

**A STUDY ON LENGTH-WEIGHT RELATIONSHIP, FOOD AND FEEDING
HABITS OF INDIAN SCAD, *DECAPTERUS RUSSELLI* (RUPPELL, 1830)
ALONG THE NORTHWEST COAST OF INDIA**

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ABSTRACT

Length and weight relationship of *Decapterus russelli* (Ruppell, 1830) is worked out to be $W = 0.00312 L^{3.00}$ which indicates the isometric growth of the fish. Study on food and feeding habits revealed that the species is carnivorous, pelagic, feeding primarily on small crustaceans and small fish species, viz. *Acetes indicus*, ostracods, *Apogon* sp., *Leiognathus* sp., sciaenids, *Nemipterus japonicus*, *Myctophid* sp., *Trichiurus* sp., *Therapon* sp., *D. russelli* and occasionally on prawns. It is a selective feeder on *Acetes indicus*.

INTRODUCTION

Decapterus russelli (Ruppell, 1830) (Family Carangidae) is a commercially important fish constituting on an average 2194 tons/year (30%) of the carangid landings which was 7315 tons/year in Maharashtra during 1984-88. It is caught throughout the year along the northwest coast of India by pelagic trawl, mostly in the depth range of 55-90 m and males are usually dominant in the catches. The fish probably migrates to deeper water after attaining penultimate stage of maturity (Bapat *et al.*, 1982). During the period 1984-88, Maharashtra and Gujarat contributed on an average 309,236 tons (28%) and 228,278 tons (20.6%) against 1,105,668 tons total marine fish landings on the west coast of India. In the above fishery, carangids contributed nearly 5% in Maharashtra alone (Alagaraja *et al.*, 1992). In spite of this, there is no detailed report on the length-weight relationship and food and feeding habits of *Decapterus russelli* off the northwest coast of India except a brief study on food and feeding habits by Bapat *et al.*, (1982) and brief information on its occurrence along the northwest coast of India (Rao, 1966) and along the Vizhinjam coast (Sreenivasan, 1979). Hence the present detailed investigation was undertaken to study the length-weight relationship and feeding biology of this commercially important carangid.

MATERIAL AND METHODS

Specimens for the present study were collected twice a week at random from Ferry Wharf, Sassoon Dock and Versova landing centre in Bombay. In addition, specimens were also collected from the pelagic trawl catches of CIFE's research cum-training vessel M.F.V. *Saraswati*, from the northwest coast of India (17°00' to 20°00' N and 69°00' E to 73°00' E) from September, 1986 to August, 1988. A total of 1,831 fish specimens ranging from 8.0 cm to 21.8 cm in total length and 4 to 950g in total weight were analysed. After recording the total length to the nearest mm, the corresponding weight of the fish was measured to the nearest gram on a monopan balance. The data on total length and weight were statistically treated by the least square method and put in its logarithmic form by using the general formula $\log W = a + b \log L$ (Le Cren, 1951). Analysis of covariance technique was carried out to test the significance of difference of growth in length and weight of the fish among males, females and juveniles. The fishes were dissected to determine the sex, stage of maturity and condition of stomachs *in situ*. Gonads and guts were carefully taken out and preserved in 4% neutral formalin for later studies. The intensity of feeding was determined by degrees of distension of stomachs as gorged, full, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$, trace and empty. The volume of each item of gut contents was determined by

volume displacement method and further analysis was done by the method of Index of preponderance (Natrajan and Jhingran, 1961). The orientation of food items in the stomachs was recorded to assess the active or passive type of predatory habit. Unrecognisable jelly like matrix or digested food were separately recorded as a constituent of the gut contents only and not as a food item.

RESULTS

The length-weight relationship of *Decapterus russelli* was worked out to be $W = 0.003120 L^{3.00}$ (Table 1). The length weight relation worked out separately for male, female and juveniles were $W = 0.006165 L^{3.14}$, $W = 0.007585 L^{3.07}$ and $W = 0.0213796 L^{2.64}$ respectively. Analysis of covariance revealed a significant difference in the growth of male, female and juveniles in terms of weight in relation to length.

Table 1 : Values of coefficient of regression and coefficient of correlation.

Sex	Coefficient of regression (b)	Coefficient of correlation (r)
Male	3.14	0.92195
Female	3.07	0.91104
Indeterminate	2.64	0.95917
Pooled	3.00	0.97979

Composition of food

Table 2 depicts the Index of preponderance and composition of various food items in the guts of *Decapterus russelli*. Crustaceans and fishes were the major food items.

Table 2 : Index of preponderance of various food items of the guts of *Decapterus russelli*

Food item	V	O	V_1	O_1	$V_1 O_1$	$\frac{V_1 O_1}{\sum V_1 O_1} \times 100$	Rank
<i>Acetes indicus</i>	170.6	264	45.72	52.90	2418.58	76.28	I
Digested matter	48.77	137	13.08	27.45	359.05	11.32	II
Fishes	114.55	54	30.70	10.82	332.17	10.47	III
Ostracod	27.15	40	7.28	8.02	58.38	1.84	IV
Prawn	12.00	4	3.21	0.80	2.57	0.08	V

Crustaceans : *Acetes indicus*, ostracods and prawns contributed 56.3% by volume of the gut contents. Among crustaceans, *Acetes indicus* alone contributed 81.33%, ostracods 13% and prawns 5.7%.

Fishes : Altogether nine species of fishes were encountered in the guts and contributed 10.47% of total volume of food consumed (Table 3). These were *Nemipterus japonicus*, *Leiognathus* sp., *Apogon* sp., sciaenids, *Muraenesox* sp., *Therapon jarbua*, *Trichiurus* sp., and *Decapterus russelli* itself.

Food compositions in different months

Monthwise percentage composition of different food items observed in the gut contents of *Decapterus russelli* has been shown in Table 3 which indicates that there were considerable variations in the percentage composition of different food items, during different months of the year of the investigation.

Acetes indicus was present in the guts throughout the year, except in December, occupying the maximum volume (100%) in August and minimum volume (3.44%) in February. It occupied more than 50% by volume in September (73.99%), May (58.77%) and in April (51.65%) and in other months it ranged between 40% to 3.44% (Fig.2). Percentage composition of ostracod was as high as 92.8% in the month of February and the lowest at 3.88% in March. In November and January it constituted 20% and 29.9% of the gut contents respectively, but absent in other months. Prawns were devoured by the fish only in the months of October (14.84%), June (15.02%) and July (1.37%).

Table 3 : Monthly percentage indices of different food items of *Decapterus russelli* during September, 1986 to August, 1988.

Food item	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
<i>Acetes indicus</i>	73.99	39.90	16.75	-	32.00	3.44	5.18	51.65	58.87	24.22	40.00	100
Ostracod	-	-	20.00	-	24.82	93.81	3.88	-	-	-	-	-
<i>Apogon</i> sp.	11.62	-	-	-	-	-	-	-	-	19.53	56.88	-
<i>Leiognathus</i> sp.	5.81	-	-	-	5.25	-	-	-	-	15.63	-	-
Sciaenids	-	8.08	39.25	-	-	-	10.36	-	24.06	-	-	-
<i>N.japonicus</i>	-	-	-	-	5.25	-	-	-	-	-	-	-
<i>D.russelli</i>	-	30.34	-	-	-	-	-	-	-	-	-	-
<i>Trichiurus</i> sp.	-	0.82	-	-	13.12	-	-	-	-	-	-	-
Myctophids	-	-	-	-	-	-	46.63	6.2	-	-	0.93	-
<i>Therapon</i> sp.	-	-	-	-	-	-	-	12.4	-	-	-	-
Eel	-	-	-	-	10.5	-	-	-	-	-	-	-
Prawn	-	14.84	-	-	-	-	-	-	-	15.62	1.87	-
Digested matter	8.58	6.01	24.00	100	8.97	2.75	33.94	29.75	16.97	25.00	0.40	-

Nine species of fishes were encountered in the guts of these specimens. Except in December, February and August at least one species of fish was observed. Percentage composition of fishes was observed to be highest in July (57.8%), followed by March (56.99%), and lowest in the month of April (18.6%). In other months it ranged between 39.25% and 24.06%. Digested unrecognisable gelatinous matrix occupied the gut contents throughout the year except in August and occupied 100% of the contents in December and minimum 0.4% only in July.

Food composition in relation to size

There was no major difference in the food constituents although composition among different size groups varied. It was observed that smaller fishes preferred smaller food items like ostracods and *Acetes indicus* than fish. The fishes above 15.0 cm preferred fish as food over *Acetes* and others.

Composition of food in relation to maturity stages

Acetes indicus was encountered at all stages of maturity of fish. The immature fishes were found to feed mainly on small crustaceans like ostracods and *Acetes* sp. Maturing and mature fishes fed primarily on fishes. Some of the ripe fishes were also noticed to feed on fishes but

otherwise empty stomachs were encountered; spent fishes were observed with full stomachs except in a few cases.

Feeding intensity in relation to months

Percentage occurrence of stomachs in different degrees of fullness in *Decapterus russelli* during 1986-88 is depicted in Table 4. It is clear from the table that there were wide variations in the feeding intensity in different months of the year. It was highest in September followed by July and lowest in December, followed by January and May. Feeding intensity was moderate in October, November, February, June and August.

Feeding intensity in relation to size, sex and maturity stages

Percentage occurrence of stomachs in different degrees of fullness in different size groups is shown in Table 5. It is clear from the Table that there were wide variations in the feeding intensity of different sizes of the species. Larger fishes (15.1 - 25.0 cm) had very high feeding intensity whereas smaller fishes between 5.0 - 10.0 cm had very poor feeding intensity. Fishes between 10.1 - 15.0 cm fed moderately.

There was no significant difference in the

Table 4 : *Percentage of stomachs in different degrees of fullness in Decapterus russelli during September 1986 to August, 1988.*

Month	Gorged	Full	3/4	1/2	1/4	Trace	Empty
September	30.43	8.70	4.35	2.17	2.17	41.3	10.87
October	11.54	19.23	-	17.31	13.46	14.63	21.65
November	7.32	12.20	-	41.46	14.63	1.32	17.07
December	-	-	-	3.03	15.15	51.52	30.30
January	-	4.61	1.54	12.31	21.54	23.08	36.92
February	5.55	27.78	-	11.11	22.22	27.78	5.55
March	6.67	3.33	-	6.67	10.00	30.00	43.33
April	11.90	21.43	-	21.43	16.67	7.14	21.43
May	8.82	-	-	2.94	-	11.76	76.47
June	8.00	4.00	4.00	16.00	12.00	24.00	32.00
July	16.67	16.67	4.17	29.17	4.17	16.67	12.50
August	9.38	28.12	-	-	-	9.38	53.13

feeding intensity between the sexes.

Immature fishes were found to have very poor feeding intensity. Maturing and mature fishes had high feeding intensity. Nearly 29% of the ripe fishes had very high feeding intensity whereas the remaining had very poor feeding and had more than 40% clearly empty stomachs.

Empty stomachs

Table 4 indicates varying percentage of empty stomachs during the different months of the study. It was highest in May (76.47) and lowest in February (5.55%). Table 5 also reveals varying percentage of empty stomachs in different size groups encountered during the investigation. 70% empty stomachs in size groups 5.0 - 10.0 cm, 18.3% in the size groups of 10.1 - 15.0 cm, 31.36% in size groups of 15.1 - 20.0 cm and 40% in size group 20.1 - 25.0 cm fishes

were observed whereas theoretically there should not be empty stomach except in those which are everted.

DISCUSSION

The present study on length and weight relationship revealed that *D. russelli* has isometric growth charactersitic, 'b' value (3.00) indicating that growth of fish by weight was proportional to the cube of its length. The compared characters were highly correlated to each other as coefficient of corelation 'r' (0.9797) was very near to 1. It is very clear from the curvilinear relationship of length and weight that growth of fish by weight was faster than its length.

The present study on food and feeding habits of *Decapterus russelli* revealed that the species is a carnivore, predated on small crustaceans and small fish. It is not herbivorous,

Table 5 : *Percentage of stomachs in different degrees of fullness in different size groups of D. russelli during September 1986 to August, 1988.*

Size group (cm)	Gorged	Full	3/4	1/2	1/4	Trace	Empty
50 - 100	-	-	-	20.00	10.00	-	70.00
101 - 150	2.80	9.85	1.40	7.00	15.49	45.07	18.30
151 - 200	12.11	13.04	0.93	15.53	10.25	16.77	31.36
201 - 250	20.00	-	-	20.00	-	20.00	40.00

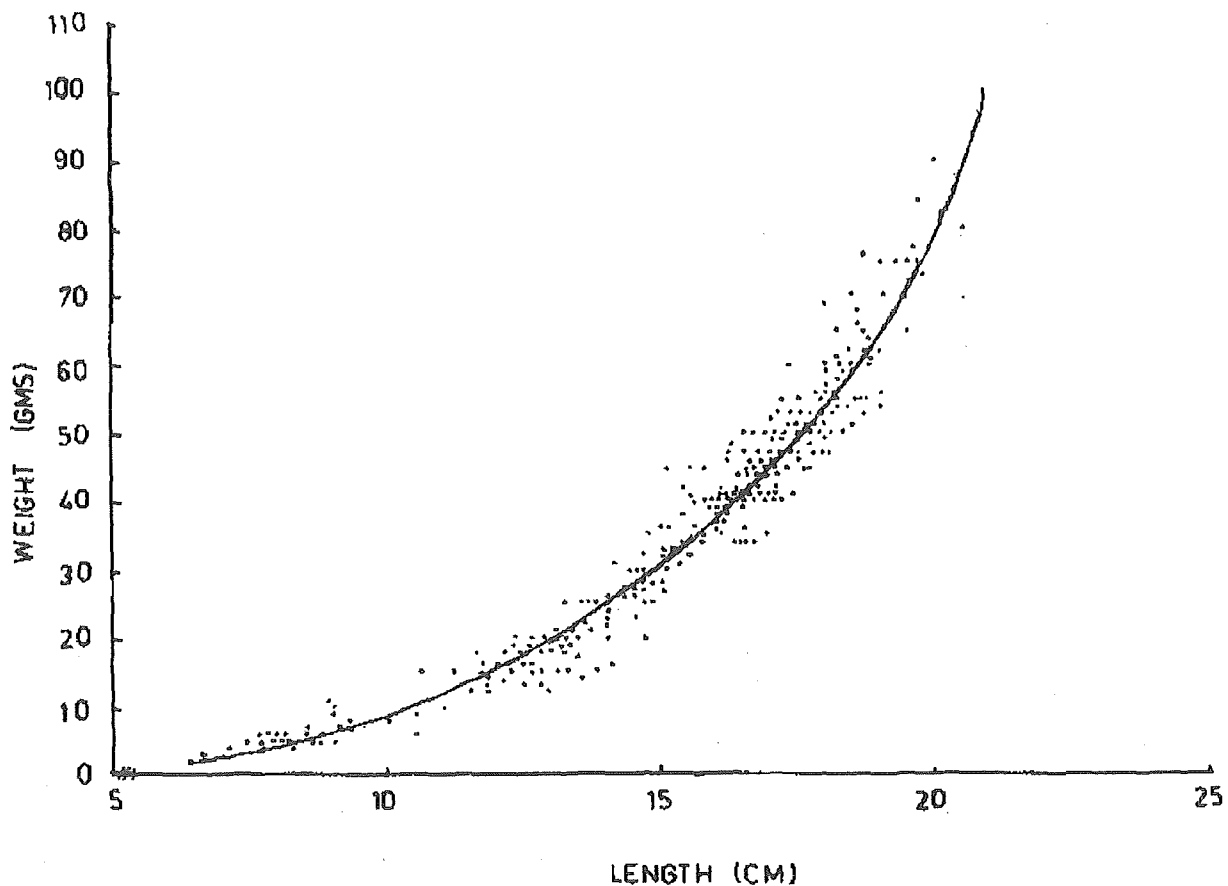


Fig. 1 Length weight relationship of *Decapterus russelli* along the north west coast of India.

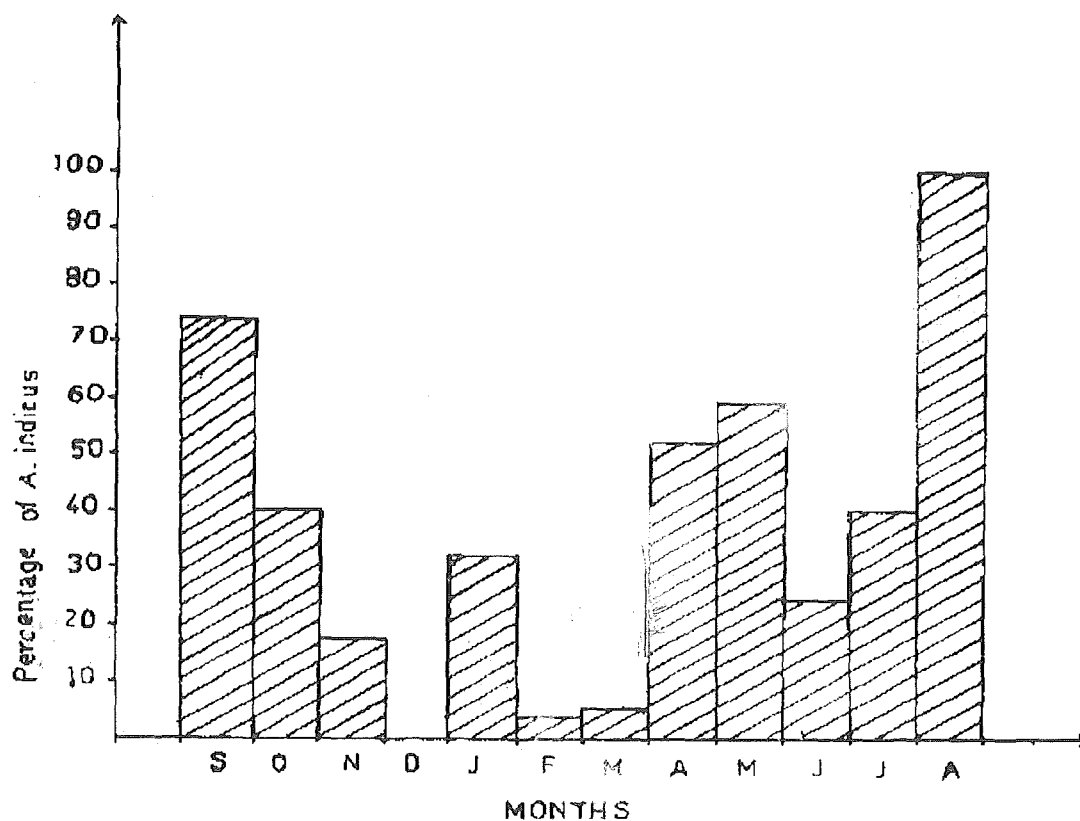


Fig. 2 Monthly percentage indices of *Acetes indicus* a food item in the total food of *D. russelli* along the north west coast of India.

nor does it feed on benthic organisms. It has a very narrow spectrum of diet, subsisting mainly on small crustaceans like *Acetes* and small fish species. These findings are in conformity with those of Sreenivasan (1979) who, however, also observed varieties of plankton and cephalopods in its diet at Vizhinjam which were conspicuously absent in the specimens examined in the present study. According to Hardy (1924) and De Silva, (1973) this type of difference in feeding habits may occur in the same species collected from different habitats at different times and at different stages of growth. Among crustaceans, *Acetes* sp. was encountered in almost all the months with a domination in most of the months and it was the sole food item in August (fig.2). But fishes were found to be the dominant food item in Vizhinjam (Sreenivasan, 1979). In the present case *Acetes* was the preferred food item as evidenced by the presence of this organism in all the months even though other food items also could have been abundant in that environment. As it is seen that this fish fed on nine species of fishes, it can be inferred that it is not very selective in case of feeding on fish; any fish easily available in the surrounding environment suited to its mouth size serves its purpose of diet. It can be a voracious feeder, as it continues feeding even when more than 33% of gut (March) is full with digested matter. Some of the spent fishes were encountered with empty stomachs. It is possible that they were caught very soon after spawning and could not feed due to spawning stress whereas others were well fed.

Feeding intensity was highest in September followed by July and lowest in December and January. This coincides with availability of suitably sized *Acetes* and fishes as it is observed that 73% *Acetes* was encountered in September and 40% *Acetes* and 57.81% fishes were encountered in the months of July. Very high feeding intensity was observed in mature (15.1 - 20.0 cm length) specimens, which seem to be the preparation for the breeding. This fish is also cannibalistic in nature.

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