

**OBSERVATIONS ON THE FOOD OF THE SANDWHITING
SILLAGO SIHAMA (FORSKÅL) FROM PULICAT LAKE**

By K. N. KRISHNAMURTHY

*Central Inland Fisheries Research Institute, Pulicat Lake Unit
19-A, Patel Road, Madras-11.*

INTRODUCTION

THE Sandwhiting, *Sillago sihama* (Forskål), locally known as 'Kelangaan' (Tamil) is an important food fish of Pulicat Lake; contributing to nearly two tonnes per month and forming 2 to 3% of the total catch from the lake. This is mainly caught by hand lines using polychaete worms as bait and the fishing is concentrated along the southern portion of the lake. This fish is also caught in drag nets, seines and bag nets but their catches are poor.

Radhakrishnan (1957) described the biology of this fish from Mandapam and Rameswaram areas with particular reference to food, spawning, fecundity, age and growth etc. Brief notes on the food of this fish from Pulicat lake were given by Chacko, Abraham and Andal (1953); from Vamsadhara estuary by Chacko and Srinivasan (1954); from Korapuzha estuary by Chacko, Mathew and George (1956) and from Gulf of Mannar by Chacko (1949). However no detailed work on the biology of this fish from Pulicat lake is available and as part of the integrated programme on the biology of important food fishes of Pulicat lake, studies on the biology of *Sillago sihama* were undertaken since 1965 and the present communication embodies the analysis of food of this fish examined during the period from August 1965 to July 1967.

MATERIAL AND METHODS

Regular weekly samples were obtained from commercial catches from the lake. Later to examine the juveniles of fish departmental netting was conducted using a nylon drag net and a velon net. Samples from the main fishing grounds of the lake and also from the sea were obtained and analysed for comparative studies. All the fish examined were mostly in fresh condition; total length, weight, sex etc., of individual fish were recorded. The stomach was removed and left in a petri dish and the walls of the stomach were cut open and the contents examined. In a few cases, preserved samples were also examined. Gastrosomatic indices were calculated for individual fish and pooled monthwise for the evaluation of feeding intensity.

Estimation of food was done by occurrence method (Hynes, 1950) and volumetric method (Pearse, 1915). Percentage of food items was computed by the method of index of preponderance suggested by Natarajan and Jhingran (1961), which brings out simultaneously the frequency of occurrence of the food element and also its bulk. During analysis of stomach contents, polychaete worms used

as baits for the capture of this fish were encountered frequently which could be made out by their comparatively bigger size and by their being used as cut pieces from big sized individuals as against those consumed as food which were comparatively smaller in size and in a partially digested condition; baits were omitted from enumeration. Most of the food components were in a partially digested condition and the identification of these were possible only upto group level. Wherever possible, identification was made upto generic and sometimes upto specific level.

The food consumed by fish was analysed in relation to its size; for this purpose the entire size range of the fish examined was tabulated into 10 mm class intervals. A gradual change in the food composition was noticed as the fish increased in length. Based on this three broad categories could be made out viz., fry, fingerlings and adults in which the gonads could be distinguished; the data is presented accordingly throughout.

FOOD OF FRY

This group include individuals of size upto a length of 40 mm. The gear used for the capture of this group was departmental velon-net. A total of 57 fishes were examined in this group of which seven had empty stomachs. The food of fry is tabulated in Table I.

TABLE I

Index of preponderance of food items of Sillago sihama

FRY

No. examined : 57; Percentage of empty stomachs—12.2.

Period of observation : September and October 1967.

	Percentage of occurrence O_i	Percentage of volume V_i	$V_i \cdot O_i$	$\frac{V_i \cdot O_i \times 100}{\sum V_i \cdot O_i}$
Copepods ..	90.8	95.8	8698.6	99.84 (1)
Mysids ..	1.8	1.6	2.9	0.03 (3)
Prawn larvae ..	1.8	1.0	1.8	0.02 (4)
Other crustacea ..	5.6	1.6	9.0	0.11 (2)

As can be seen from the table, copepods were the predominant element of the food of this group. *Oithona* sp., *Pseudodiaptomus aurivilli* and *Euterpina acutifrons* were the important copepods occurring in the food. Mysids, prawn larvae and other crustacea were the other organisms contributing to a minor share to the food. The fishes examined in this group were obtained only during September and October months of 1967 and as such no seasonal trends in the diet of this group could be noticed.

FOOD OF FINGERLINGS

The stomach contents of sixty-three fishes ranging from 41 mm to about 100 mm were included in this group. The fishes were obtained from drag nets and seines. Twenty three fishes had empty stomachs in this group. The data on food composition of this group is presented in Table II.

TABLE II
Index of preponderance of food items of *Sillago sihama*

FINGERLINGS

No. examined : 63 ; Percentage of empty stomachs : 45.5.
Period of observation : March, August 1966—April 1967.

	Percentage of occurrence O_i	Percentage of volume V_i	$V_i O_i$	$\frac{V_i O_i \times 100}{\sum V_i O_i}$
Copepods ..	4.4	1.0	4.4	0.30 (7)
Amphipods ..	11.1	2.2	24.4	1.62 (5)
Mysids ..	2.2	2.0	4.4	0.30 (7)
Other crustacea ..	11.1	9.3	103.2	6.85 (4)
Molluscs ..	2.2	3.2	7.0	0.46 (6)
Polychaetes ..	24.4	30.0	732.0	48.62 (1)
Fish ..	9.0	46.3	416.8	27.67 (2)
Mucus etc. ..	35.6	6.0	213.6	14.18 (3)

It is evident from the table that polychaetes were the predominant element of food of this group forming 47.52 %, followed by fish and crustacea. Among polychaetes, Nereids were common and among fish, *Ambassis* sp. and gobiids were met with. Crustacea included a wide variety of animals which included amphipods, mysids and copepods; molluscs also were encountered. Polychaetes showed their presence only from fish of size group 61 mm and above and occurred regularly in all the size groups along with a variety of other organisms like crustacea etc. The material for this study was available only during March, April and August. During March amphipods were more while polychaetes were common in August.

FOOD OF ADULTS

The food of three hundred and seventysix fishes of about 100 mm and above, is presented here. The important gear used for the capture of fish of this group is handlines; besides, samples were also obtained from drag nets, seines and bag nets. The data on food composition of this group is presented in Table III.

TABLE III
Index of preponderance of food items of *Sillago sihama*

ADULTS

No. examined : 376. Percentage of empty stomachs—53.0
Period of observation : August 1965—July 1967

	Percentage of occurrence O_i	Percentage of volume V_i	$V_i O_i$	$\frac{V_i O_i \times 100}{\sum V_i O_i}$
Amphipods ..	1.6	0.8	1.3	0.03 (7)
Prawns ..	6.6	2.1	13.9	0.31 (5)
Other crustacea ..	10.4	6.4	66.6	1.48 (3)
Molluscs ..	1.6	2.0	3.2	0.07 (6)
Polychaetes ..	54.1	78.8	4263.0	94.88 (1)
Fish ..	4.4	3.9	17.2	0.38 (4)
Mucus etc. ..	21.3	6.0	127.8	2.85 (2)

One hundred and ninety-nine fishes had empty stomachs in this group. From the table it is evident, that the predominant component of the food of this group is polychaetes, which accounted for 94.88%. A variety of other organisms also contributed to the food, among which crustacea represented by crabs, mysids, prawns, amphipods etc., bivalves and fish represented by gobiids etc. were encountered. Polychaetes were abundant in all the fish of this group, examined throughout the period of investigations accounting for more than 75% of the food in all the months except March and April. During these months, the samples obtained were mainly from the northern sector of Pulicat lake where the percentage distribution (Krishnamurthy, unpublished records) of polychaetes and their percentage composition in the food were very less compared to that of southern sector of the lake.

Other groups like, amphipods, prawns, molluscs and fish etc, were encountered erratically with no discernible seasonal trend in their occurrence. Analysis of food of fish captured from different zones of the lake did not indicate any marked trend in the composition except for the increased percentage of polychaetes in the food of fishes from the southern sector.

FOOD OF FISH FROM SEA OFF PULICAT

To evaluate a comparative study of the food of this fish, samples were also obtained from the sea off Pulicat and compared with that of the lake. The size range of fishes obtained from the sea was from 66 mm to 328 mm. A total number of 121 fishes were examined out of which seventy four had empty stomachs. The samples were obtained from hand lines and seines from November 1965 to May 1967. During March, June, August and September months no sample could be procured. The data is presented in Table IV.

TABLE IV
Index of preponderance of food items of Sillago sihama

FROM SEA OFF PULICAT

Size-range : 66-328 mm.
No. examined—121 ; Percentage of empty stomachs 61.0
Period of observation : November 1965 to May 1967

	Percentage of occurrence O_i	Percentage of volume V_i	$V_i \cdot O_i$	$\frac{V_i \cdot O_i \times 100}{\sum V_i \cdot O_i}$
Amphipods ..	4.2	0.5	2.10	0.14 (8)
Prawns ..	14.6	33.8	493.48	32.75 (2)
Mysids ..	6.3	0.5	3.15	0.21 (7)
Crabs ..	6.3	3.0	18.9	1.25 (5)
Other crustacea ..	8.3	24.0	199.20	13.23 (3)
Polychaetes ..	2.0	6.0	12.0	0.80 (6)
Fish ..	6.3	14.6	91.98	6.10 (4)
Mucus etc. ..	45.7	14.6	667.22	44.27 (1)
Balanoglossus ..	6.3	3.0	18.90	1.25 (5)

As can be seen from the table, the food composition of this fish obtained from sea showed a preponderance of prawns, forming the main element of food, followed

TABLE V

Sillago sihama Mean monthwise gastroscopic index, Percentage of empty stomachs etc. Lake specimens

Adults: Size—range: 101-330 mm.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Gastroscopic index	2.12	2.20	1.63	..	2.49	..	..	2.3	2.55	2.37	2.11	4.18
% empty stomachs	51.10	48.20	52.50	50.00	31.20	52.60	51.30	68.70	46.90	54.20	79.10	38.60
No. of fish examined	45	29	40	18	16	19	37	48	32	24	24	44

by other crustacea like *Hippa*, crabs, mysids and amphipods. Fish represented by *Anchoviella* sp. also were encountered in the food, while polychaetes were insignificant. *Balanoglossus* was encountered in the stomach contents forming 1.25%. As the sample obtained was small, the data was pooled irrespective of sizes.

FEEDING INTENSITY

The feeding intensity of fish was studied by pooling the gastrosomatic indices of individual fishes and tabulating the data monthwise, along with the percentage of empty stomachs.

For this study, only the adults from the lake were taken up as younger fishes were not available throughout the year as also samples from sea. As can be seen from the table, the mean monthly gastrosomatic indices do not show any clear trend and more or less uniform values were obtained in all the months except in March with a lower value and in December with a higher value. During April, June and July the index could not be calculated as the samples were either damaged or mutilated. The percentage of empty stomachs also were more or less uniform, in all the months; however, a high percentage of empty stomachs was noticed in November.

Radhakrishnan (*op. cit.*) observed that the fish feeds actively from March to May this period following immediately after spawning. However, during the present study a very large number of fish were found to have empty stomachs. It is likely that the main mode of capture of this fish in Pulicat lake by hooks and line (about 85% of the total landing) results in the fish getting frightened thereby disgorging its stomach contents, resulting in a large number of fish with empty stomachs. The percentage of empty stomachs encountered in fish captured by each type of gear is presented in Table VI.

It can be noticed, that 62.5% of the fish captured by hand lines had empty stomachs which lends support to the view stated above. Unless a detailed study on the feeding chronology is made and samples obtained from non-selective gear, it is difficult to determine the feeding intensity of this fish accurately.

FORAGE RATIO

Studies on the bottom biota of Pulicat lake were undertaken by the author during the latter half of 1967 and continued upto 1968. The composition of the fauna is shown in Table VII, along with the food composition of adults and fingerlings from the lake and a forage ratio for the two groups is worked out.

The food of fry was not considered for this study as they were plankton feeders. For adults, a high value of 4.05 is obtained for polychaetes indicating that these are available abundantly for the fish to be consumed as food or that the fish makes a deliberate attempt to search for these polychaetes and select them as food from among the fauna inhabiting the bottom of the lake. Other groups of animals encountered in the fauna are perhaps avoided as indicated by the forage ratio (Hess and Swartz, 1940).

TABLE VI

*Percentage of empty stomachs encountered in Sillago sihama in different types of gear**Lake-specimens*

	Hand lines	Drag nets	Seines	Bag nets
Total no. of fish	62.5 253	35.2 193	29.5 17	45.0 33

TABLE VII

Forage ratio of Sillago sihama

	Sea Anemone	Nematodes	Polychaetes	Amphipods	Other crustacea	Molluscs	Minor groups	Protochordates	Fish	Copepods
% in fauna	0.6	12.6	23.4	49.5	10.6	2.6	0.25	0.05	0.4	..
% in stomach : adults (forage ratio in brackets)	..	..	94.88 (4.05)	0.03	1.77 (0.16)	0.07 (0.02)	..	..	..	..
% in stomach : fingerlings (forage ratio in brackets)	..	..	47.52 (2.03)	1.58 (0.03)	6.97 (0.65)	0.45 (0.17)	..	..	..	0.28

In case of fingerlings the forage ratio also points out to the indication of polychaetes being the preferred food item in later stages.

It should also be pointed out that the above observations should be viewed with caution as biota studies were made subsequent to the studies on the food of this fish.

CONCLUSIONS

Studies made on the food composition of *Sillago sihama* from Pulicat lake reveal that there are three trophic phases in the life of this fish. Fry feed primarily on copepods whereas adults subsist mainly on polychaetes. In between these two groups a transitory phase comprising fingerlings with a mixed diet of polychaetes, copepods and other crustaceans, is noticed, though again polychaetes are dominant individually as a group over other food items. The change-over from a planktonic food, mainly on copepods, to that of a bottom feeding habit, mainly on polychaetes, is brought in early in life of the fish, which was noticed in the stomach contents of this even from 61 mm size onwards. No seasonal or sectoral change inside the lake in the food of *Sillago sihama* was observed. Analysis of food composition of this fish from sea indicated the predominance of prawns and other crustaceans while polychaetes were insignificant as an item of food.

Chacko (1949) reported that the fish is an omnivorous feeder and 'browses among sea weeds and corals' in Gulf of Mannar. Present observations, however, indicate that the adults of *Sillago sihama* in Pulicat lake feed exclusively on polychaetes, as observed by Chacko *et al* (1953, 1954 and 1956) and Radhakrishnan (1957) in different areas. A deliberate search for polychaetes appears to be made by this fish as evidenced by forage ratio; this selective feeding on polychaetes is fully exploited by the fishermen who make use of these worms as the sole bait for the capture of this fish.

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