FOOD AND FEEDING HABITS OF *JOHNIEOPS SINA* (CUVIER)

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ABSTRACT

The stomach contents of juvenile and adult *Johnieops sina* from the inshore fishing grounds off Calicut show no period of active feeding either in the juveniles or in the adults. In the food of juvenile, planktonic forms dominated; copepods being most predominant. The adult is carnivorous; fishes ranked first in the food followed by prawns, polychaetes, amphipods, *squilla* sp. and a variety of other organisms living at or near the bottom. The differences in the food composition between juveniles and adults suggest the two different habitats of the fish in the two stages.

INTRODUCTION

Johnieops sina (Cuvier) is one of the commonest species constituting the jewfish fishery of the Malabar coast. The only information available on the food and feeding habits of the species is that based on the brief references made by Venkataraman (1960) and George et al (1968). Food studies were made as a part of the biological studies undertaken on this species at Calicut from July 1969.

MATERIAL AND METHODS

Random samples of the fish were collected every week from the landings of Pattenkolli vala, Ayilachala vala, castnets and mechanised trawl nets at Vellayil. The material was also collected from the weekly catches made by the departmental boat-seine. As the size at first maturity for the fish was found to be 115 mm, all specimens up to 115 mm were grouped as juveniles, and those above this size as adults; the food analysis was done separately.

The total length and stage of maturity for individual fish were recorded and the stomach was preserved in 5% formalin for further analysis. The intensity of feeding was determined based on the degree of distension of the stomach and the amount of food contained in it; the stomachs were classified as gorged, full, ¾ full, ½ full, ¼ full, trace and empty. The food of the species was analysed by displacement method and points (volumetric) method (Hynes 1950, Pillay 1952). The index of preponderance was calculated by the method of Natarajan and Jhingran (1961).

Feeding Intensity

The fish was considered to have actively fed when the stomachs were gorged, full or ¾ full; moderately fed when ½ full; and poor when ¼ full or less.

Juveniles

Specimens with empty stomachs appeared among juveniles in lesser proportion than in adults. The percentage of empty stomachs was higher during 1972-73 and 1973-74 when compared to the other years (Table 1). The majority of fish were in the category of 'poor feeding' in all seasons, except in 1971-72, when the actively feeding individuals showed a steep rise.

In order to see whether there is any seasonal variation in the feeding intensity, a monthly analysis of the data was also made (Table 2). The fish population sampled was found to be dominated by poorly-fed fish. However, slight variations in feeding intensity were observed, the intensity being comparatively high in November in 1969, May, July and December in 1971, February, March, May to June and December in 1972, April in 1973 and May in 1974; indicating no regular periodicity in the intensity of feeding in different seasons.

Adults

The incidence of empty stomachs was higher in adults than in juveniles, the percentage of occurrence ranging from 29.45 in 1970-71 to 51.43 in 1973-74. The percentage of actively feeding individuals was very low and showed a range of 6.18 in 1970-71 and 18.00 in 1972-73. The percentage of actively feeding fish was slightly higher in certain months, viz, September 1969, April and November 1970, June and December 1972, February and November 1973 and March and April 1974 (Table 3). This indicated the absence of regular feeding periodicity.

Food Composition

Juveniles

The relative importance of the different food items in terms of index of preponderance for different seasons are shown in figure 1. Copepods were found to be the predominant food item in juveniles, these having occupied the first rank among different categories of food items in 1970-71, 1972-73 and 1973-74 and a very prominent position in other seasons. The next was prawns in all seasons and in 1969-70 these even formed the principal food item. Mysids ranked third and they were found to be main diet in 1971-72. Amphipods also formed one of the important food constituent of juveniles. In order to see whether there is any seasonal variation in the food of juveniles, monthly analysis was done and the index of preponderance of different food items is given in figure 2.

TABLE 1. *Intensity of feeding in percentage in juvenile and adult* J. sina *in different seasons during* 1969-74.

	Juveniles						*Adults*					
	No. of fish examined	*Active*	*Moderate*	*Poor*	*Empty*	*Everted*	*No. of fish examined*	*Active*	*Moderate*	*Poor*	*Empty*	*Everted*
69-70	86	22.43	9.29	54.15	14.13	——	96	9.28	12.34	35.94	32.35	10.19
70-71	294	20.05	15.14	43.13	11.66	1.02	161	6.18	9.80	50.74	29.45	3.63
71-72	223	43.42	16.89	32.03	7.40	0.26	226	16.47	11.42	35.36	34.82	1.93
72-73	61	18.59	15.95	20.08	45.38	——	100	18.00	18.00	19.00	45.00	——
73-74	130	18.53	15.43	28.04	38.00	——	151	12.74	15.48	20.35	51.43	——

TABLE 2. *Intensity of feeding in percentage in Juvenile* J. sina *in various months 1969-74.*

Season	*Intensity of feeding*	*Percentage in different months*											
		Jul.	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*Jun.*
69-70	Active	—	—	—	—	33.34	—	21.60	14.32	15.38	20.00	30.00	—
	Moderate	—	—	—	—	—	—	8.10	—	7.69	30.00	10.00	—
	Poor	—	—	—	—	33.33	—	62.10	85.68	53.83	30.00	60.00	—
	Empty	—	—	—	—	33.33	—	8.20	—	23.10	20.00	—	—
70-71	Active	75.00	—	—	—	25.00	33.30	14.24	21.84	18.00	22.65	22.54	—
	Moderate	—	—	—	—	—	13.32	26.70	17.16	22.00	22.65	19.32	—
	Poor	25.00	—	—	—	50.00	33.30	44.57	54.60	52.00	43.79	41.86	—
	Empty	—	—	—	—	25.00	20.08	12.71	6.40	8.00	10.91	9.84	—
	Everted	—	—	—	—	—	—	1.78	—	—	—	6.44	—
71-72	Active	—	100.00	—	75.00	37.05	30.7	16.24	41.84	32.00	17.86	28.00	100.00
	Moderate	—	—	—	—	28.56	15.4	11.60	16.10	40.00	49.98	24.30	—
	Poor	100.00	—	—	25.00	21.80	38.5	44.08	32. 38	12.00	32.17	46.00	—
	Empty	—	—	—	—	8.80	15.4	28.08	9.66	16.00	—	2.70	—
	Everted	—	—	—	—	2.85	—	—	—	—	—	—	—
72-73	Active	—	—	—	—	27.27	33.33	20.0	18.18	—	50.00	—	—
	Moderate	—	—	—	—	18.18	33.3	—	63.64	—	—	12.50	—
	Poor	—	—	—	—	18.18	—	30.00	—	—	50.00	62.50	—
	Empty	—	100.00	—	100.00	36.37	33.4	50.00	18.18	—	—	25.00	—
73-74	Active	—	—	—	—	11.10	18.2	—	24.00	19.98	24.99	50.00	—
	Moderate	28.56	—	—	—	16.65	9.09	—	12.00	15.54	16.66	25.00	—
	Poor	28.56	—	—	—	11.10	45.45	25.0	16.00	39.96	33.32	25.00	—
	Empty	42.88	—	—	—	61.15	27.8	75.00	48.00	24.53	25.03	—	—

TABLE 3. *Intensity of feeding in percentage in adult* J. sina *in various months during* 1969-74.

Season	*intensity of feeding*	*Percentage in different months* *Jul*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*
69-70	Active	—	—	16.66	7.69	6.25	5.26	11.10	—	16.66	—	—	—
	Moderate	—	—	—	7.69	6.25	10.52	22.20	11.11	33.36	20.00	—	—
	Poor	—	—	66.68	23.07	25.00	21.04	38.55	22.22	16.66	6.00	50.00	—
	Empty	—	—	16.66	53.86	56.25	63.18	27.35	55.56	16.66	—	—	—
	Everted	—	—	—	7.69	6.25	—	—	11.11	16.66	—	50.00	—
70-71	Active	—	—	—	5.55	33.33	14.28	3.84	—	11.10	—	—	—
	Moderate	—	—	—	11.10	—	14.28	3.84	—	—	12.00	16.64	50.00
	Poor	33.34	—	37.50	38.85	33.34	57.16	53.76	85.52	85.52	61.15	60.00	50.00
	Empty	66.66	—	62.50	44.50	33.33	7.14	34.72	4.76	16.65	28.00	25.12	—
	Everted	—	—	—	—	—	7.14	3.84	9.52	11.10	—	8.32	—
71-72	Active	—	—	—	4.00	26.30	21.21	8.00	11.11	7.68	8.33	11.10	100.00
	Moderate	26.00	—	—	28.00	10.52	9.09	6.00	55.56	20.48	—	7.40	—
	Poor	66.68	—	40.00	44.00	52.66	36.36	34.00	11.11	35.84	33.32	70.40	—
	Empty	33.32	—	60.00	24.00	50.52	33.34	48.00	32.22	33.47	41.69	11.10	—
	Everted	—	—	—	—	—	—	4.00	—	2.53	16.60	—	—
72-73	Active	20.00	50.00	—	8.68	9.09	38.45	12.50	33.33	—	14.28	—	—
	Moderate	20.00	—	—	17.36	27.27	—	6.25	33.33	14.28	28.56	42.84	—
	Poor	60.00	—	—	43.40	9.09	—	18.75	33.34	14.28	14.28	—	—
	Empty	—	50.00	—	30.56	54.45	61.55	62.50	—	71.44	42.88	57.16	—
73-74	Active	13.32	—	10.00	—	23.52	14.28	—	6.25	22.54	37.50	—	—
	Moderate	6.66	—	20.00	9.08	29.40	9.52	14.28	6.25	9.66	—	50.00	—
	Poor	6.66	—	30.00	13.62	23.52	14.28	14.28	12.50	38.64	—	50.00	—
	Empty	73.36	—	40.00	77.30	23.56	61.92	71.44	75.00	20.16	62.50	—	—

Copepods: Copepods ranked very high in the food in almost all the months of observation except in February, May, July and November 1970, May, August and October 1971, February, June and December 1972 and May 1974. The copepod diet was composed of species of *Acrocalanus, Calocalanus, Pseudodiaptomus, Labidocera, Centropages, Undinula, Euchaeta, Oncaea, Corycaeus* and *Euterpina*.

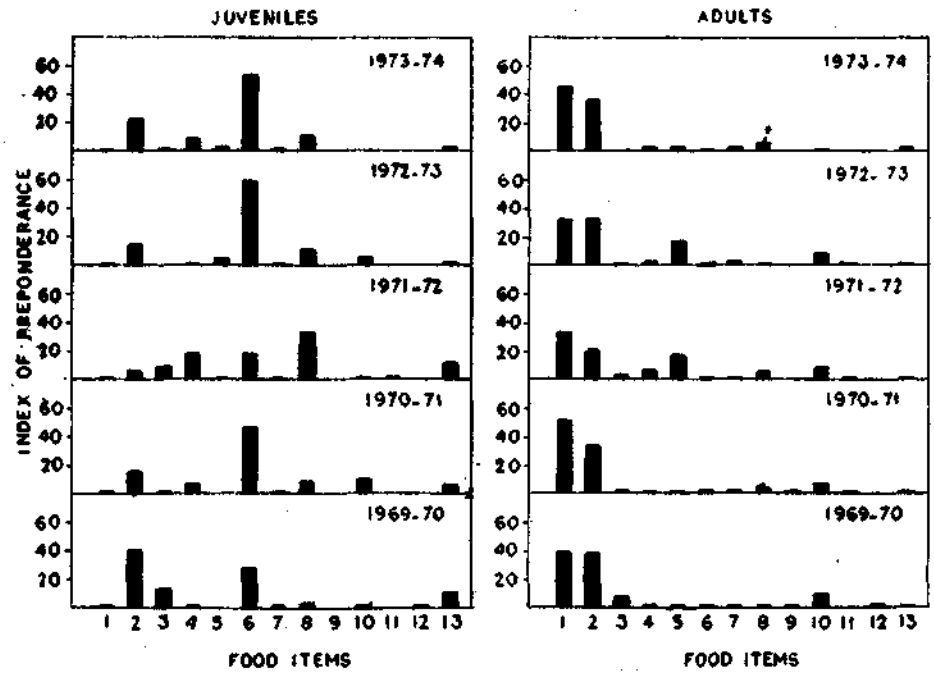

FIG. 1. Index of preponderance of food items in juvenile and adult *J. sina* during 1969-74. 1. Teleosts 2. Prawns 3. *Acetes* spp. 4. Amphipods 5. *Spilla* spp. 6. Copepods 7. Crabs 8. Mysids 9. Mysis stage of decapods 10. Polychaetes 11. Molluscs 12. Detritus 13. Others.

Prawns: Small-sized prawns represented by species like *Penaeus indicus, Parapenaeopsis stylifera, Metapenaeus affinis, M. dobsoni* and *Alpheus* sp. ranked second in the juvenile diet. The small shrimp, *Acetes* spp. formed part of the food in many months of observation, being an important food constituent in February-May 1970, May and December 1971 and May 1972.

Mysids: Mysids were present in the diet almost round the year, with peak occurrence in January 1970, February and August 1971, January to March 1972, May and November 1973 and January and March 1974.

Amphipods: Amphipods were also an important food constituent, the common amphipods observed being *Oxycephalus* sp, and *Cheiriphotes megachelis*.

Others: Crabs represented by juvenile *Neptunus* sp., *chaetognaths, teleosts* constituted mainly by small sized *Cynoglossus macrostomus, Leiognathus* sp., *Gerres* sp., *Pristipoma* and *Anchoviella tri,* mysis stage of decapods, prawn larvae *Alima* and adult stomatopods, polychaetes comprised mainly of a nereid species and *Prionospio pinnata* and molluscs were other items of food recorded occasionally in the stomach in minor quantities.

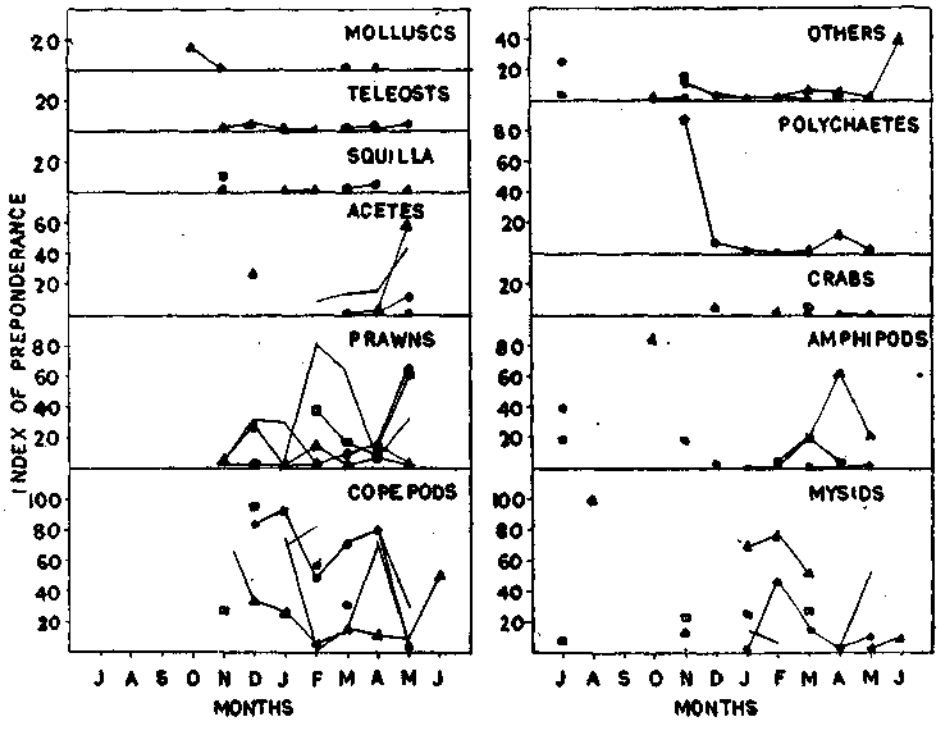

FIG. 2. Index of preponderance of food items of juvenile *J. stna* in different months during 1969-74.

Adults

Figure 1 gives the index of preponderance of various food items during different seasons. Teleosts formed the most important food item in all seasons except in 1972-73, when prawns ranked first. Next to teleosts came prawns. The third was *Squilla* sp. in 1971-72 and in 1972-73, polychaetes in 1969-70 and 1970-71 and mysids in 1973-74. Other items of food present in small quantities were *Acetes* spp., mysis stage of decapods, amphipods, isopods, ostracods, copepods, *Lucifer* sp., crabs, bivalve and univalve molluscs and detritus. The data collected on the food of adults were also subjected to monthly analysis to understand the difference in the food, if any, between different months (figure 3).

Teleosts: Teleosts formed the predominant food item of adults almost throughout the year. Among fishes the following species could be identified; *Cynoglossus macrostomus., Anchoviella tri., A. heteroloba, Johnius* sp., *Polynemus heptadactylus, Leiognathus bindus, Bregmaceros mcclellandi* and *Trypauchen vagina.*

Prawns: Prawns occupied the second place, the common species being *Parapenaeopsis stylifera, Metapenaeus affinis, M. dobsoni, M. monoceros* and *Alpheus* sp.

Polychaetes: Polychaetes, mostly *Prionospio pinnata* were also quite important in the food of this fish.

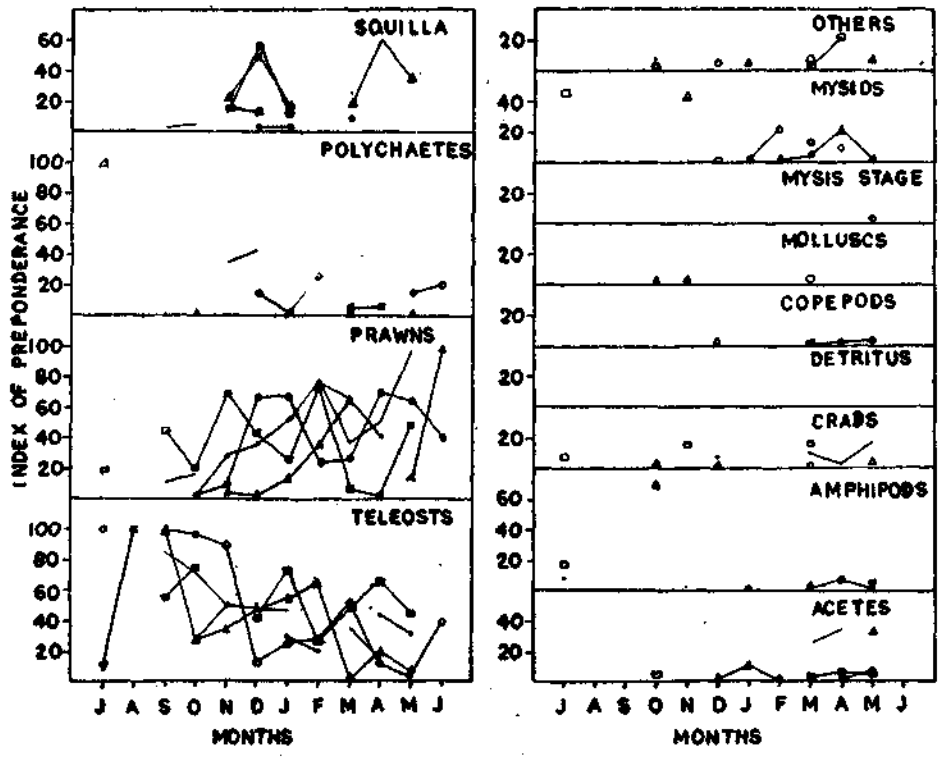

FIG. 3. Index of preponderance of food items of adult *J. sina* in different months during 1969-74.

Others: *Acetes* spp., mysids(Mysis stage of decapods, other decapod larvae, *Lucifer* sp., amphipods, isopods, ostracods, copepods, crabs, bivalves molluses (*Arca* sp., *Perna* sp.), univalve molluscs (*Cypriala* sp, *Turbo* sp.), stomatopods, and detritus were other items observed among the stomach contents, but their relative importance in the food was generally low.

Discussion

Qasim (1972) observed that since the food association in fishes is generally ecological, it is more appropriate to group the various food components based on their habitat and so in the present study in addition to the taxonomic grouping of the food components, an attempt has also been made at an ecological grouping of the forage animals. Thus the examination of the stomach contents showed the juvenile fish to be mainly a zooplankton feeder, copepods constituting the single largest item, though organisms of other ecological habitats like prawns and amphipods also occurred in good proportions. The adult fish was a more active carnivore, feeding mainly on teleosts and invertebrates like prawns, stomatopods, amphipods and polychaetes that live at or near the bottom. The almost complete absence of truly planktonic forms in the diet of adults, in contrast with the food of juveniles, is apparently due to the different habitat of the fish. Venkataraman (1960) observed that prawns, polychaetes, teleosts, *Acetes* sp., and amphipods were the chief food items. He also pointed out the bottom feeding nature of the fish. The stomach contents of the species as given by George et al(1968) consisted of fish, amphipods, mysids, sergestids, Megalopa and Alima larvae, caridean and penaeid prawns and polychaetes. Bhusari (1975) also recorded teleosts prawns *Squilla,* amphipods, polychaetes and molluscs in the gut contents of the fish. The present observation, while confirming the carnivorous nature of the adult has shown that the juvenile fish is mainly a zooplankton feeder.

For understanding the general patterns of distribution and composition of food species in the environment and its relation to the food of the fish, the data of Bhimachar and Venkataraman (1951), George (1953), Seshappa (1953), Seshappa and Bhimachar (1955) and Mukundan (1967) have been used. As stated earlier the predominant food component of the juveniles was zooplankton comprised mainly of different species of copepods. George (1953) and Mukundan (1967) observed that copepods formed the single consistantly dominant zooplankton group in the Calicut inshore plankton almost through out the year, except during south-west monsoon. A positive correlation existed between the monthly pattern of copepod abundance in the plankton and in the stomach contents, though in certain months inspite of the abundance of copepod in the plankton, the copepod content in the stomach was poor, probably due to the easy availability of equally preferable food elements in the environment. The peak spawning period of the species (November to February) was found to coincide with the peak occurrence of copepods in the plankton. Prawns, constituted mainly by *Parapenaeopsis stylifera* and *Metapenaeus dobsoni,* were an important food constituent in both juveniles and adults. Prawns form a considerable part of the demersal catches in the area, the species of prawns caught being *Parapenaeopsis stylifera, Metapenaeus dobsoni M. affinis* and *Penaeus indicus* in order of abundance. Thus the dominant species in the environment dominated

in the stomach also. *Acetes* spp., an important food item in the juvenile and in the adult especially in juveniles, was observed in plenty in the environment and in the stomach during March to May. Stomatopods, represented by *Squilla* sp. was plentiful in the environment during January to May, when it was found in abundance in the stomach contents also. The major portion of the teleost contents in the stomach was in an unidentifiable condition, but the examination of the remaining part showed *Cynoglossus macrostomus, Anchoviella tri* and *Anchoviella* sp. to be the more common species. The major species observed in the departmental experimental boat-seine (*Paithuvala*) catches are *Cynoglossus macrostomus, Anchoviella heteroloba, A. tri, Ambassis gymnocephalus,* and *Polynemns heptadactylus* (Bhimachar and Venkataraman, 1953). The occurrence of polychaetes represented by *Prionospio pinnata* and a nereid species in the diet of adults was higher in the post monsoon months. Seshappa (1953) observed that there was a rapid recolonisation of the inshore sea bottom by polychaetes (mainly *P. pinnata*) and amphipods and the bottom fauna continued to be rich during November to April. Similarly amphipods assumed some importance in the diet, when they were well represented in the fauna of this area.

Thus some general trends of positive correlation between the food organisms in the environment and that in the stomach contents could be observed. The present observation indicated the absence of any selective feeding of the species.

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