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DEPARTMENT OF AGRICULTURE AND TECHNICAL
INSTRUCTION FOR IRELAND.

ON A YOUNG STAGE OF THE
WHITE SOLE, PLEURONECTES
(GLYPTOCEPHALUS) CYNOGLOSSUS.

BY

E. W. L. HOLT AND L. W. BYRNE.

(Appendix No. IV. to Part II. of the Report on the Sea and Inland Fisheries
of Ireland for the Year 1901.)

APPENDIX, No. IV.

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PLATE III.

Our present knowledge of the life history of this species, shortly summarised in Cunningham's "Marketable Marine Fishes," p. 233 (1896), and McIntosh and Masterman's "British Marine Food Fishes," p. 372 (1897), is derived from the following papers:—

Cunningham, P.R.S., EDIN., XXXIII., p. 101 (1886), ovum, vitelligerous larva, 3·99—5·9 mm.

Holt, Sci. Trans. R. Dub. Soc., ser. 2, IV., p. 455 (1891), ovum, V., p. 84 (1893), ovum, vitelligerous larva and early stage after absorption of yolk, 4·16—5·57 mm.; young, 42 mm.

Petersen, Rep. Danish Biol. Station, IV., p. 126 (1893), young 45 mm.

Goode and Bean, Oceanic Ichthyology, p. 430 (1895), young 57 mm.

We have in these papers a fairly complete account of the development and life-history of *P. cynoglossus* from the ovum to the termination of the vitelligerous stage of the larva at a length of 5·5 to 6 mm. Of its subsequent development nothing has been definitely known until the left eye has reached the summit of the head and the young fish has adopted the habits of the adult. This stage has been figured by Goode and Bean from the western side of the Atlantic; and somewhat more advanced specimens, from European waters, in which the migration of the eye has been completed, although the actual length is less, have been described and figured by Petersen, and by one of the present authors. To these stages should, in our opinion, be added (as will hereafter appear) the young pleuronectid of 32 mm. described by Petersen (*loc. cit.*, p. 130, fig. 20) and attributed by him, not without some hesitation, to the halibut (*Hippoglossus vulgaris*) rather than to the species now under consideration.

The length of the specimen which gives occasion for this note is 25·5 mm., of which the caudal fin occupies 3·5 mm.; the fin-ray formula is D. 108, A. 95; the vertebral centra cannot be accurately counted, but are certainly many more than fifty in number. Miss Woodward's drawing renders further detailed description unnecessary.

We refer it without hesitation to *P. cynoglossus* for the following reasons:—

(1.) The fin-ray formula, which is normal for *P. cynoglossus*: there are far too many anal rays for *H. vulgaris* or *P. hippoglossoides*.

* Witch (England), Craig-fluke (Scotland). For commercial purposes the Irish and English names are often also applied to the megrim or ox sole, *Rhombus (Lepidorhombus) megastoma*, a fish of less market value.

(2.) The elongated form and numerous vertebrae: the subgenus *Glyptocephalus*, Gottsche, is characterized by a very high number of vertebrae for pleuronectids; *P. cynoglossus* has 58, (*H. vulgaris* has about fifty only).

(3.) It agrees well in size and form with the known larvæ of *P. cynoglossus*, described by one of us from neighbouring localities. For comparison's sake it may be mentioned that a dab in the same stage as *P. cynoglossus*, 42 mm. long, is 15 to 16 mm. in length, while a dab in the same stage as the specimen under consideration (25.5 mm.) is about 10.5 mm. long, and the proportional increase in growth is almost identical.*

Petersen's larva, alluded to above, had a fin-ray formula of D. 104, A. 88, and was of a similarly elongated form, besides agreeing with our larva in the spinous armature of the gill-cover shortly to be noticed, and should therefore, in our opinion, be attributed to the same species.

P. cynoglossus, especially when immature, appears normally to live in water of greater depth than any other pleuronectid found on our coasts, excepting, perhaps, *Rhombus megastoma*, *Rhombus Boscii*, and the little-known *Solea Greeni*; on the Irish survey the young were always found in deep water, and the specimen now under consideration was taken in an ordinary tow-net sunk to 90 fath. on the eastern edge of the Porcupine Bank (90 mi. S. by W. $\frac{1}{4}$ W. of Cleggan Head, 175 fath.), 7th June, 1901.

The large number of vertebrae and porous nature of some of the bones of the head found in *Glyptocephalus* are, no doubt, correlated with a deep-sea habitat, and it is not improbable that the long duration of the pelagic stage and large size attained by *P. cynoglossus* before assuming the form and habits of the adult may be, in part, due to the same cause. A far more interesting feature in the development is the presence on the gill-cover of a spinous armature (see Fig. 3). Although the larvae of the "Psettinæ"† genera, *Rhombus* (*Psetta*) *Phrynorhombus*, and *Zeugopterus* have long been known to pass through a spine-bearing stage, we are not aware of its having been elsewhere found in a "Pleuronectine"‡ flat-fish. This spine-bearing stage appears to throw considerable light upon the origin of the Pleuronectidae. It seems reasonably plain that the presence of spines on the head or operculum cannot possibly be of any use to a fish which habitually lies with one side upon the bottom or even upon a perpendicular rock-face, and is far more likely to be an ancestral character derived from some such early Zeorhombine or Berycoid form, as Boulenger‡ suggests.

The presence of such spines in the Psettinæ Pleuronectids alone might perhaps be regarded as a secondary character; but when they are found to reappear in the only Pleuronectine form which we know to have a long larval history§ it seems difficult to interpret

* In such comparisons a margin must be allowed for the individual variation of length (in regard to stage of metamorphosis) so frequently observed in young flat fishes of any species.

† We only employ these terms as a matter of convenience, and in no way agree that there is any necessity to subdivide the *Pleuronectidae* into families and sub-families, as has sometimes been done.

‡ Ann. Mag. Nat. Hist., ser 7, X. 295 [1902].

§ As inferred by the large size attained before the completion of the metamorphosis.

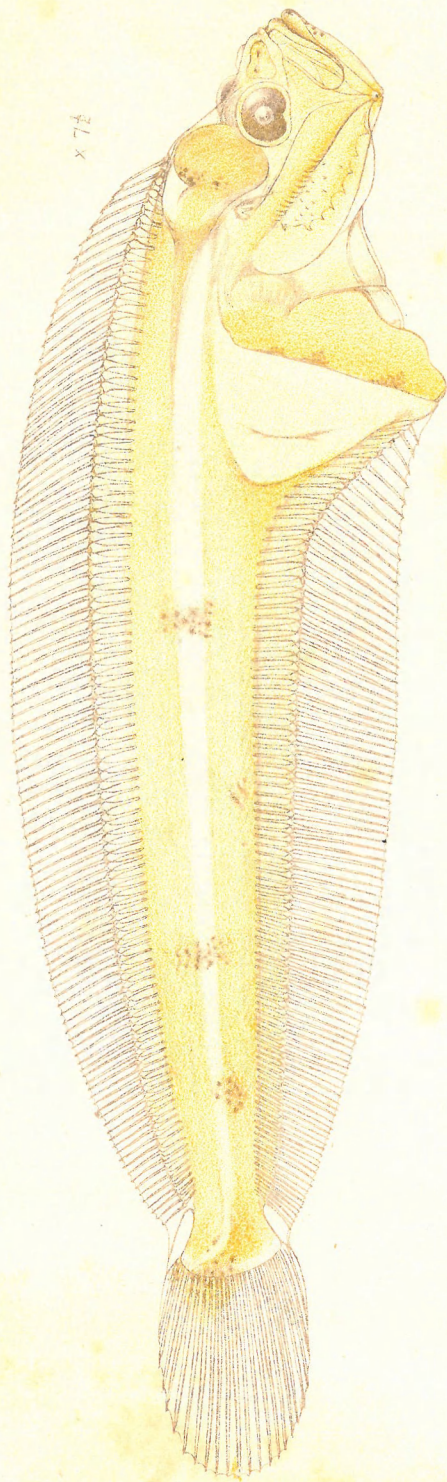
their presence otherwise than by supposing that the spine-bearing stage has been suppressed in the life-history of the Pleuronectine forms inhabiting shallow water. In these the early assumption of the adult form is commonly correlated with a migration to the extreme sandy margin in the spring and summer, where the conditions of life would be unfavourable to an incompletely metamorphosed larva. It is possible that small bottom-living animals, suitable for the food of the younger stages of a pleuronectid, are less abundant in the deeper water to which *P. cynoglossus* is at all known stages of its life-history confined. If this were so the retention of a prolonged larval history or its extension would be a necessary item in the evolution of the species. It is true that the dab (*Pleuronectes limanda*), though perhaps most abundant immediately after metamorphosis in shallow water, contrives to find a living at the same stage at depths well within the range of the adult white sole;* but the dab, at least when adult, is more markedly omnivorous than any other Pleuronectid of our acquaintance. An extended larval phase is not invariably associated in Pleuronectids with a deep-sea habitat, as is shown by the life history of *Arnoglossus Grohmanni*,† a small fish, confined in the adult form to shoal water, the larva of which, having regard to the ultimate size of the two species, attains dimensions relatively greater than the larva of the white sole.

The latter presents among British Pleuronectines structural characters which go far to justify its exclusion from the genus *Pleuronectes*, and as it recedes from this genus it tends to approach, in the number of its vertebræ and fin-rays, deep-sea habitat, and, perhaps, its larval history also, the Hippoglossine forms. The remaining forms may be roughly arranged in a series *P. microcephalus—limanda—platessa—flesus*, marked by (i.) the adoption of a more and more inshore habitat, (ii.) a decreasing number of vertebræ and fin-rays, and (iii.) a more and more restricted larval history.

* Advanced larvae of the white sole have, however, only been found so far at depths beyond the range of the dab; so the zones of depth suited to earliest bottom-living stages of the two species may be separated by a fairly wide interval, abridged in later life by the shoreward migration of the white sole.

† Previously known on the Irish coast by a few specimens at scattered localities *A. Grohmanni* has, since 1890, proved to be common in shallow water in Ballynakill and Bofin harbours, and Cleggan bay, Co. Galway. In the adult form its range seems to be, in British and Irish waters, from tide marks to about ten fathoms.

2



x 7 1/2



1



x 30

3

GMW. Woodvard del. et lith.

Pleuronectes cynoglossus.

West. Newman chromo.

