J. Mar. Biol. Ass. India, **52** (1) : 92 - 95, January - June 2010

Short Communication

†Ray fishery by trawlers off Chennai and some aspects of biology of the scaly whipray *Himantura imbricata* (Bloch & Schneider, 1801)

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Abstract

Rays are important components in the elasmobranch landings by different gears at Chennai fisheries harbour, contributing about 75.4% to the annual average elasmobranch landings. The annual average catch of rays during 2002-'07 was 588.3 t and the maximum catch of 1297.4 t was recorded in the year 2002. Eleven species contributed a major portion to the landings of rays by trawlers at Chennai, among which *Himantura jenkinsii* dominated the catch, forming 38.6% and *H. imbricata*, 8.0%. The disc width (DW) range of *H. imbricata* in the landings was 110-229 mm and 130-289 mm for males and females, respectively. The annual average mean size was greater in females. The annual average sex ratio (M:F) was 1:1.11. The disc width-weight relationships were $W = 0.00022DW^{2.676}$ and $W = 0.00005DW^{2.965}$ for male and female, respectively. Analysis of covariance showed that the slopes differed significantly, at 5% level, between the sexes. More than 95% of fishes sampled were in well-fed condition. Analysis of gut contents revealed *H. imbricata* to be a benthic carnivore feeding mostly on small crustaceans, cephalochordates, molluscs, polychaetes and small fishes.

Keywords: Chennai, ray fishery, *Himantura imbricata*, disc width-weight relationship, gut contents

Introduction

Rays are important components in the elasmobranch landings by different gears at Chennai fisheries harbour. Major contribution to the total landing of rays is by trawlers. Although there is a wide diversity in the species composition of rays landed at Chennai, eleven species occur regularly in the fishery. *Himantura imbricata* (Bloch & Schneider, 1801) is landed mostly by trawlers and contributes 5-7% to the elasmobranch landings by this gear. There is very little information on the present status of fishery and biology of rays from Chennai. Published information are on the biology of stingrays from Porto Novo (Devadoss, 1978a, b, 1984), fishery and biology of batoids off Cuddalore (Devadoss, 1978c), breeding and development in batoids (Devadoss, 1998) and biology of rays from Mumbai waters (Raje, 2003, 2007). Raje (2007) has given an account of some aspects of biology of *Amphiotistius imbricatus* (= *H. imbricata)* from Mumbai. The present paper is on the trawl fishery of rays off Chennai, the disc width-weight relationship and feeding biology of *H. imbricata* based on the data collected during 2002-'07.

Material and Methods

Data on the landings of elasmobranchs including rays, and fishing effort by trawlers based at Chennai fisheries harbour were collected from Fishery Resource Assessment Division, CMFRI, for the years 2002 to 2007. Species composition of rays, disc width (DW) frequency, sex ratio, disc width-weight relationship and food and feeding habits of *H. imbricata* were collected at weekly intervals during the same period. Monthly difference in sex ratio (number of females for every male) was analysed using Chi-square (Ψ^2) test (Fisher, 1970). Due to

†Presented in the International Symposium "Marine Ecosystem-Challenges and Opportunities (MECOS 09)" organized by the Marine Biological Association of India during February 9-12, 2009 at Kochi.

ban on trawling from 15th April to 31st May every year, no data could be obtained for the month of May. The number of specimens examined was 2274, of which 1079 were males and 1195 were females. The disc width (mm) – weight (g) relationship for males and females was estimated separately by regression after logarithmic transformation and the equality of the two regression lines was tested by Analysis of Covariance (Snedecor, 1961). Feeding condition was noted from the degree of fullness of gut and classified as empty (E), trace (T), quarter full (Q), half full (H), three-fourth full (TH), full (F) and gorged (G). The gut contents were identified and ranked according to the number of guts (in percentage) in which each item was encountered.

Results and Discussion

Fishery: Elasmobranchs formed 4.1% of the annual average trawl landings at Chennai fisheries harbour during the period 2002-2007. The annual average landing of elasmobranchs during this period was 779.8 t and the maximum catch of 1644 t was recorded in the year 2002 (Table 1). Rays contributed 75.4% to the elasmobranch landings. The annual average catch of rays during the period was 588.3 t and the maximum catch of 1297.4 t was recorded in the year 2002. The catch rate for rays ranged from 0.70 kg/h to 1.24 kg/h with an average of 0.94 kg/h.

Species composition: The major species that contributed to the landings of rays by trawlers at Chennai during the period 2002-2007 were: *Himantura jenkinsii* (Annandale, 1909), *H. imbricata, H. bleekeri* (Byth, 1861), *H. uarnak* (Forsskal, 1775), *Hypolophus sephen* (Forsskal, 1775), *Dasyatis kuhlii* (Muller and Henle, 1841), *D. alcockii* (Annandale, 1905), *Gymnura poecilura* (Shaw, 1804), *Aetobatus narinari* (Euphrasen, 1790), *Rhinoptera javanica* (Muller and Henle, 1841) and *Mobula diabolus* (Shaw, 1804). These eleven species together formed about 97.2% of the rays landed. *H. jenkinsii* dominated the catch forming 38.6%. *R. javanica*, *M. diabolus* and *H. imbricata* formed 12.7%, 12.5% and 8.0% of the catch, respectively (Fig. 1).

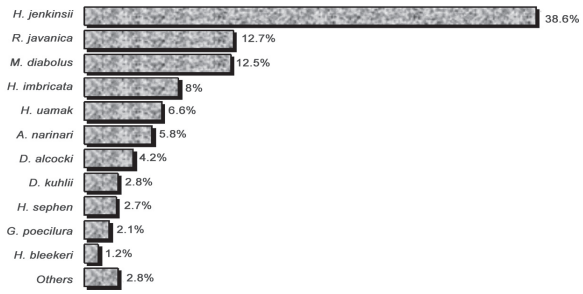

Fig. 1. Species composition (%) of rays landed by trawlers at Chennai during 2002-2007

***Disc width composition of H. imbricata*:** The disc width range of *H. imbricata* in the trawl landings at Chennai during the period 2002-07 was 110-229 mm and 130-289 mm for males and females, respectively. The annual average disc width composition (Table 2) showed that males were dominant in smaller ranges while females were dominant in larger ranges. The annual average mean size was greater in females (193.0 mm) than in males (178.9 mm). The mean size of females remained higher in all the months (Fig. 2). The maximum reported size for this species (male/ unsexed) was 250 mm (Froese and Pauly, 2009). Raje (2007) reported the disc width range of males and females of *H. imbricata* from Mumbai as 140-340 mm and 130-360 mm, respectively. In the present study, the minimum DW recorded were 110 mm for males and 133 mm for females; and the maximum DW recorded were 226 mm for males and 281 mm for females.

Table 1. Annual catch and effort of elasmobranchs and rays landed by trawlers at Chennai during 2002-2007

Parameters	2002	2003	2004	2005	2006	2007	Total	Average
Actual fishing hours ('000 h)	1047.3	912.1	525.8	326.4	499.4	457	3768.0	628
Elasmobranchs (t)	1644.1	956.5	488.8	493.8	534.6	561.3	4679.1	779.9
Rays (t)	1297.4	694.8	369.6	367.5	377.5	423	3529.8	588.3
% of rays in elasmobranchs	78.9	72.6	75.6	74.4	70.6	75.4	75.4	75.4
Catch rate of rays (kg/ h)	1.24	0.76	0.70	1.13	0.76	0.93	0.94	0.94

Table 2. Annual average disc width (DW) distribution (in percentage) of male and female *H. imbricata* during 2002-07

DW (mm)	Male	Female
110-119	100	0
120-129	100	0
130-139	35.3	64.7
140-149	53.8	46.2
150-159	41.5	58.5
160-169	70.3	29.7
170-179	62.6	37.4
180-189	62.3	37.7
190-199	44.6	55.4
200-209	31.6	68.4
210-219	18.8	81.2
220-229	1.8	98.2
230-239	0	100
240-249	0	100
250-259	0	100
260-269	0	100
270-279	0	0
280-289	0	100
Mean DW (mm)	178.9	193.0

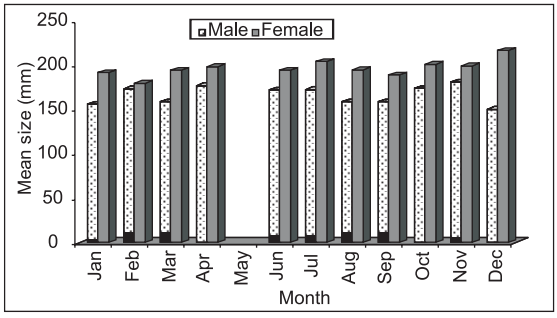

Fig. 2. Monthly mean size (DW, mm) of *H. imbricata* landed by trawlers at Chennai during 2002-07

***Sex ratio*:** The annual average sex (M:F) ratio for the period 2002-07 was 1:1.11 (Table 3). The annual sex ratio did not show significant variation between the years. However, the monthly sex ratio showed significant variation from homogenous distribution of sexes at $\alpha = 0.05$ in September, October and December (Table 4). Females dominated the catches in most of the months. While Devadoss (1978b) reported a sex ratio of 1.05 male:1 female in *Dasyais imbricatus* (=*H. imbricata)* off Porto Novo, Raje (2007) reported the sex ratio as 1 male:1.4 female off Mumbai, and found the sex ratio significantly different in February, April and November, with preponderance of females.

Table 3. Annual sex ratio of *H. imbricata* landed by trawlers at Chennai; 'n' refers to number of specimen examined

Year	n	Male (%)	Female (%)	Sex ratio (M:F)
2002	332	48.5	51.5	1 : 1.06
2003	501	48.3	51.7	1 : 1.07
2004	352	46.1	53.9	1 : 1.17
2005	448	45.5	54.5	1 : 1.2
2006	381	45.4	54.6	1 : 1.2
2007	260	52.6	47.4	1 : 0.9
Pooled	2274	47.5	52.5	1 : 1.11

Table 4. Chi-square values for monthly sex ratio in *H. imbricata* landed by trawlers at Chennai (average for the period 2002-07)

	Male (%)	Female (%)	Chi-square value
January	45.6	54.4	0.620
February	72.2	27.8	3.556
March	45.7	54.3	0.257
April	50.6	49.4	0.013
May	No observation		
June	50	50	0.000
July	54.5	45.5	2.058
August	43	57	2.674
September	37.8	62.2	4.378**
October	35.5	64.5	7.838**
November	57.3	42.7	2.042
December	36.1	63.9	7.515**

**Significant (α =0.05)

***DW relationship*:** The DW-weight relationships (Fig. 3) for male and female *H. imbricata* were as follows:

Males : $W = 0.00022\ DW^{2.676}$ ($r = 0.933$)

Females : $W = 0.00005\ DW^{2.965}$ ($r = 0.936$)

Analysis of covariance showed that the slopes differed significantly between the sexes ($\alpha = 0.05$). Devadoss (1984) reported difference between the slopes in the DW-weight relationship of male and female *H. imbricata* from Porto Novo, and mentioned that the exponent is greater in females.

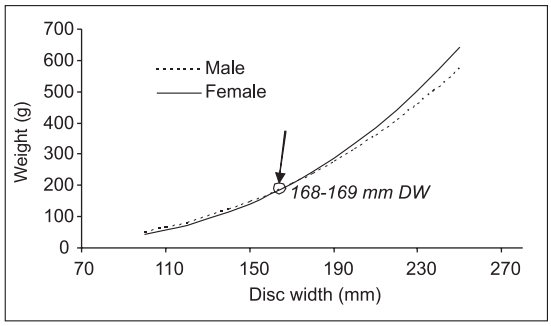

Fig. 3. Disc width-weight relationship in *H. imbricata*

The two curves intersect at sizes 170-190 mm, indicating that females tend to be heavier beyond this length. In the present study also, the two curves were found to intersect between 168 and 169 mm DW, beyond which females tend to be heavier. While males were heavier than the females by almost 14% at 100 mm DW, females were heavier than the males by about 8% at 226 mm DW (size of the largest male encountered in the present study). Raje (2007) found no significant difference in the DW-weight relationship between male and female *H. imbricata* from Mumbai.

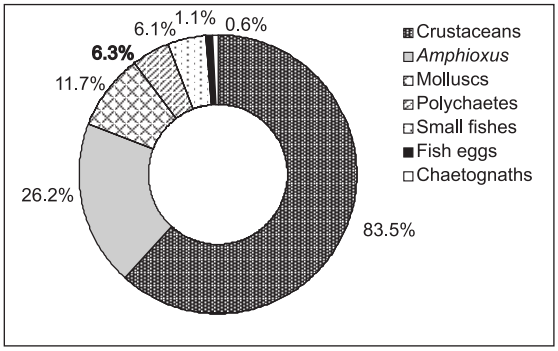

Fig. 4. Number of guts (in percentage) in which each classified food item was encountered

Food and feeding: More than 95% of fishes sampled were in well-fed condition. In 62.1% of the samples, the gut was half-full, and in 33.9% the gut was full. Empty gut condition was encountered in only 4% of the samples. Analysis of gut contents showed that *H. imbricata* is a benthic carnivore feeding mostly on small crustaceans, cephalochordates (*Amphioxus* sp.), molluscs, polychaetes and small fishes. Sand and debris were found in the stomachs of 92.4% of the rays sampled. It was found that 83.5% of fishes had fed on crustaceans, 26.2% on *Amphioxus* sp., 11.7% on gastropods, 6.3% on polychaetes and 6.1% on small fishes (Fig. 4). Among the crustaceans, small crabs, shrimps, amphipods, mysids and stomatopods were encountered. Among molluscs, gastropod shells were dominant. Chaetognaths and fish eggs were also observed in a few samples. Raje (2007) also reported crustaceans as the dominant food of *H. imbricatus* from Mumbai. Devadoss (1978a, 1984) reported that the preferred food of rays from Porto Novo and Cuddalore waters were bottom living organisms such as crustaceans, molluscs and polychaetes.

Acknowledgements

The authors are grateful to Dr. G. Syda Rao, Director, C.M.F.R.I. and Dr. E. Vivekanandan, Head of Demersal Fisheries Division, C.M.F.R.I. for encouragement.

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Received: 14.07.09
Accepted: 22.02.10