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Note

Food and feeding habits of *Otolithes cuvieri* (Trewavas, 1974) from Ratnagiri, Maharashtra

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ABSTRACT

The present report on food and feeding habits of *Otolithes cuvieri* is based on the examination of gut contents of 781 fishes within the size range of 83-300 mm collected from Ratnagiri, Maharashtra. Based on index of relative importance values, crustaceans like *Acetes* spp. and penaeid prawns were found to be the dominant food items followed by fishes, cephalopods and gastropods. Crustaceans were predominant in most of the months. Fishes of smaller lengths preferred only *Acetes* spp. Dominance of empty stomachs in most of the months as well as in different size groups indicates low feeding intensity of the species.

Keywords: *Acetes*, Index of relative importance, *Otolithes cuvieri*, Ratnagiri

Information on the feeding habits of marine fish and predator-prey relationship is useful in order to assess the role of marine fish in the ecosystem (Bachok *et al*., 2004). Data on diet composition are useful in the creation of trophic models as a tool to understand complex coastal ecosystems (Lopez-Peralta and Arcila, 2002). Diet analysis of fishes allows us to understand their feeding strategy and intra- or inter-specific interaction (competition and predation) and also indirectly indicate community energy flow (Ramirez-Luna, 2008). Hence the knowledge on the relationship between the fishes and food organisms is essential for the sustaninable exploitation of fish stocks.

Sciaenids, commonly called as jewfishes, croakers or grunters, are widely distributed in different parts of the world including tropical and sub-tropical waters of Indian Ocean (Druzhinin, 1974) and Atlantic Ocean (Lowe, 1962). In Maharashtra, after prawns and mackerel, sciaenids are the most important fishery resource. Among different species of sciaenids, *Otolithes cuvieri* contributes to about 22% of the total sciaenid landings in Maharashtra (CMFRI, 2011). Studies on the food and feeding habits of *O. cuvieri* along north-west coast of India has been conducted by earlier researchers like Chakraborty (1988) and Telvekar *et al.* (2006) from Bombay waters and Rao (1985) and Manojkumar (2003) from Veraval. There is no report avaible on the food and feeding aspects of this species along Ratnagiri coast where it forms an important trawl fishery. Hence, the present study was undertaken to analyse thefood and feeding habits of *O. cuvieri* along Ratnagiri coast.

Samples of *O. cuvieri* were collected from the landings of commercial trawlers at Mirkarwada landing centre in Ratnagiri during December 2009-May 2011. About 781 fishes were collected within a length range of 83 mm to 300 mm. Fresh specimens were brought to the laboratory, cleaned and wiped. Total length (nearest 0.01 mm) and weight (nearest 0.01 g) were measured. In order to examine the stomach conditions, fishes were dissected, and after recording the sex and maturity stages, the stomachs contents were examined. The intensity of feeding was determined by the degree of distension of stomachs and the amount of food contained in it, based on which stomachs were classified as gorged, full, ¾ full, ½ full, ¼ full, trace, and empty by eye estimation (Pillay, 1952). The fish was considered to be highly fed when the stomachs were gorged and full, moderately fed when ¾ full and ½ full, and poorly fed when¼ full, trace, and empty. Weight of the stomach was measured for the estimation of gastrosomatic index (GaSI) which was calculated as described by (Desai, 1970):

GaSI = weight of the stomach x 100 / total weight of the fish

The stomach contents were emptied into a clean petridish and various food items were separated and identified up to possible taxonomic level. Food items were measured quantitatively by volumetric displacement method using a measuring cylinder. The food items were mostly found in advanced state of digestion beyond condition of identification, which were treated as digested matter. The occurrence and number of items in each stomach were noted for further study. Index of relative importance (IRI) (Pinkas *et al.*, 1971) was estimated to know the importance of each food item which was calculated as:

IRI = (%N+%V)* %F

where, %N = percentage of numerical composition, %V = percentage of volumetric composition and % F= percentage of frequency of occurrence.

The month-wise data collected for the two years were pooled together for one year. Data during June and July months were not obtained due to fishing ban during these months along Maharashtra coast. These data obtained were tabulated month-wise and size-wise for further inferences.

The major prey groups of *Otolithes cuvieri* were *Acetes* spp. and penaeid prawns followed by fishes. The fish species recorded were *Cynoglossus* spp., *Sardinella longiceps*, *Bregmaceros mcclellandi, Thryssa* spp., *Leiognathus* spp., *Nemipterus* spp., *Saurida tumbil,* puffer fish, *Apogon* spp., sciaenids and *Trichiurus* spp. The species was found to feed on cephalopods like *Loligo*, *Sepia* and *Octopus* spp. as well as gastropods. Other crustacean food items encountered in their stomachs included squilla and crabs. From the %IRI derived for each food item (Table 1), it can be concluded that *Acetes* spp. ranked first (55.68%), followed by penaeid prawns (35.85%), *B. mcclellandi*, (3.07%),, *Cynoglossus* spp. (1.83%), *S. longiceps* (1.51%) and *Nemipterus* spp. (0.80%).

Month-wise % IRI for different food items (Fig. 1) indicated crustaceans were dominant in all the months except October when fish was the dominant food item. Penaeid prawns were the dominant food item in most of the months, from January to April and November to December with maximum in November (99.13%). *Acetes* spp. was dominant from May to September with maximum contribution (97.63%) in September. Fishes were also recorded in most of the months with maximum during October (100%). Cephalopods were encountered occasionally from March to May. Length-wise analysis (Fig. 2) of stomach contents showed that *Acetes* spp. was the preferred food in most of the size groups. In the smaller length groups (80-99 mm and 100-119 mm), *Acetes* spp. was the sole food item. Penaeid prawns were observed from length group 140-159 mm onwards. Fishes were observed in most of the length groups. Cephalopods and gastropods were found in larger length groups from 180-199 mm onwards.

Observations on feeding condition in different months indicated poor feeding intensity throughout the year as only empty and trace stomachs were found to be dominant in most of the months (Table 2). High intensity of feeding was observed during February and December as maximum percentage of gorged stomachs (2.33%) and full stomachs (12%) were found during these months. Maximum occurrence of empty stomachs (73.81%) was found during November. Feeding intensity in relation to length (Table 3) revealed relatively higher feeding intensity in larger size groups of 280-299 mm and 260-279 mm. Empty stomachs were observed to be dominant in all the length groups.

The results of the present study indicate *O. cuvieri* is a carnivorous fish feeding mainly on crustaceans, fishes, cephalopods and gastropods. The values of index of relative importance indicated crustaceans as the most important diet component in which *Acetes* spp. being dominant followed by penaeid prawns. Rao (1985) reported from Veraval that *O.cuvieri* feeds mainly on *Acetes* spp. and *Solenocera* spp., supplemented by teleosts and concluded that it is a carnivorous species. The position of mouth, the presence of strong canine teeth, less

Table 1. Index of relative importance of different food items in the gut contents of *O. cuvieri*

Food items	% Occurrence (O_i)	% Volume (V_i)	% Number (N_i)	IRI	%IRI
Penaeid prawn	13.99	9.28	21.05	424.47	35.85
Acetes spp.	10.08	6.72	58.67	659.28	55.68
Squilla spp.	0.41	0.79	0.31	0.45	0.04
Crab	0.41	0.21	0.31	0.21	0.02
B. mcclellandi	3.91	3.10	6.19	36.33	3.07
Sardinella longiceps	1.85	8.27	1.39	17.89	1.51
Nemipterus spp.	1.23	6.79	0.93	9.53	0.80
Cynoglossus spp.	2.06	8.68	1.86	21.69	1.83
Thryssa spp.	0.41	3.20	0.31	1.44	0.12
Leiognathus spp.	0.62	0.70	0.46	0.72	0.06
Saurida tumbil	0.21	0.79	0.15	0.19	0.02
Puffer fish	0.21	2.79	0.15	0.61	0.05
Apogon spp.	0.41	1.01	0.31	0.54	0.05
Sciaenids	0.41	0.34	0.31	0.27	0.02
Trichiurus spp.	0.21	3.02	0.15	0.65	0.06
Loligo spp.	1.44	2.79	1.08	5.59	0.47
Sepia spp.	0.82	1.16	0.62	1.47	0.12
Octopus	0.21	1.36	0.15	0.31	0.03
Gastropod	0.41	0.39	5.57	2.45	0.21
Digested matter	30.25	9.23	-	-	-

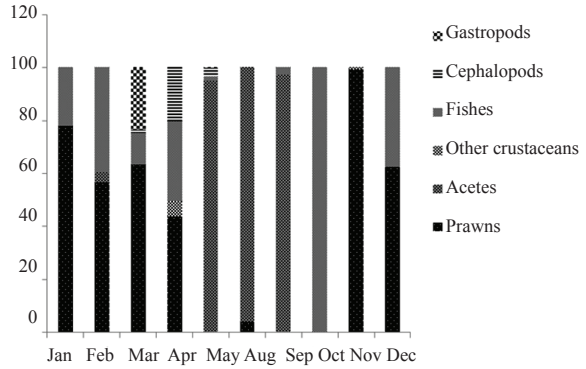

Fig. 1. Month-wise percentage index of relative importance of different food items in the stomach of *O. cuvieri*

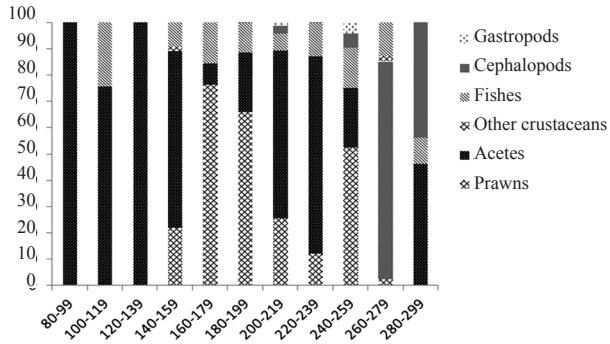

Fig. 2. Length-wise percentage index of relative importance of different prey items in the stomach of *O. cuvieri*

Table 2. Month-wise percentage of feeding intensity in *O. cuvieri*

Months	No. of specimens	High feeding		Moderate feeding		Low feeding		Empty
		Gorged	Full	3/4th full	½ full	¼ full	Trace	
January	101	0.99	4.95	8.91	12.87	21.78	14.85	35.64
February	86	2.33	2.33	5.81	20.93	26.74	22.09	19.77
March	92	-	1.09	1.09	8.70	26.09	22.83	40.22
April	95	-	5.26	5.26	10.53	17.89	13.68	47.37
May	106	-	5.66	1.89	15.09	27.36	18.87	31.13
August	45	2.22	-	2.22	13.33	22.22	15.56	44.44
September	59	-	1.69	0.00	8.47	33.90	16.95	38.98
October	63	-	9.52	6.35	3.17	25.40	4.76	50.79
November	84	-	-	-	-	10.71	15.48	73.81
December	50	-	12.00	4.00	16.00	34.00	32.00	2.00
Total	781	0.51	4.10	3.71	11.01	23.94	17.54	39.18

number of gill rakers, large stomach and smaller intestine are suggestive of the carnivorous nature of *O. cuvieri*. Karandikar and Thakur (1951) also supported the carnivorous feeding habit based on the records of fishes, crustaceans, molluscs and annelids in the stomach of *O. cuvieri*. Chakraborty (1988) recorded only four species of fishes *viz*., *Coilia dussumieri*, *Polynemus* spp., *Bregmaceros* spp. and *Lactarius lactarius*. However, Manojkumar (2003) reported isopods and copepods in the diet components of *O. cuvieri,* in addition to crustaceans and small fishes. Difference in the dominance of different food items can be attributed to the variation in their availability between habitats. Chakraborty (1988) noticed gradual change in food habit from crustacean diet to fish diet with the growth of fish. Manojkumar -(2003) stated that as the fish grows, it slowly becomes a more active feeder, feeding mainly on large invertebrates and fishes as observed in the present study. He also concluded that the fish becomes more ichthyophagous with age, whereas Raje (2000) stated that there is not much difference between the feeding habits of middle and large sized specimens.

Several studies revealed that the highest percentage of empty stomachs occurs during reproduction, owing to a significant decrease in food intake (Morte *et al*., 2001). According to Mathialagan and Sivakumar (2012) low feeding activity during peak breeding may be attributed to fully developed gonads, permitting limited space in the stomach and they also stated that variation in high and low values of feeding intensity was found to be more in females as compared to males because of the fact that ovaries occupy more space than testes. Gulati (1987) opined that fully developed gonads which occupy a larger part of body cavity, block the distensibility of stomachs which may be responsible for the low feeding intensity during breeding season. However, in the present study, feeding intensity was generally poor and empty stomachs were also found in juvenile, immature, mature and spent specimens. So correlation between maturity and cessation of feeding activity could not be established with certainty. Similar observations were also reported by Telvekar (2002) from Bombay waters. Moreover, feeding activity changes with seasons corresponding to variations in the abundance of fish, and seasonal changes in water temperature and food organisms (Sakamoto, 1982).

The present study provides basic information on the diet composition and feeding habits of *O. cuvieri* along Ratnagiri coast, which will be useful to understand the relationship with its food organisms. This data can be used for the estimation

Table 3. Length-wise percentage of feeding intensity in *O. cuvieri*

Length group (mm)	No. of specimens	High feeding		Moderate feeding		Low feeding		Empty
		Gorged	Full	3/4th full	½ full	¼ full	Trace	
80-99	8	-	-	-	12.50	12.50	25.00	50.00
100-119	25	-	4.00	-	4.00	24.00	20.00	48.00
120-139	27	-	-	-	3.70	11.11	22.22	62.96
140-159	68	-	-	1.47	4.41	27.94	14.71	51.47
160-179	174	0.57	1.15	6.32	11.49	27.59	18.97	33.91
180-199	159	-	1.26	3.14	8.18	22.01	20.13	45.28
200-219	167	-	2.99	3.59	6.59	29.34	17.37	40.12
220-239	74	-	5.41	8.11	13.51	25.68	18.92	28.38
240-259	46	0.22	0.43	0.65	2.17	2.17	0.87	3.48
260-279	17	0.00	5.88	11.76	23.53	23.53	5.88	29.41
280-299	14	7.14	0.00	7.14	21.43	14.29	14.29	35.71

of its trophic level and to create trophic models which are of paramount importance for management of aquatic resources and to understand complex coastal ecosystems.

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