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FEEDING BIOLOGY OF THE SCAD *DECAPTERUS DAYI* WAKIYA

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ABSTRACT

Decapterus dayi is a pelagic carnivore, feeding on small fishes, fish eggs and larvae, planktonic crustaceans polychaetes and molluscs. Food preference was observed towards *Stolephorus* spp., *Leiognathus* spp., *Sardinella* spp., larval fishes, *Acetes* spp., *Penaeus* spp., alima larvae, copepods and *Cresis* sp. Small fishes prey mostly upon crustaceans while larger ones are piscivorous. Fishes formed major portion of the diet during different months and times of the day. Feeding was observed to be active in pre and post-monsoon months while it was poor during monsoon. Neither stages of maturity nor time of the day had much influence on feeding.

Based on the food preference and feeding behaviour of *D. dayi* introduction of light fishing in the exploitation of the scad is suggested.

INTRODUCTION

STUDIES on the food and feeding habits of fishes envisage knowledge on the food preference and influence of age, time season and stages of maturity on food composition and feeding intensity, which are of utmost importance in both the capture and culture fisheries. Such an important aspect of the biology of *Decapterus dayi* Wakiya was not given due attention so far, though the species forms commercial fishery of some importance all along the Indian Coast.

With the view of obtaining this information a detailed investigation was carried out during 1971–1975 and the results of these observations are presented in this account.

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MATERIAL AND METHODS

Samples of *D. dayi* were collected from the local fish landing centre twice a week. Fishes were measured fresh and examined for gonadial condition and gut contents. A total of 4942 specimens were examined. Based on the distension of the stomach, fishes were grouped into different categories such as gorged, full, 3/4 full, 1/2 full, 1/4 full, little and empty. Food items were identified upto generic level wherever possible and they were measured quantitatively by volumetric displacement method. Index of preponderance introduced by Natarajan and Jhingran (1961) was applied for food analysis for every month separately and pooled.

FOOD

Composition of food

Composition of various food items and their relative importance are presented in Table 1. Fishes, crustaceans, molluscs and polychaetes formed the major groups of food items. Among the fishes, *Stolephorus* spp., *Sardinella* spp. and *Leiognathus* spp. formed significant component of the diet. Among the crustaceans, respectively, zooplankters such as copepods, euphausids, crustacean larvae, fish eggs and larvae were effectively filtered. Absence of

TABLE 1. *Composition of various food items of* D. dayi *(pooled for 5 years* 1971–75)

Fishes	Index	Crustaceans	Index	Polychaetes	Index	Molluscs	Index	Others	Index
Stolephorus spp.	42.87	*Penaeus* spp.	5.30	*Nereis* spp.	0.18	*Sepia* spp.	0.03	*Sagitta* spp.	0.81
Leiognathus spp.	23.96	*Acetes* spp.	5.61			*Loligo* sp.	0.40	Sponge spicules	0.01
Sardinella spp.	1.38	*Lucifer* sp.	1.07			*Cresis* sp.	4.01		
Sphyraena spp.	0.05	*Macrosetella* spp.	0.07					Sand grains and algal filaments	0.01
Apogon spp.	0.03								
Cynoglossus spp.	0.01	*Acartia* spp.	0.01					Unidentified digested	0.17
Platycephalus spp.	0.01	*Corycaeus* spp.	0.01						
Diodon spp.	0.01	*Euterpina* spp.	0.01						
Tetrodon spp.	0.01	Other copepods	3.29						
Decapterus sp.	0.01								
Saurida spp.	0.01	*Portunnus* spp.	0.01						
Sciaena spp.	0.05	Mysids	0.71						
Leptocephalii	0.07	Amphipods	0.30						
Other juvenile fishes	1.09	Euphausids	0.01						
Clupeid larvae	0.01	Alima larvae	4.51						
Other fish larvae	4.39	Megalopa larvae	0.01						
Fish eggs	0.01	Cypris larvae	0.10						
Fish scales	0.01	Crustacean appendages	0.02						
Fish bones	0.01								
Digested fish	0.15								
K	74.14		21.04		0.18		4.44		1.00

Penaeus spp., *Acetes* spp., alima larvae and copepods were the major components. Molluscs were represented by the pteropod *Cresis* spp. and the cephalopods *Loligo* sp. and *Sepia* spp. Polychaetes, chaetognaths and other groups of animals formed an insignificant portion of the food spectrum. Tiews (1958) and Tiews *et al.* (1975) also observed similar composition for a related species of *Decapterus* from Manila Bay.

Due to the possession of well developed sieving mechanism with 12–14 and 31–35 gillrakers in the upper and lower arches canine teeth and other well developed oral armature also evidence the fact that the *D. dayi* essentially feeds by sieving.

Food preference

In spite of the presence of the large spectrum of food components, it was observed that certain items occur repeatedly on different occasions and at times wholly in the stomach probably indicating preference of such items as food. Incidence of 310 such occasions were encountered and the percentage occurrence of each item is given in Table 2. *Stolephorus* psp., *Leiognathus* spp., fish larvae, *Acetes* spp., alima larvae, *Penaeus* spp. and *Cresis* sp. were of common occurrence. Instances of food preference among the carangids have been earlier observed by Sreenivasan (1974) in the case of *Megalaspis cordyla* and by Kosaza (1974) in *Trachurus japonicus* where even the larvae select and feed only on few of the many copepods found predominantly in the environment.

and *Sardinella* spp. Moreover the trophic spectrum shows a wide trend from 5 in 40 mm size groups to 21 to 23 items in 160–180 mm groups. This increase in number of items has an adaptive significance in utilising the available food for survival whenever the availability of preferred items is limited.

TABLE 2. *Percentage occurrence of food items found exclusively in the stomach contents of* D. dayi

Fishes	%	Crustaceans	%	Polychaetes	%	Molluscs	%
Stolephorus spp.	25.49	*Acetes* spp.	6.77	*Nereis* spp.	0.65	*Loligo* sp.	1.94
Leiognathus spp.	11.94	*Penaeus* spp.	3.87			*Sepia* spp.	0.97
Apogon spp.	0.32	*Lucifer* sp.	1.61			*Cresis* sp.	11.29
Cynoglossus spp.	0.32	*Macrosetella* spp.	0.65				
Sciaena spp.	0.97	*Euterpina* spp.	0.32				
Sardinella spp.	1.29	Other copepods	6.13				
Decapterus sp.	0.32	Amphipods	0.97				
Fish larvae	11.91	Mysids	1.61				
Other fish juveniles	2.90	Alima larvae	6.45				
		Cypris larvae	0.97				
		Megalopa larvae	0.32				
		Crustacean appendages	0.32				
	55.16		29.09		0.65		14.20

Food in relation to size

Indices of preponderance of various food items found in different size groups are given in Fig. 1. Planktonic crustaceans from the total diet in smaller groups and this was replaced by fishes in higher size groups. This change in food pattern is dependent on the area of filtration formed by the gill apparatus as explained by Magnuson and Helts (1971). In the smaller fishes gillrakers are closely set with small gaps in between and smaller organisms only are sieved. Whereas in larger fishes with comparatively larger gaps in between the gill rakers, larger organisms are retained. Moreover the smaller fishes cannot move so swiftly as to prey upon fast moving organisms and therefore need to rely on the plankters. With increase in size, foraging is mainly on shoaling fishes like *Stolephorus* spp., *Leiognathus* spp.

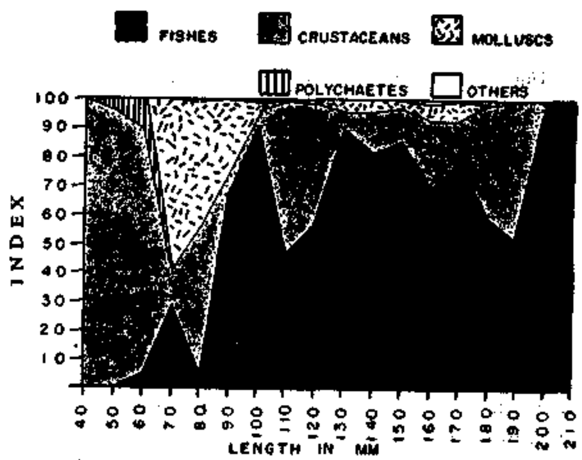

Fig. 1. Composition of food items in different length groups of *D. dayi*.

Food composition in different months

Average indices of various groups of food components found in the stomach contents of

D. dayi in different months during the years 1971–75 are presented in Fig. 2. Fishes dominated the diet during most of the months *i.e.* January to May, July, August, October and November whereas crustaceans were significant in the months of June and September, and molluscs in December. This observation points out that availability is the major factor influencing the food composition; yet only when the preferred items are scarce, the fish look for other items of less preference as evidenced by the presence of fishes alone in majority of months eventhough other food items also can be occurring in the environment.

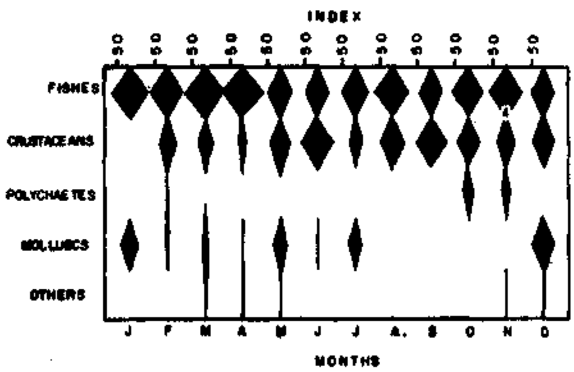

Fig. 2. Monthwise food composition in *D. dayi*.

Diel variations in the food composition

To find out the difference in the food composition during different times of the day, the sample collected during morning (fed during night time) and in the afternoon (fed from early morning to mid-day) were separately analysed and the relevant data on the composition of various groups of food items found during day and night are presented in Fig. 3. In both cases fishes are bound to be the major component in the diet, but comparatively more in night. Such habit of consuming more fish during night is common among many carangids(Hobson, 1968). This is possible because of the possession of large eyes which enable the fish to hunt and prey visually after dark, particularly on fish shoals (Hobson, 1973). Besides vision, the

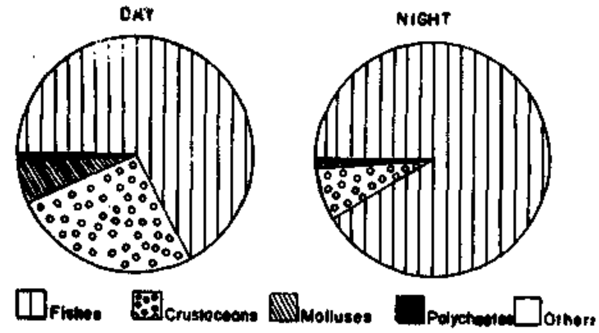

Fig. 3. Composition of food items in *D. dayi* during day and night.

fact that nocturnal predators also use olfactory sense organs and lateral line receptors to locate the prey (Manteifel and Radakov, 1961) is of consideration.

FEEDING

For the purpose of comparison, the gorged and full stomachs were grouped as actively fed, 3/4 full and 1/2 full as moderately fed and 1/4 full and little as poorly fed.

Feeding intensity in relation to months

Average percentage of different conditions of feeding in different months during the years 1971–73 are presented in Fig. 4. During pre-monsoon months of February, March, April, May and post-monsoon months of November and December, the intensity of feeding was high whereas during monsoon the feeding was poor. Strangely the active feeding observed in July appears to be an exception. In January, the feeding was moderate. A careful examination of food composition and the intensity of feeding suggests that the dominance of fishes in the food item coincides with high intensity of feeding, offering further evidence that the fishes were the preferred food items.

Diel variations in the feeding intensity

Intensity of feeding in relation to day and night are presented in Fig. 5. Feeding intensity was observed to be good in both day and night, but comparatively higher during day. So it is evident that *D. dayi* feeds actively both in day and night. Similar cases of feeding activity both in day and night were observed by Mitani (1960), Suzuki (1965), Kosaza (1970), Wickland (1972) and Sreenivasan (1974) among carangids.

Fig. 4. Monthwise feeding intensity in *D. dayi.*

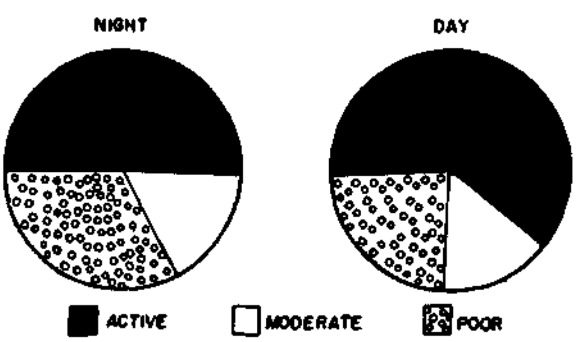

Fig. 5. Variations in feeding intensity in *D. dayi* during day and night.

Feeding in relation to sex and maturity

For studying the feeding intensity in relation to maturity, the fishes were classified into indeterminate and immature (Stages I and II), maturing (Stage III), mature (Stages IV, V and VI) and spent (Stage VII). Different intensities of feeding in these groups of fish are given in Fig. 6. Active feeding was observed in indeterminate, immatuie, matuiing and spent individuals. Comparatively less feeding activity was observed in mature fishes.

General Remarks

Foregoing observations indicate that *D. dayi* is a pelagic carnivore subsisting mainly on small fishes and zooplankters. This habit is being utilised by native fishermen in the hooks and line

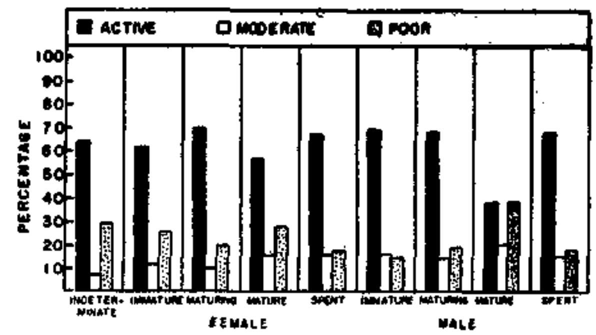

Fig. 6. Sex and stage-wise feeding intensity in *D. dayi.*

fishery for this species where anchovies aie being used as the main bait. The fact that this fish also takes artificial baits indicates that sense of vision plays a majoi role in the search for food.

At Vizhinjam, the hooks and line fishery is restricted to the day time only. Present observations indicate that there is no cessation of feeding in the night. Fuither Tiews (1958) observed that this fish is attracted to light during nights. In a related species *Caranx ruber* artificial light induced feeding during dark nights (Wickland, 1972). Carangids were observed to migrate to sea surface in nights and to bottom layers during day depending on the optimum lights for comfort and feeding (Munasinghe, 1972). Such a behaviour is utilised in the bagnet and trawl fisheries of Manila Bay (Tiews, 1958) and Wadge Bank (Munasinghe, 1972) for carangids during night with lights. These methods are worth trying in Indian Coasts also to exploit this untapped pelagic resource.

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