	—	—	—	—	—	0.02
14. Diodontid ..	—	—	—	—	—	—	—	—	0.2	—	—	—	0.02
15. *Pellona* sp. ..	—	—	—	—	—	—	—	3.3	—	14.8	—	—	1.5
16. Clupeid remains..	—	—	—	—	—	—	—	—	2.4	—	—	—	0.2
17. Squamipinnid ..	1.3	—	—	—	—	—	—	—	—	—	—	—	0.1
Teleosts ..	94.4	90.3	71.8	65.6	64.3	76.8	67.3	52.8	78.0	94.0	45.2	51.8	71.0
18. Crustacean remains ..	—	0.1	0.8	0.1	0.1	—	—	1.2	—	—	4.2	3.5	0.8
19. *Alima larva* ..	2.0	0.1	20.2	25.2	17.8	15.6	31.3	41.8	20.1	0.7	20.8	21.3	18.8
20. *Acetes* sp. ..	—	5.8	7.2	—	16.9	8.0	—	—	1.4	—	—	—	3.3
21. Megalopa ..	—	—	—	3.3	0.7	—	—	4.0	—	—	0.1	—	0.7
22. Amphipod ..	—	—	—	—	0.1	—	—	—	—	—	0.1	—	0.02
23. Isopod ..	—	—	—	—	0.1	—	—	—	—	—	—	—	0.01
Crustaceans ..	2.0	6.0	28.2	28.6	35.7	23.6	31.3	47.0	21.5	0.7	25.2	24.8	23.63
24. Cephalopod ..	—	0.5	1.0	5.7	—	—	—	—	—	0.9	—	—	0.7
25. Gastropod ..	—	—	—	—	—	—	1.3	—	0.3	0.4	—	—	0.2
26. Digested and mucous matter..	3.5	3.0	—	—	—	—	—	—	—	4.0	30. 0	23.5	4.5

SUMMARY

The food and feeding habits of juveniles and adults of *S. guttatus* were studied from samples collected at Lawson's Bay, Waltair during the period 1957-59. Teleosts, mainly represented by *Anchoviella* sp., *Trichiurus* sp., and *Sardinella* sp., were the predominant food items. *Alima larva* was the most frequently observed organism in the stomachs.

Food of juvenile *S. lineolatus* and *S. commerson* was also analysed.

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REFERENCES

KRISHNAMOORTHY, B. 1958. Observations on the spawning season and the fisheries of the spotted seer *Scomberomorus guttatus* (Bloch & Schneider). *Indian J. Fish.*, **5** (2) : 270-81.

KUMARAN, M. 1962. Food of juveniles and adults of *Scomberomorus commerson* (Lacêpède) and *S. guttatus* (Bloch & Schneider) of the South Kerala Coast. *Symposium on scombroid fishes.* Marine Biological Association of India, Mandapam Camp. Jan. 1962. (M.S.)

KUTHALINGAM, M. D. K. 1959. Observations on the food and feeding habits of post larvae, juveniles and adults of some Madras fishes. *J. Madras Univ.*, B. **29** (2) : 139-50.

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

VIJAYARAGHAVAN, P. 1955. Life history and feeding habits of the spotted seer *Scomberomorus guttatus* (Bloch and Schneider). *Ibid.*, **2** (2) : 360-72.