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Food and Feeding Habits of *Sillago sihama* (Forsskal, 1775) (Family: *Sillaginidae*) from Karachi Coast

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ABSTRACT

Sillago sihama has been found as carnivore fish on the basis of contents analysis from stomachs. *Sillago sihama* is a crustacean, teleosts, mollusks, echinoderms and polychaetes feeder. Stomach contents were consisted of echinoderms *Amphipholis squamata*, *Ophioplocus imbricatus*, mollusks, bivalves *Cardium* sp., *Tellina* sp., *Anadora* sp., gastropod shells, crustaceans *Pagurus digenus* (hermit crab) *Acetes* sp., Carideans, polychaetes *Lumbrineris* sp., polynoid worm (scale worms) Eunicid worms, *Gozia zeder*, rotifer *Hydratina* sp., Echiuroid worm, monaxone spicules, gills, appendages, chela, parts of carapace, eyes and flash of crabs and prawns, telson of prawns, scales and eggs of fish, parts of bivalves and gastropod shells, parts of sea urchin shells, partially digested earth worms and polychaete worms, nematodes, broken arms of star fishes, fecal material, mucous and sand. Overall 4.21% stomachs were found to be gorged, 8.23% full, 14.55% $\frac{3}{4}$ full, 17.24% $\frac{1}{2}$ full, 24.52% $\frac{1}{4}$ full, 26.43% barely full and 4.78% were empty it was noticed that feeding activity slows down during the spawning months. Overall this fish changes its food habit with the change in season.

Keywords: *Sillago sihama*, silver whiting, feeding habits, gut contents, Karachi coast.

1. Introduction

Various scientists have worked on food and feeding habits of teleosts including Radhakrishnan [1], Shrivastava *et al.* [2], Rhizkalla *et al.* [3], Krishnamurthy [4], Safi and Khan [5], Hoda & Khan [6] and many others. Various methods are in prevalence in the studies of stomach contents analysis of fishes such as those discussed by Hynes [7], Pillay [8], Das and Moitra [9, 10], Ahmed and Akhtar [11], Windel [12], Windel and Bowen [13] and Nargis and Hussain [14]. A short account of *Sillago sihama*'s food and feeding habits was given by Chacko [15].

No simple classification of feeding systems is completely satisfactory. The objectives of dietary studies are to understand how animals live and grow, what foods may influence their abundance and distribution, and the relative quality of feeding conditions. The study of the food and feeding habit based upon analysis of stomach contents play great role in understanding fish ecology and promoting aquaculture.

Study of food and feeding habit also helps in the study of length-weight relationship, reproductive biology as well as fecundity. Hence this specie was selected for the study of food and feeding habits by analyzing the stomach contents.

2. Material and Method

For the study of food and feeding habits of the fish, stomachs were noted for their fullness after which the stomach contents were discharged into Petri dishes and examined qualitatively and quantitatively. Food contents were grouped into 8 categories i.e. teleosts, echinoderms, mollusks, crustaceans, annelids, unidentified and miscellaneous as fragments of semi digested, appendages or parts of animals. The points method which is essentially a 'volumetric method' and 'occurrence method' which was originally described by Swynnerton & Warthington [16] and reviewed by Hynes [17] have been adapted with slight modifications allotting the points for fullness of the stomachs i.e. 100, 75, 50, 25, 12, 6 and 0 for gorged, full, $\frac{3}{4}$ full, $\frac{1}{2}$ full, $\frac{1}{4}$ full, little and empty stomachs respectively. The points assigned to food categories were ascertained by sub-dividing the total points allotted to the stomachs. All the points gained by each food item were summed up and scaled down to give a percentage composition of food of all fish examined.

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In the occurrence method the number of fish in which each food item occurs is listed as percentage of the total number of fish examined, as given below

$$\frac{\text{No. of fish feeding on a particular food item}}{\text{No. of fish examine}} \times 100$$

3. Results and Discussions

An exploratory examination of the gut contents showed that *Sillago sihama* is an omnivorous feeder as stated by Chacko [15].

Fish with the highest percentage of the intensity of feeding in 6 categories of fullness of stomach occurred in September, 2004 (16.21%). The percentage of fullness (gorged) was observed nil in November, December 2003, January, February, March, November 2004 and January 2005. The seasonal characters of the food of fish as found in this study, have been shown in Table 1.

3.1 Food Items of *Sillago Sihama* in Different Months

Miscellaneous constitutes the largest group in importance as the food constituents of *Sillago sihama* (63.24%) (Table 3). Annelids particularly polychaetes were observed in highest percentage in November 2004 (30.99%). Crustaceans were found to be present in stomachs of *Sillago sihama* in almost all the months including the parts of animal body i.e. gills,

appendages, chela, parts of carapace, eyes and flesh of crabs and prawns, telson of prawns etc. Teleosts included partially digested bony fish, parts of fish flash and eggs (Table 5).

3.2 Food In Relation to Size

The percentage of occurrence of various food elements of *Sillago sihama* was distinctly different as related to the fish size. Juvenile i.e. fishes below 150 mm T.L have less number of food material while adult fishes i.e. above 150 mm T.L have high percentage of gorged and full stomachs. (Table 2). However it was clear that juveniles of *Sillago sihama* feed mainly on crustaceans like prawns and crabs and polychaetes and occasionally on echinoderms and molluscs. The adults mainly feed on crustaceans, molluscs, polychaetes, echinoderms and teleosts and occasionally on poriferens, oligochaetes and other minor phyla. A few nematodes were also observed in a few stomachs. (Table 4)

During the study of present investigation a large number of fishes were found with little food contents. The frequent occurrence of empty stomachs with little contents may be probably dependent on the ratio between size of the fish and size of the prey as cited by Allen (1935) [18] or on the calorific value of the diet as explained by Longhurst (1957) [19] i.e. where fish is an important food item the daily intake will be less because of the higher calorific value of the diet and as much empty stomachs will be more common

Table 1: Percentage of feeding intensity of *Sillago sihama* in different

Month/Year	Stomachs Examined	Gorged 100	Full 75	3/4 full 50	1/2 full 25	1/4 full 12	Barely Full 6	Empty 0
Sep. 03	33	3.03	6.06	21.21	36.36	24.24	6.06	3.03
Oct. 03	32	6.25	3.12	18.75	18.75	18.75	15.62	18.75
Nov. 03	21	-	9.52	9.52	19.04	28.57	19.04	14.28
Dec. 03	31	-	6.45	12.90	9.67	35.48	35.48	-
Jan. 04	31	-	3.22	9.67	19.35	25.80	38.70	3.22
Feb. 04	29	-	13.79	10.34	24.13	31.03	20.68	-
Mar. 04	26	-	-	3.84	19.23	42.30	26.92	7.69
Apr. 04	34	5.88	14.70	17.64	14.70	20.58	17.64	5.88
May.04	31	6.45	16.12	35.48	22.58	12.90	-	3.22
Jun. 04	30	10.0	3.33	20.00	33.33	33.33	-	-
Aug. 04	32	6.25	18.75	25.00	18.75	18.75	12.50	-
Sep. 04	37	16.21	10.81	18.91	16.21	27.02	8.10	2.70
Oct. 04	46	6.52	6.52	6.25	8.69	21.73	41.30	8.69
Nov. 04	29	-	13.79	6.89	13.79	17.24	44.82	3.44
Dec. 04	50	2.0	4.0	-	14.00	28.00	50.00	2.00
Jan. 05	30	-	3.33	13.33	-	10.00	70.00	3.33
% occurrence (Ava .of 16 months)	522	3.91	8.34	14.37	18.03	24.73	25.63	4.76

Table 2: Percentage of feeding intensity of *Sillago sihama* in different size groups.

Size groups T.L (mm)	Stomachs examined	Gorged 100	Full 75	$\frac{3}{4}$ full 50	$\frac{1}{2}$ full 25	$\frac{1}{4}$ full 12	Barely Full 6	Empty 0
100-109	5	-	-	20.00	20.00	20.00	40.00	-
110-119	8	-	-	-	25.00	12.50	25.00	37.5
120-129	6	-	16.66	-	-	50.00	16.66	16.66
130-139	24	4.16	-	8.33	16.66	20.83	41.66	8.33
140-149	24	-	4.16	16.66	8.33	37.50	25.00	8.33
150-159	64	3.12	10.93	15.62	20.31	21.87	25.00	3.12
160-169	104	2.88	5.76	11.53	19.23	25.00	28.84	6.73
170-179	65	1.53	6.15	12.30	7.69	26.15	38.46	7.69
180-189	70	5.71	8.57	12.85	18.57	22.85	30.00	1.42
190-199	50	6.00	6.00	6.00	22.00	24.00	32.00	4.00
200-209	31	9.67	22.58	32.25	16.12	16.12	3.22	-
210-219	25	8.00	-	20.00	28.00	20.00	24.00	-
220-229	26	7.69	11.5	19.23	19.23	38.46	3.84	-
230-239	6	-	33.33	16.66	-	33.33	16.66	-
240-249	11	-	27.27	45.45	9.09	18.18	-	-
250-259	2	-	-	50.00	50.00	-	-	-
260-269	-	-	-	-	-	-	-	-
270-279	1	100	-	-	-	-	-	-
% occurrence (Ava. of 16 months)	522	8.75	8.99	16.87	16.48	22.75	20.60	5.51

Table 3: Percentage total points of food contents of the stomach of *Sillago sihama* in different months.

Months	Teleosts	Echinoderms	Molluscs	Crustaceans	Annelids	Poriferans	Miscellaneous	Nematodes
Sep. 03	-	2.90	0.96	9.68	0.48	-	85.95	-
Oct. 03	0.60	-	4.23	29.38	1.20	-	58.51	6.04
Nov. 03	-	5.60	-	41.47	7.17	4.48	40.11	1.12
Dec. 03	-	1.60	-	12.84	-	-	84.73	0.80
Jan. 04	-	-	-	3.68	11.97	-	84.33	-
Feb. 04	-	6.45	1.29	23.22	9.67	-	59.33	-
Mar. 04	-	4.58	4.58	24.35	9.74	-	56.73	-
Apr. 04	-	-	1.32	15.26	9.70	-	73.15	0.52
May. 04	-	-	-	13.72	-	-	86.25	-
Jun. 04	-	9.09	-	11.96	-	-	78.93	-
Aug. 04	-	4.24	1.15	37.26	7.71	-	49.60	-
Sep. 04	5.67	5.33	1.69	53.51	0.97	1.30	32.11	-
Oct. 04	0.25	9.49	1.72	58.67	1.72	-	28.11	-
Nov. 04	-	-	6.52	11.41	30.99	-	51.04	-
Dec. 04	-	0.80	-	14.80	4.03	0.67	79.66	-
Jan. 05	-	-	19.45	17.16	-	-	63.38	-
% points ave. of 16 months	0.40	3.13	2.68	23.64	5.95	0.40	63.24	0.53

Table 4: Percentage total points of food contents of stomach of *Sillago sihama* in different size groups.

Size range T.L (mm)	Teleosts	Echinoderms	Molluscs	Crustaceans	Annelids	Poriferans	Miscellaneous	Nematodes
100-109	-	-	-	55.55	-	-	44.44	-
110-119	-	-	-	13.51	13.51	-	72.96	-
120-129	-	-	-	76.92	5.12	-	17.94	-
130-139	0.70	12.91	-	19.71	23.00	2.34	41.28	-
140-149	-	-	1.27	31.76	2.34	-	64.60	-
150-159	-	3.86	1.65	28.31	1.10	-	64.77	0.27
160-169	-	0.26	1.97	26.07	5.74	0.87	65.06	-
170-179	-	8.44	4.99	19.58	-	0.38	65.80	0.76
180-189	0.75	6.12	8.59	15.88	7.58	0.50	60.02	0.50
190-199	0.66	-	1.48	20.47	1.65	-	73.64	2.06
200-209	3.95	-	7.25	24.07	4.28	-	60.39	-
210-219	-	1.30	8.49	21.69	-	-	61.95	6.53
220-229	-	1.07	2.69	29.15	6.47	-	59.91	0.64
230-239	-	-	-	4.34	17.39	-	78.25	-
240-249	-	18.12	5.72	29.58	14.31	-	30.32	1.90
250-259	-	-	-	-	-	-	99.99	-
270-279	-	2.00	6.00	10.00	-	-	82.00	-
% points ave. of 16months	0.35	3.18	2.94	25.09	6.02	0.24	61.37	0.74

Table 5: Stomach contents of *Sillago sihama*.

Group	Species
Teleosts	Osteichthyes fish and other unidentified fishes
Echinoderms	<i>Amphipholis squamata</i> , <i>Ophioplocus imbricatus</i>
Molluscs	Bivalaves, <i>Cardium</i> sp., <i>Tellina</i> sp., <i>Anadora</i> sp., & gastropod shells
Crustaceans	<i>Pagurus digenus</i> (hermit crab), <i>Acetes</i> sp, Carideans
Polychaetes	<i>Lumbrineris</i> sp, polynoid worm (scale worm), Eunicid worms
Nematodes	<i>Gozia zeder</i>
Miscellaneous	Rotifer hydratina sp, Echiuroid worm, Monaxon spicules, gills, appendages, chela, parts of carapace, eyes and flesh of crabs and prawns, scales and eggs of fish, parts if bivalve and gastropod shells, parts of sea urchins shell, partially digested earthworms and polychaete worms nematodes, arms o star fishes, fecal material, mucous and sand.

4. Conclusion

In the present study it was noticed that the molluscs are present in reasonable quantities in the stomachs of *Sillago sihama*. This observation is similar to those made on *Sillago maculata* by Coull *et al.* (1995) [20]

Some polychaetes, echinoderms and crustaceans were also observed in the stomachs of *Sillago sihama* in reasonable quantities. This observation is similar to those made on *Sillago sihama* in Pulicat Lake feed exclusively on polychaetes, echinoderms and crustaceans as observed by Chacko *et al.* (1956) [21] and Radhakrishnan (1957) [1] and Krishnamurthy (1969) [22].

Krishnamurthy (1969) [22] suggested that no seasonal or sectoral change inside the Pulicate Lake in the food of *Sillago sihama* was observed and analysis of food composition of this fish from sea indicated the predominance of prawns and other crustaceans while polychaetes were insignificant as an item of food. Chacko (1949) [15] reported that the fish is an omnivorous feeder and browses

among sea weeds and corals in Gulf of Mannar.

It is suggested that *Sillago sihama* is a crustacean, teleost, molluscs, echinoderms and polychaetes feeder and fish changes its food habit with the change in season. Similar observations have also been made by De Groot (1971) [23].

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