FOOD AND FEEDING OF LIZARD FISHES *(SAURIDA* SPP.) FROM NORTH WESTERN PART OF BAY OF BENGAL*

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ABSTRACT

The food and feeding of *Saurida turnbil* was studied with reference to size of fish, time (seasonal and diurnal), regions (latitude zones), sex and maturity. Though there was not much difference in the composition of the food in respect of the above factors, variations were however, 6bserved in the intensity of feeding. Fish formed the single major component <70 to 80%) of the food. The feeding intensity was low during the spawning period. Two peaks, one in the morning and the other in the noon, were observed in the feeding intensities according to time of day. The maturing fish bad the highest feeding intensity. The values of Ivlev's index of electivity *(E)* for *Letognathus blttdus* were positive for *6* months and negative for 4 months. The results[1] of studiesi on the food and feeding of *S. undosquomis* and *S. longimarms* are more or less similar.

INTRODUCTION

The earlier studies on the food and feeding of *Saurida* spp. from Indian waters by Vijayaraghavan (1957), Basheeruddin and Nayar (1959), Kuthalingam (1959) and Rao (1964) as well as from the Japanese, Chinese and Philippine waters (Suehiro 1942, Okado and Kyushin 1955, Tung 1959, Hayashi et al 1960, Yamada et al 1966, Tiews et al 1972) were mostly qualitative and did not cover all the aspects dealt in this paper. Hence a detailed investigation was undertaken on the food and feeding of *S. tumbil* and 5. *undosquamis* during the period 1964-1968 and the results are presented.

MATERIAL AND METHODS

The area of the study covered between latitudes 16° 40'N-21° OO'N along the north-western part of the Bay of Bengal. The area was divided into squares 10 x 10 miles each by marking off each degree of latitude and longitude into 6 divisions. Systematic linear bottom trawling was conducted by the trawlers of

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Government of India every month in the squares along parallels of latitude at 30' intervals. The parallels chosen were 17° 05', 17° 35', 18° 05', 19° 05' 19° 35', 20° 05' and 20° 35', but referred to for convenience as 17° 10', 17° 40', 18° 10', 18° 40', 19° 10', 19° 40', 20° 10' and 20° 40' respectively. The squares coming under each of the parellels, were grouped into zones designated after the above parallels of latitude ie., the area was divided into the above mentioned latitude zones (Fig. 1).

The material was obtained from the catches of the Government of India trawlers, M. T. Ashok, M. F. V. Champa and M. V. Sea Horse based at Visakhapatnam during the period 1964-1966. M. T. Ashok covered all the latitude zones during 1964-1965 while in other years the northern zones were not covered. M. F. V. Champa and M. V. Sea Horse fished in zones 17° 40' and 18° 10' only.

Samples were collected in respect of long voyage on board the trawlers and in the case of daily fishing trips at the jetty. Samples of juveniles were collected from shore seine catches at Lawson's Bay, Vishakhapatoam. The total length and weight, the fullness of the stomach and the stage of maturity of each fish were noted. The stomachs and gonads were dissected out and preserved in *5%* Formaldehyde for further studies. The quantitative analysis was done by the points method (Hynes 1950) in the years 1964 and 1965 and by the volumetric method in 1966,

The feeding index expressed as the percentage of stomachs with food and the feeding intensity expressed as the average number of points or average volume of food taken, were calculated for each month for studying the quantitative seasonal trends in the food of *S. tumbil* and *S. undosquamis.*

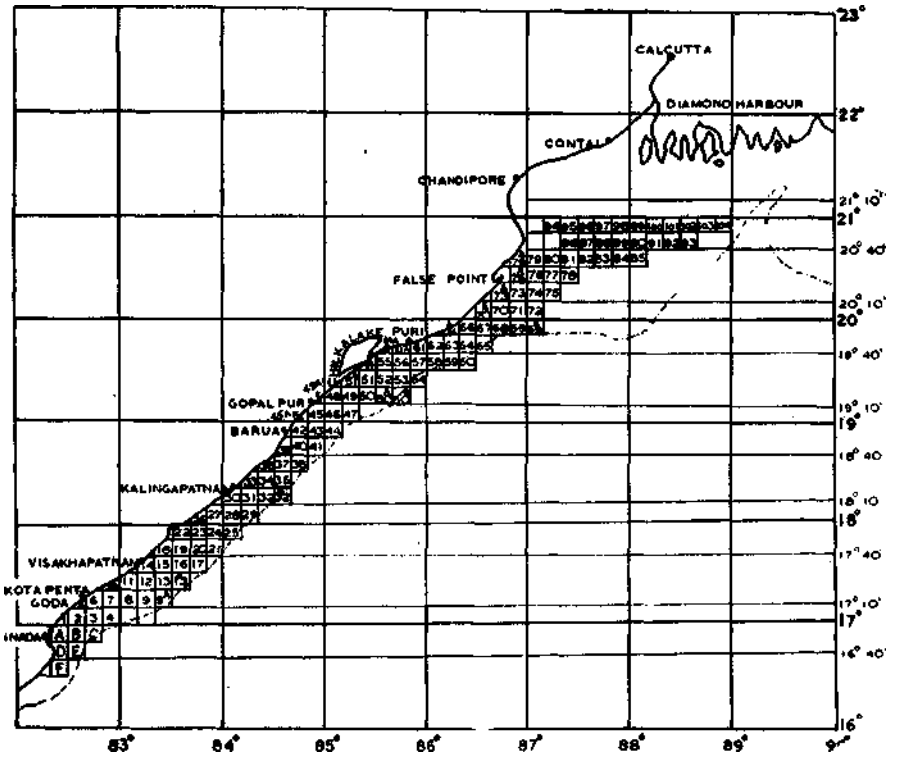
In respect of *S. tumbil,* 2170 fish were examined (1533 by the points method and 637 by the volumetric method), and in the case of *S. undosquamis 111* specimens. The food of these two species was studied with reference to three size groups, < 16(A), 16-30(B), and 31-45(C) cm (total length). This division was not purely arbitrary. The first stratum represents fish which have not completed one year. They are caught occasionally in the trawls but are found mainly in the landings of shore seines and boat seines. The second stratum consists of 1-year-old fish while the 'third stratum consists of 2-and 3-year-old fish. Maturity commences in the second stratum and the size at 50% maturity falls at the end of second or beginning of third stratum.

The food components were identified up to genus and when possible up to species. However, when the food was in an advanced stage of digestion, identification up to the broader group only was possible.

The question of selective feeding in *S. tumbil* was also examined. For this Ivlev's electivity index (E) was used, which as defined by him (Ivlev, 1961), is:

$$\frac{r_i - P_i}{n + P_i}$$

Where r_i is the relative abundance of an inagredient in the ration and Pj is the relative abundance of the same ingredient in the food complex of environment.



PIO. 1. Map of northwestern part of Bay of Bengal showing the areas fished by Govt, of India trawlers during 1964-68.

RESULTS

Items of diet

The overall average composition of the food of *S, tumbil* and *S. undo-squamis* by the points and volumetric methods for the period of this investigation are given in tables 1 and 2 respectively. It can be seen that fishes formed

the major food item, squids and prawns coming next in importance. The results of analysis of food by the points method and volumetric method were more or less similar. Amongst fish items *Leiognathus* spp., (particularly *L. bindus), Stolephorus* spp., *Trichiurus* spp., *Rastrelliger kanagurta, Johnius* spp., *Saurida* spp., were important. Digested fish that could not be identified formed 31.1% of the food by the points method and 11.7% by the volumetric method.

Food in relation to length

The composition of the food averaged for the three length strata (Total length) < 16(A), 16-30(B) and 31-45(C) cm, taking into account the data of all zones, by the points and volumetric methods for *S. tumbil* and *S. undosquamis* are given in table 1 and 2. The results of analysis by both the methods are more or less similar. Fishes formed the major food item (79.0 to 93.1%), crustaceans and squids making up the rest.

The food of the size group < 16 cm consisted of small fishes especially, *Stolephorus* spp., *Leiognathus* spp., *Sardinella* spp., while that of 16-30 and 31-45 cm size groups consisted more of large fishes, comprising mainly *Trichiurus* spp., *Leiognathus* spp., *Upeneus* spp., *Rastrelliger kanagurta* and carangids. In general the size of the prey increased with the size of the predator, as is to be expected. The percentage of crustaceans and cephalopods in the food was observed to be more in the size group 16-30 cm than in the group 31-45 cm indicating that the large-sized individuals of both the species have a strong preference for fish item. The diet of the two large size-groups appears to be more varied than the size group < 16 cm in that it is composed of more number of species of fishes and prawns. Arqongst crustaceans, prawns formed the major component in the food of the size group 16-30 cm while in the size group < 16 cm the percentage of *Squilla* was high.

Cannibalism was observed in all the size groups but it was more pronounced in the size group 31-45 cm in the case of *S. tumbil* and < 16 cm in case of 5. *undosquamis.* The feeding intensity (average number of points or volume) increased with the size of the fish.

Seasonal variations in the composition of food

Material from zone 17° 40' only has been used for this study as this zone was covered in all the months during 1964-1966. Seasonal variation of the four main categories of food i.e., fishes *Squilla,* prawns and squids are shown in Fig. 2 for *S. tumbil* and Fig. 3 for *S. undosquamis.* It may be seen from the figures that fishes invariably formed the major food item in most of the months and the rest comprised prawns and squids in more or less equal proportions. In some months the food consisted of fish only. *Squilla* spp. occurred mainly during May-July and September-December. Prawns were observed in the gut contents almost throughout the year the maximum being in the periods April-June and

TABLE 1. *Feeding index, intensity and percentage composition of food of* S. tumbil *according to size groups from ail zones.*

Size groups	Points method				Volumetric methixl			
	A	B	C		A	B	C	
Length range (cm)	1-15	16-30	31-45	Total	1-15	.16-30	31-45	Total
No. of fish examined	9	1095	429	1533	36	413	188	637
No. of stomachs empty	4	594	243	841	1	197	72	270
Percentage of stomachs with food	55.6	45.8	43.4	45,2	97.2	52.3	61.7	57.6
Average volume of stomach points/cc	3.2-2	4.71	5.10	4.82	0.29	2,40	9.5	4.37
FOOD ITEMS:								
Percentage composition								
Fishes	93.1	85.6	88.8	86,6	89.6	82,6	81.1	81.7
Unidentified	58.6	30.9	31.2	31.1	19.4	13.5	10.7	11.7
Stolephorus spp.	—	8.0	0.5	5.7	34.7	15,2	1.6	6.6
Leiognathus spp.	34.5	1'6.2	9.7	14.3	5,7	16.5	4.6	8.9
TricMurus spp.	—	8.6	12.4	9.7	—	6.4	9.2	8.2
Sardinella spp.	—	0.8	0.5	0.7	—	4.1	1.5	2.4
Upeneus spp.	—	2.2	1,5	1.9	—	0.7	7.7	5.2
Saiaenids	—	4.4	3.9	4.3	5.7	2.4	3.2	2.9
Caraagids	—	21.6	4.1	3.0	—	1.5	4.3	3.3
Bregmaceros sp.	—	0.2	—	0.2	—	0.3	0.03	0.1
Sawrida spp.	—	3.3	3.6	3.4	4.7	5.6	13.8	10.9
RastrelUger kanagurta	—	1.5	6.4	2,7	—	2.0	13.7	9.5
Other fishes	—	6i9	16.0	9.6	19.4	14.4	10.8	12.0
Crustaceans	6.9	7.2	6.0	6.8	9.5	6.7	10.9	9.4
Squiila sp.	—	0.7	0.1	0.5	—	0J15	—	0.05
Prawns								
Unidentified	—	0.5	—	0.4	—	0.1	0.06	0.1
Penaeld prawns (unidentified)	6.9	0.6	0.2	0.5	—	—	—	—
Oairid prawns (unidentified)		0.2		0.2	–	0.05	–	0.02
Penaeus spp.	—	0.4	3.4	1,3	—	2.6	10.6	7.7
Metapenaeus spp.	—	3.2	1.8	2.8	—	2.6	—	0.9
Metapenaeapsis spp.	—	0.5	—	0.3	—	0.8	0.06	0.3
Parapenaeopsis spp.	—	0.3	—	0.2	9.5	—	—	0.04
Parapenaeus spp.	—	0.3	—	0.2	—	0.15	0.18	0.15
Others	—	0.5	0.5	0.4	—	0.25	—	0.1
Melluscs		7.2	5.2	6.6	0.9	10.6	7.9	8.9
Loiigo sp.		6.4	5,2	6.0	0.9	10.6	7.9	8.9
Sepia sp.	—	0.8	—	0.6	—		—	
Other groups						0.05		0.02

TABLE 2. *Feeding index, intensity and percentage composition of food of* S. undosquamis *according to size groups from all zone.*

	Points method				Volumetric method			
Size groups	A	B	C		A	B	C	
Length range (cm)	1-45	16-30	31-4-5	Total	1-15	16-30	3il-45	Total
No. of fish examined	83	477		565	37	175		212
No. of fish with empty stomachs	33	218		253	17	74		91
Percentage of stomachs with food	60.3	54.3	60.0	55.3	54.1	57.7		57.1
Average number of points or volume (cc)	6.85	6.34	18.00	6.49	0.65	' 1.48		1.34
FOOD ITEMS:								
Percentage composition								
Fishes	90.8	91.6	100.0	91.6	79.0	90.7		89.7
Unidentified	39.7	24.8	5.6	26.6	10.3	6.9		7.1
Stolephorus spp.	13.9	H8.9		17.2	43.2	14.9		17.3
Leiognathus spp.		6.8		5.6	4.9	14.9		11.3
TricMurus spp.		0.3		0.3				
Sardinella spp.	21.4	16.1		16.5	18.5	30.6		29.6
Upeneus spp.		0.2		0.2				
Sciaenids	3.5	1.1		1.4				
Carangids		6.4	66.6	6.9				
Bregmaceros spp.	1.8	0.8		0.9		2.0		1.8
Saurida spp.	10.5	0.9		2.4		6.7		6.1
Rastralliger kanagurta		5,3		4.3		4.2		3.9
Other fishes		10.6	27.8	9.3	2,1	13.5		12.6
Crustaceans	3.0	5,3		4.9	0.4	4.7		4.3
Squilh sp.	3.0	1.9		2.1		0.6		0.6
Prawns								
Unidentified		1:1	—	0.9	0.4	0.7		0.7
Pemaeid prawns (unidetnfied)		1.5	—	1.2	—	1.9		1.7
Carid prawns (unidentified)					—	0.1		0.1
Penaeus spp.		0.3		0.2				
Metapenaeus spp.								
Metapenaeapsis spp.		0.2		0.2		0.6		0.6
Parapenaeopsis spp.								
Parapenaeus spp.						0.8		0.7
Others		0.3		0.3				
Molluscs	6.2	3,1		3.5	20.6	4.6		6.0
Loligo sp.		3.0		2.5	20.6	4.4		5.8
Sepia sp.	6.2	0.1		1.0		0.2		0.2

November. In the case *S. undosquamis* the percentage of prawns was high during January, February and July. Squilla sp. and cephalopods were observed in the guts mostly during September-January period and occasionally in other months.

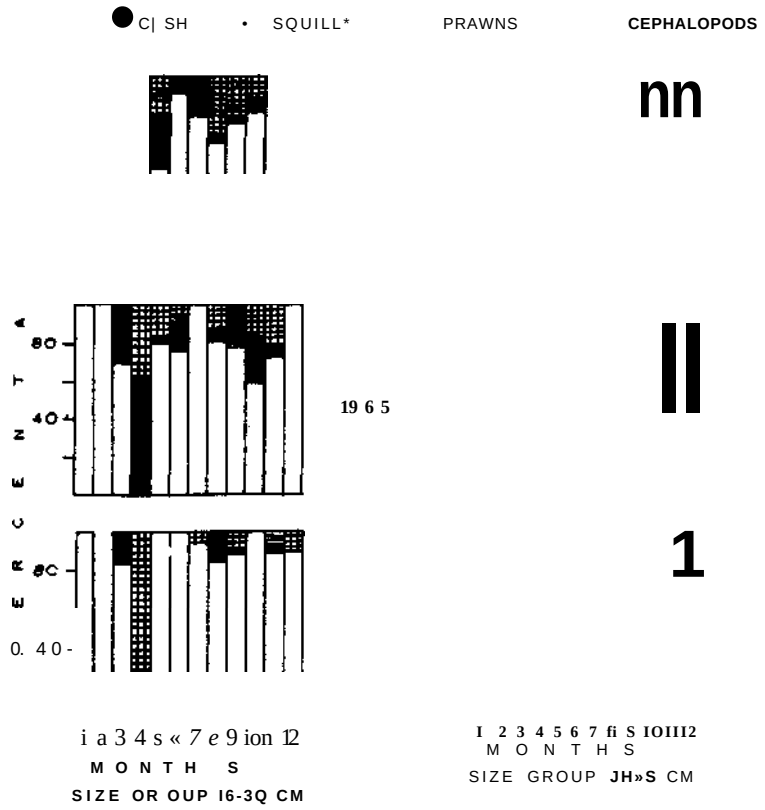


FIG. 2. Monthly percentage composition! of fish, squilla, prawns and squids in the food of *S. tumbil* from zone 17° 40'.

Seasonal changes in the feeding index and feeding intensity

Material from zone 17° 40' only has been used for his study.

5. *tumbil:* The monthly feeding indices and intensities by points and volumetric methods for the period 1964-66 are shown in Figs. 4 and 5. The seasonal changes in the amount of feeding were studied with reference to size groups 16-30 cm and 31-45 cm separately and also for both the size groups combined, referred to 31-45 cm separately and also for both the size groups combined, referred to as 'all fish,' Specimens of the size group < 16 cm were not used in this study as they were available only during few months.

All fish (16-45 cm): In general the value for feeding index and feeding intensity gradually increased from February onwards reaching the peak in June or July and dropped to a low level in August. The values shot up in September followed by a decline in October-November and another rise in December-January.

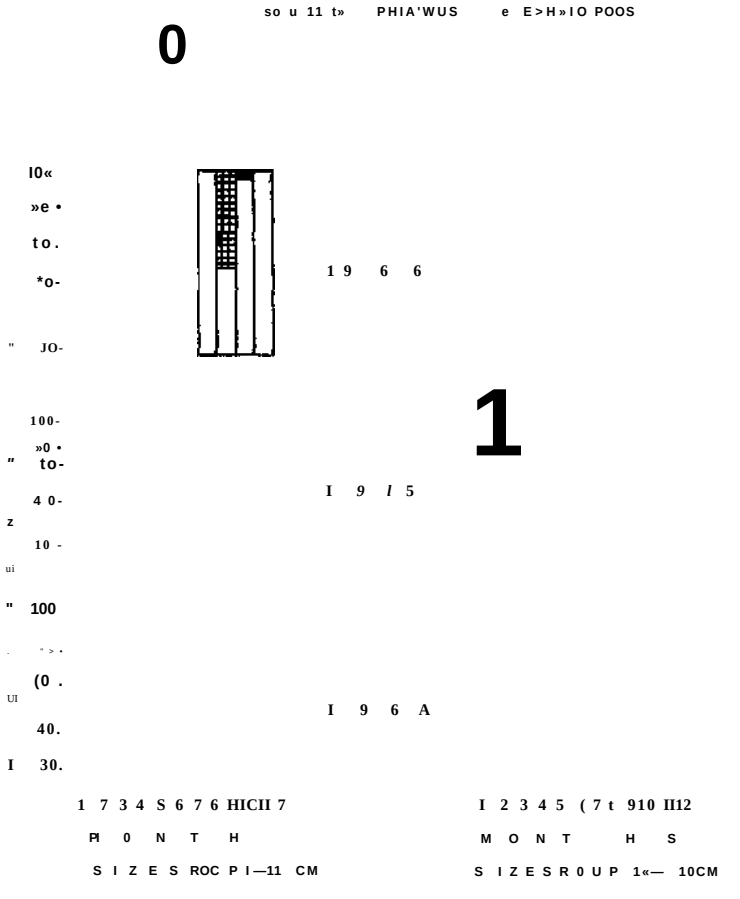


FIG. 3. Monthly percentage composition of fish, squilla, prawns and squids in the food of *S. undosquamis* from zone 17° 40'.

Size group 16-30 cm: Fish of this size group showed exactly the same trend as 'aM fish with two peaks, one in June/July and the other in December/January (Fig. 4). Secondary peaks were observed in September 1964, April 1965 and October 1966.

Size group 31-45 cm (Figs. 4 and 5): The graph for the monthly feeding indices and intensities of this group showed three peaks i.e. in May-June, August-September and December-January. During the other months the feeding was moderate or poor.

S. undosquamis (Figs. 6 and 7): In general July-August and December-January were the periods of peak feeding index and intensity while September-October was the period when these values were the lowest, except in 1964. The values were either poor or moderate in other months.

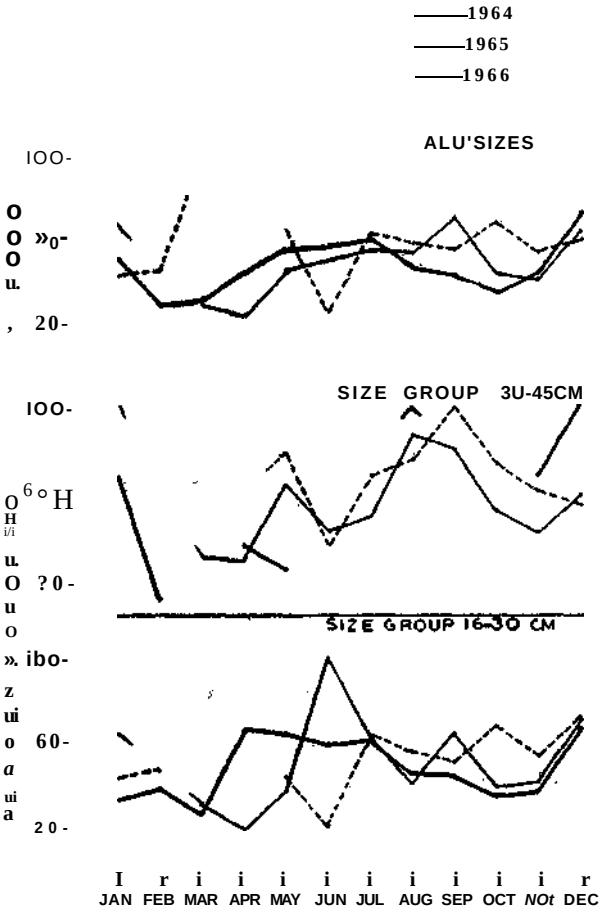


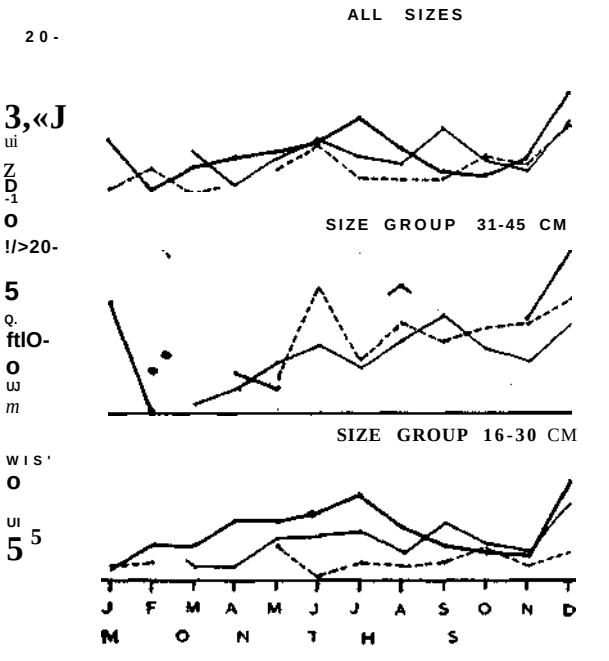
FIG. **4.** Monthly feeding index in different size groups of S. *tumbil* **from[1] zone 17° 40'.**

Food in relation to sex and maturity

S. tumM: There was not much difference (qualitative or quantitative) in the food of males and females and so the data of the two sexes were pooled. Next the data were analysed with reference to stage of maturity to find out whether there are difference in the food of fish in different stages of maturity. For this purpose the maturity scale was classified into four stages, Immature, maturing,

mature and spent. There was no difference in composition of the food of fish in different stages of maturity but differences were observed in respect of feeding intensity.

The data for *S. tumbil* according to the points and volumetric methods are given in Table 3 and it can be seen from it that the maturing fish had the highest feeding intensity, spent fish ranking second. The lowest feeding intensity



FIG, 5 Monthly feeding intensity in different size groups of *S. tumbil* from zone 17° 40".

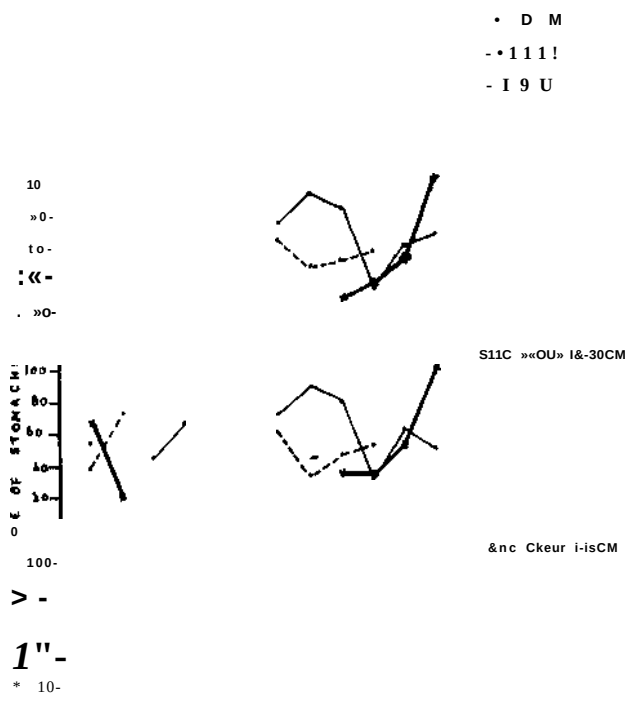
was observed in immature fish by the points method. But by the volumetric method the lowest value was observed in mature fish and this may be due to the fact that only 4 fish in this stage were available for study.

5. *undosquatnis:* Table 4 shows that the feeding intensity was the highest in mature fish followed by maturing and immature fish in that order. The highest

feeding index was observed in immature fish in 1964 and 1965 when the food was analysed by the points method and in mature fish in 1966 by the volumetric method.

Food in relation to different periods of the day

S. tumbil: For studying the variations in the amount and nature of food during different periods of the day, samples collected by the present author from different hauls on board the trawler were taken into consideration. The data analysed by the points and volumetric methods are presented in Table 5. It may be



PIG. 6. Monthly feeding index in different size groups of *S. undosquamis* from zone 17° 40'.

mentioned that the Government of India trawlers operated only during day time from 6 am. to 6 pm., during the period of this investigation. The operations of the trawlers were divided into the following periods of 2£ hours duration for a comparative study of the food and feeding during different period of the day.

Morning	0600 to 0830 hrs.
Forenoon	0830 to 1100 hrs.
Noon	1100 to 1330 hrs.
Afternoon	1330 to 1600 hrs.
Evening	1600 to 1830 hrs.

It may be seen from Table 5 that the feeding index and feeding intensity showed two peaks, One in the morning and the other in the noon. During the period of study of food by the volumetric method, fish could be collected in the morning and noon only. Fish caught in the morning showed higher feeding intensity than those caught in the noon while the reverse was observed in the case of feeding index.

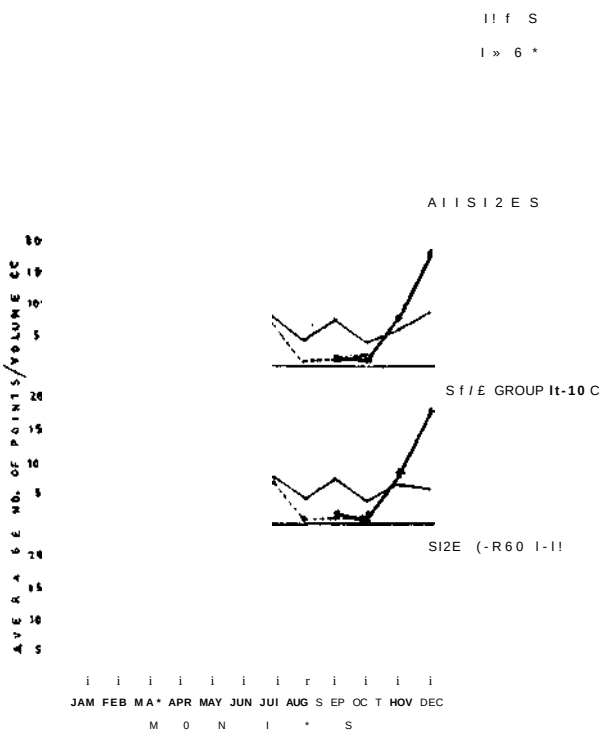


FIG. 7. Monthly feeding intensity in different size groups of 5. *undosquamis* from zone 17° 40'.

S. undosquamis: The relevant data are given in Table 6. Analysis of available data by the points method showed that the feeding index, and intensity were higher in. the morning than noon while the analysis by volumetric method showed that the feeding index and intensity were higher in the morning and afternoon than in the forenoon and noon. From the data presented by Hayashi et al (1960) for *S. urtdosquamis* in Japanese waters, it appears that the feeding index values were higher in the periods 6.00 to 8.00 hrs. and 14.00 to 16.00 hrs.

Food of juveniles of S. tumbil *from inshore area*

Juveniles of *S. tumbil* 50-130 mm in length were collected from shore-seine catches at Lawson's Bay, Waltair. Juveniles of fishes (mainly *Stolephorus*

TABLE 3. *Feeding index and feeding intensity according to maturity in* S. tumbil *by points method and Volumetric method.*

Stage of maturity	No. of fish examined	Percentage of stomachs with food	Average number of points/cc
Points Method			
immature	993	42.5	4.27 points
Maturing	393	49.9	5.74 points
Ma tore	36	50.0	5.19 points
Spent	35	45.7	5.62 points
Volumetric Method			
Immature	411	55.7	3.02 cc
Maturing	183	59.6	7.96 cc
Mature	4	25.0	1.50 cc
Spent	14	50.0	7.76 cc

spp., *Leiognathus* spp., *Sciaenids* and *Saurida* spp.) formed the major part of the stomach contents. Squids and prawns were taken in small quantities.

Food selectivity by S. tumbil: The dominance of *L. bindus* in the food of *S. tumbil* suggests that it may be a preferred item. For knowing whether *S. tumbil* showed preference for *L. bindus.* Ivlev's (1961) index of electivity was employed. The data from one of the trawlers namely, M.F.V. Champa for the period May 1965 to February 1966 were used. During this period this vessel fished in a limited area off Visakhapatoam (zone 17°40'). Samples of *S. tumbil* were obtained from this trawler in different months and the percentage of *L. bindus* in the food (by volume) found out. The monthly percentages of *L. bindus* (by volume) in the catches of this trawler were also recorded. From these the monthly

TABLE 4. *Feeding index and feeding intensity according to maturity in* S. undosquamis *by points method and volumetric method.*

Stage of maturity	No. of fish examined	Perecentage of stomachs with food	Average number of points/cc
Points Method			
Immature	413	54.7	6.23 points
Maturing	69	53.6	6.47 points
Mature	50	50.0	6.96 points
Volumetric Method			
Immature	176	59.1	1.18 cc
Maturing	60	53.3	1.22 cc
Mature	30	73.3	3.41 cc

TABLE 5. *Feeding index, feeding intensity and the composition of food of* S. tumbil *during different periods of the day.*

Time (hours)	No. of fish examined	% of stomachs with food	Average number of points or ave. volume (oc)	Percentage composition of food			
				Fish	Squilla	Prawns	Cephalopods
By points method (1964 and 1965)							
06.00-08.30	47	46.8	5.67	97.3			**2.7**
08.30-11.00	28	32.1	3.64	100.0			
11.00-13.30	70	42.9	4.47	86.3	—	**7.7**	6.0
13.30-16.00	15	20.0	1.26	47.4			52.6
16.00-18.30	22	40.9	3.30	79.5			20.5
By volumetric method (1966)							
06.00-08.30	39	51.3	5.27	95.0	—	0.3	4.7
08.30-11.00	Nil						
11.00-13.30	38	68.4	3.45	93.9	0.2	1.3	4.6
13.30-16.00	Nil						
16.00-18.30	Nil						

indices of electivity were calculated and are shown in Table 7 along with other relevant data (the catch per hour of the predator and prey). The index of electivity could be calculated for all the 10 months for the size group 16-30 cm while for the size group 31-45 cm, it could be calculated for one month, i.e., December 1965 only, as in the other months *L. bindus* was not observed in the guts of fish of this size range.

From Table 7 it can be seen that out of 10 months, the values of E in 6 months were positive while in the other months they were negative. The average E for the entire period (average of monthly percentages were used to give equal importance to all months) showed a positive value of 0.244.

The highest positive value for E was observed in July and the next two values in order of magnitude were observed in January and February, 1966. The monthly fluctuations in the abundance of *L. bindus* in the stomach of 5. *tumbil* and in the trawl catches were similar. The peaks in the abundance of L. *bindus* in the trawl catches and in the stomach paralleled in the months of May and December 1965, and February 1966. But in July 1965, the abundance of L. *bindus* in the food was high (30%) while it was low in the trawl catch (table 7).

Food of Saurida longimanus

Out of 31 specimens examined, 18 had empty stomach while in the rest the degree of fullness of stomach ranged from *i* to *. Fish and prawns were

TABLE 6. *Feeding index, feeding intensity and the composition of the food of* S. undosquamis *during different periods of the day.*

Time (hours)	No. of fish examined	% of stomachs with food	Average number of points or ave. volume (cc)	Percentage composition of food			
				Fish	Squilla	Prawns	Cephalopods
By points method							
06.00-08.30	22	72.7	8.00	67.0	11.4	10.2	11.4
08.30-11.00	—	—	—	—	—	—	—
11.00-13.30	26	23.0	3.20	100.0	—	—	—
13.30-16.00	—	—	—		— —	—	—
By volumetric method							
06.00-08.30	20	45.0	1.07	81.0	3.6	16.4	
08.30-11.00	1	Nil	—		– –	– –	–
11.00-13.30	10	30.0	0.60	100.0	—	—	—
13.30-16.00	8	75.0	1.25	99.0	—	1.0	—

observed in the stomachs, the former being dominant. The fish item consisted of *Stolephorus* spp., *Trichiurus sp.,* small eels *(Muraenesox* sp.), *Saurida* spp., and *S. longimanus.* The prawn item consisted entirely of penaeids.

DISCUSSION

The present studies have shown that the three species of *Saurida* feed on organisms found on or near the bottom. They are mainly piscivores, the percentage of fishes in the stomach contents being about 80. The other items of food were the crustaceans and the cephaiopods. Okada and Kyushin (1955), and Tung (1959) have also reported that *S. tumbil* from the East China Sea and Yellow Sea feed mostly on fishes, clupeids and *Acropoma faponicum* was the favourite item. According to Tiews et al (1972), 80% of the food of *S. tumbil* from the Philippine waters consisted of fishes, the rest being composed of squids, prawns and digested mater. Amongst fishes *Stolephorus* spp., *Gobius* spp. and *Leiognathus* spp., occupied the first three places in the order of importance. Kuthalingam (1959) found small amounts of copepods, cirripede larvae, decapod larvae and *Sagitta* in the stomachs of adults but none of these items were recorded in the adult fish in the present investigation.

The feeding intensity of *S. tumbil* has been found to be low during the spawning time (October-November). This is in contrast to what is reported by Tung (1959) and Yarwada et al (1966) who observed high feeding intensity in both the sexes during the spawning period. Tiews et al (1972) did not observe any seasonal variation in the diet or feeding frequency of *S. tumbil* from the Philippine waters.

TABLE 7. *Monthly indices of electivity of* S. tumbil *for* Leiognathus bindus *during the period May* 1965 to *February* 1966 *(Data from the Govt, of India trawler, M. F. V. Champa),*

	% of *L. bindus* in stomachs ri	% of *L. bindus* in catch Pi	Electivity index ri~Pi / ri+Pi	Catch per hour (kg) of *L. bindus*	Catch per hour (kg) of *S. tumbil*
Size group 16-30 cm					
1965					
May	13.4	3.46	0.389	3.21	1.72
June	2.2	3.20	-0.185	2.20	0.58
July	30.0	0.80	0.948	0.60	0.28
August	16.6	30.80	-0.299	21.86	2.35
September	6.1	13.80	-0.386	5.10	2.62
October	11.8	6.41	0.295	2.95	1.65
November	8.5	9.70	-0.066	6.20	3.92
December	50.5	34.20	0.192	24.40	4.92
1966					
January	15.8	2.36	0.740	0.81	9.09
February	28.5	6.69	0.619	2.48	10.70
Average	18.34	11.14	0.244		
Size group 31-45 cm					
1965					
December	95.7	34.20	0.473	24.40	4.92

The present author, and Rao (1964) have found that the intensity of feeding in *S. tumbil* was highest in the morning and thereafter gradually declined in the evening followed by a slight rise in the night while Hayashi et al (1960) found that *S. elengata, S. undosquamis* and *S. tumbil* from Japanese waters, showed little difference in the feeding activiy during different periods of the day and also between day and night.

Many authors have tried to establish a relationship between feeding intensities and catch rates of demersal fishes (Konstantinov 1964, Woodhead 1964, Parrish et al 1964). De groot (1964) and Hempel (1964) found that the catches and catch rates of plaice were considerably higher during day time, when the feeding was more intensive than at night. Rao (1964) observed that *Leiognathus bindus* and *Secutor ruconius* became most vulnerable for capture in the trawl nets during the period of their maximum feeding activity. In Table 8 are presented the average catch rates of *S. tumbil* and *Leiognathus bindus* the dominant food item, realized by the trawlers during different periods of the day. While the high catch rate of *S. tumbil* in the noon could be attributed to the high feeding intensity observed in the noon, the poor catch rate realized in the morning period cannot be explained in relation to feeding.

TABLE 8. *Average catch rates of* S. tumbil *and* Leiognathus bindus *realized by the Govt, of India trawlers during different periods of the day.*

Period of the day	Catch: per hour of *S. tumbil* (kg)	Catch per hour of L. *bindus* (kg)	Effort in hours
06.30 to 08.30 hrs. (Morning)	0.68	2.02	77.17
08.30 to 11.00 hrs. (Forenoon)	1.28	0.65	84.00
11.00 to 13.30 hrs. (Noon)	1.14	2.15	89.41
13.30 to 16.00 hrs. (Afternoon)	0.75	1.83	73.88
16.00 to 18.00 hrs. (Evening)	1.64	6.22	27.25

The electivity index (E) of *S. tumbil* for *L. bindus* for the period May, 1965 to February, 1966 in this investigation has shown positive values in 6 months and negative values in 4 months. Similar results have been reported by Sekharan (1966) in the case of Sardines, *Sardinella gibbosa* and *S. albella,* and by Anraku and Azeta (1965) in the food of Juveniles of the yellow tail, *Serioia quinqueradiata* from the Japanese waters. It may, therefore, be argued that the electivity index E, though suitable for laboratory work, may not be satisfactory in nature and cannot be mechanically used in food studies as pointed out by Nikolsky (1963). According to Ivlev (1961) the electivity index depends, among other factors, on the density of the predator and prey. In the present studies a consistent trend was not observed between the feeding intensity (of *S. tumbil)* on the one hand and the densities of the predator and prey (Miscellaneous small fish) on the other in different zones.

The fact that besides the dominant item's, *L. bindus* and *Stolephorus* spp,. other species of fishes formed a considerable part of the food of 5. *tumbil* shows that, in the absence of these two items, *S. tumbil* feeds on other available fish, not sparing even individuals of its own species. Cannibalism was observed frequently in *S. undosquamis* also.

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