NOTES AND MEMORANDA.

Polyprion cernium, Val.—Two specimens of this fish, the stone basse or wreck-fish, were obtained on September 21st. The one was sent by Mr. Dunn, of Mevagissey, the other captured by hook and line off Plymouth. The first specimen measured 19½ inches, the second 20½ inches.

It is singular that two of these fishes, which are by no means common, should have occurred at the same time. If the statement to the effect that these fishes are in the habit of following wreckage be true, it may be that several have arrived off our coast in this manner. The fish is common at Madeira.—W. L. C.

Scomber scomber, Linn (the Mackerel).—In sorting some young fish, chiefly the "mackerel midges" of *Motella tricirrata* which were taken at the surface at the end of July by Mr. F. Klotz, of the s.s. "Dominican," I found three specimens which prove to belong to this species, of which the later larval stages had not hitherto been recognised.

The total lengths are respectively 13·75, 16·5, and 18·5 mm. In the largest specimen the head and abdomen are about equal in length, and together a little longer than the caudal region, exclusive of the caudal fin. The eye and the snout are each about one third, and the greatest height of the body is about three quarters of the length of the head. The general shape of the fish is very much the same as that of the young Temnodon figured by Agassiz (*Young Stages of Osseous Fishes*, Proc. Am. Ac. Art. Sci., vol. xiv, 1878, pl. ii, fig. 5), but the upper jaw is slightly the longer. The caudal, which is completely metamorphosed, is separate, and appears to be notched in a similar manner, but is rather damaged in all my specimens. The same interval occurs between the anus and the anterior anal rays as in Temnodon. The differences in the rays of the permanent dorsal and anal fins, which are visible in the persisting embryonic fin-membrane of those regions, are also those of the adults. In my examples the first dorsal occupies the adult position, separated by a wide interval of embryonic membrane from the second. The ridges from which spring the rays of the continuous anterior parts of the permanent second dorsal and anal fins are continued

backwards towards the caudal peduncle, and are strongly notched at intervals. Each notch marks the site of one of the finlets of the adult, but at the present stage it is occupied only by a single stout ray. There are five such isolated rays in the anal fin of the specimen of 16·5 mm. (in which the fins are the most expanded), thus corresponding in number to the finlets of the adult.

The colours in spirit specimens are as follows:—In the largest specimen the eye, gill-cover, and sides of the abdomen are silvery. There is a large deep black patch on the top of the head, due to pigment in the pia mater of the optic lobes; some smaller black patches occur on the snout, jaws, and isthmus. There is a dark line along the dorsum and at the base of the anal fin. From these lines dark pigment dots extend along the myomeres to the lateral line, the region of which is thickly powdered with such dots. The two smaller specimens differ only in exhibiting less pigment on the sides of the body, very little being present in the smallest, in which also the silvery matter is so little developed as to allow the black peritoneal pigment of the abdominal roof to be clearly visible.

In the early part of the same month I took at the surface a few much smaller fish, to which at the time I devoted little attention beyond noting the light blue colour of the eye, and the presence of yellow amongst the black pigment of the top of the head and abdomen. They are all rather badly injured, but the larger amongst them, about 9·5 mm., approach the smallest of the series previously described in the shape of the head and the distribution of black pigment. The permanent dorsal and anal fins are not yet represented, so afford no assistance. The differences in the proportions of the pre- and post-anal regions are not more than might be expected in the same species at such different stages. The smallest specimen sufficiently well preserved to be of any use measures 7 mm., and while certainly belonging to the same species as that of 9·5 mm., it also approaches the oldest stage to which I have been able to rear mackerel larvæ from the egg. The largest of such measures 4·88 mm., and the black pigment differs from that of the tow-net specimens only in quantity, and not in distribution. The large light blue eye, and the presence of yellow pigment in the regions indicated above, are features which both series possess in common.

Though, owing to the bad condition of the smaller tow-net specimens, absolute proof is wanting, I think it very probable that they are really mackerel. They were taken on the 8th July, about twenty miles N.N.E. (magnetic) of the Horn Reef Light-vessel, coast of Jutland. The locality and date of the larger specimens are mentioned elsewhere by Mr. Cunningham.—E. W. L. H.

Year-old Pilchards.—Since the last date mentioned in my paper in the previous number, our anchovy-nets have only been shot once, on April 23rd, when only eight pilchards were taken, all except one over 19 cm. (7½ inches) in length. But I was informed by W. Roach that a large number of sardine-sized pilchards were taken with a mackerel seine on May 23rd and June 8th in Whitsand Bay. We received one specimen of the former capture—it was 14·9 cm. long; and six specimens of the latter, which measured 15·4 to 16·6 cm.

Some of these yearling fish were said to have been sent to the Mevagissey factory to be tinned. Pilchard ova have been very abunndant in the tow-nets worked a few miles outside the Breakwater this September.—J. T. C.

Muggiæa atlantica.—Since the publication of my account of this Siphonophore in the previous number of the Journal I have obtained evidence that it appears annually in abundance in the neighbourhood of Plymouth South. I first noticed it this year in the produce of a somewhat large-meshed tow-net (mosquito netting) worked at a depth of about 20 fathoms, on the east side of the Eddystone, on August 25th; and soon after it appeared among the plankton collected a few miles outside Plymouth Breakwater. Towards the middle of September it became very abundant, and was secured in perfect condition and in various stages.

At the present date (September 26th) it still occurs, but its numbers have much decreased. Mr. Rupert Vallentin, of Falmouth, has drawn my attention to the fact that as long ago as 1849 a pelagic animal was described and figured by Charles Wm. Peach in the Twenty-ninth Report of the Royal Institution of Cornwall, which can be recognised as identical with *Muggiæa atlantica*. The title of the paper in which the description occurs is *Observations on the Luminosity of the Sea, with descriptions of several of the objects which cause it, some new to the British coasts.* The organisms I refer to are described in this paper under the name Diphydiæ, in which family is included also a Protozoan of the family Tintinnidæ. The description of the Siphonophore is by no means correct, the polypes of the eudoxomes being mistaken for ova; but the figures, though very rough and inaccurate, leave no doubt in my opinion that *Muggiæa* was the form which Peach had under observation. A remarkable feature of the paper is the record it gives of the pelagic organisms observed in successive months of the year in the course of four years, 1846 to 1849. In this record we find that in 1849, the "Diphydiæ" were observed for the first time on July 1st, and on July 20th occurred in thousands: in October they were also noticed. They are not mentioned in the observations of other years, but these were much less numerous, and the omission does not prove that *Muggiæa* did not occur in those years. Peach's collections were made in Fowey Harbour and just outside of it.—J. T. C.

Hippoglossus vulgaris, Linn. (the Halibut).—On the 30th April I succeeded in pressing some apparently ripe ova from a female halibut in the market. I had no opportunity of examining the ovary, but external pressure caused the extrusion through the genital orifice of a quantity of yellowish viscous putrid liquor, amongst which were a quantity of collapsed zonæ radiatæ, and the ripe ova referred to. The fish was dead, and appeared very stale. All the ova were dead and more or less decomposed, but some were sufficiently fresh to illustrate the living condition.

The diameter varies from 3·070 to 3·818 in my specimens; the yolk conforms to the condition met with in other dextral Pleuronectids, being colourless, translucent, and homogeneous, and destitute of an oil-globule. The zona is thin, measuring ·03 to ·04 mm. in optical section, and remarkably delicate and flexible.

Externally it is finely dotted; internally are a number of slight ridges, which give the whole structure the appearance of being irregularly scribbled with fine striæ. Laminæ are clearly visible, but radial pores cannot be seen in optical section in fresh preparations.

The ova are evidently pelagic, and the extreme delicacy and flexibility of the zona (which is such as to render it difficult to pick up an egg with the forceps without causing it to collapse) suggests that a large perivitelline space may be formed under natural conditions, since this takes place in the long rough dab (*Hippoglossoides limandoides*), which is the nearest relative of the form before us, and in which the conditions of the zona are very similar.

Ripe but unfertilized ova were obtained by Prof. McIntosh shortly afterwards, and from a brief note which he has published (Ann. Mag. Nat. Hist., July, 1892) it appears that some of them were a little larger than the largest of mine.

It is evident that the halibut's ova are not commonly to be met with along our coasts, since such relatively enormous structures could not fail to have attracted attention in the tow-nets.—E. W. L. H.

Rhombus maximus, Linn. (the Turbot).—I am not aware that the ova of this important species have ever been described in sufficient detail to ensure their recognition if met with in the contents of the tow-net, nor is there any description whatever of the embryonic and larval stages.

Ova taken from a number of females at Grimsby and on the North Sea showed but little variation, the usual diameter being 1·01 mm., and the extreme sizes ·99 and 1·06 mm. The oil-globule is nearly always ·21 mm., but may be as small as ·18 mm. Thus the ova of ·77 mm., supposed by Wenchebach to be ripe, must have been unusually small if they were really in that condition.

The yolk is colourless and homogeneous, but the oil-globule in recently spawned ova has a very pale ochreish tint. This is hardly visible unless a great number of ova are together in a vessel, when the globules impart their colour to the whole mass. Under similar conditions the ova of the brill (*R. bevis*) exhibit the colour of a very weak solution of ink, also due to the oil-globules.

The zona exhibits much the same characters as that of the brill, but the markings due to elevations of the internal surface are less closely set, forming a rather open network, of no regular pattern. They are retained, at all events in artificially fertilized examples, until a late period of development *in ovo*. The whole structure is less delicate than that of the megrim (*Rhombus megastoma*).

Fertilization does not appear to affect the dimensions; the peri-vitelline space is small. Unfertilized ova seem to retain their vitality for an unusually long period; some were successfully fertilized 17 hours after they were taken from the parents. Sir James Maitland's experiments with the milt of Salmonidæ will be remembered in this connection.

I was only successful in hatching one lot of ova. The larvæ began to emerge on the seventh day, but most emerged on the ninth day. None lived for more than a few days after hatching. They were very likely more feeble than those hatched under natural conditions, although as the attempt to rear them was made at sea, with plenty of good water available, I do not know why they should have suffered.

The newly hatched larva measures only 2·14 mm., of which considerably more than half is occupied by the yolk. The oil-globule is ventral in position instead of posterior, as seems to be the case in the brill. The marginal fins are narrow, the pectorals remote from the eye, and the whole larva appears less advanced than is usual in Pleuronectids at the time of hatching.

Both black and coloured chromatophores are present, the latter being the most numerous. In the newly hatched larva they are simple and almost entirely to the head, trunk, and tail, and to the periblast internal to the oil-globule; but they soon become dendritic and spread all over the skin, except at the caudal extremity, being less abundant than elsewhere on the yolk-sac. When first visible the coloured pigment is pale yellow, but by the time of

hatching it has deepened to a very red orange by reflected, bright red rust-colour by transmitted light. A day or two after hatching it is an intense fiery orange by reflected, inclining somewhat to crimson by transmitted light. This coloration is more closely approached by the hybrid turbot and brill larvæ, described by Professor McIntosh (Reps. S. F. B., 1891), than by any other British form with which I am acquainted. It appears from subsequent observations by the same author (Ann. and Mag. Nat. Hist., July, 1892) that the true-bred brill larva does not materially differ from the hybrid.

It had been surmised by Professor McIntosh and myself, in the absence of any exact information on these stages of the turbot, that a minute Pleuronectid ovum and larva, the species F of McIntosh and Prince (op. cit.), might prove to belong to that form. The present observations show that this is not the case, since, apart from the differences in dimensions of the ovum, the pigmentation is entirely different, and the turbot at no stage exhibits the peculiar reticulate structure of the epidermis which always characterises species F. Hence the affinities of the latter must be sought elsewhere, probably amongst the top-knots.

A remarkable tendency was observed, which may render the artificial culture of the turbot a matter of difficulty.

In the several clutches which I fertilized the ova sank to the bottom at from two to seven days after fertilization. They did not appear unhealthy, and continued to develop as well as such as remained floating, but it was impossible to separate them from the dead ova, which always form an unpleasantly large item in the contents of a hatching jar.

The same behaviour was exhibited by four different clutches of ova fertilized for me by fishermen at sea: in one case I am informed that the ova sunk after only a few hours, though at the end of two days they still looked healthy; they were then thrown away, on the ground that if they were not dead they ought to be.

Thus we have pretty strong evidence that there is a general tendency in the turbot's egg to sink sooner or later after fertilization, and we know from Raffaele that this is a regular feature in the development *in ovo* of *Trachinus*; it happens also occasionally in the gurnard and some other forms.

I imagine that the successful culture of a pelagic ovum which assumes a demersal nature at an uncertain period will be difficult.

Later Stages.—Like the ova and larvæ, the younger metamorphosing stages seem to have escaped the notice of naturalists. In fact, the earliest examples which could indubitably be referred to this species are those enumerated by Mr. Cunningham in an earlier

number of this Journal (N. S., No. 2, p. 105). The smallest of these meausres 15 mm. The series of younger examples, doubtfully referred by Professor McIntosh and Prince (op. cit., pp. 845—847) to this species, is acknowledged by these authors to be incomplete, and in the light of more recent observations it seems certain that some of them are not turbot.

It has recently been my good fortune to obtain such a series of specimens, ranging from 5·50 to 16·25 mm., as serves in great measure to fill up the existing gap in the life history. They were taken at the surface in various parts of the North Sea, partly by myself and partly by Mr. F. Klotz, skipper of the steam trawler "Dominican," to whom I am also indebted for much other valuable material. The localities and dates of capture are enumerated elsewhere by Mr. Cunningham, so need not be recapitulated here.

Reserving for the present a detailed and illustrated description, I think the following characters will serve to ensure the recognition of similar examples.

All specimens which I have examined possess a well-developed air-bladder. The snout is short and obtuse, less than the diameter of the eye in smaller examples, about equal to it in examples of 11 mm., and becoming slightly greater in larger specimens. The articular region is more or less prominent at all stages. In the smallest example the tail is narrow and the abdomen prominent, the body slightly flattened, and the eyes practically symmetrical. At about 7 mm. the asymmetry becomes better marked. By the deepening of the caudal region the prominence of the abdomen has disappeared. The greatest height of the body without fins is nearly a third of the total length, and occurs in the region of the clavicle. The marginal fins are still very narrow. At about 11 mm. the contour is roughly fusiform; the greatest height, about half the total length without the caudal fin, is situated just behind the anus, or midway between the snout and the origin of the caudal fin. The marginal fins are much broader and supported by rays. The right eye is just beginning to show above the ridge in a specimen of 13·5 mm. In the largest example about half of the right eye is visible from the left side, and the greatest height of the body is nearly two thirds of the total length without the caudal fin. The fin-ray formula, in specimens in which it is ascertainable, agrees sufficiently with that of the adult.

The most peculiar feature of these young turbot is the cephalic armature. In its maximum development it may be described as follows:—A pectinate ossific ridge overhangs the postero-dorsal region of each eye; a short ridge, bearing stout, postero-ventrally directed and somewhat curved spines, occurs on the articular region

of the mandible, in such a position as to be almost masked by the maxilla when the mouth is closed. The pre-operculum bears short, outwardly directed spines along the entire length of its keel, and longer backwardly directed spines are present on its posterior portion, the margin of which is also serrated. The free edges of the sub-operculum and inter-operculum are strongly serrated near their union.

The spines above the eye seem the earliest developed, as they are present even in my smallest example. The ridge on which they are borne seems to represent the outer edge of the frontal scuta, which must ossify at an earlier period than the rest of that structure. The ridges of each side become opposed in the process of metamorphosis, and persist in the adult, but they lose their prominence and the serration of the edges before the oldest stage in my series is reached. The mandibular armature is early formed and early lost, but its (apparent) position is marked in the adult by the strong lateral keel of the articular. The opercular spines do not seem to be present in the smallest examples, in which the scutes of this region are probably not yet ossified. They reach their maximum development in specimens of about 10 or 11 mm., and thereafter tend to disappear, doubtless by the growth of additional bony matter around them. The serrations of the sub-operculum and inter-operculum persist longer than the rest, and are visible, though very blunt, in my largest example. Indentations exist in the margin of these scutes even in a specimen of 25 mm. kindly sent to me from Plymouth, and very faint indications of the same can be made out in a specimen of 175 mm., though none are perceptible in adult specimens. At no stage of which I have any knowledge is there any spinous process or processes in the region of the otocyst, and this serves to distinguish young turbot from certain of the small forms attributed by McIntosh and Prince (loc. cit.) to this species, and also from some remarkable Pleuronectid larvæ which were obtained during the survey on the west coast of Ireland. Since the smaller larvæ briefly described by the Scotch authors are said to agree in pigmentation with those which exhibit spines on the otocyst, it seems very unlikely that any of them are turbot, and therefore the North Sea series which I have described above are probably the first recorded examples at those sizes.

It is interesting to find a Pleuronectid passing through a stage in which its cephalic armature is as powerful as, and for the most part homologous with, that of a Percoid or Scorpænoid, though I cannot call to mind any form in which the mandibular spines of the young turbot are represented. Amongst Acanthopterygians we are familiar with instances in which, while the head is practically

unarmed in the adult, it is well armed in the young (*e. g. Naucrates*), and it is frequently the case that the armature of this region is more powerful in the young than in the adult. If protective in function it is easy to understand that the spines of the turbot would only be required as long as the pelagic habit is maintained, but I think it is not less probable that their significance is simply ancestral.—E. W. L. H.

ERRATUM.

N. S., Vol. II, No. 3, p. 282.

Under *Gadus esmarkii*, for "30 to 50 fathoms cable" read "30 to 50 fathoms ca." (circa).