

ON THE NATURAL HISTORY OF *KOWALA THORACATA* CUV. & VAL., WITH SPECIAL REFERENCE TO ITS GONADS AND EGGS.¹

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The beautiful sardine *Kowala thoracata* Cuv. & Val. yields an important seasonal fishery on the west coast of India, and has consequently been one of the subjects of study in the Marine Biological Station, West Hill, Calicut, since 1930. The species was first described by Cuvier and Valenciennes² under two names *Kowala thoracata* and *Meletta lile*, but Regan³ has shown that the two names refer to the same species for which he selected the name *Kowala thoracata* presumably on the basis of its page priority. Regan gives the range of distribution of this fish as "Kurrachee to New Guinea", while according to Fowler⁴ *Clupeoides lile* is found from "Western India to East Indies and Tahiti"

The fishery of this sardine commences on the West Coast in July and lasts till March. According to the statistics collected by the Department of Fisheries, Madras, on an average about 10,000 maunds valued at Rs. 17,000 are caught annually from the Malabar and South Kanara coasts. It is mostly consumed fresh, but the surplus in the case of heavy catches is salted and dried.

Food.—*Kowala thoracata* feeds on plankton. The following organisms have been found in its stomach-contents :

I.—*Zooplankton.*—(1) Copepods consisting chiefly of *Paracalanus* sp., *Acartia* sp., *Oithona* sp., (2) *Evadne* sp., (3) Crab-Zoea, (4) Larval bivalves, and (5) Fish-eggs.

II. *Phytoplankton.*—(1) Species of *Coscinodiscus*, such as *C. jonesianus*, *C. gigas* var. *dioramma*, and *C. oculus-iridis*, (2) *Fragilaria* sp., (3) *Chaetoceras lorenzianum*, (4) *Thalassiothrix nitzschoides*, (5) *Ceratium massiliense*, (6) *Peridinium depressum* and *P. ovatum*, (7) *Tintinnus* sp., (8) *Dinophysis homunculus*, and (9) *Biddulphia* sp.

Kowala thoracata appears to be destructive to fish-eggs and in one instance its food was found to consist mainly of eggs of the South Indian mackerel, *Scombrus microlepidotus*. It is very likely that it follows spawning shoals of fish and feeds on their eggs. This may be responsible for the natural fluctuations in the abundance of the fishes on whose eggs it feeds.

Size, Maturity and Spawning Season.—Specimens ranging from 60 mm. to 120 mm. in length have been collected. Day⁵ mentions that the species attains "about 4 inches in length" Young specimens less than 60 mm. have not been found in the commercial catches.

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² Cuvier, G. and Valenciennes, A., *Hist. Nat. Poiss.* XX, p. 363, 378 (1847).

³ Regan, C. T. *Ann. Mag. Nat. Hist.* (9) X, p. 588 (1922).

⁴ Fowler, H. W., *The Fishes of Oceania, Mem. Bernice P. Bishop Mus.* X, p. 31 (1928).

⁵ Day, F., *Fishes of India*, pp. 638, 639, pl. clxii, fig. 1 (1878).

Fish measuring 100-110 mm. formed the bulk of the specimens sampled and examined. Sexual maturity is attained when the fish reach a length of about 90 mm.

Specimens partly or fully spent were seen in February 1936. In December 1938, female specimens with fully mature transparent ova were obtained. It may, therefore, be inferred that spawning season of this sardine roughly ranges between the months of November and February.

Reproductive organs and eggs.—The left ovary and the left testis only are functional. The right ovary and the right testis are vestigial, as sections showed neither oogonia nor spermatogonia respectively. One would expect this character to be included among the generic characters of the genus *Kowala*, but the fact that it has not been done indicates that this has not been noticed previously. A sinistrorse emphasis in the organisation of animals is found in other groups as well, as for instance, in the survival and development of the organs on the left side of the Echinoderm larvae, the functioning of the left ovary and oviduct in Aves, and the functioning of the left ovary in Monotremes. In the last two cases the males are not affected, whereas in *Kowala thoracata* both sexes are affected. This phenomenon of sinistrorse emphasis coupled with the dexteratrophy either in one sex or in both sexes is not easy to explain. What factors were instrumental in the organs of one side in the ancestors of a bilaterally symmetrical animal becoming reduced and those of the other better developed, and why should the left have got the stress and not the right? These are problems for the animal physiologists and embryologists.

On 1st December, 1938, female specimens with mature transparent ova occurred in the catches. Artificial fertilisation resulted in the formation of the vitelline membrane indicating perhaps fertilisation. The fertilised egg is a typical clupeoid egg with vacuolated yolk and a large space between the egg-proper and the vitelline membrane. A number of yellow oil-globules are found in each egg, the number varying from four to eight. The entire egg including the perivitelline space measure about 0.8 mm. in diameter. The number of eggs on an average in a ripe female is about 8,000 which is a comparatively low figure for a clupeid. Even making allowance for the atrophy of the right ovary, the fecundity of this sardine is low when compared with that of the herring (*Clupea harengus*) and the pilchard (*Clupea pilchardus*) which lay about 30,000 and 60,000 eggs respectively.