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FEEDING HABITS OF SKIPJACK TUNA, *KATSUWONUS PELAMIS* ASSOCIATED WITH FLOTSAM IN MINICOY, LAKSHADWEEP

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ABSTRACT

Feeding habits of skipjack tuna associated with flotsam and those from free schools were studied based on data collected from the pole and line fishery from Minicoy during 1999-2001. The flotsam were found in different months but was more frequent during Sept./ to Nov. A preponderance of smaller size groups below 40 cm (48%) was seen around flotsam whereas in free schools size groups above 50 cm (65%) dominated. Stomach contents of 828 individuals were analysed. In flotsam associated skipjack, stomachs were found to be either empty or with natural prey. Caridian shrimps were found to be the main food in all size groups and were actively fed. The average ration per 1000 g body weight ranged between 17.3 and 39.4 ml suggesting that the flotsam have a function related to feeding rather than refuge.

Key words : Skipjack tuna, Minicoy, Flotsam, Feeding habits.

INTRODUCTION

It is well known that tunas aggregate around floating and drifting objects of both living and non-living ones. This habit has long been utilized for their exploitation. The advantages of fishing from schools associated with flotsam are the reduction in scouting time and the consequent reduction in the use of fuel and above all increased catch rate. In Mnicoy, fishing from such schools by pole and line and troll line is very common. Here though flotsams are observed regularly during the fishing season, they are more frequent from Sept. to Nov. Observations on tunas associated with flotsam have been made earlier from here (Mohan 1985; Livingston 1989). However, specific studies on feeding habit of tunas associated with flotsam have not been made. Hence in this study, an attempt has been made to understand the feeding habits of skipjack tuna associated with flotsam and compared it with the feeding habits of skipjack tuna from unassociated schools based on data collected from Minicoy.

MATERIAL AND METHODS

In Minicoy, normally the flotsam material is also brought to the shore after fishing. So their physical verification is possible. In addition to this, enquiry with the fishermen and observation of species composition of the catch and size composition of the tuna also reveal the nature of the school. Here the catches are unloaded in the beach and the fishermen share the tunas among themselves. More over the entrails are removed before they are taken home. This facilitates on the spot collection of data (Feb.1999-March 2001) on size, weight, sex, feeding condition, type of food etc; besides the collection of catch and effort data. For detailed study, guts of tunas of known length and weight are taken to the laboratory. In the laboratory, the stomachs are weighed and the contents sorted and weighed both by volume and weight. The prey was identified to the lowest possible taxon. For feeding condition, six stages were fixed based on the distension of the stomach such as empty, ¼, ½, ¾, full and gorged. The guts containing natural prey only were taken to assess the feeding condition. The guts containing baits alone were also treated as empty. Nevertheless, the quantity of bait present gives an indication of the feeding response. Fishes with gorged, full, ¾ and ½ condition were treated as actively fed and the rest as poorly fed. The average volume of food(R) taken by fish was estimated by $R = V/N$ where V is the total volume of food consumed by N number of fish. Since the prey was mostly intact, the value R is taken to represent the quantity of food consumed during an active period and hence termed ration as done by Devaraj (1999). The ration per 1000 g body weight of the predator was estimated by using the expression $R1 = R/W * 1000$ where W is the mean weight of the predator in gm in the sample.

RESULTS

Food composition: Natural food items found were mainly prawns though squids numbering 1 to 4 were also seen occasionally. In unassociated schools, besides prawns and squids, filefishes, *Decapterus* sp. etc; were also found. Both juveniles and adults had fed on prawns (Table 1).

Seasonal variation: Prawns were seen from Sep. to Nov. and in Feb. and squids in Feb. and April. In unassociated schools, during the same period, prawns became food in Nov. only. Consumption of *Decapterus* sp. and filefishes were noted in Nov and squids in the months of Feb. and April.

Occurrence of flotsam fishery: The fishery was observed from Feb. to March and Sep. to Nov. in 1999, April and Nov. in 2000 and Feb. to March in 2001 (Table 2). The flotsam materials were logs, nylon net pieces, nylon rope with plastic buoy, etc;

Condition of feed: The guts of tunas from a flotsam associated school were either uniformly empty or with natural prey (Table 2). When natural prey was present, the feeding condition was good. Thus the schools observed from Sep. to Nov. in 1999, April in 2000 and Feb. in 2001 were found to be actively fed. But the tunas observed from unassociated schools during the same period were found to be poorly fed except in the month of Nov. in 1999 and 2000. The prey was found to be intact in the tunas from both the schools indicating very little elapse of time after ingestion. Significant ($p<0.05$) deviation was found between free and flotsam school (Table 3).

Table 1 Feeding condition and food contents of *K.pelamis* along with size range and dominant size groups.

	Free school		Flotsam school	
Month	Size range (cm) & dominant group	Condition & dominant food	Size range (cm) & dominant group	Condition & dominant food
Feb.1999	42-58(50)	Empty to ¾ squid, bait	30-54(48)	0 to ¾ bait
March			34-60(48-50)	0 to ¾ bait
Sep.	50-58(54)	Empty	38-46(44)	½ Prawn,
Oct.	44-58(54-56)	¼ Bait	42-56 (46)	½ Prawn
Nov.	42-62(52-58)	Empty to full Prawn	26-66 (56)	½ Prawn
April 2000	40-68(52-54)	0 to ¼ Digested food, squid	20-38 (24)	½ Digested food, squid
Nov.	36-56(46-48)	0 to ¾ *Decapterus* sp File fish	28-50(36)	Empty
Feb.2001	50-64(56-58)	½ to full bait	24-46(28)	½ Prawn, squid.
March	-	-	26-54(34)	0 to ¾ bait

Variation in average food: The average food obtained during an active period in a month ranged from 22 to 41.4 ml (Table 4). The natural prey in unassociated school was found only in Nov. and it was 48.4 ml. The calculated food per 1000 g body weight of tuna varied from 17.3 to 39.4 ml in flotsam associated school and 19.9 ml in unassociated school.

DISCUSSION

Tunas in general are considered to be opportunistic feeders. Therefore the caridean prawns, *Thalassocaris* sp. and *Leptochela* sp.found in the stomachs as major food items may be an indication of the abundance of this prey and their easy accessibility. Menard *et al* (2000) observed that under fish aggregating devices(FADs), stomach contents rarely contained the same category of prey with the same degree of digestion and for a given school, empty stomachs and more or less full stomachs were observed simultaneously. But in the present observation, the category of prey, viz. prawns were seen with the same degree of digestion in a school in different months. Moreover, for a given flotsam associated school, simultaneous occurrence of empty stomachs and more or less full stomachs were observed very rarely. In majority of the cases, either it was completely empty or with natural prey.

Table 2 Number of tuna sampled and percentage of empty stomachs

Month	Unassociated		Flotsam associated	
	Number	% empty	Number	% empty
Feb.1999	71	69	50	100
March	0	60		100
Sep.	53	83	50	0
Oct.	25	100	26	0
Nov.	97	13	30	0
April 2000	47	47	30	0
Nov.	5	44	25	100
Feb.2001	55	100	25	0
March	0	0	129	100
Total	403		425	

In the Indian Ocean, Roger (1994) found that all the guts of tunas sampled from sets under FADs before sunrise were empty. Since the pole and line and troll line fishing in Minicoy are practiced as day fishing and the fishing starts very late in the morning, an all round sampling of tuna covering 24 hours is not possible. However, tunas caught in the forenoon as well as afternoon contains either empty stomachs or stomachs with different feeding conditions. In the present observation, prawns were the only prey. The intactness and near freshness of the prey prove that they fed at day time (fishing time). Menard *et al* (2000) found that the tunas of size less than 90 cm including skipjack tuna do not feed under drifting FADs and they will have to leave the FADs during the day and may form free swimming loose schools to feed. In the present observation the tunas were found associated with the flotsam. It is also seen that the tunas always show a feeding frenzy when the baits are thrown. Tunas with empty stomach are found to take good quantity of baits when thrown overboard. This also clearly shows that they will feed while schooling under the flotsams.

Table 3 Comparison of guts of skipjack associated with flotsam and those from unassociated shoals.

	Df	Σx^2	Σy^2	Σxy	b	Df	Deviation from regression (SS)	MSS
Within								
Unassociated shoals	8	8097.56	3235.56	2678.0	0.33	7	2349.9001	
Flotsam shoals	8	8897.56	15622	10899.33	1.22	7	2270.5425	
						14	4620.4426	330.0316
Pooled	16	16995.12	18857.56	13577.33	0.7988	15	8010.6881	534.0459
		Difference	between	Slopes		1	3390.2455	3390.246
Total	17	17022	18914.44	10147		16	12865.7026	804.1064
		Difference	between	adjusted	means	1	270.0605	270.0605

Slopes = 10.27248 1,14 Significant at 5%
Elevation = 1.9775 15,1 Not significant.

Table 4 Observed stomach contents (ml) and body weight (kg) of skipjack from which stomach samples were taken.

Month	Body mass (kg)			Observed stomach contents in ml (ration)			
	Min	Max	Mean	Min	Max	Mean	Body weight (1000 g)
Sep. 99	1.0	1.65	1.27	10	35	22	17.3
Oct.	1.45	3.4	1.87	15	60	37.5	20.1
Nov.	0.3	4.5	1.86	10	90	41.6	22.36
Apr. 00	0.2	0.6	0.4	10	25	15.4	38.4
Feb. 01	0.3	1.6	0.65	10	50	24.4	39.4

The fact that the same type of food item is present in all the size groups from juveniles to adults indicates that there is no shifting of feeding habit from one group to another as the size increases. Magnuson (1969) found that the maximum capacity of the stomachs of captive skipjack tuna was 7 % of the weight of the fish. But during an entire day, they ate food weighing around 15 % of their body weight. In the present observation, maximum capacity of the gut was found to reach 4.4 % of the weight of fish. But this quantity is arrived taking into consideration of the food consumed in an active feeding period in a day. The frequency of feeding is not considered. So it is likely that the maximum capacity will be higher than the present capacity.

The large yellow fins are found to feed on the scombridae associated with the FADs and thus have a high biomass for predation (Yesaki 1983). But for the smaller tunas associated with the FADs, the potential prey available under FADs is very low (Menard 2000). So they are of the opinion that FADs have a refuge function for small tuna and function related to feeding for large tuna. According to Mohan (1985), association of tunas with flotsam is only a coincidence and they serve as mere companions drifting in the same direction with the tuna school. But Livingston (1989) suggested that this is an ecological adaptation for a pelagic mode of life. The fact that the tunas and other pelagic fishes congregate not only around drifting objects but also around fixed FADs suggest that these objects are not serving as mere companions drifting in the same direction. As tunas are adapted for a pelagic mode of life, this cannot be an ecological adaptation also. Considering the nature of flotsam materials such as net pieces, plastic buoys with coir ropes etc; the assumption that it serves as a refuge does not appear plausible. The tunas associated with the flotsam always show a feeding frenzy when the live baitfishes are thrown from the boat indicating that they are in search of food. But the flotsams observed were all minor objects that could not attract forage organism of such magnitude as to be preyed upon by a large shoal of tuna. So it is likely that the tunas moving in front of a school may be attracted to the flotsam by the presence of forage organisms and others follow them as part of the shoaling behaviour.

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