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PREDATORS OF NON-PENAEID PRAWNS OF MUMBAI COAST[1]

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Non-penaeid prawns, *Acetes* spp., *Nematopalaemon tenuipes* and *Exhippolysmata ensirostris* were found to be important forage organisms of fishes occurring along the Mumbai coast. Their predators have been enlisted from the investigations carried out by various workers in the region and degree of their predation quantified. Of the 79 species of commercially important fishes, cephalopods and crustaceans, 97.4% predated on non-penaeid prawns. *Acetes* spp. was the food of 92.4%, *N. tenuipes* of 34.2% and *E. ensirostris* of 21.5% fishes. As these prawns support pelagic as well as demersal fisheries of commercial importance in the region, a detailed investigations of their prey-predator relationship may enable us to understand the effects of exploitation of prey organisms on predators.

Key words: Non-penaeid prawns, food, predators, commercial fisheries, Mumbai coast, prey-predator relationship

INTRODUCTION

Crustaceans are one of the most important groups of organisms, particularly for fishes. Many fishes, whether benthophagous, planktophagous, carnivorous or herbivorous pass through a phase in their development when they use planktonic crustaceans as food (Nikolsky 1963). Among crustaceans, prawns are widely preyed upon owing to their relatively smaller size and less defensive body structures. Besides, being benthic in nature, they are predated by a majority of demersal fishes in the tropical coastal waters.

The marine non-penaeid prawns comprising of the tiny epipelagic, sergestid shrimp *Acetes* spp., the palaemonid prawn *Nematopalaemon tenuipes* and the hippolytid prawn *Exhippolysmata ensirostris* constitute a commercially important fishery along the north-west coast of India. The average annual production of non-penaeid prawns is 46,990 tonnes and contributes to 16.4% of the total marine fish landings of Maharashtra. Non-penaeid prawns form fisheries of commercial importance only along north-west coast of India, including Gujarat, therefore it is characteristic (Deshmukh 1993). Being smaller in size and abundant in the coastal waters, they are also the prime forage organisms for the coastal fishes of this region.

Although there are several investigations on the food and feeding habits of a large number of marine fishes and other organisms of commercial importance in the coastal waters of Mumbai, there is no account that enumerates predators of the forage organisms. The present investigation, therefore, not only lists the predators of the non-penaeid prawns in the region but also attempts to signify their importance in the marine economy along the coast of Mumbai.

METHODS

The degree of predation reported by various investigators as 'mostly', 'moderately', 'sometimes' and 'occasionally' has been quantified by assigning them ++++, +++, ++ and + signs respectively and negative predation by the – sign for the three species of non-penaeid prawns, namely *Acetes* spp. *Nematopalaemon tenuipes* and *Exhippolysmata ensirostris* (Table 1).

RESULTS AND DISCUSSION

Table 1 enumerates the predators and their degree of predation on the non-penaeid prawns in Mumbai waters. Of the 79 fish species investigated by various workers for their food and feeding habits in Mumbai waters, 77 (97.5%) are predators of the non-penaeid prawns. Only two species, *Cynoglossus macrolepidotus* (Rao and Dwivedi 1989) and *Tripauchen vagina* (Kulkarni 1976) have not been reported to feed on these prawns. *Acetes* spp. are predated by 73 (92.4%) species, *N. tenuipes* by 27 species (34.2%) and *E. ensirostris* by 17 (21.5%) species of fishes.

In the case of *Acetes* spp. 5.1% fishes consumed them 'mostly', 22.8% 'moderately', 34.2% 'sometimes' and 30.4% 'occasionally'; 7.6% fishes have not been reported to feed on it. Such high predation on *Acetes* spp. by the juveniles and adults of most fishes may be attributed to the small size and delicate, translucent, and defenceless body of the prey. *Acetes* spp. is also devoid of a strong rostrum and hard calcareous shell. The gregarious swarming habit of the species in coastal waters perhaps enables the predators to devour it in large quantity.

Table 1: Predators and their degree of feeding on non-penaeid prawns in Mumbai waters

S.No.	Name of predator	Extent of predation on			Remarks	Reference
		Acetes spp.	*N. tenuipes*	*E. ensirostris*		
1.	*Engraulis hamiltoni*	++	—	—	Feeds mainly on prawn larvae and *Acetes*	Bapat, 1948.
2.	*Engraulis purava*	+++	—	—	Adults feed mainly on *Acetes* spp.	Bapat and Bal, 1952.
3.	*Engraulis dussumieri*	++	—	—	quantity of prawns in majority	——— " ———
4.	*Engraulis commersonius*	+	—	—	Feeds mainly on prawn larvae	——— " ———
5.	*Coilia dussumieri*	+	—	—	Occasionally feeds on *Acetes* spp.	Bapat and Bal, 1952; Fernandez, 1986.
6.	*Clupea toli*	+	—	—	Crustacean food increases with the size of fish	——— " ———
7.	*Kovala coval*	+	—	—	Feeds on crustacean larvae	Koshey, 1996.
8.	*Clupea brachysoma*	+	—	—	Prawn larvae form 8-10% of food	Bapat and Bal, 1952.
9.	*Pellona elongata*	+	—	—	*Acetes* forms 44% of food	——— " ———
10.	*Pellona motius*	+	—	—	% of prawns is 12-15	——— " ———
11.	*Pellona filigera*	+++	—	—	Juveniles have 15% of food with prawn larvae but adults mainly feed on *Acetes* and other pelagic crustaceans	Bapat,1948; Meenakshisundaram and Marathe, 1962; Suseelan and Nair, 1969.
12.	*Thryssa malabarica*	++	—	—	Crustaceans form the major food which includes *Acetes*	Pawar, 1994.
13.	*Ilisha filigera*	++++	—	—	Bulk of the food is constituted by a single item namely, *Acetes*	Johnson, 1992.
14.	*Chirocentrus dorab*	++	—	—	Next to fish crustaceans are important in the diet in which *Acetes* is dominant	Pawar, 1992.
15.	*Harpadon nehereus*	++++	+++	+	Juveniles and adults mainly feed on *Acetes* and non-penaeid prawns	Bapat, 1959, 1970.
16.	*Polynemus indicus*	++	++	+	Adults feed on *N. tenuipes*, but juveniles on *Acetes*	Karekar, 1954.
17.	*Polynemus tetradactylus*	++	+	+	About 48-52% food of juveniles is of crustacean origin	Bapat and Bal, 1952.
18.	*Polynemus heptadactylus*	+++	++	++	*Acetes* is the food of juveniles but *N. tenuipes* and *E. ensirostris* are eaten by adults	Nayak, 1965; Ivan, 1987.
19.	*Saurida tumbil*	++	++	+	*Acetes* and *N. tenuipes* form considerable quantity of food	Dighe, 1977.
20.	*Pomadasys hasta*	+	+	+	Crustacean food is relatively less but in some months it formed the entire diet	Suseelan and Nair, 1969; Deshmukh, 1973.
21.	*Nemipterus japonicus*	+++	+	—	Out of crustaceans, *Acetes* is the most favoured food items in all stages of maturity	Acharya, 1980.
22.	*Nemipterus mesoprion*	++	+	—	——— " ———	Chakraborty pers. comm.

Table 1: Predators and their degree of feeding on non-penaeid prawns in Mumbai waters (*contd.*)

S.No.	Name of predator	Extent of predation on			Remarks	Reference
		Acetes spp.	*N. tenuipes*	*E. ensirostris*		
23.	*Nemipterus delogae*	++	+	—	——— " ———	——— " ———
24.	*Pseudosciaena diacanthus*	—	++	+	Prawns including *N. tenuipes* and *E. ensirostris* are important next to fish diet	Bhatt *et al.* 1964; Rao, 1964; Suseelan and Nair, 1969.
25.	*Sciaenoides brunneus*	+	++	+	Juveniles feed on all species of non-penaeid prawns but adults take penaeids and *N. tenuipes*	Kutty, 1967; Suseelan and Nair,1969; Jayaprakash, 1974.
26.	*Otolithus ruber*	+++	+++	—	Crustaceans form 58% of the diet; *Acetes* and *N. tenuipes* are important food items	Vaidya, 1960; Suseelan and Nair, 1969.
27.	*Otolithus cuvieri*	++	—	—	Bulk of the food is formed of crustaceans, in which *Acetes* contributes major percentage	Gulati, 1987.
28.	*Otolithus argenteus*	+++	—	—	Mainly subsists on fishes and crustaceans in which *Acetes* is common	Basrur, 1975.
29.	*Johnius dussumieri*	+	+	+	*Acetes* and other prawns form a considerable part of diet	Bapat and Bal, 1952; Sawant, 1963; Suseelan and Nair, 1969.
30.	*Johnius carutta*	++	+	—	Free living crustaceans and *Acetes* form the main food	Chakraborty, 1988
31.	*Johnius vogleri*	+++	-	++	*Acetes* is one of the major food items	——— " ———
32.	*Johnius macrorhynus*	++	+	+	*Acetes* is one of the major food items	——— " ———
33.	*Johnius sina*	++	—	—	*Acetes* is moderately fed	Dukhande, 1991.
34.	*Johnius glaucus*	+++	—	—	*Acetes* prevailed in the gut in all the months and formed the major food	Wasnik, 1994.
35.	*Megalaspis cordyla*	+++	—	—	*Acetes* is one of the major food items	Datar, 1954; Bapat *et al.* 1982; Shendye, 1994.
36.	*Atropus atropus*	+++	—	—	Crustaceans form the major diet with *Acetes* forming the bulk	Kochar, 1988.
37.	*Carangoides malabaricus*	++	—	—	The crustaceans varied from 42-80% in the food and *Acetes* formed the favourite diet	Kochar, 1988.
38.	*Chorinemus toloo*	+	+	+	Young ones feed on small prawns	Bapat, 1948.
39.	*Decapterus russellii*	+++	—	—	*Acetes* is the major food item with ponderal index of 37.62%	Tamhane, 1999.
40.	*Decapterus dayii*	+++	—	—	*Acetes* is one of the major food items	Raje, pers. comm.
41.	*Allepes djedaba*	+++	—	—	*Acetes* is the major food item	Raje, 1993.

Table 1: Predators and their degree of feeding on non-penaeid prawns in Mumbai waters (*contd.*)

S.No.	Name of predator	Extent of predation on			Remarks	Reference
		Acetes spp.	*M. dobsoni*	*E. ensirostris*		
42.	*Rastrelliger kanagurta*	++	—	—	*A. indicus* was found in large numbers in the gut in October	Bapat *et al.* 1982; Shendye, 1994.
43.	*Trichiururs lepturus*	++	+	+	Non-penaeid prawns form the major food item	Chakraborty, pers. comm.
44.	*Lepturacanthus savala*	++	+	—	In the gut *Acetes* is dominant during January and October	Rizvi, 2001.
45.	*Eupluerogrammus muticus*	++++	+	—	*Acetes* is a prominent food during February-May and November-December	Rizvi, 2001.
46.	*Muraenosox talabonoides*	+	+	+	Highly carnivorous, and its juveniles feed on crustaceans and prawns	Mohamed, 1955; Suseelan and Nair,1969
47.	*Arius thalassinus*	+	—	—	Though a benthic feeder, consumes significant quantity of prawns including *Acetes*	Suseelan and Nair,1969; Rane, 1996.
48.	*Arius dussumieri*	+	—	—	Canivorous bottom feeder, stomach shows *Acetes*	——— " ———
49.	*Arius sona*	+	—	—	Prawns form 18% of the diet	Singh, 1965.
50.	*Arius jella*	+	—	—	Food consists of some crustaceans and prawns	Suseelan and Nair,1969
51.	*Arius maculatus*	+++	—	—	*Acetes* is a common food item, sometimes stomach is gorged with it in older fish	Roy, 1979.
52.	*Osteogeneiosus militaris*	+	—	—	Consumes considerable quantity of non-penaeid prawns	Raje, pers. comm.
53.	*Begmaceros macclellandi*	++	—	—	*Acetes* and prawn larvae form the bulk of the food	Bapat, 1948; Parulekar, 1964.
54.	*Mugil parsia*	+	—	—	3.33% of food is *Acetes*	Bapat, 1948.
55.	*Cynoglossus macrolepidotus*	—	—	—	Non-penaeid prawns not observed in the gut	Rao and Dwivedi, 1989.
56.	*Apogon bendansis*	++	—	—	50% food is *Acetes*	Bapat, 1948.
57.	*Apogon wassinki*	+	—	—	Food consists of small crustaceans and *Acetes*	Bapat, 1948.
58.	*Lactarius lactarius*	+++	—	—	Mainly feeds on fishes and Crustaceans but *Acetes* is the favourite food	Choudhary, 1978.
59.	*Pampus argenteus*	++	—	—	Presence of *Acetes* in stomachs of young pomferts suggests they are major food item	Rege and Bal, 1963.
60.	*Equula indicator*	++	—	—	Feeds on small prawns and their larvae	Bapat, 1948.
61.	*Tripauchen vagina*	—	—	—	Stomach contents did not show presence of non-penaeid prawns	Kulkarni, 1976.

Table 1: Predators and their degree of feeding on non-penaeid prawns in Mumbai waters (*contd.*)

S.No.	Name of predator	Extent of predation on			Remarks	Reference	S.No
		Acetes spp.	*N. tenuipes*	*E. ensirostris*			
23.	*Nemipterus delogae*	++	+	—	——— " ———	——— " ———	42.
24.	*Pseudosciaena diacanthus*	—	++	+	Prawns including *N. tenuipes* and *E. ensirostris* are important next to fish diet	Bhatt *et al.* 1964; Rao, 1964; Suseelan and Nair, 1969.	43.
25.	*Sciaenoides brunneus*	+	++	+	Juveniles feed on all species of non-penaeid prawns but adults take penaeids and *N. tenuipes*	Kutty, 1967; Suseelan and Nair,1969; Jayaprakash, 1974.	44.
26.	*Otolithus ruber*	+++	+++	—	Crustaceans form 58% of the diet; *Acetes* and *N. tenuipes* are important food items	Vaidya, 1960; Suseelan and Nair, 1969.	45.
27.	*Otolithus cuvieri*	++	—	—	Bulk of the food is formed of crustaceans, in which *Acetes* contributes major percentage	Gulati, 1987.	46.
28.	*Otolithus argenteus*	+++	—	—	Mainly subsists on fishes and crustaceans in which *Acetes* is common	Basrur, 1975.	47.
29.	*Johnius dussumieri*	+	+	+	*Acetes* and other prawns form a considerable part of diet	Bapat and Bal, 1952; Sawant, 1963; Suseelan and Nair, 1969.	48.
30.	*Johnius carutta*	++	+	—	Free living crustaceans and *Acetes* form the main food	Chakraborty, 1988	49.
31.	*Johnius vogleri*	+++	-	++	*Acetes* is one of the major food items	——— " ———	50.
32.	*Johnius macrorhynus*	++	+	+	*Acetes* is one of the major food items	——— " ———	51.
33.	*Johnius sina*	++	—	—	*Acetes* is moderately fed	Dukhande, 1991.	52.
34.	*Johnius glaucus*	+++	—	—	*Acetes* prevailed in the gut in all the months and formed the major food	Wasnik, 1994.	53.
35.	*Megalaspis cordyla*	+++	—	—	*Acetes* is one of the major food items	Datar, 1954; Bapat *et al.* 1982; Shendye, 1994.	54.
36.	*Atropus atropus*	+++	—	—	Crustaceans form the major diet with *Acetes* forming the bulk	Kochar, 1988.	55.
37.	*Carangoides malabaricus*	++	—	—	The crustaceans varied from 42-80% in the food and *Acetes* formed the favourite diet	Kochar, 1988.	56.
38.	*Chorinemus toloo*	+	+	+	Young ones feed on small prawns	Bapat, 1948.	57.
39.	*Decapterus russellii*	+++	—	—	*Acetes* is the major food item with ponderal index of 37.62%	Tamhane, 1999.	58.
40.	*Decapterus dayii*	+++	—	—	*Acetes* is one of the major food items	Raje, pers. comm.	59.
41.	*Allepes djedaba*	+++	—	—	*Acetes* is the major food item	Raje, 1993.	60.
							61.

Table 1: Predators and their degree of feeding on non-penaeid prawns in Mumbai waters (*contd.*)

S.No.	Name of predator	Extent of predation on			Remarks	Reference
		Acetes spp.	*N. tenuipes*	*E. ensirostris*		
62.	*Scoliodon laticaudus*	+	+	+	Among the prawn species in the diet, all three non-penaeids were identified	Mathew, 1992.
63.	*Dasyatis sephen*	+	++	+	The three non-penaeid prawns were consumed fairly	Raje, 2003.
64.	*Dasyatis uarnak*	—	+	—	*N. tenuipes* had fair occurrence in the stomach	——— " ———
65.	*Trygon walga*	—	++	—	——— " ———	——— " ———
66.	*Gymnura macrura*	—	++	—	——— " ———	——— " ———
67.	*Loligo duvauceli*	++	+	+	Small non-penaeid prawns constitute the major food	Kuber, 1987.
68.	*Sepia aculeata*	+	+	—	Small non-penaeid prawns constitute the major food	Kuber, pers. comm.
69.	*Charibdys cruciata*	+	—	—	Occasionally feeds on *Acetes*	Deshmukh, unpublished data.
70.	*Metapenaeus affinis*	++	—	—	Proportion of *Acetes* in diet increases from Nov-March, and in May it is exclusive in the diet	Mehendale, 1959.
71.	*Metapenaeus brevicornis*	+++	—	—	In adults *Acetes* is the major food item	Kathuria, 1967.
72.	*Parapeneopsis sculptilis*	+++	—	—	Foregut is mostly full of *Acetes*	Kathuria, 1967; Aravindakshan, 1979.
73.	*Parapeneopsis hardwickii*	++	—	—	*Acetes* forms exclusive diet	Kathuria, 1967.
74.	*Parapeneopsis stylifera*	+	—	—	Occasionally feeds on *Acetes* in some months	Kathuria, 1967.
75.	*Solenocera crassicornis*	++++	—	—	*Acetes* is the major diet	Kathuria, 1967; Kunju, 1967.
76.	*Penaeus japonicus*	++	—	—	Occasionally *Acetes* is seen in the stomach	Kathuria, 1967.
77.	*Penaeus merguiensis*	++	—	—	Occasionally *Acetes* is seen in the stomach	Kathuria, 1967.
78.	*Nematopalaemon tenuipes*	++	—	—	Occasionally *Acetes* is seen in the stomach	Kunju, 1979; Deshmukh, 1988
79.	*Exhippolysmata ensirostris*	+++	—	—	*Acetes* is the most common food item	Deshmukh, 1988.

N. tenuipes was found to be predated 'moderately' by 2.5% 'sometimes' by 11.4%, and 'occasionally' by 22.8% fishes. This species also has a relatively small and defenceless body structure without a hard calcareous exoskeleton. Long spider leg-like pereopods enable it to lead a pelagic life, but without strong swimming ability, which makes it an easy prey for predators. *E. ensirostris* is, however, taken only 'sometimes' by 2.5% fishes and 'occasionally' by 19% fishes. It possesses a relatively hard exoskeleton and a long, acutely pointed, serrated rostrum, which being an organ of offence, perhaps makes it less vulnerable to predation.

Bapat (1948), and Bapat and Bal (1952) investigated food habits of young ones of 26 species of fishes occurring in coastal waters off Bombay (= Mumbai), and commented

that prawn larvae and *Acetes* spp. were their major food items. These fishes included pelagic clupeids such as *Engraulis hamiltoni*, *E. dussumieri*, *E. purava*, *E. commersonianus*, *Stolephorus commersoni*, *Coilia dussumieri*, *Pellona filigera*, *P. brachysoma*, *P. elongata*, *P. motius* and *Clupea toil*.

Bapat (1959, 1970) studied details of the food habits of Bombay Duck *Harpadon nehereus*, an important carnivore, forming a major pelagic fishery along the north-west coast of India. It is the major predator of non-penaeid prawns, which in certain months of the year feeds entirely on *A. indicus*. But during April-May and August-September it consumes a good quantity of *N. tenuipes* in addition to *A. indicus*. The fish also consumes considerable quantity of *E. ensirostris*. Among the non-penaeid prawns, *Acetes* spp. is the most favourite food of Bombay Duck. Pillai (1980) attempted to correlate the abundance of Bombay Duck with its prey. He suggested that in the inshore waters of Bombay, where Bombay Duck is abundant, the catches of *Acetes* are low on account of heavy feeding by the Bombay Duck. Devaraj (1987) postulated that since the sergestid shrimp *Acetes* spp. are the main food of Bombay Duck, the discontinuous distribution of the species along the north-west and north-east coasts of India is primarily due to the enormous biomass of these shrimps, which feed on the large quantity of detritus produced by the load of domestic sewage generated by the metropolitan cities of Bombay (=Mumbai) and Calcutta (= Kolkata), located on the two coasts respectively.

Food of most of the important pelagic fishes occurring in the coastal waters also consists of *Acetes* spp. as reported by Suseelan and Nair (1969) for *Ilisha filigera*, Bapat *et al.* (1982) and Shendye (1994) for *Megalaspis cordyla*, Chakraborty (pers. comm.) for *Truchiurus lepturus* and Rizvi (2001) in the case of Ribbon Fishes *Lepturacanthus savala* and *Eupluerogrammus muticus*. The Indian Mackerel *Rastrelliger kanagurta* is a planktivore, feeding on phytoplankton in early stages and zooplankton in later life, but Bapat *et al.* (1982) reported that its shoals occurring along the north-west coast were found to have *Acetes* spp. in their stomach. Similarly, the golden anchovy *Coilia dussumieri* forms an important pelagic fishery along the north-west coast, but the fish grazes mainly on the zooplankton and crustacean larvae, including *Acetes* spp. (Fernandez 1986). In the case of Silver Pomfret *Pampus argenteus*, which forms a lucrative fishery around Mumbai, Rege and Bal (1963) have stated that small shrimps belonging to the genus *Acetes* were found in the toothed pharyngeal pouches of the juveniles, suggesting possibility of these shrimps forming one of the major food item of young ones of fish. In the case of carangid fishes, Kochar (1988) reported that *Atropus atropus* and *Caranx ignobilis malabaricus* have crustacean diet, in which they constituted as much as 89.5% in certain months and *Acetes* was the favourite food. Similarly, *Decapterus russelli* (Tamhane 1996) and *A. djedaba* (Raje 1993) also prey upon *Acetes* spp. with a high index of preponderance.

Some of the dominant perches, *Nemipterus japonicus* (Acharya 1980), *N. mesoprion* (Chakraborty pers. comm.) and *Pomadasys hasta* (Suseelan and Nair 1969; Deshmukh 1973) also have *Acetes* spp. as one of their occasional food items. The young of threadfin fishes, such as *Polynemus indicus*, *P. tetradactylus* and *P. heptadactylus* (Bapat 1948; Karekar 1954; Karekar and Bal 1958; Nayak 1965; Kagwade 1970), have a crustacean diet with *Acetes* spp. constituting the important forage organisms.

It is obvious to find the pelagic fishes of this coast feeding on the non-penaeid prawns, which themselves are pelagic, but several studies indicate that even demersal fishes prey upon these prawns. Suseelan and Nair (1969) investigated food habits of 17 species of demersal fishes from Bombay waters and commented that prawns, in general, and *Acetes indicus*, in particular, were the common food item at the top of the food index.

Sciaenids are perhaps the most common demersal fishes in the coastal waters of Mumbai and their food mainly consists of non-penaeid prawns. 'Ghol' (*Pseudosciaena diacanthus*) and 'Koth' (*Sciaenoides brunneus*) are the largest sciaenids, which form characteristic fisheries in the region. Rao (1963) and Bhatt *et al.* (1964) reported that adults of 'Ghol' and 'Koth' feed mainly on fishes in addition to penaeid and non-penaeid prawns, which include *A. indicus*, *N. tenuipes* and *E. ensirostris*, but Bapat and Bal (1952) and Jayaprakash (1974) found that their young mainly feed on *Acetes* spp. The lesser sciaenids such as *Johnius dussumieri* (Bapat and Bal 1952; Savant 1963; Suseelan and Nair 1969), *J. vogleri*, *Otolithus cuvieri*, *Johnius macrorhynus* (Chakraborty 1988), *J. sina* (Dukhande 1991) and *J. glaucus* (Wasnik 1994) also feed mainly on *Acetes* spp. Vaidya (1960), Suseelan and Nair (1969), and Gulati (1987) showed that bulk of the food of *Otolithus cuvieri* is constituted by crustaceans, in which *Acetes* spp. form a major percentage. Similarly, Basu (1975) found that *O. argenteus* subsists mainly on crustaceans and fishes and rarely on other organisms. He remarked that *Acetes* spp. and squilla (*Stomatopoda*) are the common food items, in addition to *Leander tenuipes* (= *N. tenuipes*) and *E. ensirostris*. He further states that crustaceans are the major food in smaller length groups as compared to the larger ones and in relation to maturity stages, crustaceans dominate in all maturity stages and *Acetes* is the most favoured food.

The highly carnivorous Conger Eel *Muraenesox talabonoides* feeds, besides many fishes, on the non-penaeid prawns (Mohamed 1955). Similarly, catfishes *Arius sona*

(Singh 1965), *A. jella* and *A. dussumieri* (Suseelan and Nair 1969) and *Arius thallassinus* (Rane 1996), though predominantly benthic feeders, consume considerable quantity of prawns, including the three species of non-penaeid prawns. Roy (1979) reported that in catfish *Arius maculates*, *Acetes* spp. was the common food item during most months in older fishes, and sometimes their stomachs were gorged with *Acetes* spp..

Among the elasmobranchs, the Shark *Scoliodon laticaudus* feeds on non-penaeid prawns among which *Acetes* spp. is the common food item, found throughout the year with the index of preponderance varying from 0.004 in March to 15.44 in September (Mathew 1992). Four species of rays, *Dasyatis sephen*, *D. uarnak*, *Trygon walga* and *Gymnura macrura* fed on non-penaeid prawns, among which *N. tenuipes* was the common food item (Raje 2003).

Among the highly demersal fishes, the Tongue Sole *Cynoglossus macrolepidotus* feeds on benthic crustaceans (Rao and Dwivedi 1989), and none of the non-penaeids are reported to form its diet. The gut contents of *Tripauchen vagina*, a common gobid fish occurring in the coastal waters of Mumbai, also did not show presence of any of the non-penaeid prawns (Kulkarni 1976).

Of the invertebrate predators of non-penaeid prawns, Kuber (1987) noted that the cephalopods, *Loligo duvauceli* and *Sepia aculeata* feed on non-penaeid prawns and sometimes their mantle cavity is full with *Acetes* spp. Deshmukh (unpublished data) found that the stomach of the pelagic marine crab *Charybdis cruciata* is occasionally gorged with *Acetes* spp. The works on the food and feeding habits of some of the penaeid prawns of the region, Mehendale (1959): *Metapenaeus affinis*, Kathuria (1967): *M. brevicornis*, Kunju (1967): *Solenocera indicus* (= *S. crassicornis*) and Aravindakshan (1979): *Parapeneopsis sculptilis* have shown that *Acetes* spp. is their major food item, and their foreguts invariably show entire specimens of *Acetes* spp.. The food habits of non-penaeid prawns, *N. tenuipes* and *E. ensirostris* (Deshmukh 1988) revealed that the *N. tenuipes* feeds on *Acetes* spp. occasionally, while *E. ensirostris* feeds on it voraciously.

It is seen from the foregoing account on feeding habits of majority of pelagic and demersal fishes, cephalopods and crustaceans that the non-penaeid prawns form one of their most important food items in general, but their young ones feed on *Acetes* spp. in particular. Investigations on the food habits of other fishes may reveal that they too may be feeding on non-penaeid prawns. Thus, non-penaeid prawns form the single most important group of forage organisms preyed upon by a vast majority of fishes in the coastal waters, of Mumbai. They play a far greater role in the marine economy of the coastal waters and must be responsible for supporting the huge biomass of economically important fisheries of Bombay Duck, sciaenids, polynemids, carangids, cephalopods and the penaeid prawns of the region.

Thorson (1960) reviewed the feeding habits and food requirements of predatory fishes in north-eastern Atlantic and commented that fishes in temperate waters consume on an average food 5-6% of their own living weight per day. He further added that invertebrate predators are extremely predaceous, and consume food corresponding to about 25% of their living weight per day. If the same were true for the tropical waters, then the biomass of non-penaeid prawns would be far greater than what is exploited along the coast of Mumbai. A detailed quantitative analysis of predation of the species of fishes and other marine organisms of commercial importance, which play a vital role in the food web of the coastal water, would therefore, help in understanding the complexities of predator-prey relationships. This may, in future, enable us to know feeding movements, seasonal abundance, and fluctuations in catches of the commercially important coastal fishes.

The 'dol' net fishery along the Maharashtra coast (Deshmukh 1993) and the Saurashtra coast of Gujarat (Khan 1986) exploits non-penaeid prawns (i.e. prey organisms) on a large scale. But, the catch consists mostly of tiny *Acetes* spp., which soon after catching turns into a semi-decomposed paste (Deshmukh 1993). However, the catch is either used as manure or reduced to fish-meal, from which economic returns to the fishermen are very poor. Despite this, exploitation of *Acetes* spp. on an enormous scale by trawlers in Gujarat state in recent years (CMFRI 1997) has caused serious concern, as to whether it would adversely affect the production of predators (i.e., commercially important fishes) from that region. It is apparent that on account of their low commercial value, but great significance in the marine food web, the exploitation of non-penaeid prawns on a large scale would not be advisable. However, in-depth study of the predator-prey relationship of the non-penaeid prawns should be taken up immediately to understand species interactions for the management of the important fisheries of the entire Gujarat-Maharashtra region. This can throw some light not only on the impact of exploitation of the non-penaeid prawns, but also on the abundance and fluctuations of the commercially important fishes.

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