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FEEDING HABITS OF JARBUA TERAPON, *TERAPON JARBUA* (FAMILY TERAPONIDAE), FORSSKAL FROM THE COAST OF PAKISTAN

Hamid Badar Osmany and Syeda Kashifa Zohra

Marine Fisheries Department, Karachi, Pakistan.
(hamid61612002@yahoo.com)

ABSTRACT

A study from February 2015 to January 2016 was conducted to investigate the feeding habits of *Terapon jarbua*. Two hundred and seventy specimens of the species were collected mostly from Karachi fish harbor on monthly basis to investigate the seasonal variation in food selection. The analysis of stomach contents comprised seven groups including, fish, crustacean cephalopod, shells, fish scale, sand and Polychaetes

Key-words: Feeding habit, Jarbua terapon, *Terapon jarbua*, coast, Pakistan.

INTRODUCTION

The study of stomach content is widely used in fish ecology and relationship between aquatic animals (Fagbenro *et al*., 2001). Food and feeding habits of fish are very important, the class and value of food directly effects fish development, survival and reproduction while indirectly effect its mortality (Wootton, 1990). Studies on feeding habit gives information on the amount and class of food consumed by fish. Feeding habits studies of fish are useful in identifying some of the high level trophic association in an ecosystem and are estimating fish production (Pauly and Christensen, 2000). This also provides the assessment in the role of marine fish in an ecosystem, the knowledge of the feeding habit of species is important to implementing in fisheries management.The food and feeding habits varies from each month. This variation is due to change in the composition of food creatures taking place at different seasons of the year.

Detailed work has been done by many scientists on food and feeding habit like Moffet and Hunt (1943), Khan (1947), Hynes (1950), Karim and Hussain (1972), Doha (1974), Dewan and Saha (1979), Jhingran (1983), Bhuiyan and Haque (1984), Bhuiyan and Islam (1990, 1991) Hossain *et al.* (1991), Bhuiyan *et al.* (1997, 1998, 1999)and others. They divided fish food into three groups (a) Main food (b) Occasional food and (c) Emergency food. In the light of this, present study focused on main food which is highlighted in seven group including, fish, crustacean cephalopod, shell, fish scale, sand and Polychaetes

MATERIALS AND METHODS

A total of 270 specimens of *T. jarbua* were collected from February 2015 to January 2016mostly from Karachi fish harbor. Monthly collections were made to know the seasonal variations in food selection. After collection, 10% formalin solution was immediately injected into stomach of each fish to stop the contamination in stomach. Practical work was done in the biological laboratory of Marine Fisheries Department, Karachi.

After measurement a scissor was used to open the stomach and stomach content was taken into a petri dish or bowl for further study. Most of the food content was identified by naked eye. The frequency of various factors in the food was estimated by occurrence method and is expressed in the percentage on annual basis (February 2015 – January 2016).

RESULTS

Table 1 showing the detailed and combined variation of food items found in the stomach of *T . jarbua* which is prescribed in quite precisely in Table 2. Table3. Showing detailed of female variation in food tem found in the stomach of *T. jarbua* followed by a summery in Table 4. Table 5 showing detail food item in male of *T. jarbua* followed by a summary in Table 6. All food items divided into seven groups namely fish, crustacean cephalopod, shell, fish scale, sand and Polychaetes (Table 7).

Table 1. Combined percentage variation of different food items found in the stomach of *T. jarbua* during study from February 2015 to January 2016.

S.No.	Item	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
I	**Fish**												
	Miscellanies fish	2.98	1.19	3.57	1.19	2.38	1.79	2.98	1.19	0.60	2.98		
	Hair tail fishes		0.60										
	Tongue sole	0.60		1.19				0.60	0.60	0.60			
	Spiny flathead			1.79									
	Pony fishes		1.19		0.60	0.60	1.19					1.19	1.19
	Anchovies					0.60							
	Fish juveniles					0.60							
	Stargazers						0.60						
	Sea catfishes							0.60	0.60				
	Trevallies									0.60			
	Codlets		0.60								0.60	0.60	
	Sand perches			0.60									
	Lantern fishes						0.60						
	Goatfishes						0.60						
	Threadfin breams						0.60						
	Pipe fishes	0.60											
II	**Crustaceans**												
	Squilla	2.38		1.19		0.60	0.60		0.60	1.19	2.98	1.19	
	Miscellanies Shrimp	0.60	0.60	1.79	0.60	0.60	1.19	1.19			0.60		
	Solenocerid shrimp							0.60					
	Kiddi shrimp										0.60		
	Sergestid shrimp		1.19										
	Miscellanies Crab	2.38	0.60	4.17	1.79	1.79		1.19	0.60		1.79	1.19	0.60
	Moon crabs			0.60									
	3 spot swimming crab											0.60	1.19
III	**Cephalopods**												
	Octopus	4.17		1.79	2.38	0.60					0.60	0.60	
	Squids	0.60	0.60	1.19									
IV	**Shells**												
	Gastropods	0.60			1.19	0.60							
	Bivalves				0.60	0.60							
V	**Fish scale**				0.60	1.19							
VI	**Sand**						0.60		0.60				
VII	**Polychaetes**					0.60			0.60				

Table 2. Combined monthly summery of percentage variation of different food items found in the stomach of *T. jarbua* during study from February 2015 to January 2016.

S.No.	Item	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
I	**Fish**	4.17	3.57	7.14	1.79	4.17	5.36	4.17	2.38	1.79	3.57	1.79	1.19
II	**Crustaceans**	5.36	2.38	7.74	2.38	2.98	1.79	2.98	1.19	1.19	5.95	2.98	1.79
III	**Cephalopods**	4.76	0.6	2.98	2.38	0.6					0.6	0.6	
IV	**Shells**	0.6			1.79	1.19							
V	**Fish scale**				0.6	1.19							
VI	**Sand**						0.6		0.6				
VII	**Polychaetes**					0.6			0.6				

Fish

Most dominant diet of the fish was found in high quantity throughout the year. Combined percentage was 41.57 whereas in female it was 45.35 % and 37.50 % in male. Highest combined percentage was found in the month of April which was 7.14% and lowest in the month of September to January. In female highest percentage was in April which was 8.14 % and a decline was observed from August to January. In male highest percentage was in the month of April which was 6.10 % and a decline was observed from September to January. Pony fishes were dominating in the stomach with 5.95 % followed by Tong sole with 3.57%

Crustacean

Second dominated group of the diet, including crab, shrimp and squilla. Combined percentage was 39.16 % whereas it was 36.05 % in female and 42.5 % in male. Highest combined percentage observed in the month of April which was 7.74 % and decline from May to June. In female highest percentage was 6.98 % which was observed in the month of February and November and was found absent in the month of September to October. In male highest percentage was 9.76 % in April and was lowest 1.22 in the month of June, July and January. Most dominant amongst these was crab with 15.12 % followed by shrimp 10.5 % and Squilla, 10.47 % respectively.

Cephalopod

Third dominant group of this fish diet comprising octopus and squids which was 12.65 % of the total diet not found regularly which was 13.95% in female and 11.3 % in the male. In female it was found from February to May but was most dominant in the month of February with 6.98 % and not found in rest of the year. In male it was found from February to June except in very meager quantity in the months of November and December. Highest percentage was in May with 3.66 % and completely absent from July to October and in January. Mostly depending on octopus

Shells

Contribution of this group was not high in the diet of this fish,it was 2.41 % of the total diet. In female it was 1.16 and 3.75 % in male respectively. In female a piece of gastropode was found only in the month of Feburary which was 1.16 %. In male in May it was 3.66 % and 2.44 %. in June, an operculam was found in each month and tinny bivalve (Placuna) shells were also found.

Fish scale

Quantity of this group was not so common it was 1.81 % of the total diet and found in two small size fishes 16 cm and 24 cm respectively from May to June, both were male. Highest percentage was in June which was 2.44 %. Apparently it looks like of fish *Elops machnata*.

Sand

Contribution of this group is very poor in the diet, it was 1.2 %.it was found only on one occasion of each sex. In female it was found in the month of July which was 1.16 % and in male it was 1.22 % in the month of September.

Table 3. Percentage variation in female of *T. jarbua* of different food items found in the stomach of during study from February 2015 to January 2016.

Female

S.No.	Item	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
I	**Fish**												
	Miscellanies fish	3.49	2.33	3.49	1.16	1.16	3.49	2.33	1.16		3.49		
	Hairtail fishes		1.16										
	Tongue sole	1.16		2.33				1.16	1.16	1.16			
	Spiny flathead			2.33									
	Pony fishes				1.16	1.16	1.16					2.33	2.33
	Anchovies					1.16							
	Fish juveniles					1.16							
	Stargazers						1.16						
	Sea catfishes												
	Trevallies									1.16			
	Codlets												
	Sand perches												
	Lantern fishes												
	Goatfishes												
	Threadfin breams												
	Pipefishes												
II	**Crustaceans**												
	Squilla	4.65									4.65	1.16	
	Miscellanies Shrimp	1.16	1.16	1.16	1.16	1.16	2.33						
	Solenocerid shrimp							1.16					
	Kiddi shrimp										1.16		
	Sergestid shrimp												
	Miscellanies Crab	1.16		3.49	1.16	3.49		1.16			1.16		1.16
	Moon crabs			1.16									
	3 spot swimming crab												1.16
III	**Cephalopods**												
	Octopus	5.81		3.49	1.16								
	Squids	1.16		2.33									
IV	**Shells**												
	Gastropods	1.16											
	Bivalves												
V	**Fish scale**												
VI	**Sand**						1.16						
VII	**Polychaetes**					1.16			1.16				

Table 4. Summary of monthly percentage variation in female of *T. jarbua* of different food items found in the stomach during study from February 2015 to January 2016.

Female

S.No.	Item	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
I	**Fish**	4.65	3.49	8.14	2.33	4.65	5.81	3.49	2.33	2.33	3.49	2.33	2.33
II	**Crustaceans**	6.98	1.16	5.81	2.33	4.65	2.33	2.33			6.98	1.16	2.33
III	**Cephalopods**	6.98		5.81	1.16								
IV	**Shells**	1.16											
V	**Fish scale**												
VI	**Sand**						1.16						
VII	**Polychaetes**					1.16			1.16				

Table 5. Percentage variation in male of *T. jarbua* of different food items found in the stomach during study from February 2015 to January 2016.

Male

S.No.	Item	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
I	**Fish**												
	Miscellanies fish	2.44		3.66	1.22	3.66		3.66	1.22	1.22	2.44		
	Hairtail fishes												
	Tongue sole												
	Spiny flathead			1.22									
	Pony fishes		2.44				1.22						
	Anchovies												
	Fish juveniles												
	Stargazers												
	Sea catfishes							1.22	1.22				
	Trevallies												
	Codlets		1.22								1.22	1.22	
	Sand perches			1.22									
	Lantern fishes						1.22						
	Goatfishes						1.22						
	Threadfin breams						1.22						
	Pipefishes	1.22											
II	**Crustaceans**												
	Squilla			2.44		1.22	1.22		1.22	2.44	1.22	1.22	
	Miscellanies Shrimp			2.44				2.44			1.22		
	Solenocerid shrimp												
	Parapenaeopsis stylifera												
	Sergestid shrimp		2.44										
	Miscellanie Crab	3.66	1.22	4.88	2.44			1.22	1.22		2.44	2.44	
	Moon crabs												
	Three spot swimming crab											1.22	1.22
III	**Cephalopods**												
	Octopus	2.44			3.66	1.22					1.22	1.22	
	Squids		1.22										
IV	**Shells**												
	Gastropods				2.44	1.22							
	Bivalves				1.22	1.22							
V	**Fish scale**				1.22	2.44							
VI	**Sand**								1.22				
VII	**Polychaetes**												

Table 6. Summary of monthly percentage variation in male of *T.jarbua* of different food items found in the stomach during study from February 2015 to January 2016.

Male

S.No.	Item	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
I	**Fish**	3.66	3.66	6.10	1.22	3.66	4.88	4.88	2.44	1.22	3.66	1.22	
II	**Crustaceans**	3.66	3.66	9.76	2.44	1.22	1.22	3.66	2.44	2.44	4.88	4.88	1.22
III	**Cephalopods**	2.44	1.22		3.66	1.22					1.22	1.22	
IV	**Shells**				3.66	2.44							
V	**Fish scale**				1.22	2.44							
VI	**Sand**								1.22				
VII	**Polychaetes**												

Table 7. Summary of total gender percentage of *T. jarbua* during study from February 2005 to January, 2016.

S.No.	Name	female	male	Combined
1	Fish	45.35	37.5	41.57
2	Crustacean	36.05	42.5	39.16
3	Cephalopods	13.95	11.3	12.65
4	Shells	1.16	3.75	2.41
5	Fish scale		3.75	1.81
6	Sand	1.16	1.25	1.2
7	Polychaetes	2.33		1.2

Table 8. Seasonal feeding movement of *T. jarbua* showing empty and fulness of stomach during Study from February 2015 to January 2016.

S.No.	Month	Number of fish	% of empty stomach	% of fullness
1	Feb	29	58.6	41.4
2	Mar	17	35.3	64.7
3	Apr	39	61.5	38.5
4	May	14	64.3	35.7
5	Jun	24	62.5	37.5
6	Jul	16	50	50
7	Aug	29	37.9	62.1
8	Sep	8	87.5	12.5
9	Oct	15	33.3	66.7
10	Nov	46	28.3	71.7
11	Dec	9	22.2	77.8
12	Jan	24	87.5	12.5
	Total	270	52.4	47.6

Polychetes

This group was countered in small quantity in the diet of this fish which was 1.2 % of the diet. It was found on two occasions in female which was 1.16 % in June and September respectively.

DISCUSSION

The present study is based on a systematic study of one year which has revealed the carnivorous feeding habits of *T. jarbua* which is further classified as benthivores. Species which has conical teeth, slightly recurved, in villiform bands outer row is much enlarged which helps to prey soft tissue animals such like fish, cephalopods etc, whereas vomer and palatine on roof of the mouth help to crush shells of different animals (Plate 1). Due to this, wide variety of food items were found in the stomach of this species in different months (Plate 2)

Plate 1. Conical teeth, slightly recurved, in villiform bands outer row much enlarged of *T jarbua.*

Plate 2. . Food variety of *T. jarbua* in different months.

Plate2. (continued). Food variety of *T .jarbua* in different months.

T. jarbua is primarily a coastal species which is found in warm temperature water but presence of lantern fishes and solenocerid shrimp in its stomach shows that fish sometime approaches to deeper water also for food.

Manoharan *et al.*(2012) in their brief description describe the feeding habits of *T. jarbua* collected from Parangipettai coast, South East Coast of India during January 2011 to December 2011 that fish has carnivorous habits, dominant died depend on crustacean, fish and polychete. Most food items of present study are almost similar except of few items with different composition. Percentage of polychete are low in present study, it is dominated by fish, crustacean, cephalopods, shells, fish scale, sand and polychete respectively. Dominated food items found in

both sexes are different, female dominating with fish and then crustacean whereas male were dominating with crustacean and then fish. Venkataraman (1956) and Prabhu (1955) had experimented that crustacean is the main food item in fish. In the beginning some microscopic study was conducted but items were unidentified because of semi digested materials so it came to an end. Some digested material and other miscellaneous materials were also ignored which was not supporting above seven groups.

Whitfield and Blaber (1978) has described scale eating habit of the marine teleost *T. Jarbua* from St. Lucia from March 1975 to March 1976 that fish can remove scales of some living fishes like *Argyrosmus hololepidotus* and *machnata*. Some scale found in the months of May and June and very much similar to scale of *Elops machnata.*

Many studies shows that higher percentage of empty stomach was found during the months of reproduction (Ozyurt *et al.*, 2012). Nandikeswari *et al*. (2014) described the spawning season of *T. jarbua* from February to July. Thistrend was observed during the months from April to July during present studies.

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