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OBSERVATIONS ON THE FOOD AND FEEDING HABITS OF STRIPED PIGGY, *POMADASYS STRIDENS* (FORSSKAL, 1775) (FAMILY; POMADASYIDAE) FROM KARACHI COAST, PAKISTAN

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ABSTRACT

Pomadasys stridens (Forsskal, 1775) is an excellent food fish and widely distributed in the Indo- pacific region. It inhabits higher part of rocky tide pools, and shallow waters.
The pattern of food and feeding habits of *P. stridens* were studied during the period from January 2001 to April 2002 using points and frequency of occurrence methods. The fish was observed to be carnivorous, which fed mainly on Crustaceans (14.53), mollusks (11.57) small teleosts (11.1), and pollychaets (1.99) etc. Analysis of fullness of stomach revealed 4.84% gorged, 9.76% full, 2.85% three fourth full, 10.07% half full, 14.39% quarter full, 23.04% little and 35.04% were found to be empty. Feeding intensities were higher in fishes of larger size groups (140-219mm total length) while poor feeding condition was exhibited by smaller size groups (50-139mm total length). The composition of food of different size groups and seasons was calculated. Semi digested food, Crustaceans and miscellaneous food materials were the most frequent food items for smaller size groups (50-139mm), while the diet constituent shifted to semi digested food, miscellaneous, molluscs, teleosts and crustaceans in larger size groups (140-219 mm total length).

Key-words: Food & feeding habit, *Pomadasys stridens*, Karachi, Pakistan.

INTRODUCTION

Food intake and feeding habits of fishes vary from month to month. There are several reports on the reproductive biology, growth, ecology, length weight, fecundity, feeding habit and population dynamics of different species of family Pomadasyidae (Grunt) from various countries of South east Asia, America, Australia, India, China, Israel, UAE and Pakistan (Konchina, 1978; Adebiyi, 2013; Deshmukh, 1973; Jayabalam, 1991; Blaber, 1997; Imad, 1985; Iqbal, 1989; Bianchi, 1985; Hussain and Ahmad, 1992; Majid, *et al*., 1992; Beaumer,, 1978; Majid and Imad, 1991; Iwatsuki *et al.*, 1998; Ben-Tuvia, A, 1976; Al-Ghais, 1995; Amtyaz and Khan, 2004; 2005).

Practically, no work has been under taken on the food and feeding habits of *Pomadasys stridens* from Pakistan. The present study was, there fore, under taken. However some works are available on the food and feeding habits of some other important fishes like Croaker, Torputitora, Mullets, Halmablennius sp, Rainbow trout, Eleotid fishes, Pony fishes, Gerreidae, *Pomadasys commersonni* and Saddle grunt etc, noteably by Ajazuddin (2000; 2001), Bapat and Bal (1952), Latifa & Bal (1985), Venkataraman (1960), Metacalf *et al*. (1997), Nordlie, (1981), Jayabalam, (1991), Cyrus and Blaber, (1983), Vander Westhuizen and Marais, (1977), Amtyaz and Khan, (2005); Such information is vital for the proper management of the fisheries and for optimum utilization of the resources.

MATERIALS AND METHODS

A total of 391 specimens of *Pomadasys stridens* (Forsskal, 1775) were collected from commercial fish landings at Karachi fish harbour (West wharf and Korangi creek) during January 2001 to April 2002. Fishes were preserved in 10% formalin immediately after collection to stop further digestive action. The total length and body weights of all fish were determined. The stomachs were removed and each was opened to determine the degree of fullness, after which the stomach contents were discharged into Petri dishes and examined qualitatively. Food contents were grouped into six categories such as teleosts (fishes), Molluscs, crustaceans, polychaetes, miscellaneous food materials and fragments of semi-digested food. The stomach contents were then weighed and preserved in 70% alcohol for further analysis, which is based on the occurrence and points method of Hynes (1950) with slight modifications allotting the points for fullness of stomach according to an arbitrary 7-point scale- 100, 75, 60, 50, 25, 5, 0, points were awarded for gorged, full, ¾ full, ½ full, ¼ full, barely full and empty stomach respectively based on inspection and estimation. The points assigned to food categories were ascertained by subdividing the total points allocated to stomach. All the points gained by each food categories were summed up and scaled down to give a percentage composition of food of all fish examined. In the "occurrence" method the number of fish in which each food items occurs is listed as percentage of total number of fish examined, calculated by ratio of number of fish feeding on particular food and number of fish examined multiplied by 100.

RESULTS

Feeding habits

The data on the stomach contents of 391 specimens of *Pomadasys stridens* are shown in Table 1 & 2. From table 1, it is evident that the intensity of food out of 391 stomachs, 264 (67.52%) were with food and 127 (32.48%) without food. Among these 4.84% stomachs were gorged with food, 9.76%) were full, 2.85%) were ¾ full, 10.07%) ½ full, 14.39%) ¼ full, 23.04%) were barely full. The amount of different food groups taken by fish is shown in Tables 2 and 3. Among different food groups, semi- digestive food materials were the most dominant food group by percentage of total occurrence (46.51%) whereas next to semi- digestive food materials, crustaceans were the second most important food group (14.53%). Next to crustaceans, miscellaneous (14.32%), mollusks (11.57%) teleosts (11.1%), and polychaetes (1.99%) occupied the successive positions by percentage of total occurrence (Tables 2, 8 & 9).

Food in relation to seasons

Fish with the highest percentage of intensity of feeding in 6 categories of fullness of stomach occurred in January 2001 (14.28%). After January 2001 the percentage of fullness (gorged) decreased and it was nil in March, April, June, July, August, September and November 2001. After November 2001 the percentage of fullness (gorged) increased up to January 2002 (21.62%) and after February 2002 it was again becoming nil in March and April 2002 as shown in Table 1. The percentage of empty stomach were high in April 2002 (64.7%), (64.28%) in both March 2001 and April 2002. While percentage of gorged stomach was high in January 2002 (21.62%) (Table 1, 2 & 7). The food items of *Pomadasys stridens*, which occurred in the stomach in different months, are:

1. Semi-digested food materials

This item occupied the first place in the diet of *Pomadasys stridens* constituting about 46.51% and 30.51% among all the groups of food items (Table 2, 3 & 8). This food item was observed in all the months and includes the parts of animal body, which could not identify. The highest abundance of semi- digested food materials was observed in the month of August 2001 (85.71%) and the lowest in January 2002 (27.45%).

2. Crustaceans

This item ranked second in importance as the food constituents of *Pomadasys stridens* about 14.53% among all the groups of food items (Table 2, & 8). This food item was observed in all months and consists of mainly of prawn, mantis shrimp, squilla, megalopa larvae of crabs, small crabs and prawn mysis (Table 8). The maximum percentage of occurrence of food items was recorded in the month of April 2001 (33.33%) and the minimum in May 2001 (6.67%) while they were totally absent in August 2001(Table 2).

3. Miscellaneous

It ranked third in importance as the food constituent of *Pomadasys stridens* (Table 2 & 8). It included prawn eyes, head, uropode and appendages, crab carapace and chela, fish eggs, scales, eye lens, head, vertebrae, otolith, cuttle-fish bone, fecal pellets, shell fragments, debris, sand particles and mud. The fish consumed the maximum of this miscellaneous matter in March 2001 (28.57%) and the minimum in December 2001 (5.26%), while it was scanty in April 2001 (Table 2 & 8).

4. Molluscs

This item ranked fourth in importance as the food constituent of *Pomadasys stridens* (Table 2, 3 & 8) and included species of cephalopods, gastropods and bivalves (Table 8). Molluscs were found in all the months except February 2001, March 2001, April 2001 and August 2001.The maximum amount of molluscs (37.25%) & (32%) were recorded in the month of January 2002 & February 2002 respectively. The minimum amounts of mollusks in July 2001 (2.38%) & June 2001 (3.45%). A gradual decline was observed from January2002 to April 2002 (Table 2 & 3).

5. Teleosts

Teleosts occupied fifth obvious position in the diet of *Pomadasys stridens* (Table 2 & 8). The highest abundance of teleosts were observed in October 2001, April 2001 and December 2001 (35.71%, 22.22% and 21.05%) and the lowest in June 2001 (3.45%), while it were scanty in March 2001, July 2001, August 2001 and September 2001 (Table 2 & 3). The common fish species observed being *Johnius* sp., *Sardine*, *Silago sihama*, *Lutjanus* sp., *Alectis* sp, *Leiognathus* sp., *Megalapsis* sp. etc.

6. Polychaetes

A small percentage of food consists of polychaetes ranked as sixth important food item on the basis of their occurrence and % total points in the stomach contents of (Table 2, 3 & 8). The highest percentage of Polychaetes was observed in July 2001 (7.14%) & April 2002 (7.14%) (Table 2 & 8). While the lowest percentage was observed in February 2002 (2.00%) and March 2002 (2.86%). It was entirely absent in the months of March 2001- May 2001, August 2001-October 2001 and then in January 2002 and February 2002.

Feeding intensity in relation to fish size

The stomach of 264 specimens (excluding 127 empty stomachs) of *Pomadasys stridens* was divided into two groups to facilitate the composition of their feeding intensity. The first comprised of smaller size groups, 50-139 mm of total length and second consisted of the larger size groups, 140- 219mm of total length. The percentage volume of various feeding intensities suggests that food intake was poor (gorged and full with their percentage 0.00% & 3.33% respectively) in smaller size groups, 50-139mm (Table 4). The larger size groups of fishes ranging 140- 219mm exhibited intense feeding condition (gorged and full with their percentage 6.19% & 8.4% respectively). While the occurrence of empty stomachs were 27.22% in fishes of smaller size groups (50- 139mm) and 33.62% in fishes of larger size groups (140- 219mm).

Food in relation to fish size

The percentage of occurrence of various food elements of *Pomadasys stridens* was distinctly different as related to the size. Juveniles i.e. fishes below 140mm have less number of food material, while adults fishes i.e. above 140mm have high percentage of gorged & full stomachs. However it was clear that juvenile of *Pomadasys stridens* feeds mainly on crustaceans like squilla, prawns, crabs & also on some molluscans, while adult fishes feeds on crustaceans, molluscans, some teleostan fishes and some polychaetes etc.

Table 1. Season of the year and percentage of intensity feeding of *Pomadasys stridens* from the Karachi- Sindh coast (N=.391).

Month	Stomach examined	Gorged	Full	3/4 Full	1/2 Full	1/4 Full	Barely full	Empty
2001 Jan	28	14.28	25	0	3.57	10.71	28.57	17.86
2001 Feb	25	4	4	0	8	12	32	40
2001 Mar	8	0	0	0	12.5	12.5	37.5	37.5
2001Apr	14	0	0	7.14	7.14	7.14	14.28	64.28
2001 May	28	3.57	7.14	3.57	0	10.71	10.71	64.28
2001 Jun	31	0	6.45	0	6.45	19.35	25.81	41.93
2001 Jul	35	0	2.86	11.43	14.28	42.86	20	8.57
2001 Aug	10	0	0	0	20	0	50	30
2001 Sep	19	0	5.26	0	0	10.53	47.37	36.84
2001 Oct	21	4.76	14.29	0	14.29	14.29	23.81	28.57
2001 Nov	27	0	7.41	0	7.41	22.22	22.22	40.74
2001 Dec	22	13.64	18.18	0	13.64	13.64	9.09	31.82
2002 Jan	37	21.62	32.43	2.7	10.81	18.92	5.4	8.1
2002 Feb	32	15.62	21.87	6.24	18.75	18.75	3.12	15.62
2002 Mar	37	0	5.4	2.7	24.32	10.81	27.03	29.73
2002 Apr	17	0	5.88	11.76	0	5.88	11.76	64.7
% Occurrence (average of 16 month)		4.84	9.76	2.85	10.07	14.39	23.04	35.04

Table 2. Percentage occurrence of various groups of food items in the stomach of P. *stridens* in different months from Karachi-Sindh coast (N=.391).

Month	Stomach examined	Teleosts	Molluscs	Crustaceans	Polychaetes	Miscellaneous	Semi-digestred food
2001Jan	28	18.6	13.95	18.6	0	11.63	37.21
2001Feb	25	4.54	0	18.18	4.54	18.18	54.54
2001Mar	8	0	0	14.29	0	28.57	57.14
2001Apr	14	22.22	0	33.33	0	0	44.44
2001May	28	20	20	6.67	0	6.67	46.67
2001Jun	31	3.45	3.45	17.24	3.45	27.59	44.83
2001Jul	35	0	2.38	23.91	7.14	14.28	52.38
2001Aug	10	0	0	0	0	14.29	85.71
2001Sep	19	0	7.69	15.38	0	7.69	69.23
2001Oct	21	35.71	3.57	10.71	0	10.71	39.29
2001Nov	27	9.52	4.76	14.29	4.76	19.05	47.62
2001Dec	22	21.05	15.79	21.5	0	5.26	36.84
2002Jan	37	13.72	37.25	9.8	0	11.76	27.45
2002Feb	32	16	32	10	2	12	28
2002Mar	37	5.71	22.86	11.43	2.86	20	37.14
2002Apr	17	7.14	21.43	7.14	7.14	21.43	35.71
% Occurrence average of 16 month)		11.1	11.57	14.53	1.99	14.32	46.51

Table 3. Percentage total points of food contents of P.stridens in different months from Karachi- Sindh (N=.391)

Month	Stomach examined	Teleosts	Molluscs	Crustac-eans	Polych-aetes	Miscell-aneous	Semi- dig-ested food
2001Jan	28	38.53	17.43	21.1	0	7.8	15.14
2001Feb	25	12.82	0	19.23	0.51	22.31	45.13
2001Mar	8	0	0	16.67	0	50	33.33
2001Apr	14	41.18	0	38.23	0	0	20.59
2001May	28	28.15	40.21	6.7	0	4.02	20.91
2001Jun	31	5.68	2.27	35.23	3.41	25	28.41
2001Jul	35	0	5.12	31.28	11.79	10.26	41.54
2001Aug	10	0	0	0	0	4	96
2001Sep	19	0	2.94	47.06	0	2.94	47.06
2001Oct	21	75.65	1.74	4.69	0	3.48	14.43
2001Nov	27	12.79	5.81	23.25	11.63	16.28	30.23
2001Dec	22	22.75	29.94	17.96	0	5.99	23.35
2002Jan	37	11.65	60.6	4.33	0	8.16	15.24
2002Feb	32	18.44	46.56	7.5	1.56	5.94	20
2002Mar	37	12.34	38.27	12.96	2.47	15.43	18.52
2002Apr	17	16.32	34.69	8.16	4.08	18.37	18.37
% Total points (ave-rage of 16 months)		18.52	17.85	18.4	2.21	12.5	30.51

Table 4. Percentage of intensity of feeding of in different size groups of Pomadasys stridens from Karachi-Sindh coast (N=.391).

Size-groups (mm, TL)	Stomach examined	Gorged	Full	3/4 Full	1/2 Full	1/4 Full	Barely	Empty
50-59	1	0	0	0	0	0	100	0
60-69	0	0	0	0	0	0	0	0
70-79	0	0	0	0	0	0	0	0
80-89	0	0	0	0	0	0	0	0
90-99	5	0	0	0	20	40	40	0
100- 109	8	0	0	12.5	12.5	50	0	25
110- 119	9	0	11.11	22.22	22.22	22.22	22.22	0
120- 129	18	0	5.55	5.55	11.11	50	16.67	11.11
130- 139	2	0	0	0	0	0	0	100
Mean		0	3.33	8.05	13.17	32.44	15.78	27.22
140- 149	23	0	0	0	17.39	4.35	39.13	39.13
150- 159	40	0	7.5	0	2.5	12.5	25	52.5
160- 169	55	3.64	18.18	0	5.45	10.91	18.18	43.64
170- 179	91	6.59	14.28	0	6.59	20.88	26.37	25.27
180- 189	77	7.79	14.28	7.79	16.88	10.39	10.39	32.47
190- 199	54	14.81	12.96	3.7	11.11	11.11	20.37	25.92
200- 209	6	16.66	0	0	16.66	0	16.66	50
210- 219	2	0	0	0	0	100	0	0
% ocurrence (average of 16 months)		6.19	8.4	1.44	9.57	21.27	19.51	33.62

Table 5. Percentage of occurrence of various grouped of food items in the stomach of P. stridens in different size groups from Karachi- Sindh coast (N= 391)

Size- groups (mm, TL)	Stomach examined	Teleosts	Molluscs	Crusta-ceans	Polych aetes	Miscell aneous	Semi digested food
50-59	1	0	0	0	0	0	100
60-69	0	0	0	0	0	0	0
70-79	0	0	0	0	0	0	0
80-89	0	0	0	0	0	0	0
90-99	5	0	0	16.67	0	0	83.33
100- 109	8	0	0	20	10	20	50
110- 119	9	0	7.69	23.08	7.69	15.38	46.15
120- 129	18	4.35	0	21.74	8.69	21.74	43.48
130- 139	2	0	0	0	0	0	0
140- 149	23	0	10.52	5.26	5.26	15.79	63.16
150- 159	40	16	8	16	4	8	48
160- 169	55	8.16	14.29	16.33	2.04	12.24	46.94
170- 179	91	11.65	14.56	12.62	0	18.45	42.72
180- 189	77	21.35	23.59	13.48	0	13.48	28.09
190- 199	54	12.9	24.19	16.13	3.23	11.29	32.26
200- 209	6	20	0	0	0	20	60
210- 219	2	0	0	0	0	50	50

Table 6. Percentage total points of food contents of *P. stridens* in different size-groups from Karachi-sindh coast (N=.391).

Size-groups (mm,TL)	Stomach examined	Teleosts	Molluscs	Crusta-ceans	Polych-aetes	Miscell-aneous	Semi- dig-ested food
50-59	1	0	0	0	0	0	100
60-69	0	0	0	0	0	0	0
70-79	0	0	0	0	0	0	0
80-89	0	0	0	0	0	0	0
90-99	5	0	0	27.27	0	0	72.73
100- 109	8	0	0	35.71	7.14	19.08	38.09
110- 119	9	0	14.08	30.99	11.27	14.08	29.58
120- 129	18	5.26	0	28.42	15.79	9.47	41.05
130- 139	2	0	0	0	0	0	0
140- 149	23	0	20.37	7.41	7.41	17.41	47.41
150- 159	40	20	22.22	22.67	0.44	6.67	28
160- 169	55	15.32	31.42	18.62	1.92	8.04	24.67
170- 179	91	23.43	27.27	10.3	0	10.91	28.08
180- 189	77	25.25	38.45	12.06	0	11.31	12.93
190- 199	54	19.49	42.05	14.1	3.08	5.9	15.38
200- 209	6	58.06	0	0	0	3.23	38.71
210- 219	2	0	0	0	0	50	50

Table 7. Season of the year and percentage of feeding intensity of *Pomadasys stridens* from Karachi-Sindh coast (N=.391)

Month	Stomach examined	stomach with food.	Empty
2001 Jan	28	82.14	17.86
2001 Feb	25	60	40
2001 Mar	8	62.5	37.5
2001Apr	14	35.72	64.28
2001 May	28	35.72	64.28
2001 Jun	31	58.07	41.93
2001 Jul	35	91.43	8.57
2001 Aug	10	70	30
2001 Sep	19	63.16	36.84
2001 Oct	21	71.43	28.57
2001 Nov	27	59.26	40.74
2001 Dec	22	68.18	31.82
2002 Jan	37	91.9	8.1
2002 Feb	32	84.38	15.62
2002 Mar	37	70.27	29.73
2002 Apr	17	35.3	64.7
% Occurrence (average of 16 month)		64.97	35.04

Table 8. Percentage composition of different food items and their Rank in the food of *Pomadasys stridens* (No. 391).

Food items	Percentages of occurrence method	Ranks
Teleosts	11.1%	5
Molluscs	11.57%	4
Crustaceans	14.53%	2
Polychaetes	1.99%	6
Miscellaneous	14.32%	3
Semi- digested food	46.51%	1

Table 9. Stomach contents of *Pomadasys stridens.*

Group	Species
Teleosts	*juveniles of Johnius sp. Sardine, johnius sp., sillago sihama, megalapsis sp. Alectis, solea, juvenile of lutjanus sp., etc.*
Molluscs	*Solen sp., Soletellina sp., Ensis sp., Pholas sp., Pteropodes, Placuna sp., Sepia sp., Potamids cingulates, Telescopium sp.,Cresesis sp., Marcia sp., Bullia sp.*,etc.
Crustacean	*Parapenaeopsis stlifera, Parapanaeopsis hardwickii, Oratosquilla sp., Ebia sp., Parapenaeopsis acculirostris, Metapenaeus sp., Macropthalmus sp, Acetes sp.,. Alepheus sp., Solenocera sp., Heteropanope glabra, Philyra sp., Eucerata haswelli, Charybdis sp,Mututa lunaris, Sergestes semissis, Gammarus.*
Polychaetes	*Dioptera sp., Nereis, Hetero nereis* etc.
Miscellaneous	Shrimp eyes & uropodes, Crab appendages & chela, Fish scales & vertebrae, Fish egg capsule of gastro-podes & natids, Sand & Molluscan shell fragments, Gill pieces of bivalves, mud etc.

DISCUSSION

Food and feeding habits of *Pomadasys stridens* were found to be comparable to Indo- Pakistani grunt fishes (Deshmukh, 1973; Bianchi, 1985; Blaber, 1997; Imad, 1985; Munro, 1965; Amtyaz and Khan, 2005). All including the present study agree to the fact that grunt fishes (Dhoter) are carnivores feeding on crustaceans, fishes, molluscs and polychaetes, and show variation in relation to different size groups, seasons and environmental biota.

Out of 391 stomachs of *Pomadasys stridens* studied 4.84% were gorged, 9.76% full, 2.85% ¾ full, 10.07% ½full, 14.39% ¼ full, 23.04% little and 35.04% were empty. Semi-digested and miscellaneous food materials together constituted 60.83%, Crustaceans 14.53%, Molluscans 11.57%, Teleosts 11.1% while polychaetes occurred occasionally 1.99%. During April-September the percentage of feeding intensity never exceeded more than 70% (35.3-70%) except in July 2001 where the percentage is 91.43%. And that during winter i.e. October-March the intensity was 59.26%-91.9% (higher than other months). The intensity of feeding was high during cold seasons than warm seasons. This phenomenon is in conformity with Ajaz, (2000; 2001) on *Trichurus haumela*, Thomas (1961) on *Upeneus tragula* and Ranagarajan (1970) on *Lutjanus kasmira*, Jayaprakash (1974) on *Otolithoides brunneus*. Raintjes *et al*. (1953) found in yellow fin tuna *Thunnus albacares*, the increment of stomach contents with the increase in the length of the fish. The observation is in agreement with the present study. The intensity of feeding of larger size groups ranged (140-219mm total length) is high (14.59% for both gorged and full while the smaller size groups ranged (50-139mm total length) shows low feeding intensity i.e. (3.33% for both gorged and full size). The variation in quantity of food in stomach may be related to the fact that the larger stripped piggy eat organisms of great dimension than those consumed by smaller specimens, there fore, the larger the fish, the greater the size range of individual food elements and the greater the range in amount of stomach contents that may be expected. It is assumed that young fishes are not so active and expert and hunting small food fishes. In smaller groups several food items were found to be absent.

Deshmukh, (1973) recorded the occurrence of prawns, Echiurus, polychaetes, squilla, crab, tunicates, mollusks & teleostean fishes in the stomachs & intestines of *Pomadasys hasta*. In the present study it was noted that the crustaceans are present in reasonable quantities in the stomachs of *Pomadasys stridens.* This observation is similar to those made on *Pomadasys hasta* by Deshmukh, (1973) and *Pomadasys commersonni* by Vander Westhuizen and Marais (1977).

It shows that *Pomadasys stridens* feed on crustaceans, molluscs, small fishes & polychaetes. Since these organisms are active swimmers, it may be called a predator and the feeding habits depend on the availability of the food in the environment. On the whole *Pomadasys stridens* appears to be macrophagous fish feeding on a variety of crustaceans, molluscs and small juvenile fishes, and it is similar in feeding habit of other Pomadasys sp. as observed by other works (Deshmukh, 1973; Vander Westhuizen and Marais, 1977; Amtyaz and Khan, (2005).

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