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Preliminary observations on dominance of crustacean larvae in the diet of little tunny *Euthynnus affinis* (Cantor, 1849) caught off Chennai and Cuddalore coasts

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ABSTRACT

The food habits of little tunny *Euthynnus affinis* caught by hooks and line off Chennai and Cuddalore in Tamil Nadu were studied from December 2011 to August 2012. A total of 358 samples were collected from both the centres and gut contents were analysed. Almost 42% of the guts were full and 22% were found to be either quarter full or with traces of food contents. About 35% of the guts were empty. Index of relative importance (IRI) was calculated for the prey items. Crustacean larvae (91%) were dominant among the gut contents, followed by fishes (4%) and molluscs (2%). Among the crustacean larvae, brachyuran megalopae and crablets formed about 45% while the stomatopod alima larvae formed 21%. Phyllosoma larvae of scyllarid lobsters and pueruli larvae of spiny lobsters were also found among the identified crustacean larvae.

Keywords: Crustacean, *Euthynnus affinis,* Food, Index of Reletive Importance (IRI), Larvae, Tuna

Introduction

Tunas as apex predators, play an important role in pelagic ecosystem of oceanic waters (Griffiths *et al*., 2009). This ecological role in marine food webs has strong influence on structuring ecosystem (Essington *et al*., 2002). They are opportunistic feeders and prey not only on fish but also on organisms of different trophic levels to satisfy their high dietary requirement (Korsmeyer and Dewar, 2001). Hence, dietary information of tuna is of particular importance to gain insight into dynamics and modeling of ecosystem. There are numerous studies that describe the diet of different tuna species in the world. However, complete understanding of feeding habits of many tuna species is lacking.

Tunas are exploited all along the Indian coast by different gears (mainly gillnets and longlines) and are represented by about seven species. The little tunny, *Euthynnus affinis* (Cantor, 1849) is a coastal tuna, occurring in waters of 0 to 200 m depth range in the pelagic realm. It is the most abundant species and is commonly caught in hooks and line as well as gillnets along the Indian coast. Along the coast of Tamil Nadu, gillnets contribute to the bulk of the catches, while hooks and line fishery is also practised. Stock assessment and fishery of this species is well studied from different parts of the Indian coasts (Kasim and Abdussamad, 2003; Kasim and Mohan, 2009). However, information on the food and feeding of this species is limited to few investigations (Kumaran, 1964; Kasim and Mohan, 2009; Prathibha *et al.*, 2010; 2012). The present study reports preliminary observations on the diet composition of *E. affinis* caught by hooks and line fishing off Chennai and Cuddalore coasts of Tami Nadu.

Materials and methods

Samples of *E. affinis* were collected from different landing centres between Chennai and Cuddalore during December 2011 - August 2012. A total of 358 fresh individuals were collected for this study of which, 199 were from Kovalam, in the length range of 302-559 mm and 159 from Cuddalore, in the length range of 413-559 mm. Samples collected were caught in hooks and line at 24 to 70 m depth range off Kovalam and Cuddalore coasts, using live baits. All the samples were transported in ice boxes to the laboratory for further analysis. Total

length (TL in mm) and whole body weight (W in g) of each individual were measured. Guts of all samples were dissected out and weighed. Guts were preserved in 4% formalin for further detailed study. The fresh baits (scads, sardines) used for fishing were not included in the list of gut contents, if found in just swallowed condition. This was done so as to evaluate the natural prey availability and choice of the species.

Based on the fullness of state, the guts were categorised into five types *i.e.,* full, half, quarter, trace and empty. Preserved guts were cut open and contents extracted for qualitative and quantitative analyses. Constituents of the diet content were identified initially up to group level depending on the state of freshness or degeneration, identification was attempted up to generic and species level wherever possible, particularly in the case of fishes. Quantitative analysis of the diet samples were determined following numeric method.

Index of Relative Importance (IRI)

The Index of Relative Importance IRI (Pinkas *et al*., 1971) was calculated as follows:

$IRI_i = (\%N_i + \%W_i)\ \%F_i$

where $\%N_i$ is the percentage of food item i in number, $\%W_i$ is percentage of food item i in weight and $\%F_i$ is percentage of occurrence frequency in the food item i. Although IRI may not be a good index (MacDonald and Green, 1983), this index was used in this paper because IRI has often been used in other studies on stomach contents and presents ease of comparison with the results of other studies.

Results and discussion

About 35% of the guts were observed to be empty, 42% full and 22% were found to be either quarter full or with traces (Fig. 1). The occurrence of different fullness states has been recorded in most fish species across global waters. Qasim (1972) attributed frequent occurrence of empty stomachs to secretion of strong gastric juices which expedite the faster digestion in carnivorous fishes. Continuous feeding habit, gap between time of feeding and time of capture and reaction of the fish to being captured (often characterised by evisceration in several species) are all contributory factors to the occurrence of different fullness states, particularly empty guts, in the sampled fishes.

In the present study, the diet of *E. affinis* predominantly consisted of three groups *viz.,* fish, crustacean larvae and molluscs. Crustacean larvae dominated the prey list both by number and occurrence (Table 1). The crustacean larvae included brachyuran megalopa larvae and crablets (45%), stomatopod alima larvae (21%), shrimp larvae (13%) and phyllosoma larvae of scyllarid lobsters (0.1%) (Fig. 2). Fishes and molluscs contributed only about 4% and 2%, respectively in total diet. Crustacean larvae predominantly occurred in the guts across all the size group samples (Fig. 3).

Crustacean larvae formed the main food in the guts of skipjack tuna caught in south-west coast of India (Raju, 1964; Sivadas and Anusukoya, 1999). Earlier reports on *E. affinis* from the south-west coast indicate lesser quantity of crustacean larvae (Kumaran, 1964). However the present observation (nearly after 48 years) shows predominance of crustaceans, particularly larvae, in the diet of this species. In contrast, fishes and fish larvae have been generally observed to be the main food items in gut content of the tunas in India. Such diet patterns have been observed in other species of tunnies, both in India and other parts of the world (Griffith *et al*., 2009; Prathibha *et al.,* 2010, 2012). Tropical tunas of similar size to mackerel tuna that frequent oceanic habitats beyond continental shelves have shown preference for epipelagic fish, crustaceans and cephalopods. Graham *et al.* (2007) found juvenile yellowfin tuna (<50 cm FL) around Hawaiian Islands to feed on stomatopods, decapods, crustaceans and teleosts in the upper mixed layer. In western Indian and Pacific oceans and in the western Pacific Ocean, yellowfin tunas were observed to consume epipelagic fish, crustaceans and cephalopods (Zamorov *et al.,* 1992; Bertrand *et al.,* 2002; Potier *et al.,* 2004). Similar dietary pattern has been reported in skipjack tuna (Thomas, 1962; Raju, 1964; Sivadas and Anusukoya, 1999) and little tuna caught from Indian waters (Kumaran, 1964).

In the present study, the prey fish comprised *Decapterus* sp., *Lutjanus* sp., sardines and silverbellies. Of these, *Decapterus* sp. occurred in 32 individuals and silverbellies occurred in two individuals. Dominance

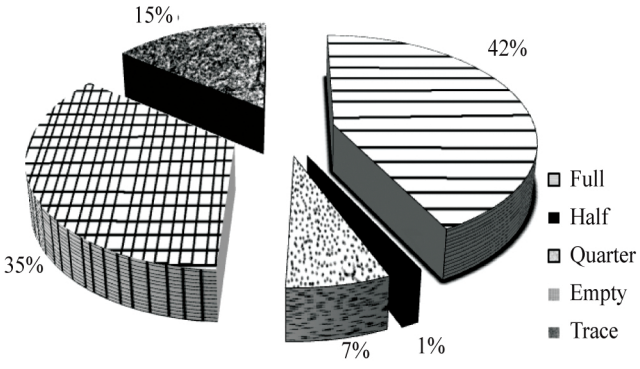


Fig. 1. Gut condition of *E. affinis* caught off Kovalam and Cuddalore

Table 1. Index of Relative Importance (IRI) of prey items in the diet of *E. affinis* collected from Chennai coast

Content	W	%W	FO	%FO	N	%N	IRI	%IRI
Crablet	45.11	3.916	22	17.188	97	11.201	259.81	12.871
Alima/Psuedozoea	48.69	4.226	18	14.063	185	21.363	359.84	17.826
Megalopa larvae	36.69	3.185	18	14.063	440	50.808	759.28	37.614
Shrimp Larvae	2.71	0.235	9	7.031	74	8.545	61.74	3.058
Mollusc/Prosobranch	1.12	0.097	4	3.125	13	1.501	4.99	0.247
Fish	853.5	74.084	3	2.344	32	3.695	182.29	9.031
Digested matter	121.2	10.520	32	25.000	21	2.425	323.63	16.032
Cephalopod	43	3.732	21	16.406	3	0.346	66.92	3.315
Phyllosoma/Pueruli	0.05	0.004	1	0.781	1	0.115	0.09	0.005

W – weight (mg); FO – Frequency of occurrence; N – Numbers

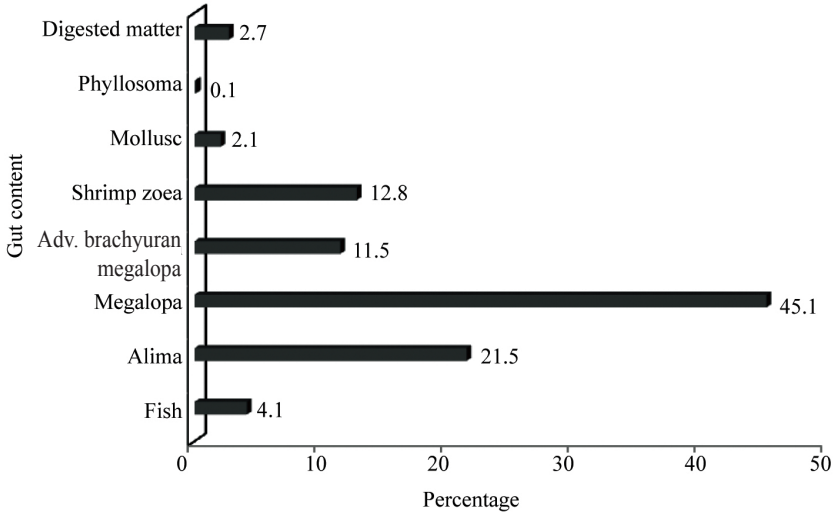


Fig. 2. Occurrence (%) of prey in total number of prey observed in the diet of *E.affinis* caught off Kovalam and Cuddalore

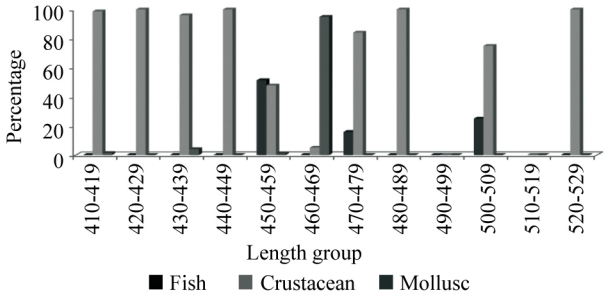
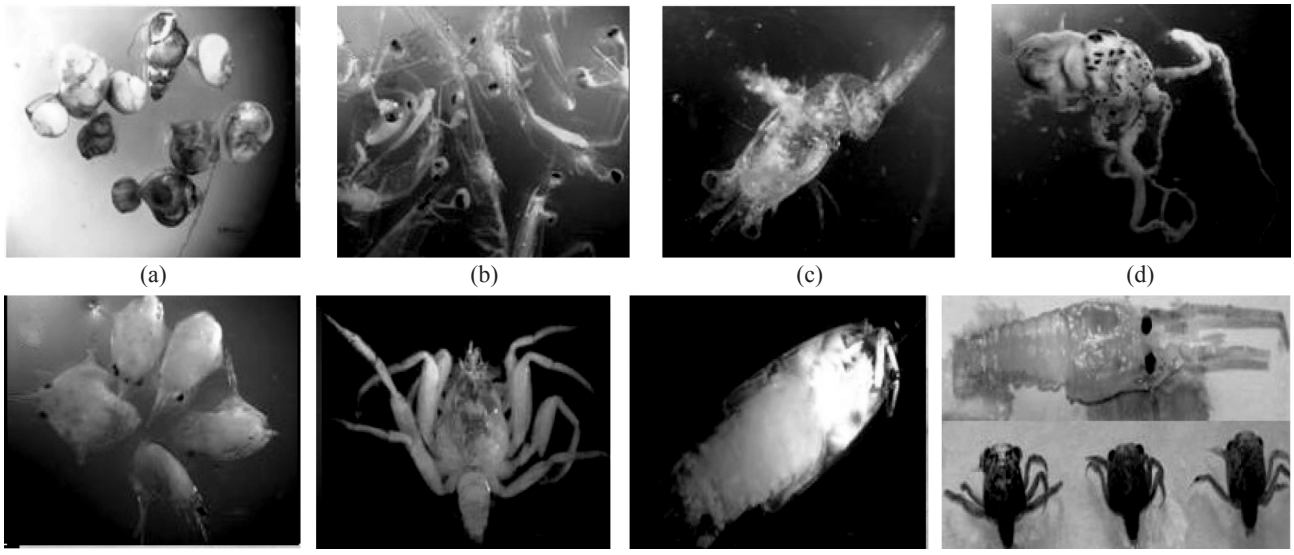


Fig . 3. Length-wise diet composition of *E. affinis* caught off Kovalam and Cuddalore

in occurrence of *Decapterus* and sardines is associated with the fact that these species were largely used as bait for catching tuna, and therefore was screened wherever they were found to be in a whole/freshly swallowed state. However, *Decapterus* sp. has been found to be the main food component in stomach content of other tunas in Indian coasts (Kumaran, 1964; Fofandi *et al.*, 2012). Molluscs were represented by small epipelagic gastropods, *Loligo* sp. and juvenile octopus.

Little tunnies are opportunistic and epipelagic predators that consume a variety of epipelagic prey including fish, crustaceans and cephalopods (Bahou *et al.,* 2007). The dietary pattern of *E. affinis* as observed in the present study is not very different from other species of tuna as well as in same species reported from south-west coast of India. However, the complete dominance of crustacean larvae is a deviation from earlier observations since most of the documented studies report the presence of crustaceans or crustacean appendages rather than crustacean larvae. The presence of scyllarid larvae (or phyllsosma) along with alima indicates the possibility of coastal shoaling at the time of recruitment of stomatopod, brachyuran and scyllarid larvae into the coastal zone before settlement, which has been found to coincide with the recruitment of lobsters and stomatopods (Kizhakudan *et al.*, 2007). Linoy Libini and Ajmal Khan (2012) found a strong link between lunar phases and fish (including tuna) catch along the Cuddalore coast. Incidentally, maximum crustacean larval recruitment has also been noticed along the Kovalam coast during the



(a) (b) (c) (d)

(e) (f) (g) (h) and (i)

Fig. 4. Larval forms identified in the diet contents of *E. affinis* caught off Kovalam and Cuddalore

(a) Planktonic prosobranchs, (b) Stomatopod pseudozoea, (c) Caridean shrimp zoea, (d) Young cephalopod, (e) Brachyuran zoea, (f) Brachyuran megalopa, (g) Advanced alima, (h) Spiny lobster puerulus, (i) Advanced brachyuran megalopa

new moon phases during the lowest low tides and high tide periods of the year (Kizhakudan *et al.*, 2007). The present study provides a basis for further investigations on the possibility of deriving a link between the availability of little tuna in coastal waters and settlement of larvae of crabs, stomatopods, caridean shrimp and lobsters, particularly off rocky patches with increased benthic communities like (crabs, corals, caridean shrimp, stomatopods, and macrurans).

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