

OBSERVATIONS ON SHOALS OF THE JAVANESE COWNOSE
RAY RHINOPTERA JAVANICA MÜLLER & HENLE FROM THE
GULF OF MANNAR, WITH ADDITIONAL NOTES ON THE SPECIES*

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FOUR species of *Rhinoptera* were recorded from Indian waters (Misra, 1951) of which *R. javanica* appears to be the common species in the Gulf of Mannar. The natural distribution of this species from India, Ceylon, Malay Peninsula, Siam, China and Malay Archipelago (Misra, 1947) has been extended by definite records to western Indian Ocean (South Africa) by Smith (1961). In this context it may be mentioned that *R. javanica* has been reported from east Atlantic as well (Fowler, 1946), but as pointed out by Bigelow and Schroeder (1953) comparisons of Atlantic and Indian Ocean material is lacking and in the absence of which, with our present knowledge, it will be desirable to consider the range of distribution of the species as Indian Ocean and western Pacific.

In view of the economic importance both as a food fish as well as a predator on pearl oysters and due to lack of detailed synonymies for the species from this region, available references to the species from the Indo-Pacific are given below.

Rhinoptera javanica Müller and Henle, 1841

Rhinoptera javanica Müller and Henle, 1841. *Syst. Besch. Plagiostomen*. p. 182, pl. lvii (type locality; Java, according to Bertin, type from Malabar coast is in the Paris museum); Bleeker, 1849. *Verh. Bat. Gen.*, 22: *ichth. Madura*, p. 6, Kammal 1850. *ibid.*, 23: 13; 1858. *Acta. Soc. Sci. Indo-Neerl.*, 3: 6; Dumeril, 1865. *Hist. Nat. Elasmobr.*, 1: 647 (Malabar); Günther, 1870. *Cat. Fish Brit. Mus.*, 8: 494; Bleeker, 1873. *Ned. Tijds. Dierk.*, 4: 120; Day, 1878. *Fish. India.*, p. 744, pl. cxcv, fig. 4 (Kurrachee); 1889. *Faun. Brit. India, Fish.*, 1, p. 61, fig. 25 (Seas of India to Malay Archipelago); Bartlett, 1896. *Sarawak Gazette.*, 26: No. 366, p. 134; Duncker, 1903 (1904). *Naturh. Mus. Hamburg, Mittell.*, 21: 194; Shipley and Hornell, 1906. *Roy. Soc. Rep. on Pearl Oyster Fisheries*, pt. V; 60-68 (parasites); Southwell, 1912-13. *Ceylon. Adminstr. Rep.*, p. E. 50; Garman, 1913. *Mem. Mus. Comp. Zool. Harvard.*, 36: 446 (Java; India); Hora, 1924. *Mem. Asiatic Soc. Bengal.*, 6: 645; Chabanaud, 1926. *Service Oceanogr. Peches Indo-Chine*, 1^o note, p. 6; Fowler, 1921. *Proc. Acad. Nat. Sci. Phila.*, 71: 597; Pillay, 1929. *Journ. Bombay Nat. Hist. Soc.*, 33: 354 (Travancore); Deraniyagala, 1933. *Ceylon Jour. Sci.*, 54: 370; Fowler, 1936. *Bull. Amer. Mus. Nat. Hist.*, 70: Pt. 1, p. 139; Umali, 1936. *Edible Fishes, Manila*, p. 46, fig. 12; Fowler, 1938. *Fisheries Bulletin.*, No. 1, p. 20; Umali, 1938. *Philippine Jour. Sci.*, 65: 182; Fowler, 1941. *Bull. 100 U.S. Nat. Mus.*, 13: 476; Sarangadhar, 1942. *Ind. Journ. Med. Res.*, 30: 558

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(Bombay); Misra, 1947. *Rec. Ind. Mus.*, 45: 40-41; 1951. *Rec. Ind. Mus.*, 49: 129; Herre, 1953. *Checklist of Philippine Fishes, U.S. Fish Wildl. Serv. Res. Rept.*, 20, p. 52; Mendis, 1954. *Fishes of Ceylon. Bull. No. 2*, p. 79, 152, 180; Munro, 1955. *The Marine and Fresh-water fishes of Ceylon*, p. 16; Scott, 1959. *An introduction to the sea fishes of Malaya*, p. 9; Smith, 1961. *The sea fishes of Southern Africa*, p. 504.

Rhinoptera affinis Bleeker, 1862, *Nat. Verh. Holl. Maatsch. Wetensch.*, p. 19.

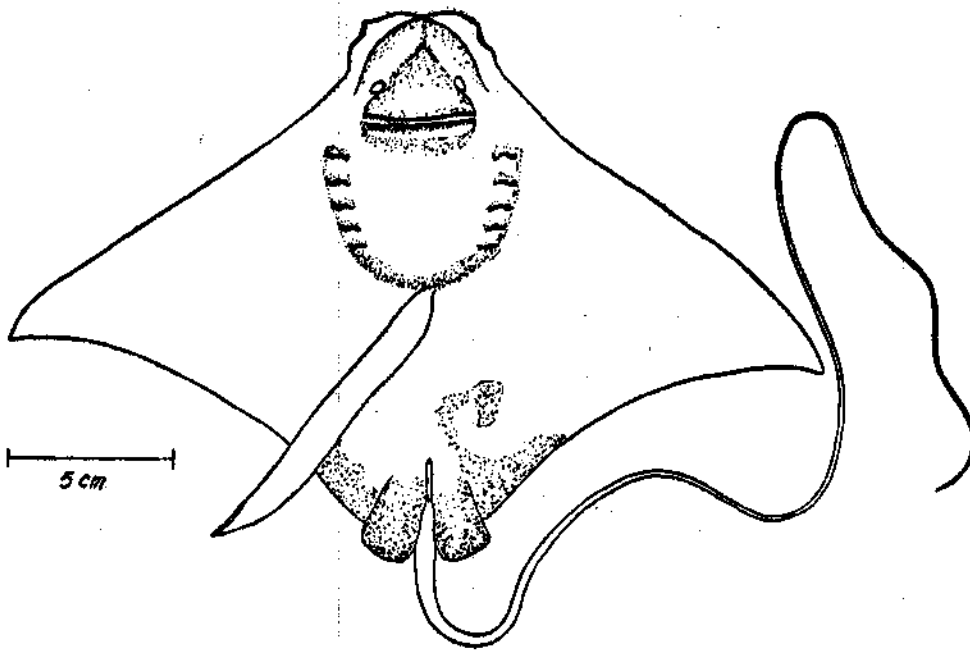
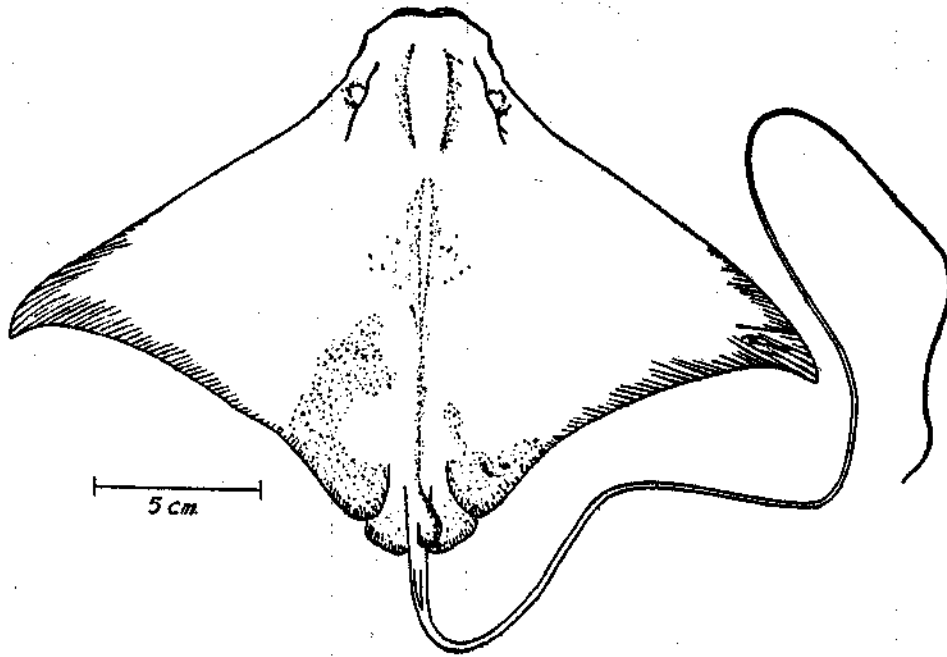
Method of capture. In the Gulf of Mannar and Palk Bay, rays are usually fished by a special bottom set gill net (*Thirukai valai* in tamil) operated at depths varying between 8 to 10 fathoms. A few specimens of *R. javanica*, locally called *Valvadi thirukai* in tamil, are occasionally landed along with other rays of commercial importance at the fishing centres on the Gulf of Mannar and Palk Bay, in the vicinity of Mandapam. Occasionally they are also caught in shore-seines locally termed *Karai valai*.

Abundance and size. Landings of this species are generally not heavy along the coast of Gulf of Mannar. But on two occasions it was observed by the author to occur in great shoals and of such occurrences of *R. javanica* other than what is given by Shipley and Hornell (1906) from Dutch Bay, Ceylon, based on hearsay, there appears to be no information. It reads 'These fishes appear to be gregarious, going about in shoals of great numbers. A reliable fish curer has informed me that during the pearl fishery of 1889 a single net operated on the adjacent coast took in a single haul 7000 individuals. My informant was certain as regards the number stated as it was he himself who purchased the entire catch. His men, even with additional help took eight days to complete the cutting up. To keep the fish till ready to cut up, the whole lot was buried in trenches in sand after being roughly eviscerated. Afterwards the men started at one end and worked methodically through the trenches one after the other. The same year cholera broke out in the pearl fishery camp in the vicinity (Dutch Bay) and many of the ignorant natives traced the source of the epidemic to this vast heap of fish which no doubt gave off a strong fishy odour during curing operations.'

Local fishermen who are quite familiar with the species inform that occasionally it does appear in enormous shoals. Since the two observations made by the author throw some light on the habits of this species, more details are given below.

On 23rd December, 1959, about 500 specimens of *R. javanica* were landed at 9 a.m. by a shore seine at Pudumadam (Gulf of Mannar). Exact sex ratio figures were not available but it was reported that majority were females with intra-uterine embryos, some of which were actually examined and an embryo collected for detailed study (Figs. 1 & 2).

On 17th January, 1962, after a lapse of two years, 540 specimens of this ray were landed at 8 a.m. by one shore seine at 'Mulli Theevu,' an island approximately 15 miles from the village Kilakarai, facing Gulf of Mannar. A part of the catch (105) was landed at Kilakarai and the rest at Periapattinam along the same coast. As in the first instance, majority (up to 75%) were reported to be females carrying young ones. During the previous week, it was reported, about 250 specimens of the same species were landed at 'Vala Theevu' and 450 at Rameswaram Road on the Gulf of Mannar. However, details of size, sex and whether any of them carried embryos were lacking in these reports.



Rhinoptera javanica

FIG. 1. Dorsal view of embryo.

FIG. 2. Ventral view of the same.

On both the occasions, it was noticed by the author that majority of the females carried one embryo while a few had none. But it should be pointed out here that the number of embryos each female would give birth to, in a season could not be stated with certainty since it is commonly known that these fishes eject out the advanced embryos on capture and hauling up into boats, which under normal conditions might involve some more time.

TABLE I*

Measurements and body proportion in percent of width of disc of four specimens of R. javanica from Gulf of Mannar

Character	Female embryo : Pudumadam 23-12-1959	Female adult : Kilakarai 17-1-1962	Male adult : Kilakarai 17-1-1962	Female embryo : Kilakarai 17-1-1962
Width of disc (distance between tips of pectorals)	25.40	146.00	133.00	31.00
1. Length of disc (Snout to tip of ventrals)	16.50 (64.96)	90.00 (61.64)	82.00 (61.65)	19.40 (62.58)
2. Length of disc (Snout to posterior end of pectorals)	15.50 (61.02)	—	—	18.30 (59.03)
3. Mouth to anterior end of cloaca	10.10 (39.76)	58.00 (39.73)	51.00 (38.35)	12.40 (40.00)
4. Width of snout (Maximum)	4.15 (16.34)	20.50 (14.04)	19.50 (14.66)	4.85 (15.65)
5. Orbit (horizontal diameter)	0.80 (3.15)	—	—	0.90 (2.90)
6. Interorbital space	4.15 (16.34)	18.00 (12.33)	17.60 (13.23)	5.00 (16.13)
7. Length of tail (from origin to tip)	51.30 (201.97)	104.50 (71.58)	113.50 (85.34)	58.10 (187.42)
8. Height of dorsal	1.10 (4.33)	7.00 (4.79)	7.00 (5.26)	1.05 (3.39)
9. Length of ventral	3.00 (11.81)	16.50 (11.30)	15.00 (11.28)	3.45 (11.13)
10. Width of mouth	2.80 (11.02)	14.00 (9.59)	13.50 (10.15)	3.55 (11.45)
11. Snout to mouth	2.95 (11.61)	16.00 (10.96)	14.50 (10.90)	3.50 (11.29)
12. Distance from first to fifth gill-slit	2.80 (11.02)	14.00 (9.59)	12.00 (9.02)	3.35 (10.81)
13. First gill-slit from angle of mouth	1.45 (5.71)	7.20 (4.93)	6.70 (5.04)	1.90 (6.13)
14. Weight (in lbs.)	0.54	92.00	75.00	0.84

* All measurements given in centimetres. Parentheses indicate percentages.

In both the recent instances recorded by the author here, the size of the rays was almost the same, the length of the disc (from tip of snout to end of ventrals) varying about one metre and the width (distance between the tips of the pectorals) one and a half metre. Measurements and body proportions of an average male, female and two embryos are presented in Table I. The data given would indicate that there is hardly any noticeable difference in the relative body proportions of adult males, females, and embryos except in the width of interorbital space and length of tail. The interorbital space is smaller and the tail appears much longer in the embryos, when compared to adult specimens. The tail may be mostly damaged in adults which makes it difficult for reliable measurements. Evidence as to the maximum size to which the species ordinarily grows in Indian waters is lacking but from the data presented on average size of individuals in Table I, it could be well over 150 cm. (5 feet) in disc width. The males, however, appear to be smaller. It may incidentally be mentioned here, the Atlantic species of *Rhinoptera* are known to attain at least 210 cm. (7 feet) as referred to by Bigelow and Schroeder (1953). The still-born embryo with the umbilical scar retained, collected from one female at Kilakarai on 17-2-1962 measures 31 cm. in width of disc and from this it may be inferred that the breadth at birth may be little over this, which compares well with that for the Atlantic species, *R. bonasus* (about 14 inches or 35 cm.) as cited by Bigelow and Schroeder (1953).

Food. A casual examination of the stomach contents on the field, of 20 specimens of the fish landed at Kilakarai on 17-1-1962 revealed nothing but finely crushed pieces of shell, obviously those of some bivalve molluscs, since the diet of all the species of *Rhinoptera* in general was reported to consist mainly of oysters, clams, and other large bivalve molluscs which are rooted from sea bottom (Bigelow and Schroeder, 1953). In majority of cases the stomachs were empty with the walls in a collapsed condition. Shipley and Hornell (1906) reported that the food of *R. javanica*, as evidenced by the stomach contents, to be exclusively molluscan. They consisted almost wholly of Lamellibranch fragments, the genus *Macra* mentioned from one of the specimens examined from Dutch Bay (Ceylon). Thomas, as cited by Shipley and Hornell (1906) stated that *R. javanica* devours pearl oysters also.

Embryonic and adult colouration. There is no difference in colour of males and females in the fresh condition, the adults being black above and white on the mid-ventral surface. The ventro-lateral sides are grey as also the posterior ends of pectorals, ventrals and a greater portion of tail. The tips of fins of adults are dark green and some large females have a few yellow spots scattered over the ventral surface. The intra-uterine embryo with the umbilical connection persistent is pale brown in colour except for the tips of pectorals, the ventrals and two grey patches dorso-laterally. The tail is dark brown in colour. The intra-uterine embryo that has lost the umbilical connection but still with the scar, attained almost the colour of adults. It will be of interest to note here, Joseph (1961) observed a female albino of *R. bonasus* which had a male embryo of normal pigmentation from Chesapeake Bay when a large number of specimens of this species were caught. However, there was no record of a similar instance for *R. javanica* from Indian waters in spite of the occurrence of such enormous shoals.

Discussion and conclusions. The numerical abundance of these fishes at times is not uncommon, since such incursions were known to occur when they appear in far greater numbers in some years and in some localities than is ordinarily the case (Bigelow and Schroeder, 1953). The authors summarized documented incursions of *R. bonasus* reported since 1815 along the Atlantic coast of the United States and

more recently Joseph (1961) recorded two instances of such concentrations of 330 rays in one pound net and about 600 in another during the spring and early summer of 1960 from Chesapeake Bay. In the present case (from Gulf of Mannar) it is interesting to note that the same species visited nearby localities twice during the span of two years and also other places as well, on the same coast. It may be mentioned here, during the same period the author has not come across *R. javanica* in such large concentrations in Palk Bay nor is he aware of any earlier reports of such along other parts of the Indian coast.

The observations presented here clearly indicate that most of the females during December-January period, in the Gulf of Mannar, had intra-uterine embryos in different stages of development. This may probably coincide with the period of parturition.

Sexwise, the females were seen to outnumber the males, in both the observations recorded here.

Most of the stomachs examined were empty with few crushed bits of shell indicating that feeding might not have been the primary reason for the irregular appearance and such large scale movements of this ray, although feeding was observed to be associated with schooling for allied species from Atlantic. Since we have, at present, little information as to the feeding rhythms of this or allied species it will be difficult to draw a positive conclusion.

It is not known whether the repetition of the occurrence of such large shoals at irregular intervals could even be a reflection of the depletion of breeding populations (such as the ones recorded here) by mass capture on such occasions. It is understood that as the stocks are depleted fast, recruitment and reappearance of breeding shoals would involve certain amount of time, based on maturity, breeding season etc. In this connection it will also be of interest to ascertain whether there could be a second breeding season for the species in the same year.

Economic importance. Although the species *R. javanica* does not sustain a substantial fishery at any particular locality along the Indian coast, their importance is by no means insignificant especially when they occur in such abundance. *R. javanica* is consumed fresh when available in fewer numbers and is pit cured with salt when huge shoals are landed. The cured product is exported to interior places for marketing. In the fresh condition, it was reported, a ray of 90 lbs. weight fetches a price of Rs. 6 locally.

Apart from the food value, *R. javanica* is of negative economic importance in that it was reported to be a predator on pearl oysters. In this respect, their occurrence in such enormous numbers as are recorded here, may even prove injurious to the pearl beds of Gulf of Mannar.

SUMMARY

The occurrence of large shoals of *Rhinoptera javanica* in the Gulf of Mannar is reported.

Particulars of size, abundance, sex ratio and economic importance are mentioned.

The possible reasons for the large scale movements of these fishes are discussed.

REFERENCES*

BIGELOW, H. B. AND SCHROEDER, W. C. 1953. *Fishes of the Western North Atlantic: Part II*, pp. 465-480. Sears Foundation for Marine Research, Yale University.

JOSEPH, B. 1961. An albino Cownose ray, *Rhinoptera bonasus* (Mitchell) from Chesapeake Bay, *Copeia*, 1961, No. 4, pp. 482-483.

* Other references are given under synonymy.