

NOTES ON EGGS, LARVÆ AND JUVENILES OF FISHES FROM INDIAN WATERS

1. *Xiphias Gladius* Linnaeus

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INTRODUCTION

SINCE December 1957 plankton collections were being made from the West Coast and Wadge Bank during the cruises of the Research Vessel "Kalava" of the Indo-Norwegian Project which is utilised by the Central Marine Fisheries Research Station for oceanographic and fisheries investigations on a co-operative basis. During a cruise to Minicoy and some other islands of the Laccadive Archipelago in February 1958 I was able to collect a number of eggs, larvæ and juveniles of fishes. In the meanwhile I have had also the occasion to examine the larval and juvenile fishes collected from the Indian Ocean by the Danish "Dana" expedition of 1928-30 which were placed at my disposal some time ago for study. While the "Dana" collection will be treated separately, reference will be made to it whenever comparison is necessary, when dealing with other collections. It is proposed to describe specimens of special interest collected during the cruises of R. V. "Kalava" along with some other fish larvæ from coastal waters in the first few articles of this series.

The swordfish, *Xiphias gladius* has a worldwide distribution in all the warm seas and is of special interest as a powerful and pugnacious sportfish with a record weight of over 500 kg. The meat being of very high quality it is much sought after by commercial fishermen in some parts of Europe, America and Japan. It occurs in the Indian seas beyond the continental shelf and is only rarely caught by fishermen from coastal waters. In recent years specimens of swordfish have been brought to the Bombay markets occasionally but not being a familiar kind of fish they are reported to be sold very cheap. There is little information on the biology of the fish from the Indian seas though considerable attention is being paid to the study of the swordfish and other billfishes in the United States in the waters off Florida Coast where they support a very lucrative sportfish industry.

LARVA OF *Xiphias gladius* Linnaeus

A post-larva of *Xiphias gladius* was collected on 28-2-1958 at about 17.30 hrs. from Station No. 218, Lat. 10°·03' N, Long. 74°·10' E 30 miles east of Kalpeni Island in the Laccadives in an ordinary surface tow net. The characteristic elongated snout with spinous ridges and absence of ventral fins show beyond doubt that the larva is of *Xiphias gladius* (Figs. 1 and 2).

The specimen is 16.27 mm. in total length and 15.25 mm. in standard length. The head is about 2 in the standard length and the eye 8 in the head and nearly 5.5 in the snout. The upper jaw projects conspicuously beyond the lower and the former is provided with 36 teeth and latter with 39 teeth on each side. Those near the angle of the jaw are smaller than the rest. There are three interrupted groups of spines on the snout dorsally. There is a preorbital ridge with four spines and a supraorbital ridge with 8 spines. The preopercle has two closely set rows of spines the anterior with three spines and the posterior with two of which one is long and conspicuous. Just below the angle of the jaws there is a keeled ridge of five spines which after a short interruption extends forward along the side of the mandible with 6 spines. There is a conspicuous spinous projection with 2 spines dorsolaterally on the cranium with another smaller one having 2 spines in the temporal region. In addition to these there is a small spinous projection a little below and posterior to the cranial spines. Two very small spinous projections are present immediately below the post-cranial spine.

Table of measurements in mm.

Total L	Standard L	Head L	Snout L	Eye Diam.	Upper jaw	Lower jaw	Snout to dorsal	Snout to anal	Snout to vent.
16.27	15.25	7.65	5.31	0.97	6.39	5.65	7.59	11.71	11.59

L = Length.

Dorsal fin is single and is narrow at the anterior end and broader behind. Only 43 rays could be counted. A small portion of the preanal is present as a thin membrane immediately in front of the vent. Anal is slightly narrower than the dorsal and has 16 rays. Caudal is heterocercal and only 16 rays could be made out. Pectorals are rounded and all the fin rays are not distinct. Ventrals are absent.

Spinous scales arranged in rows give the body a conspicuously spiny appearance. There are two prominent rows on each side which run un-

interruptedly along the entire length of the body one dorsally and the other ventrally. Immediately below the dorsal and above the ventral rows are two shorter rows and between them a number of interrupted rows as shown in the figure. The scales have two and rarely three conical spines the bases of which are connected.

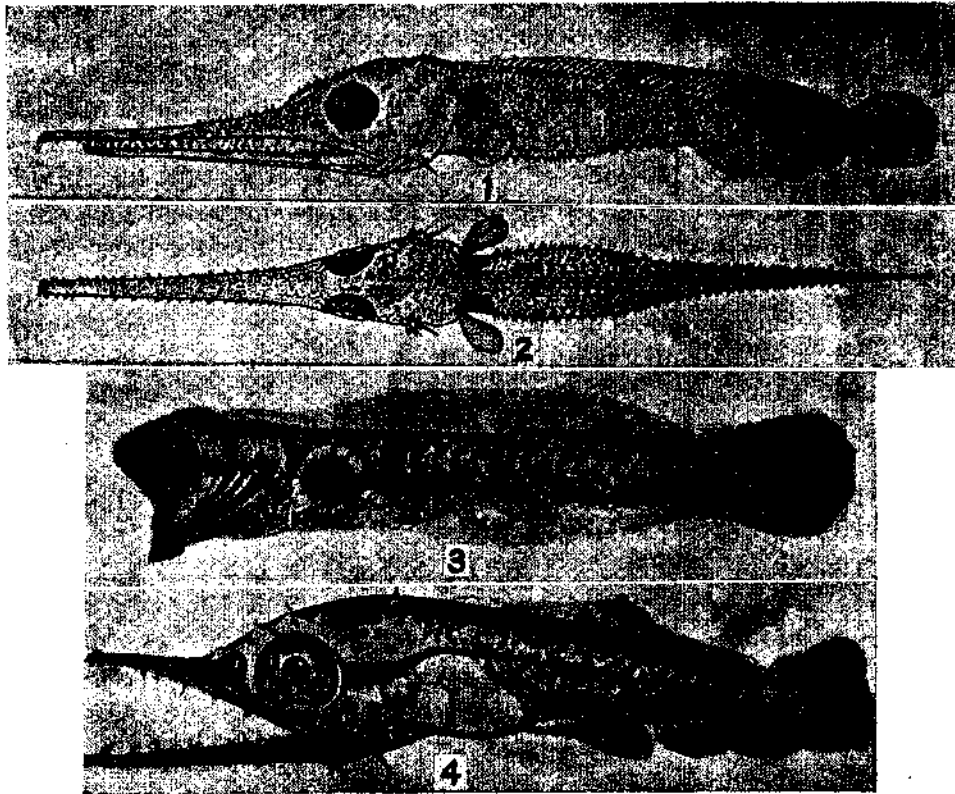


FIG. 1. Side view of 16.27 mm, *Xiphias gladius* collected from the Laccadive sea on 28-2-1958.

FIG. 2. Dorsal view of the above.

FIG. 3. *Xiphias gladius* 5.56 mm. long from the Mediterranean. Reproduced from Sanzo (1922).

FIG. 4. Larval *Xiphias gladius* 6.4 mm. long from the Mediterranean. Reproduced from Sanzo (1930).

The general colour of the specimen is brown in formalin. There is pigmentation of varying intensities all over the body except in the spiny ridges and pectoral fins. The snout is heavily pigmented on the dorsal side and so also the intraorbital space and the cranium. The body also is fairly heavily pigmented with the ventral side comparatively lighter in colour.

There are concentrations of chromatophores at the posterior end of the dorsal and anal fins. The barred pattern described by other workers in older stages is only very feebly discernible.

The paucity of information on the swordfish in the Indian seas has evidently lead Arata (1954) to state that this area appears to be relatively "barren". The only report of larval swordfish from the Indian Ocean is by Lutken (1880) from near Reunion Island east of Madagascar and by Tåning (1955) from the west coast of Sumatra collected by the Dana Expedition. The present record from the Laccadive Sea indicates that the fish breeds not very far from the west coast of India also. The surface temperature of the sea at the time of collection was 28.45° C. and the current was towards the south. The indications are that spawning would have taken place in February itself somewhere towards the north and the larva would have been drifted to this place by the current.

The breeding season of the swordfish in the Atlantic is from January to October, in the Mediterranean from June to September and in the north-west Pacific from April to September. Embryonic stages and early larvæ of *Xiphias* have been described by Sanzo (1910, 1922 and 1930) and Sella (1911) from the Straits of Messina in the Mediterranean, larval and juvenile stages from the Atlantic and the Pacific have been described by Arata (1954), Nakamura *et al.* (1951) and Yabe (1951) and post-larval stages from the North Atlantic by Tåning (1955). The specimen from the Laccadive Sea is intermediate between the 13.24 mm. stage figured by Sanzo (1922) and 18.2 mm. stage described by Arata (*op. cit.*) and very much similar to the 15.6 mm. stage described by Tåning (1955). There are no significant differences in the important characters among the above post-larvæ collected from such widely separated areas.

A feature of special interest that one will see in the early larval development as given by Sanzo (1922 and 1930) is the remarkably quick transition from the smooth bodied 5.56 mm. 7 days old larva hatched out in the laboratory to the 6.4 mm. larva collected from the field. The figures of these are reproduced here for comparison (Figs. 3 and 4). The earliest stage described by Arata (1954) is 6.1 mm. in standard length (total length 6.3 mm.) and though this has not been figured it is clear from the description that it has already developed the elongated snout and cranial, temporal and preopercular spines characteristic of the swordfish larva. In the 5.56 mm. stage the head length is only $\frac{1}{4}$ the standard length while in the 6.1 mm. stage it is $\frac{1}{2}$ the standard length. Differences within the above sizes are so marked that it will be interesting if intermediate stages could be obtained and the process of transition studied.

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