

XIV NOTES FROM THE BENGAL FISHERIES LABORATORY, No. 7

ON SOME INDIAN TORPEDINIDAE FROM THE ORISSA COAST.

By B. PRASHAD, D.Sc., Offg. Director of Fisheries, Bengal.

(Plates VI, VII.)

The present paper deals with some Torpedinidae that I have had a chance of collecting and observing at irregular intervals during the past two years at Puri, on the Orissa coast of the Bay of Bengal. For the sake of completeness, I have also gone over the entire collection of these forms in the Zoological Survey of India (Indian Museum, Calcutta). It has thus been possible to clear up certain doubtful points regarding the nomenclature, synonymy and variation of the various forms dealt with here. A description of a fairly advanced stage of embryos of *Narcine indica*, Henle, obtained by dissection out of a gravid female, and of the structure of the gravid uterus is also included.

Four of the six Indian genera of Torpedinidae were found at Puri; these are *Torpedo*, *Narcine*, *Narke* and *Bengalichthys*. Of the other two, *Narcobates* is a deep-sea genus and is not likely to occur near the coasts, while the occurrence of the other (*Temera*) in Indian waters is still problematical.

For the facilities regarding material and literature afforded by the officers of the Zoological Survey of India I am greatly indebted to them. My thanks are also due to Mr. J. Clinton Bond, Curator, McMahan Museum, Quetta for kindly sending me for examination a co-type of *Torpedo zugmayeri*, Englh., a species discovered in recent years on the Mekran coast of Baluchistan. It may be of interest to mention here that this is the only specimen of this species preserved in any of the Indian Museums.

Torpedo, Houttuyn.

1764. *Torpedo*, Houttuyn, *Nat. Hist.* VII, p. 453.

1909. *Torpedo*, Annandale, *Mem. Ind. Mus.* II, p. 42.

1913. *Narcacion*, Garman, *Mem. Mus. Comp. Zool. Harvard* XXXVI, p. 304.

Garman's valuable memoir, in which he has proposed to replace the generic name *Torpedo* by *Narcacion*, calls for some remark. *Narcacion* is one of the various names used by Klein, a pre-Linnean writer, in his *Historia Piscicum Naturalis* (1740-1744). The names were later accepted and published in an anonymous work commonly known as *Neuer Schauplatz* (1775-1781). In this work the authorities for generic and specific names are given, and

this in Garman's opinion amounts to republication after 1st January, 1758, the date of the development of the System of Linnaeus in the tenth edition of his *Systema Naturae*. No author, however, has accepted Garman's version; Jordan and Evermann,¹ after considering the additional arguments of Garman, are of the opinion that the generic names of Klein in *Neuer Schauplatz* are of very doubtful eligibility, as even in this work the Linnean code is not adopted for species, and further because the dictionary is an anonymous publication with an "elliptical and disorderly" method of exposition. In view of these facts it does not seem desirable to displace such well established names as *Torpedo* by Klein's nomenclature.

There is a further difficulty regarding the author of the name *Torpedo*. Günther² assigned it to Dumeril,³ who established the genus in 1806 with *Raja torpedo* as the type. Houttuyn (*loc. cit.*) had in 1764, however, used the name *Torpedo* without assigning a type, but his description of the fish fixes the Electric Ray—*Raja Torpedo*, Linn. as the type. I have, therefore, accepted Houttuyn as the author of the genus *Torpedo*.

***Torpedo marmorata*, Risso.**

1870. *Torpedo marmorata*, Günther, *Brit. Mus. Cat. Fishes* VIII, p. 450.

1909. *Torpedo marmorata*, Annandale, *Op. cit.*, p. 42.

1913. *Narcacion marmoratus*, Garman, *Op. cit.*, p. 305.

Garman's work, in connection with his description of the distribution of this species, calls for some further criticism. Except in a few instances, he has ignored Annandale's valuable papers on the Indian Elasmobranchs. For example, he gives the distribution of *T. marmorata* as "Mediterranean Sea and Eastern Atlantic," leaving out the record of the occurrence of this species at Puri on the Orissa coast. There is in the collection of the Zoological Survey another specimen taken near Vizagapatam on the same coast. Zugmayer⁴ has also recorded the occurrence of this species (with a closely allied one) on the Oman and Mekran coasts of Baluchistan. The species, therefore, has a wide distribution in the Indian seas.

The closely allied species *T. zugmayeri* described by Engelhart⁵ from a female specimen collected by Dr. E. Zugmayer off Baluchistan on the Mekran coast is quite distinct from *T. marmorata*, as I have satisfied myself by the examination of a male specimen of this species preserved in the Quetta Museum. It is distinguished from *T. marmorata* in having semilunar instead of circular spiracles, much smaller though more numerous spiracular

¹ *Genera of Fishes*, pp. 35-37. Leland Stan. Univ. Pub. California (1917).

² *Brit. Mus. Cat. Fishes*, VIII, p. 448 (1870).

³ *Zool. Analyt.*, p. 102 (1806).

⁴ *Mem. Ind. Mus.* II, pp. 1-60, pls. i-v (1909), and *ibid.*, III, pp. 1-6 (1910).

⁵ *Abh. Kön. Bayer. Akad. Wiss. München* XXVI, Bd. 6, pp. 1-35 (1913).

⁶ *Zool. Anz.*, Bd. XXXIX, Nr. 21-22, p. 647 (1912).

papillae, proportionately much smaller tail, by general colouration and a much heavier build.

Narcine, Henle.

1878. *Narcine*, Day, *Fishes of India* II, p. 733.
 1909. *Narcine*, Annandale, *Op. cit.*, p. 43.
 1913. *Narcine*, Garman, *Op. cit.*, p. 246.

In the paper cited Annandale recorded three species of this genus from Indian seas, viz. *N. timlei*, *N. brunnea* and *N. mollis*. Garman, however, has shown that the true *N. timlei* is not an Indian form, being confined to the East Indies and Japan. He thinks that the Indian species is what was described as *T indica* by Henle,¹ a conclusion with which I agree. In the same work he has also described a new species from Colombo, Ceylon under the name *N. firma*. I have not seen this form, there being no representatives of it in the Calcutta collection.

Garman, in his key for the identification of the various species of the genus *Narcine*, states that in *N. tasmaniensis* and *N. mollis* the spiracles are "at a short distance from the orbits," whereas in his description of *N. mollis* he describes them as being "near the orbits." Llyod² in the original description states that they are situated close to the orbits and this is the condition in the unique type, which I have examined. Garman's key in view of the above is incorrect. The four Indian species can, however, be distinguished from one another as follows:—

- | | | | |
|-----|---|--------|--------------------|
| I | Origin of first dorsal opposite the ends of ventrals. | | |
| | (i) Dorsal surface spotted | | <i>N. indica.</i> |
| | (ii) Dorsal surface uniform brown | | <i>N. brunnea.</i> |
| II | Origin of first dorsal slightly behind the ends of the ventrals, dorsal and ventral surfaces of the body uniformly coloured | | <i>N. mollis.</i> |
| III | Origin of first dorsal behind the ends of the ventrals by about its own basal length | | <i>N firma.</i> |

Narcine indica, Henle.

(Plate VII, figs. 4-9).

1834. *Narcine indica*, Henle, *Op. cit.*, p. 35, pl. ii, fig. 2.
 1841. *Narcine indica*, Müller and Henle, *Plagiostomes*, p. 130.
 1878. *Narcine timlei*, Day, *Op. cit.*, p. 733 (in part, not the figure).
 1909. *Narcine timlei*, Annandale, *Op. cit.*, p. 44.
 1913. *Narcine indica*, Garman, *Op. cit.*, p. 209.

Annandale pointed out in his paper the confusion made by Day in including two distinct species in his description and figure of *N. timlei*, and separated the uniformly coloured Indian species under the name *N. brunnea*, retaining the name *N. timlei* for the spotted form. This latter, however, as has been pointed out above, should be known as *N. indica*.

¹ *Ueber Narcine*, p. 35, pl. ii, fig. 2 (1834).

² *Rec. Ind. Mus.* I, p. 8 (1907).

Garman's description of *N. indica* is incomplete and erroneous owing to his having ignored the question of variation in the outlines of the disc, the relative size of the eyes and spiracles, the size and proportion of the dorsal and the caudal fin and the colouration, so well discussed in Annandale's account of *N. timlei*. All these facts are fully borne out by the large series of specimens of this species in the collection of the Zoological Survey, as also by a large number of fresh specimens that I have examined at Puri and elsewhere. The species is fairly common round Puri and a large number of specimens is caught every day in the shore seine-nets.

Except for a doubtful specimen of *N. brunnea* found in an advanced state of decomposition on the Puri beach, I did not secure any specimen of this latter species.

Narke, Kaup.

1826. *Narke*, Kaup, *Arch. Anat. Physiol.* p. 365.
 1887. ? *Astrape*, Day, *Op. cit.*, p. 734.
 1909. *Astrape*, Annandale, *Op. cit.*, p. 46.
 1913. *Narke*, Garman, *Op. cit.*, p. 312.

Day recorded a single representative of this genus from Indian waters as *Astrape dipterygia*. It is doubtful, however, in view of the arguments stated further on, whether he had ever seen the true *N. dipterygia* of Indian waters. Müller and Henle's generic name *Astrape*¹ cannot stand owing to Kaup having described the same genus as *Narke* some fifteen years earlier.

Garman in his memoir combined Annandale's new genus *Bengalichthys* with *Narke* without giving any reasons. This point is fully discussed further in the account of *B. impennis*.

Narke dipterygia (Bloch., Schn.).

(Plate VI, figs. 1, 2).

1870. *Astrape dipterygia*, Günther, *Brit. Mus. Cat. Fishes VIII*, p. 454.
 1887. ? *Astrape dipterygia*, Day, *Fishes of India*, p. 734 (in part, not the figure).
 1889. ? *Astrape dipterygia*, Day, *Faun. Brit. Ind. Fishes I*, p. 46 (in part, not the figure).

Günther and Day included in the synonyms of this fish Shlegel's *N. japonica* but this has since been recognized as a distinct species by Jordan and Fowler,² Garman and others.

In his first work Day gave a figure of *N. dipterygia* prepared from a specimen from Malabar; this figure was later reproduced in the "Fauna" volume. The specimen is preserved in the collection of the Zoological Survey. The figures referred to above led me to doubt as to whether these could be that of the true *N. dipterygia*, for they rather resembled *B. impennis* in the shape and position

¹ *Sitzb. Akad. wiss. Berlin*, p. 117 (1837).

² *Proc. U. S. Nat. Mus.* XXVI, p. 656 (1903).

of the ventral or pelvic fins, but the eyes in this figure are shown as being fairly large and prominent. The doubt was confirmed by an examination of the original specimen, which is certainly a true *B. impennis*. The eyes in the specimen are exactly as in normal specimen of *B. impennis*, and Day's figures are wrong in this particular. The second specimen from Day's collection is from Madras and is also a specimen of *B. impennis*. These are the only specimens in Day's collection of fishes in Calcutta, and both belong to *B. impennis* but were wrongly identified as *Astrape dipterygia*.

In view of these facts, therefore, it seems a little doubtful whether Day's description of *A. dipterygia* does not really apply to *B. impennis*; this fact unfortunately is, however, not easy to decide, as in certain particulars, such as the proportions of the tail and disc, his description does not apply to either species. Both the specimens from Day's collection are in a poor state of preservation and therefore give a very imperfect idea of the normal appearance of *Bengalichthys*. In any case Day's identification does not affect the nomenclature or taxonomic position of either genus. As no complete description of *N. dipterygia* is available, I have thought it desirable to redescribe the species.

Disc subcircular, slightly shorter than the tail, snout short, rounded on the anterior margin. Nostrils small. Anterior valves confluent, forming a quadrangular flap with concave lateral margins, rounded at the sides posteriorly and with a median projection; this flap is free posteriorly, extending back over the mouth and covering the upper jaw entirely in both young and adult specimens; posterior valves well developed with a free triangular portion first curving backwards and then forwards in a half loop-like manner, and lying in the concavities on the sides of the anterior flap. Mouth small, protrusible, enclosed in a deep fold of skin and divided by a median projection on both the jaws, that of the lower jaw being more prominent than that of the upper. Teeth small. Eyes small but prominent, a little less than half the length of the spiracles. Spiracles large, abutting on the eyes, varying in outline according to the condition of preservation of the specimens, with a smooth raised margin. Gill-openings small; the last one particularly reduced. Dorsal fin rounded along the margins, with an elongated base, arising a little in front of the bases of the ventrals, and separated from the caudal by its basal length. Tail slightly longer than half the total length, with a well developed caudal, and a feebly developed fold on either side. Subcaudal rounded; supracaudal much larger, rounded in some specimens, in others ending in a point. Ventrals large; with a concave outer margin in the young, becoming nearly straight in full grown individuals; arising below the pectorals. Claspers short, stout, with a deep groove on the upper surface throughout their length and another on the outer side extending to not more than half the length. Pectorals broad, with straight fin-rays showing through the skin. Electric organs kidney-shaped, extending to a little in front of the eyes, formed of irregular quadrangu-

lar or pentagonal areas, distinctly marked on both dorsal and ventral surfaces.

Colour olive-brown dorsally, borders of the disc, ventrals, the posterior margin of the dorsal and the caudal creamy white; a circular white spot on each side behind the electric organs and a similar but larger one at the junction of the pectorals and the body on each side, ventral surface creamy white.

For the sake of comparison with *B. impennis*, photographs of the dorsal and ventral surfaces of a well-preserved specimen of this species (figs. 1, 2) from Puri, and those of one of *B. impennis* (figs. 3, 4) are reproduced on plate vi.

The species is widely distributed in Indian seas, there being specimens in the collection from the Sandheads, Orissa Coast, Bay of Bengal, off Colombo and from Bombay.

Bengalichthys, Annandale.

1887. *Astrape*, Day, *Fishes of India*, p. 734 (in part), fig. 19.

1889. *Astrape*, Day, *Faun. Brit. Ind. Fishes I*, p. 46 (in part), fig. 19.

1909. *Bengalichthys*, Annandale, *Op. cit.*, pp. 47, 48.

1913. *Narke*, Garman, *Op. cit.*, p. 312 (in part).

As has been remarked already the two specimens from the late Dr. F. Day's collection in the Indian Museum identified as *A. dipterygia* really belong to this genus. Unfortunately these specimens escaped Dr. Annandale's attention at the time of his revision of the Indian Batoids, and the creation of his new genus *Bengalichthys*. His description of this genus was also short owing to his having only two specimens. Probably this, and the rather poor figure of the only species published by him, led Garman to unite the genus *Bengalichthys* with *Narke*. The two genera, however, are quite distinct and with a fair number of specimens before me, I have thought it desirable to redescribe the genus at some length, and publish good photographs of the only known species.

Head, body and electric organs united in a subcircular, fleshy disc, ending abruptly in front of the anus and including only a small anterior part of the ventral fins, snout broadly rounded, anterior narial valves confluent in a small quadrangular flap, extending up to the mouth but not covering it. Mouth small, protrusible, enclosed in a thick fold on the two sides. Eyes very small, degenerate, sunken. Spiracles large, with a smooth border without raised edges. Gill-openings small. Electric organs not distinguishable externally in fully grown specimens. Ventrals large, fleshy, lateral united with the tail and not enclosed by the disc as in *Narke*. Pectorals except for a narrow fringe entirely enclosed in the fleshy disc. One dorsal. Tail long, without any fold on lateral sides. Skin thick, fleshy, with large numbers of glandular pits on both dorsal and ventral surfaces.

Type: *Bengalichthys impennis*, Annandale, the only known species.

The genus, though closely allied to *Narke*, is certainly quite

distinct from it. As was pointed out by Annandale, probably as a result of adaptation to its presumable habits of wriggling and squirming at the bottom, the body has become very massive and fleshy, while the fins have been greatly reduced. The mouth, owing to a suctorial function, has become small, and is protrusible as a tubular structure. The eyes also have degenerated to minute structures sunk in pits, and probably functionless. All these features combined with the lateral situation of the ventrals on the tail, and the very much smaller anterior narial flap are sufficient characters for separating the genus from *Narke*.

***Bengalichthys impennis*, Annandale.**

(Plate VI, figs. 3, 4 ; pl. VII, figs. 1-3).

1887. *Astrape dipterygia*, Day, *Fishes of India*, p. 734 (in part), fig. 19.

1909. *Bengalichthys impennis*, Annandale, *Op. cit.*, p. 48, fig. 9, pl. iii (a), fig. 7.

1913. *Narke impennis*, Garman, *Op. cit.*, p. 315.

In addition to the original description by Annandale, the following points may be noted. The narial flap is very small and does not cover the mouth. The glandular pits are present on both the dorsal and ventral surfaces ; they are specially prominent on the border of the electric organs. The electric organs, though well developed and occupying the usual position between the head and the pectorals, are not visible externally, except in young individuals as pentagonal areas, through the thick skin. The pectoral "fringed ridge," mentioned by Annandale, consists of skin covering only the terminal joints of the fin-rays. It was found on dissecting out the skeletal parts in this region that the rays, instead of remaining quite straight, are retroverted upwards (pl. vii, fig. 1) for a considerable part of their length, and thus give double support to the fleshy margin of the disc ; the fins as such being reduced to the narrow fringe. The ventral fins have the greater part of their length situated behind the disc, but are enclosed, like the pectorals, in a thick muscular coating, and form lateral expansions of the tail in this region.

In the male specimens the claspers are well-developed structures but the greater part of their length is enclosed within the fin-folds. The free part shows the main channel and a small groove on either side on the dorsal surface (pl. vii, figs. 2, 3).

Besides the two original specimens of Dr. Day, one from Malabar and the other from Madras, there are in the collection of the Zoological Survey two specimens from Balasore Bay on the Orissa coast, and four from off Gopalpur, Madras. I also saw two partially decayed specimens on the Puri beach in January, 1920. It appears from these records that the species, though rare, is widely distributed in the Indian seas.

Annandale has described the colouration of the species at some length, and there is nothing further to note except that in fresh specimens it closely resembles that of *N. dipterygia*.

I. GRAVID UTERUS AND EMBRYOS OF *GARCINE INDICA*.

In January, 1919, while collecting at Puri, I secured a gravid specimen of *N indica* measuring 31 cm. in length. On dissection the specimen was found to contain four embryos in its uterus.

The uterus shows certain peculiarities. The entire inner surface is covered with spatulate villi-like trophonemata (pl. vii, fig. 4). The covering of trophonemata is so thick that no part of the uterine wall is to be seen between them. In a square inch of the wall of the preserved uterus 198 villi were counted. A typical trophonema (pl. vii, fig. 5) is spatulate, and measures 7 mm. in length with an average width of 2 mm. near the tip and 0.5 mm. near the base. Examined under the microscope (pl. vii, fig. 6) the marginal arterial loop and the thick plexus of capillaries all over the surface is distinctly to be made out.

Structures of this type have been described for a number of Indian Batoids originally by Wood Mason and Alcock¹ and later by Alcock²; to the two authors we also owe the very appropriate name of "trophonemata." I do not propose going into the histological details of these structures, as these have been admirably described by Brinckmann³ and Widakowich⁴; further, the material at my disposal would not permit my going into these details. It is, however, of interest to note that the trophonemata of this species greatly resemble those of *Torpedo ocellata*, described by Brinckmann. It may also be mentioned that the uterus was full of a yellowish milk-like secretion in which the embryos were enclosed.

But for the embryos of *Torpedo marmorata* described by De Sanctis⁵ in fair detail, no good description of Torpedinid embryos has been published. De Sanctis in his valuable paper divides the embryos into five stages:—

- (1) *Embrione squaliforme, opleurotrema,*
- (2) *Embrione Raiforme, oipotrema,*
- (3) *Embrione Torpediforme ad archi incompleti,*
- (4) *Embrione topedinetta bianca ad archi completi,* and
- (5) *Embrione topedinetta macchiata e senza filli esterni branchiali.*

The specimens (pl. vii, figs. 7, 8) described below are of interest in that they belong to a stage intermediate between stages 4 and 5 of De Sanctis.

Disc ovoid, incomplete, owing to anterior region of pectorals not having fully developed and fused with the disc. Snout prominent, knob-like, rounded at the end. Nostrils small. Anterior narial valves quite separate from one another, not having fused as yet; posterior valves very small and not fully developed. Mouth small, nearly straight, protruding above the surface and

¹ *Proc. Roy. Soc. London* XLIX, p. 363 (1891).

² *Ann. Mag. Nat. Hist.*, (6), X, pp. 4, 5 (1892).

³ *Mitt. Zool. Stat. Neapel* XVI, pp. 365-408, pls. xii-xiv (1903-1904).

⁴ *Zeitschr. Wiss. Zool.* LXXXVIII, pp. 499-545, pls. xxx, xxxi (1907).

⁵ *Atti R. Accad. Sci. Fis. Mat. Napoli* V, pp. 1-62, pls. i-iv (1873).

with well-developed longitudinal folds of skin surrounding it. Eyes large, protruding, much larger than the spiracles. Spiracles semi-lunar with a smooth margin. Dorsal fins small; second much better developed than the first. Pectorals horn-shaped, with a convex outer edge and with feebly developed fin-rays. Ventrals a little more than half the size of the pectorals. In a male specimen small elongate lobes of skin are separated off on the inner side as the clasper rudiments. Tail less than half the total length, with a feebly-developed caudal.

Measurements of a ♂ specimen (in millimetres).

| | |
|-----------------------------------|------|
| Length of disc | 27·8 |
| Maximum breadth of disc | 8·2 |
| Length of snout | 5·1 |
| Interorbital distance | 3·4 |
| Mouth to vent | 8·1 |
| Tail | 14·9 |
| Length of yolk-stalk and yolk-sac | 20·9 |

The yolk-stalk is well developed and enters the body a little in front of the anterior edge of the pectoral fins. The sac is a large, somewhat triangular, bag-like structure and has the lower surface thrown into folds. The branchial filaments (pl. vii, fig. 9), which are to be seen protruding out of all the gill-openings, are long but few in number at this advanced stage of the embryo.

The specimens preserved in rectified spirit, after fixation in formaldehyde (10%), are of a creamy colour, the yolk sac, however, is more yellowish.

