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

XI. Further Observations on the Genus *Auxis* Cuvier

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Introduction

Two species are known under the genus *Auxis* and both have been recorded from Indian coasts (Jones, 1958; Jones and Silas, 1960). Of these the short corseletted form, *A. thazard,* is found in all the warm seas while the long corseletted form *A. thynnoides* is considered to be confined to the Indo-Pacific. However, Matsumoto (1959) has expressed the view that the species occurring on the Atlantic coast of America has a long corselet, which if confirmed, would change considerably our distributional concept of the two species. While there is no doubt about the existence of two species of *Auxis* in the Indo-Pacific, it is obvious that their nomenclature requires further elucidation (Jones and Silas, MS.).

In one of the earlier articles in this series (Jones, 1960) larval stages of *Auxis* sp. and juvenile stages of *A. thynnoides* collected from the seas around India were described. Since then it was possible to examine more material and also re-examine the specimens dealt with in the previous note which have helped to give some indications on the probable distinguishing features of the early stages of the two species.

I have described from the Laccadive Sea (Jones, *op. cit.*) a few stages of *Auxis* measuring from 3·36–7·94 mm. but the specific position was left inconclusive. It was however stated that "Though both the species occur in the Indian waters, so far only *A. thazard* has been recorded from the Laccadive Sea from where these specimens have been collected and the possibility is that the larvae described could be of this species. But the chances of *A. thynnoides* also occurring there are equal and therefore any inference could only be tentative" (Jones, *op. cit.*, p. 341).

The main distinguishing features between the two species are the nature of the corselet scales and the difference in the gill raker counts but these characters are not differentiated in the larval and early juvenile stages

and therefore we have to look in for some other points of difference to distinguish them. Subsequent to the publication of the account cited above, an examination of the larval scombroids collected from the Indian Ocean by the "Dana" Expedition (1928–30) kindly placed at my disposal by the Carlsberg Foundation revealed two kinds of *Auxis* larvae among specimens less than 9 mm. in total length, a comparatively stouter type with the length of the body less than 3 times the head in which the mid-lateral row of chromatophores in the caudal peduncle is prominent and a less stout type with the length of the body about 3 times the head in which the corresponding row of chromatophores in the caudal peduncle is not so prominent. Taking into consideration the juvenile and adult body proportions one is inclined to presume that the former (stouter type) could be *A. thazard* and the latter, *A. thynnoides*. The "Dana" material is being worked out in detail and will be reported on in due course but in the meanwhile the impressions gained as a result of recent studies on the genus *Auxis* are given here to draw the attention of other workers in the subject to problems requiring elucidation.

In this connection attention may be invited to the papers of Matsumoto (1958, 1959) wherein he has distinguished two types of larvae the characters of which were detailed in his second contribution. He had the opportunity to examine fairly extensive material covering the Atlantic (including the Mediterranean and the Gulf of Mexico), the Pacific and parts of the Indian Ocean. The distinguishing features referred to by him (Matsumoto, 1959) are more or less applicable to the two types of larval *Auxis* examined by me from the Indian Ocean.

Type I *Auxis* larvae are the stouter of the two kinds described by Matsumoto (*op. cit.*) and these could be considered as *A. thazard*. Actually, he had, in his earlier paper, assigned all of them except one under the above species. As regards *Auxis* type II which are comparatively elongated, they appear to belong to *A. thynnoides*. The same could be said of the larvae described by Wade (1951) from the Philippine Sea. It would appear that the long corseletted species *A. thynnoides* (= *A. tapeinosoma* of Wade) is very common in the Philippine waters. Mead (1951) has figured two specimens under *A. thazard* collected from the Pacific Coast of Central America which appear to belong to the stouter category. Yabe and Ueyanagi (1961) have described a 6·2 mm. larva of *A. tapeinosoma* (= *A. thynnoides*) from the Pacific. Mention may be made here of the 4 mm. specimen which was tentatively placed under *Auxis* by Kishinouye (1926). Though the figure is not quite clear it appears to resemble the stouter type. The only important work outside the Indo-Pacific on *Auxis* larvae is by Ehrenbaum (1924)

who has described a number of larvae from the Mediterranean under *A. thazard*. Here also we are confronted with indefiniteness since all the stages given by him under Fig. 8 except one, *viz.*, 8 *e*, appear to belong to the elongated type in which case they should be *A. thynnoides*. We have therefore to find out the correct identity of the species of *Auxis* occurring in the Atlantic and the Mediterranean as rightly pointed out by Matsumoto (1959).

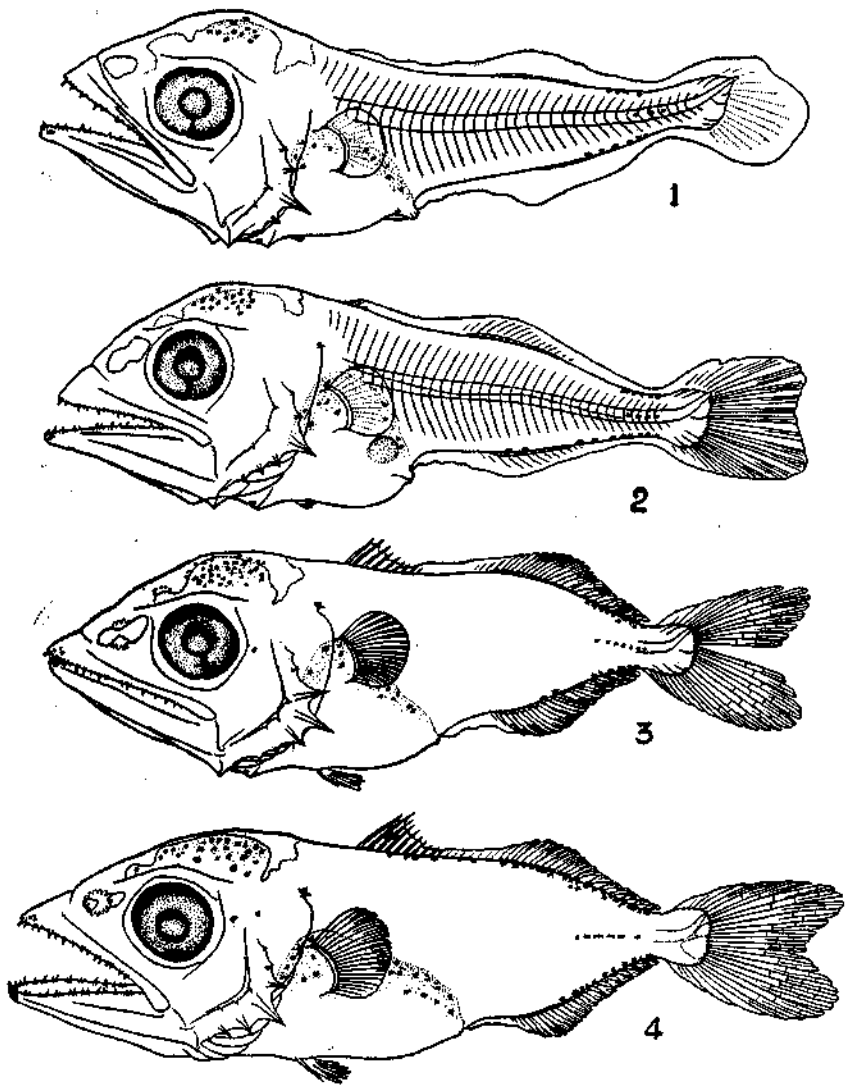
The contributions of Sanzo (1909) and Mito (1961) relate to very early stages and are therefore not discussed here.

On the above basis of separation of the two species it is found that in the Indian Ocean material examined by me larval *Auxis thazard* is more widely distributed than *A. thynnoides* which are comparatively fewer in number and are confined only to some areas close to the African Coast (Jones and Kumaran, MS.). The hauls taken from the Dana Station No. 3946 (lat. 3° 26′ S., long. 42° 58′ E.) on 3–1–1930 were most rich in larval *Auxis*, both species of which were found in the collections. A few stages belonging to the two types are briefly described here. Detailed descriptions are not attempted since figures and body measurements are given. Though the specimens were in a fairly good state of preservation the chromatophores appear to have faded to some extent in many on account of long preservation and therefore their correct depiction have become difficult. The figures therefore may not be quite comparable in the above respect with those drawn from fresh material.

Auxis thazard Lacépède

The size range of *A. thazard* in the collection is from about 4–15 mm. Of the above, 5 stages measuring 4·97 mm., 6·58 mm., 8·78 mm., 10·25 mm. and 14·42 mm. in total length are figured and some of the salient features are pointed out, drawing attention to existing descriptions of comparable stages recorded from the Indo-Pacific.

4·97 mm. larva (Fig. 1).—This stage though slightly larger is somewhat comparable to the 4·5 mm. larva described and figured by Matsumoto (1958) first as *A. thazard* and subsequently (Matsumoto, 1959) under *Auxis* type I and the 4·4 mm. stage of *Auxis* sp. described by me from the Laccadive Sea (Jones, 1960). In the Dana specimen the pelvic fins could be seen as small projections on the ventral side immediately behind the symphysis of the pectoral girdle. In other respects it is similar to those described by earlier workers.



FIGS. 1–4. Larval stages of *Auxis thazard*. Fig. 1. 4·97 mm. (lower jaw partially reconstructed). Fig. 2. 6·58 mm. (the stomach appears distended due to some fish larva it had eaten, the eye of which is faintly visible as a dark circular patch). Fig. 3. 8·78 mm. Fig. 4. 10·25 mm.

6·58 *mm. larva* (Fig. 2).—The nearest corresponding stage in the earlier descriptions is the 7·05 mm. larva by Matsumoto (1958) from the Pacific which he first gave under *A. thazard* and subsequently under *Auxis* type I (Matsumoto, 1959). The anterior spines of the first dorsal have begun to appear at this stage in the specimen under description. They are how-

TABLE I

Measurements of Auxis thazard *larvae in mm. from "Dana" Station No.* 3946 *(lat.* 3° 26′*S., long.* 42° 58′ *E.) collected on* 3–1–1930

Sl. No.	Station	T.L.	St.L.	Head	Max.W.	Snout	Eye	Sn. to D.	Sn. to vent
1	3946 III	4·97	4·39	1·62	1·36	0·62	0·57	1·93	2·35
2	,,	6·58	5·75	2·25	1·93	0·83	0·68	2·51	3·24
3	,,	8·78	7·47	3·40	2·51	1·30	0·99	3·40	4·60
4	,,	10·25	8·53	3·71	2·77	1·38	1·04	4·02	5·69
5	,,	14·42	12·05	4·50	3·50	1·72	1·30	5·13	7·84

ever not present in the 6·8 mm. larva of *Auxis* described by Wade from the Pacific and which is now presumed to be *A. thynnoides.*

8·78 *mm. larva* (Fig. 3).—There is no stage described earlier which could be considered comparable to this. This comes in between the 9·7 mm. stage described by Matsumoto (1958 and 1959) and the 7·94 mm. larva recorded by me from the Laccadive Sea (Jones, 1960). The resemblance between the "Dana" specimen and the one described by Matsumoto (*op. cit.*) is striking. In both the first dorsals are devoid of chromatophores and the preanal length of the body exceeds the postanal length.

10·25 *mm. larva* (Fig. 4).—This stage is comparable to the 11·2 mm. stage described and figured by Matsumoto (*op. cit.*) and the 11·5 mm. stage described by Mead (1951). The spinous dorsal shows pigmentation and the dorsal row of chromatophores have extended to the base of the first dorsal. The snout shows two distinct nasal apertures on each side and teeth are larger and more in number than in the previous stage. The vent has shifted posteriorly making the preanal conspicuously longer. The longest preopercular spine at this stage continues to project beyond the operculum. After reaching a length of about 11 mm. there appears to be a distinct elongation of the body.

14·42 *mm. larva* (Fig. 5).—The only description of *Auxis* larva nearest to this size is of the 13·2 mm. larva described by Matsumoto (1959). The

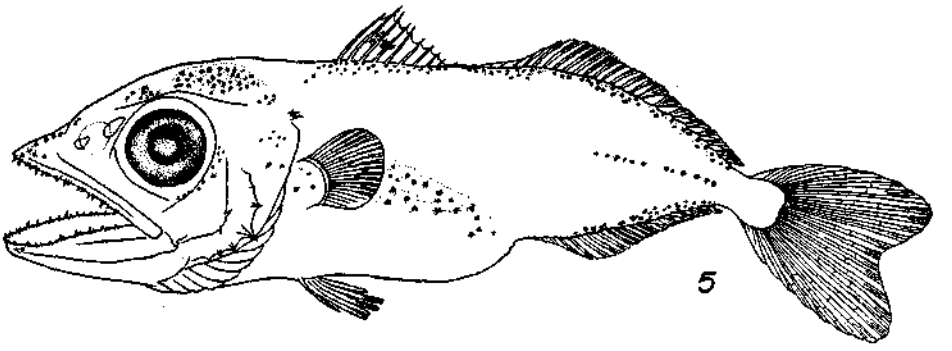


FIG. 5. *Auxis thazard* larva 14·42 mm.

anterior portion of the body, especially the abdominal region, has elongated considerably and the vent comes to be situated nearly in line with the origin of the second dorsal. There is an appreciable increase in chromatophores. The preopercular spines are reduced in size and the longest hardly projects beyond the operculum.

Larvae older than the above which could almost be considered as early juveniles have been described by Mead (1951) and Matsumoto (1959). They measure 18·0 mm. and 25·0 mm. respectively.

Auxis thynnoides BLEEKER

The sizes of larvae in the "Dana" collection presumed to belong to *Auxis thynnoides* appear to range from about 4 mm. to nearly 9 mm. According to Matsumoto (1959) the series of specimens belonging to *Auxis* type II which I consider to be *A. thynnoides* "stops at 8 mm., and all specimens above this size are referable to type I" (Matsumoto, *op. cit.*, p. 25). It is interesting that the situation is more or less the same with regard to the "Dana" material studied by me from the Indian Ocean.

4·46 *mm. larva* (Fig. 6).—This stage is more or less comparable to the 5·1 mm. larva described by Wade (1951) and the 5·2 mm. larva described by Matsumoto (*op. cit.*). The difference between this and 4·5 mm. *Auxis* type I larva of Matsumoto (1959) and 4·40 mm. larva of Jones (1960) which are now presumed to be *A. thazard* is striking.

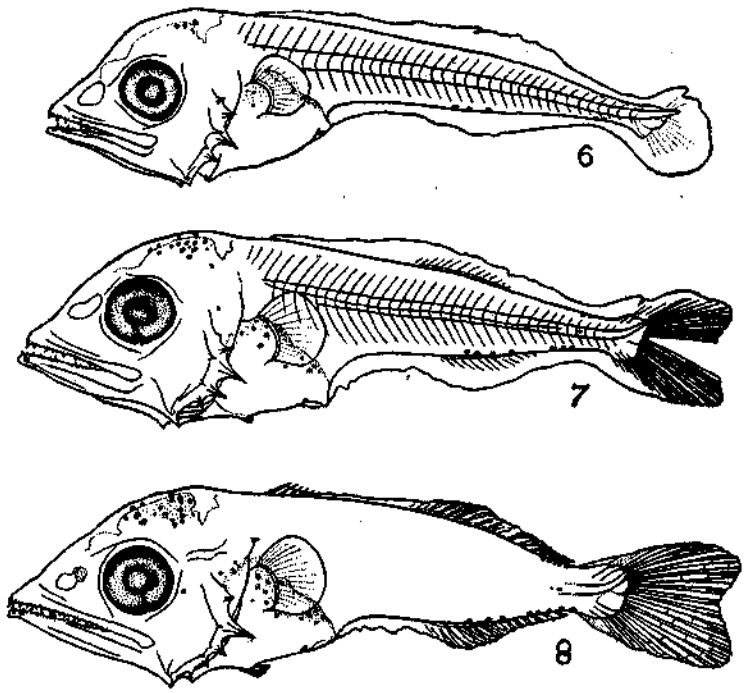
6·54 *mm. larva* (Fig. 7).—This is comparable to the 6·8 mm. larva described by Wade (1951) and to some extent to the 7·2 mm. *Auxis* type II larva of Matsumoto (*op. cit.*). Pigmentation on the body is much less than in the *thazard* type of larvae of corresponding size described by Matsumoto (1959) and Jones (1960).

TABLE II

Measurements of Auxis thynnoides *larvae in mm. from "Dana" Station No.* 3946 (*lat.* 3° 26′ *S., long.* 42° 58′ *E.*) *collected on* 3–1–1930

Sl. No.	Station	T.L.	St.L.	Head	Max.W.	Snout	Eye	Sn. to D.	Sn. to vent
1	3946 I	4·66	4·34	1·41	1·30	0·42	0·42	1·72	1·98
2	3946 II	6·54	5·64	1·93	1·72	0·73	0·63	2·25	2·83
3	3946 I	8·68	7·77	2·77	2·19	1·09	0·89	2·98	3·82

8·68 *mm. larva* (Fig. 8).—No larva of comparable size has been described earlier which could be placed under *A. thynnoides*. Except for the shorter length of head and comparatively less pigmentation it is difficult to distinguish the specimen from *thazard* type of larva.



FIGS. 6–8. Larval stages of *Auxis thynnoides*. Fig. 6. 4·66 mm., Fig. 7. 6·54 mm. Fig. 8. 8·68 mm.

It is interesting that recent studies on *Auxis* larvae by different workers have brought to light the presence of two types distributed in all the three oceans. On the basis of existing knowledge what they actually represent could only be a conjecture and the need for further investigations especially towards the correct determination of the species under the genus and their distribution is indicated. The identification of the larvae described in this note is therefore only provisional.

My previous note (Jones, *op. cit.*) dealt with 26 juvenile specimens collected from Vizingam near Trivandrum on the west coast of India which were placed under *A. thynnoides*. From a re-examination of the above material it would appear that serial numbers 1 to 14 given under Table II on page 342 of the above paper cannot be assigned with any extent of definiteness to *A. thynnoides* as has been done, while there is no doubt about the identity of the rest of the specimens as both the nature of the corselet scales and gill raker counts show that they belong to *A. thynnoides*. There is a size difference of about 50 mm. between the two lots and in the absence of intermediate stages it would be more appropriate to place the first 14 specimens under *Auxis* sp. rather than under *A. thynnoides*. In fact, in the absence of scales if we rely on the gill rakers alone, which appear to develop early in both the species, one will even be inclined to place them under *A. thazard*.

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