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FOOD AND FEEDING HABITS OF THE CUTLASSFISH *TRICHIURUS LEPTURUS(*LINNAEUS, 1758) FROM KARACHI COAST, PAKISTAN

Farzana Yousuf and Sadaf Tabassum

Department of Zoology, University of Karachi, Karachi-75270, Pakistan.

ABSTRACT

The stomach contents of 915 *Trichiurus lepturus* collected from west wharf fish harbour in Karachi coast were investigated between December 2009- December 2010. Two hundred seventy five (30.1%) stomachs were empty. Forty five Taxonomic categories were identified from the 1980 prey items analysed. It was determined that the diet of *T.lepturus* consisted of fish species, Cephalopods, Crustacean, Euphausiid, Mysidacea, Copepods and Stomatopods. The individuals of length (40-70cm) fed mainly on Euphausia, the individuals of length (70-90cm) fed Euphausia, small fish and Cephalopods, individuals of length more than 90cm fed mainly on fishes and Cephalopods. Feeding Intensity and the number of food items increased with increasing size of this ribbon fish.

Key- words: Cutlassfish, *Trichiurus lepturus*, Food and Feeding habit, Karachi Coast, Pakistan.

INTRODUCTION

The family Trichiuridae (hairtails or Cutlassfishes), which comprises 9 genera and 32 species, are generally benthopelagic on continental shelves and slopes. The Cutlassfish or largehead hairtail, *Trichiurus lepturus* (Linnaeus, 1758) is a cosmopolitan coastal pelagic fish inhabiting warm and warm - temperate shelf waters in various parts of the world (Nakamura and Parin, 1993). The taxonomic classification of members of the genus Trichiurus is confusing, because of their similar body shape and coloration. They are characterized by elongate, compressed and ribbon-like body, prominent cannine-like teeth, lack of caudal fin and the silvery colouration. They are essentially marine, but occur in the estuaries too. *T. lepturus* Linnaeus, 1758 is caught from all Chinese seas (Jiang *et al*., 1991) and is the most important commercial marine fish of China in terms of weight (Luo, 1991).

T. lepturus has a worldwide distribution along the shores of tropical and subtropical seas. It is a benthopelagic species found at depths not exceeding 350m. It is generally found along muddy bottoms of shallow coastal waters, and often enters estuaries (Nakamura, 1995).

T. lepturus is found also in the southwestern Atlantic ocean and Gulf of Mexico along the continantal shelf to 100m depths, although, it is common in shallow coastal waters over muddy bottoms (Dawson, 1967; Nakamura and Parin, 1993). *T. lepturus* migrates seasonally (Dawson, 1967; Jaureguizer *et al*., 2004; Barreiros *et al*., 2004). Robins and Ray (1986) reported that it may enter bays, cuts, and harbors in great number to spawn.

Food and feeding habits of *T.lepturus* is described in this paper from Karachi coast, Pakistan. Due to its cosmopolitan nature, the survival and abundance of the Cutlassfish depends on its adaptability to diverse environments. Studies of the diet and feeding strategy of this species may help to understand its ubiquity.

MATERIALS AND METHODS

Nine hundred and fifteen (915) specimens of *Trichiurus lepturus* (size range : 40 to 100cm, and body weight: 145 to 490gm) were analysed from December 2009- December 2010. The Collected fish were brought to the laboratory and preserved in 10% buffer formaline and subsequently preserved in 70% ethanol. The length of the fish measured was from tip of the snout to the tip of the lower lobe of the caudal fin.

The fish were dissected and the gut was placed on paper. The stomach (gizzard) of each fish was then separated out and weight individually. Afterwards these were dissected to study the contents in a Petri dish. Finally, the contents were examined under the light microscope by using Sedwick-Rafters plankton counting chamber.

Stomach contents were sorted and identified to the lowest possible taxonomic level using standard taxonomic keys (Fischer, 1978., Robins and Rays, 1986., Hoese and Moore, 1998). Number of individual prey items consumed, wet weight per prey category and frequency of occurrence per prey category were recorded for each fish. Wet weight was determined with a Ohaus analytical balance (+0.001g). Finally, prey–specific abundance (pi) was calculated as the number of prey ni divided by the total number of prey in the stomach (N).

Fish specimens were divided into three length categories ($40 < \times \leq 60$cm, $60 < \times \leq 80$cm and $80 < \times \leq 100$cm) to analyze their size dependent dietary variation. In addition, seasonal variation in diet were also investigated.

Percentage number and frequency of occurrence were used to estimate the dietary importance of each prey category (Durate and Garcia, 1999),Garcia- Berthou, 2001, Hurst and Conover, 2001):

Percentage number = 100 x The number of prey / The number of all identifiable preys

Frequency of occurrence = 100 x The number of stomach with Prey i / The number of stomach with food item.

Unidentified food items were not used in the calculation. Diet Similarity among length classes and seasons was investigated using the Schoener Overlap index (Schoener, 1970) (C),

$$Cxy = 1 - 0.5 (pxi – pyi)$$

Where pxi and pyi are the propotions by number of prey type I in the diet of groups (Length or Seasons), x and y, respectively. If the C value is bigger than 0.80, it means that the diet of 2 groups is similar.

The extent of the diet was calculated using the diversity index of Shannon- Weaver (1949);

$$H = -\sum (pi. \log 2 pi)$$

Where pi is the propotion by the number of prey type I. The index has adequate sensitivity for detecting changes in diversity and provides a general indication of the relative magnitude of trophic specialization (Berg, 1979).

RESULTS

The stomachs of 915 *T.lepturus* fishes of three length size classes, 52.8±4.06 cm, 69.2 ±4.38cm and 90.78 ± 5.41cm corresponding to mean weight 201.7±49.5g , 304.7±29.90g and 466.8±50.5g, respectively of which examined, 275 were found to be empty. Forty prey species (12 fish, 5 Copepods, 3 Euphausiids, 4 Mysidaceans, 2 Stomatopods, 4 Cephalopods and 10 Decapods crustaceans were recorded from their stomach. The number mean lengths and weights of *Trichiurus lepturus* samples are given in Table 3.

Table 1. Seasonal variations of the frequency of empty stomach.

	Spring	Summer	Autumn	winter
Number of stomach examined	350	250	200	115
Number of stomach with prey	250	190	140	60
Empty stomach (%)	28.57	24	30	47.8
FL±SD	54.3 ± 5.5	61.8 ± 9.0	71.6 ± 6.1	90 ± 7.6
Fork length range (FL, cm)	47-63cm	47-75cm	63-84cm	75-98cm
W ± SD	218.5 ± 58.9	239.1 ± 67.2	283.6 ± 88.1	371.3 ± 70.6
Weight range (g)	145-290	145-325	175-410	290-490

Table 2 represents the relative frequencies of Occurrence (FO), Percentage in number (%N) and the size –range of prey for different ontogentic stages of Cutlassfish. The Cutlassfish (TL: 40- 60cm) were found to be feeding on Euphausiids (mainly *Euphausia similis*) (90.3%N) Copepods (17.7%N) Mysidaceans (mainly *Promysis atlantica*) (50%) Undet Stomatopoda larvae (100%N) and fish (33.5%N). The Cutlassfish (TL: 60-80cm) were found to be feeding on Euphausiid (mainly *Euphausia similis*) (69.2%N), Decapods Crustaceans (20%N) and fish (42.4%N). The small adults (TL: 80-100cm) similar to that of (TL: 60- 80cm) fed mainly upon the same prey as the (TL: 60- 80cm), but in different propotion - 32.3%N of small fish, mostly *Ensgraulis purava* and 9 other fish, 23%N of Euphausiids, 16.5%N of Cephalopods mostly *Argonauta nodosa, Illex argentines, Loligo duvauceli*, 18.70%N of Decapods Crustaceans and 8.63%N of Stomatopods.

The rates of empty stomachs were nearly the same in spring and autumn. Such rates were lesser than in winter. However, this rate increased gradually from autumn to winter (Table 1).

Table 2. Percentage and frequency of occurrence of the main prey components at different size of *Trichiurus lepturus* in Karachi Coast and size-ranges of all identified prey.

	Total length-class (cm)							
	40-60	60-80	80-100	40-60	60-80	80- 100		
	Number of analysed stomach							
	350	315	250	350	315	250	Prey size-range (mm)	
	Occurrence (%)			Percentage of number			Minimum	Maximum
Copepods	21.5			17.7			0.3	2.5
Calanus sp.	17.8			21.42				
Eucalanus crassus	14.2			21.42			2.2	2.4
Eucalanus pileatus	20			25			3.0	2.5
paracalanus aculeatus	12.8			17.85			0.5	0.8
Undet.calanoidae	10.7			14.2			0.3	2.5
Euphausiids	32.2	24.24	35.5	19.6	26.2	23.74	7.0	25
Euphausia similis	83.8	57.6	54.5	90.3	69.2	60.6	7.0	25
Thysanopoda monacantha		15.3	18.18		23.07	27.2		
Undet.Euphausiacea	7.7	6.1	9.0	9.67	7.69	12.12	7.0	20
Mysidaceans	83.3			15.1			3.0	26
Mysidopsis coelhoi	20.8			25				
Promysis atlantica	41.6			50			3.0	6.0
Siriella.sp	12.5			16.66			3.0	5.0
Undet.Mysidacea	6.6			8.33			3.0	8.0
Stomatopodas	20	7	5	15.18	2.02	8.63	5.0	125
Undet.Stomatopoda			58.3			66.66	110.0	120
Undet.Stomatopoda larvae	83.3	80	25	100	100	33.3	4.0	24
Cephalopods		26.4	61.7		11.11	16.5	3.0	200
Argonauta nodosa		54.5	21.7		63.6	26.08	15.0	35
Illex argentines		32.7	26		36.36	30.43	21.0	200
Loligo duvauceli			21.7			26.08	20.7	100
Ommastrephes bartrami			13.0			17.39	90.0	90
Decapods Crustaceans	21.6	26.6	40	10.1	20	18.70	2.0	115
Acetes americanus		20	13.07		22.22	15.38	7.0	35
Artemesia longinaris		11.11	11.5		16.66	15.38	40.0	155
Leptochoela sp.	18.75			25				
Lucifer faxoni	27.5	15.5	13.8	31.25	16.66	15.38	2.0	12
Metanepherops rubellus			7.6			11.5	13.0	35
Pleoticus muelleri		15.5	13.8		16.6	15.38	27.0	116
Portunus pelagicus			13.07			15.38	15.0	30
Portunus sangunolantus			9.23			15.38		
Squilla	18.75	22.22		25	27.7			
Undet.sergestidae	12.5			18.75			7.0	8.0
Fish	35.7	27.8	30	33.5	42.4	32.3		
Anchoa marini	9.43	11.9	13.33	11.32	14.28	17.77	65.0	70
Conger cinereus	11.32	10	6.6	15.09	11.90	8.88		
Cynoscion guatucupa	9.43	8.57	4.4	11.32	9.52	6.66	50.0	280
Engraulis purava	18.8	11.9	17.7	22.64	14.28	22.22	200	200
Macrodon ancylodon	4.9		6.6	7.54		8.88	200	205
Maurolicus muelleri	3.01		7.5	3.77		8.88	30	50
Mugil sp.	7.5	12.8	8	9.43	14.28	8.88	50	55
Paralonchurus brasiliensis	3.01	9.52	7.5	7.54	11.90	8.88	25	70
Synagrops spinosis	2.64	8.09	3.5	3.77	9.52	4.44	50	55
Trichiurus lepturus		11.9	3.1		14.2	4.44	35	100
Undet.Sciaenidae	2.2			3.77			100	100
Undet.teleostei	3.01			3.77			25	

Diet variation by fish size

It was determined that prey fish were the most important food for the *Trichiurus lepturus* of 40-100cm length. Frequency of occurrence of fish category were nearly the same in all length classes for

the fish specimens examined , but their proportions changed with *Trichiurus lepturus* length. As shown in Figure 1, the most important preys of individuals in the 40-60cm, 60-80cm and 80-100cm length classes consisted of some fish species, Euphausiids, Stomatopods and Crustaceans. According to the Schoener overlap index (C), the feeding of *Trichiurus lepturus* in these 3 length classes was also similar (C = 0.833). However, except for the relation between these length groups (40-60cm, 60-80cm) the other comparisons for all the length classes were significantly different (C < 0.8) from each other (40-60 cm, 60-80 cm, 80-100cm).

In addition to prey fish, *Trichiurus lepturus* in the 40- 60cm length class also fed on small decapods Crustaceans, Stomatopods, Mysidaceans and Copepods. In the stomach of *Trichiurus lepturus* of the 60-100cm length class only Euphausiid, Small fish, Crustacean , Cephalopods and Copepods were found. The specimens of length 40-70cm feed mainly on Euphausia , of length 70- 90cm food Euphausiia small fish and Cephalopods. Specimens of the length more then 90cm feed mainly on fishes and Cephalopods. According to the Shannon - Wiener Index, prey diversity of the 60- 80cm length class was the lowest (H = 1.532, 1.333, 1.485 for the length classes of 40-60, 60-80cm, 80-100cm, respectively).

Table 3. The number (n), mean fork length (FL) and weight (w) of *Trichiurus lepturus* by length class.

Length class	N	Fish Length ± SD (Min-Max) (cm)	Fish weight ± SD (Min-Max) (g)
Small (40-50 cm)	350	52. 8± 4.06 (47-58)	201.7 ± 49.5 (145-260)
Medium (70-80 cm)	315	69.2 ± 4.38 (63-75)	304.7 ± 29.90 (270-350)
Large (90-100 cm)	250	90.78 ± 5.41 (84-98)	466.8 ± 50.5 (350-490)

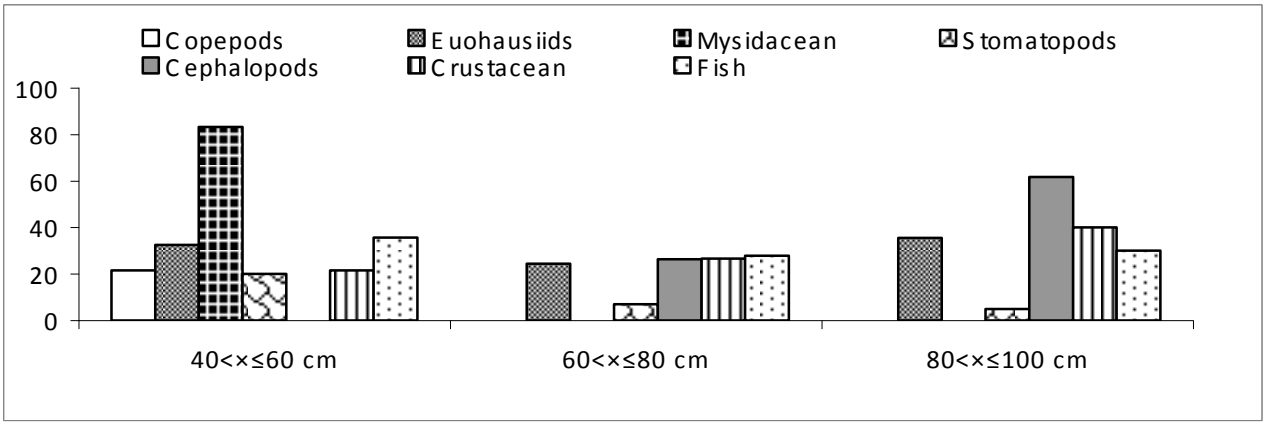

Fig. 1. Percentage of occurrence of prey categories ingested by variously sized Cutlassfish *Trichiurus lepturus* in Karachi Coast .

DISCUSSION

The fishes belonging to family Trichiuridae are of considerable industrial importance in Indian Ocean (Jacob, 1949; Gupta, 1967) and in region of South- Eastern Asia (Tsukahara, 1961, 1962; Thanh - Khanh Thai, 1962; Vuong Di Khang, 1963). The family comprises several species. Majority of them live in Northern part of Indian Ocean and in region of South - Eastern Asia.

The result of this study showed that the diet of the *Trichiurus lepturus* in Karachi Coast consisted mainly of some fish species, Copepods, Crustaceans, Euphausiids, Mysidaceans, Stomatopods and Cephalopods.

The species of *T. lepturus* selected for study are given in Table 2. It was possible to account and weight all food items in the stomach and most of the prey items were easily identified because of their size. Some fish stomachs (30.1%), however were empty. Feeding activity changed seasonly corresponding to variation in the abundance of fish, due to changes in the water temperature and dynamics of organisms (Sakamoto, 1982).

Stomach content analysis is used widely to determine food composition, feeding strategies, trophic position, energy flow (Hyslop, 1980), trophic structure (Luczkovich *et al*., 2002), and trophic partitioning (Ross, 1986) of predator and prey. Although this technique is the most commonly employed method to evaluate these relationships (Hannon and Joiris, 1989), the method presents some inherent difficulties. For example, taxonomic identification is difficult because of the digestive process (Iken *et al*., 1999) and some components in the diets are difficult to quantify, such as gelatinous plankton and detritus (Deb, 1972; Polluning and Pinnegar, 2002) . Finally, because stomach contents are based on prey consumed shortly before capture, they represent a limited view of the diet in time and space (Pinnegar *et al*., 2002; Cocheret de la Moriniere *et al*., 2003), and often high percentages of stomachs are empty (Divita *et al*., 1983, Brewer *et al* ., 1991).

The Cutlassfish proved to be well adapted to feed on many of the abundant planktonic and necktonic organisms from both coastal and continental shelf waters. These included the Euphausiid *Euphausia similis*, frequently found in stomach contents of pelagic and demersal- pelagic fish (Schwingel & Castello, 1994), the Anchovy *Engraulis anchoita*, which has an estimated winter biomass of more than two million tons (Lima and Castello,1995) and the weakfish, *Cynoscion guatucupa* which is the most abundant bony fish in demersal trawl surveys (Haimovici *et al*., 1996).

In the present study the diet of *T.lepturus* differed for different size groups. The diet of small size (40-60cm) *T. lepturus* mainly consisted of Euphausiids (mainly *Euphausia similis)*, Copepods, Mysidaceans (mainly *Promysis atlantica*) and Fishes. In large size *T.lepturus* feed mainly Euphausiids (mainly *Euphausia similis*), Decapods Crustacean, Fishes, Cephalopods (mainly *Argonauta nodosa, Illex argentines, Loligo duvauceli)* and Stomatopods. According to Sin (1978*) , T. lepturus* of less than 200 mm in length feed mainly on Shrimps, *mantis shrimps* and squid, larger fish food on anchovies and juvenile ribbon fishes , and the largest fish of this species feed on other bigger fishes. Hanabuchi (1973) pointed out that the young and immature *T. lepturus*, less than 230mm in size, have pointed teeth and are plankton feeders, whereas the adults have a tendency towards an increased number of hooked canine teeth and are mostly piscivorous.

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