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Some aspects of biology of four species of rays off Mumbai water

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ABSTRACT

Females in *Dasyatis sephen, D. uarnak* and *Gymnura micrura* and males in *Trygon walga* are dominant in the fishery of rays. Females attain larger length than males. Breeding in *D.sephen, T. walga and G. micrura* occurs during a prolonged period. These species are demersal carnivores.

Introduction

Fishery for rays is multi species and constituted by eleven species. Despite their economic importance as food fishes, very little work has been done on fishery and biology of rays except Setna and Saragdhar (1949) fromMumbai. The present communication deals with biology of four species of rays, *Dasyatis sephen* (Forskal), *D. uarnak* (Forskal), *Trygon (Dasyatis) walga* (Muller and Henle) and Gymnura *micrura* (Schneider) from Mumbai.

Materials and methods

The data were collected between November 1988 and February 1999 from the New Ferry Wharf and Versova fish landing centres. The data on disk width in cm, weight in kg, sex, maturity status of males and females and food habits were studied at the landing centre during the process of curring. Males were considered fully mature when the claspers were completely calcified and the distal cartilages of the clasper could be spread open.

The intensity of feeding was determined based on the degree of distension of the stomach and these stomachs were grouped as active (Gorged and full), Moderate (3/4 full and 1/2 full), Poor (1/4 full and trace) and empty. Average volume of food per fish was also calculated. The food items were identified up to species/ genus level. Volume and frequency of occurrence of each food item of these species were determined. The index of preponderance was calculated by the method of Natarajan and Jhingran (1961).

Results and discussion

Samples of 581 specimens of *D.sephen* comprising 265 males (size range 20.0 to 69.0 cm) and 316 females (size range 22.0 to 89.0 cm); 900 specimens of *D.uarnak* of which 419 were males ranging from 18 to 92 cm and 481 females from 18 to 160 cm; 255 specimens of *T. walga* constituted by 152 males (18 to 34 cm) and 103 females (20 to 39 cm); 265 specimens of *G.micrura*,out of which 97 were males (23-90 cm) and 168 females (26-104 cm) were examined.

Sex ratio

The male to female ratio in *D.sephen* during the entire period of investigation was 1:1.19.Monthwise sex ratio (Table 1) showed that females were dominant during January-February, April- July and September-October.

The length frequency distribution of males and females of *D. sephen* (Table 5) showed that males were dominant in most of the size groups upto 56-59 cm and females from 60 cm and above .No males were recorded after 72 cm. Mean length of females were found to be greater than that of males.

The male to female ratio in *D. uarnak* was 1: 1.15. The monthly percentage distribution of the two sexes showed that females were dominant during January-March, July, and October (Table 2). They were also dominant in most of the size groups and males were not recorded in the fishery beyond 95cm (Table 5). The females were recorded upto 160 cm and the mean size of females in the catch was slightly greater then that of males.

The sex ratio in *T. walga* was 1:0.68 (M:F) indicating the dominance of males. Monthly sex ratio (Table 3) shows predominance of males during February-April, June, August-September and December. The sex ratio in different size groups (Table 5) shows the dominance of males in most of the size groups upto 30-

TABLE 1. *Monthly sex ratio, reproductive status in females of* Dasyatis sephen *and number of free swimming young ones observed in trawl catch.*

Months	Sex ratio			Reproductive status of females in percentage				No. of free swimming young ones (22 - 30 cm.)
	No. of specimens examined	% of males	% of females	Immature	Mature	Pregnant	Postnatal	
Jan.	19	47.4	52.6	70	20	10	0	2
Feb.	51	33.3	66.7	73	23.5	3.5	0	3
Mar.	168	56.5	43.5	26	56.2	9.6	8.2	4
Apr.	59	39	61	80.6	11.1	8.3	0	5
May	77	39	61	60.5	23.7	13.2	2.6	4
Jun.	98	36.7	63.3	14.7	32.8	44.3	8.2	8
Jul.	6	33.3	66.7	75	25	0	0	2
Aug.	10	70	30	66.7	33.3	0	0	5
Sep.	11	36.4	63.6	71.4	28.6	0	0	3
Oct.	15	33.3	66.7	70	20	10	0	3
Nov.	36	52.8	47.2	70.6	17.6	11.8	0	1
Dec.	31	58.1	41.9	69.2	15.4	15.4	0	3
Pooled	581	45.6	54.4					

TABLE 2. *Monthly sex ratio in* Dasyatis uarnak.

Months	No. of specimens examined	% of males	% of females
Jan.	57	40.3	
Feb.	119	40.3	59.7
Mar.	247	41.7	58.3
Apr.	140	54.3	45.7
May	85	51.8	48.2
Jun.	10	50	50
Jul.	25	48	52
Aug.	91	50.5	49.5
Sep.	15	66.7	33.3
Oct.	60	40	60
Nov.	30	50	50
Dec.	21	61.9	38.1
Pooled	900	46.2	53.8

TABLE 3. *Monthly sex ratio, reproductive status of* Trygon walga.

Months	Sex ratio			Reproductive status of females in percentage		
	No. of specimens examined	% of males	% of females	Immature	Mature	Pregnant
Jan.	20	45	55	63.7	27.3	9.1
Feb.	55	80	20	63.7	27.3	9.1
Mar.	64	62.5	37.5	87.5	12.5	0
Apr.	24	66.7	33.3	75	25	0
May	32	34.4	65.6	90.4	4.8	4.8
Jun.	19	68.4	31.6	83.3	16.7	0
Jul.	4	25	75	33.4	33.3	33.3
Aug.	1	100	0	0	0	0
Sep.	6	66.7	33.3	100	0	0
Oct.	14	42.9	57.1	62.5	25	12.5
Nov.	11	27.3	72.7	75	25	0
Dec.	5	80	20	0	0	100
Pooled	255	59.6	40.4			

31 cm and females in all the size groups from 32-33 cm onwards. The mean size of females in the catch was more than that of males and males were not recorded beyond 38 cm. In *G. micrura* females dominated over males, the ratio being 1:1.73.The monthwise data on sex ratio showed the dominance of females in almost all the months except July (Table 4). Sex ratio in various size groups showed that males dominated in most of the length groups upto 60-63 cm, whereas, females dominated in all the larger size groups (Table 5). However, the specimens above 88-91 cm size observed were all females and mean size of females higher than that of males. Females were predominant in the catches. Similarly,

TABLE 4. *Monthly sex ratio, reproductive status in females of* Gymnura micrura

Months	Sex ratio			Reproductive status of females in percentage				No. of free swimming young ones (22 - 30 cm.)
	No. of specimens examined	% of males	% of females	Immature	Mature	Pregnant	Postnatal	
Jan.	24	37.5	62.5	60	33.3	6.7	0	2
Feb.	26	34.6	65.4	76.4	11.8	11.8	0	5
Mar.	44	40.9	59.1	73.1	19.1	3.9	3.9	4
Apr.	42	42.9	57.1	75	20.8	4.2	0	2
May	29	24.1	75.9	76.7	22.7	4.6	0	1
Jun.	10	40	60	66.7	33.3	0	0	2
Jul.	6	50	50	100	0	0	0	0
Aug.	5	20	80	100	0	0	0	0
Sep.	9	22.2	77.8	100	0	0	0	2
Oct.	33	48.5	51.5	88.2	5.9	5.9	0	5
Nov.	16	18.5	81.2	76.9	15.4	7.7	0	1
Dec.	21	33.3	66.7	50	42.9	7.1	0	1
Pooled	265	36.6	63.4					

TABLE 5. *Length frequency distribution of males and females in* D. sephen, D. uarnak, G. micrura *and* T. walga.

Size group (cm)	D. sephen		D. uarnak		G.micrura		Size group (cm)	T.walga	
	% of Males	% of Females	% of Males	% of Females	% of Males	% of Females		% of Males	% of Females
16-19	0	0	15.4	84.6	0	0	18-19	100	0
20--23	57.1	42.9	56.5	43.5	100	0	20-21	0	100
24-27	69.2	30.8	51.5	48.5	50	50	22-23	77.8	22.2
28-31	57.1	42.9	43.1	56.9	58.3	41.7	24-25	66.7	33.3
32-35	47.1	52.9	46.4	53.6	46.1	53.9	26-27	81.3	18.7
36-39	50	50	40.9	59.1	34.8	65.2	28-29	84.1	15.9
40-43	51.5	48.5	40.5	59.5	25	75	30-31	60	40
44-47	70.2	29.8	45.4	54.6	58.3	41.7	32-33	26.9	73.1
48-51	68	32	53.8	46.2	75	25	34-35	5.3	94.7
52-55	62.2	37.8	70	30	87.5	12.5	36-37	16.3	83.7
56-59	53.6	46.4	42.9	57.1	89.5	10.5	38-39	20	80
60-63	35.7	64.3	0	100	66.7	33.3	40-41	0	100
64-67	18.5	81.5	66.7	33.3	33.3	66.7			
68-71	12.5	87.5	33.3	66.7	20	80	Mean size	28.6	31.9
72-75	0	100	0	0	0	100	(cm.)		
76-79	0	100	0	100	0	100			
80-83	0	100	0	100	0	100			
84-87	0	100	50	50	5	95			
88-91	0	100	0	100	4.8	95.2			
92-95	0	0	100	0	0	100			
96-99	0	0	0	100	0	100			
100-103	0	0	0	100	0	100			
104-107	0	0	0	100	0	100			
108-111	0	0	0	0	0	0			
112-115	0	0	0	0	0	0			
116-119	0	0	0	100	0	0			
120-123	0	0	0	0	0	0			
124-127	0	0	0	0	0	0			
128-131	0	0	0	100	0	0			
132-135	0	0	0	0	0	0			
136-139	0	0	0	0	0	0			
140-143	0	0	0	0	0	0			
144-147	0	0	0	0	0	0			
148-151	0	0	0	100	0	0			
152-155	0	0	0	0	0	0			
156-159	0	0	0	0	0	0			
160-163	0	0	0	100	0	0			
Mean size (cm)	48.5	58.1	30.7	33	48	70.4			

Jemas (1966) also observed the predominance of females in the catches of related species *G. poecilura* from the Palk Bay and Gulf of Mannar.

In the present study females of all these species were dominant at higher length groups and mean length of these females obtained were greater than that of males. It appears that females attain larger size than males. This may be due

to the fact that females grow faster as reported in elasmobrachs by Ford (1921), Hickling (1930), Ripley (1946), Olsen (1954), Chen and Mizue (1973), Nair (1976) and Devadoss (1998).

Breeding

The smallest mature female of *D. sephen* with distended oviduct as uterus was at 50 cm and pregnant at 53 cm. The smallest adult male of *T. walga* measured at 28 cm and pregnant female at 30 cm.

The mature females of *D. sephen* (Table 1) were present throughout the year, pregnant ones from October to June and spent ones during March, May and June. The females of *T.walga* (Table 3) occurred in mature condition during January to July and October-November and pregnant ones during December-February, May, July and October. Mature females of *G. micrura* (Table 4) were available from October to June, pregnant specimens from October to May and post natal in March.

The occurrence of mature, pregnant and post natal females in these species were few during July to September due to restricted fishing activities in the monsoon months. The free swimming young ones of *D.sephen* (22-30 cm) occurred throughout the year, *T. walga* (less then 20 cm) during April-May, and of *G. micrura* (25-32 cm) during all the months except July. The presence of mature, pregnant and post natal females of these species and free swimming young ones in most of the months, indicates that these species may be breeding throughout the year in Mumbai water.

Prolonged breeding season in *Dasyatis imbricatus and D.sephen* (Devadoss, 1978,1998) and in *Gymnura poecilura* (Setna and Sarangther, 1949; James, 1966 and Devadoss, 1998) have been reported earlier along Porto-Nova, Madras, Bombay, Palk Bay and Gulf of Mannar and Madras. The occurrence of high percentage of pregnant females of *D. sephen* and maximum number of free swimming young ones during June suggest it's peak breeding season. Devadoss (1978) observed peak breeding season of this species during March-April in Madras water. Females of *D.sephen* produced single young one at a time. The full grown foetus measured across the disc, 157mm(210 g), 250mm(550 g) and 260mm-(760 g) inside the uterus of the females measuring 62 cm, 64 cm, and 76cm respectively. It showed that the size of the full grown embryo inside the uterus varies according to the size of the mother. A similar observation in related species *D.imbricatus* was made by Devadoss (1978).

Full grown male and female foetus of *G. micrura* measured 268, 285mm respectively, inside the uterus of a female of 46 cm length and in another female (104 cm) these were 155, 170mm respectively. This suggests that differential

TABLE 6. *Feeding intensity and average volume of stomach content in* D.sephen, D.uarnak, T.walga *and* G.micrura

Species	Condition of stomach (%)				Average volume of food (in ml.) per fish	
	Active	Moderate	Poor	Empty	Including empty stomach (ml)	Excluding empty stomach (ml)
D.sephen	5.4	19.69	46.66	28.25	4.68	7.2
D.uarnak	2.38	23.81	21.43	52.38	2.8	6.52
T.walga	11.11	17.78	33.33	37.78	2.52	3.91
G.micrura	11.32	5.66	28.3	54.72	3.56	9.94

TABLE 7. *Percentage of volume, occurrence and index of preponderence of various food items in* D.sephen, D.uarnak, T.walga *and* G.micrura

Food items	*D.sephen*			*D.uarnak*			*T.walga*			*G.micrura*		
	Occurrence	Volume	Index of preponderence	Occurrence	Volume	Index of preponderence	Occurrence	Volume	Index of preponderence	Occurrence	Volume	Index of preponderence
Teleosts:												
Coilia dussumieri	1.01	4.78	0.26	10.34	20.35	15.6	6.06	13.51	3.99	22.22	29.12	41.41
Sciaenids	2.02	3.07	0.27	3.45	5.79	1.48	0	0	0	14.82	39.08	37.07
Trypauchen vagina	0	0	0	0	0	0	0	0	0	3.7	3.02	0.71
Harpodon nehereus	0.34	0.15	0.02	0	0	0	0	0	0	3.7	1.01	0.24
Nemipterus mesoprion	0	0	0	3.45	2.53	0.65	0	0	0	0	0	0
Fish remains	0.34	0.07	0.01	24.14	26.94	48.1	0	0	0	18.52	7.5	8.89
Total	3.71	8.07	0.56	41.38	55.61	65.9	6.06	13.51	3.99	62.96	79.73	88.32
Crustaceans:												
Solenocera spp.	6.4	4.02	1.36	20.69	14.7	22.5	36.4	29.46	52.2	11.11	5.33	3.79
Parapenaeopsis stylifera	4.04	5.78	1.24	3.45	3.11	0.79	0	0	0	7.41	8.05	3.82
P. sculptilis	0.67	1.12	0.04	0	0	0	0	0	0	0	0	0
Metapenaeus affinis	0	0	0	0	0	0	3.03	8.02	1.18	0	0	0
Nematopalaemon tenuipes	8.75	5.52	2.56	6.9	2.75	1.41	6.03	3.15	0.94	7.41	3.52	1.67
Acetes spp.	0.67	0.27	0.01	0	0	0	0	0	0	0	0	0
Exhippo.ensirostris	0.34	0.2	0.01	0	0	0	0	0	0	0	0	0
Squilla spp.	5.72	5.36	1.63	6.9	2.39	1.22	9.1	7.21	3.19	0	0	0
Crabs	0	0	0	6.89	6.52	3.32	3.03	2.7	0.4	0	0	0
Prawn remain	3.03	1.94	0.31	0	0	0	27.3	27.39	36.4	0	0	0
Total	29.62	24.71	7.16	44.83	29.47	29.3	84.9	77.93	94.3	25.93	16.9	9.28
Molluscs:												
Bivalves	55.9	59.69	89.4	3.45	9.78	2.5	0	0	0	0	0	0
Sepia spp.	0.34	0.19	0.01	0	0	0	0	0	0	0	0	0
Octopus spp.	0	0	0	6.89	4.27	2.18	0	0	0	0	0	0
Total	56.24	59.58	89.4	10.34	14.05	4.68	0	0	0	0	0	0
Digested matter	2.35	1.34	0.16	3.45	0.87	0.22	6.06	3.15	0.93	11.11	3.37	2.4
Mud	8.08	6.5	2.76	0	0	0	3.03	5.41	0.8	0	0	0

growth in the males and females take place in the gestation period itself.

Food

The feeding habit indicates poor feeding activities in *D.sephen, D. uarnak, T. walga* and *G. micrura*(Table 6). The average volume of food per fish (Table 6) including empty stomach in *D. sephen* was 4.68 ml, in *D. uarnak,* 2.80 ml, in *T. walga,* 2.52 ml and in *G. micrura,* 3.56 ml, and excluding empty stomachs were 7.20 ml, 6.52 ml, 3.91 ml and 9.94 ml respectively.

Molluscs (89.36%) formed the most dominant food (Table 7) followed by crustaceans (7.16%) in *D.sephen,* whereas teleost (65.85%) formed the major food of *D. uarnak*, followed by crustaceans (29.25%) and molluscs (4.68%). Crustaceans (94.28%) formed main bulk of the diet of *T.walga.* In the gut content of G. *micrura,* teleost (88.32%) formed the most dominant food item and then crustaceans (9.28%).

Among molluscs, bivalves and *Sepia* spp. were observed in *D. sephen*. Crustaceans were constituted by *Solenocera* spp., *Parapenaeopsis stylifera, P. sculptilis, Nematopalaemon tenuipes, Acetes* spp., *Exhippolysmata ensirostris, Squilla* spp. and prawn remains. Teleosts were represented by *Coilia dussumieri,* Sciaenids and *Harpodon nehereus.* Mud (2.76%) was present whenever bivalves occurred in the diet.

Coilia dussumieri, Sciaenids, *Nemipterus mesoprion,* and fish remains comprised the fish diet of *D. uarnak. P. stylifera, N. tenuipes, E. ensirostris, squilla* spp. and crabs constituted the crustacean food.Bivalves and *Octopus* spp.were the molluscan food. Among crustaceans, *Solenocera* spp. formed the most significant component of *T. walga* and other constitutent were *Metapenaeus affinis, N. tenuipes* and crabs. The teleost noticed in guts was represented by *C. dussumieri.* Mud particles (0.80%) were present occasionally.

In the gut content of *G.micrura,* teleosts encountered were *C.dussumieri,* sciaenids *Trypauchen vagina, H. nehereus* and fish remains. The crustaceans were found to consist of *Solenocera* spp., *P.stylifera,* and *N. tenuipes*. The occurrence of demersal fishes, prawns, and molluscs in gut content of these species, suggests that these species are demersal carnivores. The carnivorous feeding habit in *D. sephen* and *D. uarnak* has been reported by Devadoss (1978) and in *G. poecilura* by Jamas (1966).

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