ON AN INSTANCE OF HERMAPHRODITISM IN THE ELECTRIC RAY, *NARCINE TIMLEI* (BLOCH AND SCHNEIDER)

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A specimen of the electric ray, *Narcine timlei*, collected from the trawl catches at Rameswaram on 12th November 1971, was found to be a hermaphrodite. The specimen measured 402 mm in total length. The important features of the male and female reproductive systems are described.

As pointed out by Atz (1964), "an outstanding feature of hermaphroditism in the elasmobranchs is its rarity". Nevertheless a few instances of hermaphroditism have been reported in sharks by Bamber (1917), Murray and Baker (1924), Arthur (1950), Chapman (1951), Fuller and Zacharov (1960) and King (1966) in *Scyliorhinus caniculus,* by Cadenat (1960) in *Centrophorus lusitanicus,* by Rowan (1929) in *Squalus acanthias,* and by Compagno and Springer (1971) in *Iago omanensis.* In skates only two instances of hermaphroditism have been recorded earlier by Matthews (1885) and Hoek (1894) and both these records are on *Raja clavata.* There does not appear to be any earlier record of hermaphroditism in rays. The present note deals with hermaphroditism observed in the electric ray, *Narcine timlei.*

The hermaphrodite electric ray was collected from the trawl catches landed at Rameswaram on November 12, 1971. The specimen measured 402 mm in total length and 209 mm and 193 mm in disc width and disc length respectively. The specimen had two partially developed claspers. A yellow substance resembling yolk material was seen extruding through the cloaca.

The female reproductive system is prominent and consists of paired ovaries and oviducts with oviducal funnels, shell glands and posterior dilated uteri. The female reproductive organs of the left side are well-developed while those of the right side are poorly developed as in normal specimens. The ovary on the left side is large and contains a number of ripe ova which are long and cylindrical with a large quantity of yolk. The ovary on the right side is small. A pair of oviducts which originate as oviducal funnels near the oesophagus and continue as narrow tubes to terminate posteriorly as dilated uteri are present. The shell gland is present at the junction of the narrow tubular portion of the

oviduct and the uterus. The oviducal funnel of the left side is larger than that of the right side probably because of the passage of the ripe ova through the former. The left uterus is considerably larger and more dilated than the right one. There are numerous long filamentous trophonemata about 4 mm to 7 mm

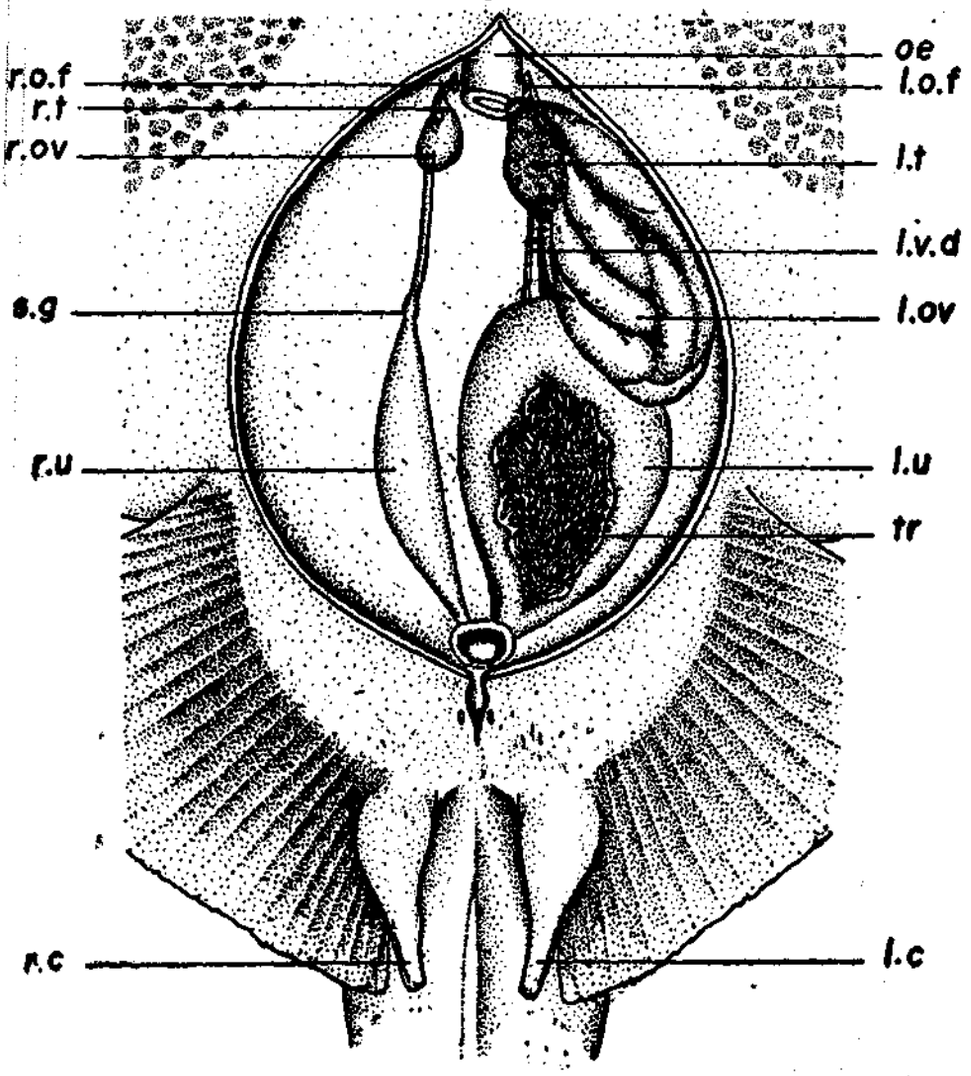

FIG. 1. *Narcine timlei.* Semi-diagrammatic drawing showing the reproductive system of the hermaphrodite electric ray.

l.c., left clasper; l.o.f., left oviducal funnel; l.o.v., left ovary; l.t., left testis; l.u., left uterus; l.v.d., left vas deferens; oe., oesophagus; r.o., right clasper; r.o.f., right oviducal funnel; r.ov., right ovary; r.t., righ testis; r.u., right uterus; s.g., smell gland; tr., trophonemata.

in length on the inner wall of the left uterus while in the right uterus the trophonemata are poorly developed. Four eggs have been observed in the left uterus.

The male reproductive system is represented by testes, of which that of the left side is prominent and situated anterior to the ovary closely attached to the later and that of the right side is rudimentary. The vas deferens could be traced only on the left side of the animal. It is a slender tube running straight along the oviduct to open into the uterus. The vasa efferentia could not be traced. A distinct seminal vesicle is not present though there is a slight dilatation of the vas deferens at the posterior end. On the right side of the animal the male ducts could not be made out.

A pair of claspers about 28 mm in length are present. The claspers are smaller in size compared to those found in normal males in which the claspers are long, stout and extend beyond the posterior end of pelvic fins. In the present abnormal specimen the claspers are not stout and they extend only up to the posterior end of the pelvic fins. The claspers are soft due to non-calcification and more or less flattened dorso-ventrally. The copulatory organs possess all the component parts as in normal males and have siphon glands associated with them.

It could be stated that the electric ray described above is functionally a female since the left ovary is mature and contains ripe ova and further a few eggs have been found in the left uterus. The male reproductive system is represented by a pair of testes, left vas deferens and a pair of claspers. The testis of the left side is fairly well-developed but immature while the right testis is rudimentary. The claspers are only partially developed and uncalclfied. It is not clear whether the presence of both reproductive systems is due to embryonic inter-sex condition or due to an incomplete sex change from male to female.

Remarks — Daniel (1934) has pointed out that a rudimentary testis is always associated with the ovary in the shark *Heptanchus maculatus*. A similar condition had been reported in *Hexanchus* sp. by Semper (1875). Apart from the above two species hermaphroditism is an abnormal feature in clasmobranchs. The abnormal hermaphrodites amongst elasmobranchs show large individual variations in the extent of development of the reproductive organs in different species. In sharks most of the instances of hermaphroditism reported are on *Scyliorhinus caniculus*. Bamber (1917) recorded a single specimen with secondary sex characters of male, testis on the left side, ovo-testis on the right side, right and left oviducts and male ducts, the latter opening into the right oviduct. Murray and Baker (1924) described a specimen with male secondary sex characters, small left clasper, normal ovary and two small testicular fragments. Arthur (1950) described four hermaphrodites; two specimens had male secondary sex characters, either right or left clasper deformed

and either ovary or testis with corresponding ducts; in the third specimen vestigial claspers and poorly developed ovary and oviducts were present; the fourth specimen had female secondary sex characters but for the presence of small claspers and female reproductive organs internally. King (1966) reported two specimens; in one specimen a ripe ovo-testis, oviducts, vasa deferentia, seminal vesicles and a single partially developed clasper were present while in the other one a ripe ovo-testis, oviducts and two small claspers were present and seminal vesicles were absent.

Abnormal females with mature ovaries and partially developed claspers have been recorded by Cadenat (1960) in *Centrophorus lusitanicus* and by Compagno and Springer (1971) in *Iago omanensis*. Springer and Lowe (1963) have mentioned about a specimen of the smooth dog shark *Mustelus higmani* with mature testes but without claspers.

Matthews (1885) recorded a hermaphrodite skate, *Raja clavata* with male secondary sex characters, fully-formed testes, male ducts and normal left oviduct. Hoek (1894) described a hermaphrodite specimen of the same species with normal left clasper, very much reduced right clasper, female reproductive organs and a testis-like structure on the left side internally.

The hermaphroditism reported here in *Narcine timlei* is an abnormal condition. In this hermaphrodite specimen only the female portion is functional and the male portion incomplete. Compagno and Springer (1971) have pointed out that in all the sharks with abnormality in the reproductive system reported so far the size of the shark was within the range of its functional sex at maturity irrespective of the external characters of the opposite sex. In *Narcine timlei* adult females are larger than adult males and in the present abnormal ray also, its size is within the range of its functional sex (female) at maturity.

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