XI.—*Notes from the St. Andrews Marine Laboratory (under the Fishery Board for Scotland).—No. XV.* By Prof. M'INTOSH, M.D., LL.D., F.R.S., &c.

1. On the Ova and Larvæ of *Gadus virens*, L.
2. On the Ova and Larva of the Turbot (?).
3. On an Egg resembling that of *Arnoglossus megastoma*, Donov.
4. On *Lumpenus lampetræformis*, Walb.
5. On *Rhombus (Zeugopterus) norvegicus*, Günther.

1. *On the Ova and Larvæ of Gadus virens, L.*

In the 'Tenth Annual Report of the Fishery Board' * a few remarks were made on the ova of this species, which hitherto had escaped observation, notwithstanding that both adults and young fishes were common off the eastern shores. In the spring of 1892 Mr. Duthie, the energetic Fishery Officer at Lerwick, forwarded a few unfertilized ova; but the capsules alone remained on reaching the laboratory, the diameter of the most perfect of these being 1·1430 millim., a size which, it is noteworthy, corresponds very closely with that of the living egg, as will subsequently be shown. In the Eleventh Annual Report of the Board † a further note was made, some living eggs having been forwarded to the laboratory from Shetland by Mr. Duthie. As far as possible these were examined and figured by Mr. J. M. Anderson, M.A., B.Sc., during my absence; but their vitality was impaired, and though one or two almost hatched, yet no free larva was seen.

Various efforts had been made to secure these eggs off the east coast of Scotland by sending a man on board steam-liners and other vessels, and by the examination of the green cod captured by the herring-boats off the Forth. Ripe males were occasionally found, but no ripe females. By various inquiries Dr. Fulton (whose ready help on this and other occasions has greatly aided such work) ascertained that one of the most promising places was Gairloch, Ross-shire; and accordingly a man was sent there in the second week of February. He found that in a single haul of the gill-nets off the mouth of the loch (near the Minch) occasionally as many as 640 green cod, besides cod and other fishes, were secured. Many ripe fishes were at once obtained, and the water in the loch teemed with the ova of this species. The first series of ova, fertilized on the 15th February at 2 P.M., passed through the early stages on this and the 16th, and on the 17th were in the

* P. 287.

† P. 242.

mulberry stage. The blastoderm had made considerable progress on the 19th, and on the 20th February, at 3 P.M., when they reached the Marine Laboratory here, the blastopore had closed and eight or nine muscle-plates had formed. Kupffer's vesicle was present in some. Many of the embryos showed minute black specks along the body, and in one a black chromatophore occurred in each eye. The yolk presented a slightly wavy aspect, which was rendered evident by careful adjustment of the focus; and the same feature was noticed in the examples of last year. The eggs are extremely buoyant, and measure 1.1430 millim., a size which exactly corresponds with the empty capsules formerly alluded to, but it is considerably larger than those sent last year from Shetland.

Next day (21st February), at 4 P.M., the black pigment in some was more distinct along the body, being grouped chiefly at the sides, yet in front a few specks invaded the median region behind the eyes. In others, however, the pigment occurred posteriorly over the body generally. Though the tail was somewhat longer than in the figure of last year*, the muscle-plates were less distinct. The alar expansion was little marked, except in the pectoral region. An abnormal egg showed a deviation of the notochord to the right, and Kupffer's vesicle was also on one side of the median line. On the 22nd February all the organs were more clearly outlined, the muscle-plates were more numerous, the lenses more distinct, and the pigment dotted all over the body. The early condition of the auditory organs in this form is interesting; and, in addition to what is given in the "Researches"†, it may be stated that in the green cod, after the solid thickening of the sensory layer of the epiblast has formed, the lumen, instead of being spherical, is elongated antero-posteriorly, the slit being somewhat spindle-shaped. No cellular elements in the auditory cysts can be made out in the living forms—probably from the extreme delicacy and transparency of the tissues. Kupffer's vesicle is still present in some. A solid longitudinal bar occurs in the region of the heart and a curved transverse line behind it. The comparative narrowness of the body of the embryo is a feature at this stage. The temperature at this time was low, so that development went on slowly. On the 23rd February the tail extended further round the yolk, which, moreover, had a peculiar oleaginous aspect, occasionally with a few streaks in its substance, and it was not much diminished. The noto-

* Eleventh Ann. Rept. Fishery Board for Scotland, pl. ix. fig. 2.

† M'Intosh and Prince, Trans. Roy. Soc. Edinb. vol. xxxv. pt. iii. pp. 760 and 761 (1890).

chord was undifferentiated and Kupffer's vesicle still visible. The black pigment was more distinct and some chromatophores were slightly stellate. A few pigment-specks occurred on the yolk at the sides of the alar expansions. The slits in the otocysts were now ovoid and proportionally shorter than yesterday. One or two otoliths, as a rule, were present.

On the 25th February the otocysts formed broadly ovoid chambers with two otoliths. The heart showed internal papillæ, but no trace of movement. The pectoral expansions were larger and the notochord distinctly cellular. The pigment spots were stellate, and some stretched beyond the line of the body into the yolk. The gut formed a pale band. The following day (26th) distinct contractions occurred in the trumpet-shaped heart, the lumen of the gut was distinct, the alar expansions had increased, and Kupffer's vesicle had disappeared, except a trace in one example. The black chromatophores were larger—eight or nine occurring on the head. Very little pigment existed on the yolk—only a few stellate patches close to the embryo. The tail almost encircled the yolk.

A considerable number were hatched on the 27th February, or twelve days after fertilization, the larvæ floating, as usual, with the yolk-sac uppermost. They differed in the distribution of the pigment from the larval cod, for the chromatophores were scattered and did not form the characteristic bars of the latter species, as indeed may be observed before extrusion. On the following day (28th February) the lumen of the gut was smaller than at first, probably from contraction, and the liver formed a granular swelling on each side in ventral veins. The pectoral folds were large. The yolk still showed a somewhat wavy structure, and many of the chromatophores had become finely ramose, especially on the head. The larval fishes became more active on the 1st March, darting forwards on slight irritation, a feature familiar in salmon-rearing and so often noticed during the development of marine fishes, and which was emphasized so conspicuously in the Hatchery at Dunbar, where the larval plaice, as soon as they had strength, kept their snouts to the current. The otocyst now showed a double margin, and a strand indicating the œsophagus extended in front of the lens, and the liver was slightly larger. Two minute vesicles occurred on the body opposite the pectoral fins, and appeared to be the ends of the segmental ducts. The notochord reached as far forward as the eye, and posteriorly its point was nearer the caudal border. Embryonic fin-rays extended a short distance outward from the notochord in the tail. The rectal cone had moved slightly downward.

A second series, fertilized on the same day (15th), arrived at the Laboratory on the 2nd March. These ova had been kept in open vessels on the spot, and conveyed here in the larval condition, viz. about the second day after extrusion. No difference of moment was noticeable.

On the 3rd March the larval green cod for the most part floated on the water with the yolk-sac uppermost, but were active when interfered with. The liver had increased in size and the urinary vesicle was more evident. The eyes showed minute black pigment-specks and were slightly silvery. The chromatophores were everywhere more finely ramose, and were dotted over the head and body, being best marked over the pectorals, above the alimentary canal, in the region of the segmental ducts, and on the trunk a short distance behind the yolk-sac. In some, indeed, an approach was made to the pigment-bars of the cod. Occasionally the yolk presents a minute oil-globule on one side, as an abnormality; but, after all, there is no great gulf between the yolk which possesses an oil-globule and that which does not.

The head of the larval fish on the 5th March stood out more clearly from the diminished yolk, the pigment had increased in the eyes, the gall-bladder was present, and the chromatophores were more conspicuously ramified. The pigment on the trunk behind the yolk-sac was sometimes grouped in two bars. The embryonic caudal rays were now longer, a few reaching the margin. The pectoral fin was carried more or less erect. The lateral sense-organs corresponded with those in the cod. The larvæ were more active, though still floating with the yolk-sac uppermost.

On the 7th March the grouping of the pigment behind the yolk-sac was more distinct and all the organs were advanced. The mouth was slightly open and the mandible projected outward. The embryonic rays in the caudal region passed further forward in the broad marginal fin. The rectum was still high, and a considerable amount of yolk was present. The development was comparatively slow, and though some specimens lived till the 13th March, the only changes were the diminution of the yolk and the more general distribution of the black chromatophores over the surface of the body. When viewed from the ventral aspect, however, most showed a somewhat regular arrangement of pigment along the sides.

The green cod thus closely approaches the cod in its development, but the arrangement of the pigment distinguishes it from a very early stage. In the later stages of larval life, however, the one approaches the other. In the postlarval condition, and especially in the young state, the eye of the

green cod is somewhat larger proportionally, probably from the shorter snout, and the mandible of the cod is longer. In the subsequent stages the presence of a barbel in the cod, the increase of the black pigment on the body and fins of the green cod, and the absence of the characteristic spots of the cod are diagnostic features.

2. *On the Ova and Larva of the Turbot (?)*.

In the Reports of the Fishery Board various remarks have been made concerning the reproduction and development of the turbot. It was also alluded to in the Trawling Report, for on the 10th July, 1884, the ripe ova of a turbot were procured off the Isle of May, and though these are preserved in spirit, the oil-globule is rendered distinct by treating with equal parts of spirit, 2 per cent. acetic acid and camphor.

An examination of various ovaries of the turbot, kindly forwarded by Dr. Fulton, and many from Iceland and other parts on the pontoon at Grimsby in 1891, gave some knowledge of the more or less ripe ovarian egg, one with yolk-spheres being figured in the Tenth Annual Report*. Mr. Holt, on the 18th June, 1892, found a ripe female on the pontoon at Grimsby, but was unable to procure a ripe male. The ova ranged from $\cdot99$ to $1\cdot06$ millim. In another ripe example he ascertained that after formation of the perivitelline space the diameter remained precisely the same, while he considered the usual diameter to be $1\cdot01$ millim. The oil-globule never varies more than from $\cdot20$ to $\cdot21$, the latter being the usual dimensions. Few of the turbot that had been examined at Grimsby the previous year were very ripe towards the end of June, though many had a few translucent eggs here and there.

On the 28th April, 1894, an egg was procured in the bottom-net in St. Andrews Bay which differs from any hitherto described and corresponds with what was previously seen in the ovary of the turbot. The diameter is $1\cdot0668$ millim., while the pale oil-globule is $0\cdot21$ millim., both measurements agreeing with those communicated by Mr. Holt. The blastopore has closed and Kupffer's vesicle is present. The tail has not advanced beyond the yolk, which shows a few wrinkles or folds at the margin. The perivitelline space is considerable. No lenses or otocysts are present. The yolk is dotted over with traces of pigment-specks, one or two lie over the oil-globule, and they also occur on the body. No

* Fishery Board for Scotland, pl. xiv. fig. 1.

tint is visible under a lens, but under a low power of the microscope the parts mentioned have a yellowish hue.

Next day (29th April) the embryo was distinctly yellowish under a lens, the most conspicuous chromatophores being over the yolk and the oil-globule. Kupffer's vesicle had disappeared, and the tail extended beyond the yolk, which had considerably diminished, as if progress were rapid. The otocysts were indicated by two ovoid translucent structures, and the heart was faintly outlined. The larval fish emerged before 8 A.M. on the 1st May, and measured 2.74 millim. The head, body, and yolk-sac were dotted all over with canary-yellow chromatophores, and at 11 A.M. a few had a tendency to throw out processes. The yolk-sac was more finely reticulated than in the topknot*, the minute vesicles or papillæ being much smaller, while they were not conspicuous on the body. Moreover, no ramifying dark chromatophores existed at the border of the marginal fin, dorsally and ventrally. The oil-globule was situated about the posterior third of the yolk-sac, a position corresponding with that in the topknot. The olfactory sacs, lenses, and otoliths were present, but no pigment existed in the eyes. When viewed from the ventral surface the pectoral thickenings were distinct, and the heart formed a papillose tube inclined to the left. Traces of segmental ducts occurred at the sides of the notochord, with enlargements in the pectoral region. The alimentary canal terminated somewhat bluntly posteriorly, and granules lay in the centre a short distance within the tip. A band from the urinary vesicle and the end of the gut passed to the fin-border a short distance behind the yolk, the distinction in this respect between the present species and the topknot, as figured by Prof. Prince, being marked. The preanal portion of the fin was very small. The notochord was multicolumnar. The larva was very buoyant, keeping quite to the surface of the water, so that currents wafted it readily about in a vessel; and, moreover, it soon wriggled forward at short intervals.

The development of this form is comparatively rapid, and, so far as can be observed, it most nearly approaches the turbot.

3. *On an Egg resembling that of Arnoglossus megastoma, Donovan.*

An egg was met with in considerable abundance in the tow-nets opposite the curing-station at Gairloch, Ross-shire, on the 21st March, 1894. It had a diameter of 1.2573

* Researches, *ibid.* pl. xvii. fig. 4.

millim., and the oil-globule measured .3810 millim. It thus differs from the egg of the hake (*Merluccius vulgaris*) as given by Raffaele in being considerably larger and in having a larger oil-globule (.94 to 1.03 millim., and oil-globule .27 millim.). It is somewhat larger than that of the sail-fluke (*Arnoglossus megastoma*) described in the Tenth Annual Report of the Fishery Board * (1.1430 millim., and oil-globule .3048 millim.), to which it had a superficial resemblance. The surface of the zona radiata, however, is marked with minute translucent vesicles, so that it appears to be variolated, thus differing from the rugose zona of the sail-fluke, which agrees with the brill and lemon-dab in being everywhere covered with raised lines or ridges.

On arrival at the Marine Laboratory on the 2nd March the embryo was about half round the yolk, with lenses and numerous muscle-plates. Kupffer's vesicle was still present. Shortly afterwards black chromatophores appeared over the oil-globule and along the sides of the body. The perivitelline space gradually increased in size from the diminution of the yolk. One larva, apparently from an earlier egg, escaped on the 3rd March. Its yolk-sac was minutely dotted with vesicles connected by intervening lines, as in the larva of the topknot, and the large oil-globule was situated posteriorly as in *Arnoglossus*, and in lateral view it had a slightly flattened outline. A small preanal portion of the marginal fin was present. The notochord was multicolumnar. The heart was visible on the left side. No pectoral expansion was yet present. The black chromatophores were nearly uniformly distributed over the body from the head to within a short distance of the tip of the tail. None appeared on the anterior part of the head, and none on the marginal fin, whereas in the larval sail-fluke (*Arnoglossus*) they occurred towards the free edge of the marginal fin dorsally and ventrally. Absolute reliance, however, cannot be placed on a feature of this kind, since considerable variation may exist. This larva floated passively in the vessel till the 6th March, and the yolk-sac had considerably diminished.

Though the spawning-period of the sail-fluke was somewhat later, viz. towards the end of May in 1892, I should have been disposed to connect this egg therewith were it not for the structure of the zona and the difference in size. Further investigation, however, may clear up the relationships. Nothing is said about the condition of the capsule of the egg of the hake by Raffaele, and the present egg is also larger.

* P 292, pl. xvi. figs. 1-10.

The hake is a common species in Gairloch, but nothing is known of the sail-fluke, though it probably also occurs in the loch.

4. *On Lumpenus lampetræformis*, Walb.

This species was one of the additions to the British fauna made during the trawling expeditions for the Royal Commission under Lord Dalhousie in 1884, the first specimen being described and figured, with his usual care and accuracy, by the late Dr. Francis Day *, who laboured so long and so ably amongst British and Indian fishes.

The occurrence of a perfectly fresh specimen of a female caught by a hook south-east of the Carr lightship on the 23rd February, 1894, gives an opportunity of making a few remarks on the coloration and other features.

The synonymy of the species is sufficiently referred to in Collett's excellent account, from examples procured in the Norwegian North-Atlantic Expedition, 1876-78 †. The only name that may be referred to is that adopted by Dr. Günther in his 'Catalogue' ‡ and 'Introduction to Fishes' §, viz. *Stichæus*. The total length of the present specimen is $9\frac{1}{8}$ inches. The general colour is speckled greyish brown, with a faint olive hue, the whole dorsum being minutely dappled in this way. The specks over the dorsum and sides are small, while about seven larger touches occur on each side above the white line of the belly. Collett || observes:—"Colour pale yellowish brown, relieved with a number of greyish-brown spots, extending laterally along the body; the abdomen above spotless and of a somewhat more silvery appearance. These spots vary considerably in size; most middle-sized examples are marked with a row of eight, stretching along the sides below the mesial line, and occasionally, too, with a similar series above, the spots composing it, which sometimes extend beyond the bases of the dorsals, alternating with those in the lower row, the interspace always exhibiting spots and cloudings, the former frequently confluent." The lozenge-shaped tail is prettily marked with seven vertical bars of the same hue. The pectorals have a faint greenish-yellow tinge towards the tip. The ventrals are white; Collett states they are without markings of any kind in the northern examples. The first part of the dorsal fin is somewhat lower than the succeeding, and has six rays

* Proc. Zool. Soc., June 17, 1884, pl. xli.

† Christiania, 1880, p. 71.

§ P. 495.

‡ Vol. iii. p. 280.

|| Op. cit. p. 76.

and two olive-brown bands, with a small third in front. The rest of the dorsal is bordered with olive-brown, and touches slant from above downward and backward at intervals. Collett describes the dorsal as "marked with oblique transverse bands." The anal is pale, with white rays. The irides are olive-brown, with a golden lustre. The cheeks are minutely dotted with the same pigment. The beautifully regular rows of scales are visible to the naked eye, but more clearly under a lens.

In the original British specimen the tail was thus described by Dr. Day:—"Caudal with one elongated ray above and another below, the five intermediate ones being somewhat concave, the remainder being shorter. Most probably this elongation is a sexual one, this fish being a male." Mr. Sim* found the caudal of his examples acuminate, as stated by Collett, and such is the condition in the present example. On examining the type-specimen in the University Museum here, it is apparent that the caudal rays have been dried and are more or less adherent. Not one ray, however, but several rays, dorsally and ventrally, are longer, the intermediate rays being shorter, though to a less extent than Dr. Day figures. These median rays seem to be more slender and to shrink more in spirit, so that if the longer rays were obliquely spread out (*i. e.* dorsally and ventrally), and also the shorter external rays which pass from the base of the caudal over and under these, a different outline would readily be formed—indeed, it would approach that of the female. This interpretation, of course, is apart from the possible injury to these median rays in the original specimen. Further, on examination of the well-preserved female here described a somewhat similar appearance is observed, the longer dorsal and ventral rays projecting and the median receding; yet the form of the fin in the fresh condition is like a broad lancet or spear-head. The foregoing observations therefore are given as a caution in regard to the apparently divergent condition of the caudal in the specimen first procured.

The ovaries were slightly developed and small, the eggs measuring .02286 to 0.3048 millim., most ranging themselves round the latter diameter. They were therefore at a comparatively early stage, thus proportionately corresponding with those procured from the Moray Firth by Mr. Sim, in which the roe was "well advanced at the end of April, much more so than the milt of the males." The ripe eggs are unknown.

Since the first recorded British specimen Mr. G. Sim has

* Journ. Linn. Soc., Zool. vol. xx. p. 38.

obtained it frequently from trawlers working on the so-called "witch"-ground of the Moray Firth, and has written an interesting account of its habits, food, and distribution. Mr. Thomas Scott, Naturalist to the Fishery Board for Scotland, has also met with various examples off the Firth of Forth. The species therefore is probably an inhabitant of the deeper water all along the eastern coast of Scotland. Dr. Günther*, again, records it from the west coast of Scotland, but he overlooks the original description of it as a British fish by Dr. Day. Mr. Sim seems to think that it is fossorial, but no certainty exists, though allied forms have this habit.

Collett states that *L. lampetræformis* is known to occur on the coast of Greenland, Iceland, Spitzbergen, and the shores of North-western Europe as far south as the Cattegat. But few examples of the species have been hitherto obtained from Greenland and Iceland. Off Spitzbergen, however, it has been repeatedly observed, individuals having been taken on each of the Swedish expeditions to the Polar Sea, and its range extends as far north as 80°. Along the coast of Norway, from Finmark to the Christiania Fjord, it would appear to be rather a common fish, and he mentions having taken a dozen at a single haul of a net in the Porsanger Fjord, West Finmark.

Two other species of the genus, viz. *L. medius* and *L. maculatus*, occur in northern waters, the former from Greenland and Spitzbergen, the latter from the same region as well as the shores of Norway and the eastern coast of North America. In *L. maculatus* the anterior part of the dorsal is somewhat differentiated, being furnished with short sharp spines and only a trace of fin-membrane.

5. *On Rhombus (Zeugopterus) norvegicus*, Günther.

A fine example of this comparatively rare form came from the same region as the preceding specimen, viz. south-east of the Carr lightship, on the 6th April, 1894.

The species was first described and figured as British by Mr. Couch† under the name of *Rhombus cordina*, Cuv., or Ekström's topknot, from a specimen obtained in the Bristol Channel in 1863. Dr. Günther, who pointed out the distinction of the British form procured off Shetland, and also that of Fries and Ekström, from the *Pleuronectes cordina* of Cuvier, gave it the name of *Rhombus norvegicus*‡. No additional

* Proc. Roy. Soc. Edinb. vol. xv. p. 211.

† 'Fishes,' vol. iii. p. 175, pl. clxvii.

‡ Cat. Fishes, iv. p. 412.

specimen was obtained till 1887-88, when Dr. John Murray found several off the west coast, and thus the late Mr. G. Brook made no additional remarks on it in his interesting "Synopsis of the Topknots," published in 1887 *. Two of Murray's specimens were $3\frac{1}{2}$ inches long, the third less. Mr. Holt † lastly procured an example, $3\frac{1}{2}$ inches long, in 30-31 fathoms, off St. John's Point, Donegal Bay, in 1891, the soundings being sand, gravel, and rock.

The present example is $3\frac{3}{8}$ inches, or 85 millim., long, and is a female with developing ovaries. As Couch observes, the elongation of the body, in contrast with the other British topknots, is characteristic; but in this instance it cannot be said that the body is proportionally thinner than in the other forms—it is quite as thick. The scales are more distinct than in Müller's topknot, and probably also than in the others, considerably larger in proportion, and are more elongated antero-posteriorly on the sides of the body. The free edge of the scale is also conical, instead of forming a nearly straight spinous edge. This bluntly conical edge is beset with a row of slightly curved spines, usually numbering about thirty-five or thirty-six, and more or less uniform in size, though the median are generally a little larger, besides a series of shorter spines—best marked at the apex of the cone—which occur between and behind the others. On the white surface the shape of the scales is the same, but the median teeth appear to be a little larger. These scales invade the base of the caudal on the right or white side, as Couch says, as far as they do on the left; but the fin-rays beyond, both in this and the other fins, have none. The character of the armature of the scale thus differs quite from the condition in the other forms, in which eight or nine spines occur, the median, moreover, greatly exceeding the others. The scales which cover the left surface of the fin-rays are more elongate and show considerable variation in regard to the symmetrical position of the terminal spines, the character of which, however, remains the same. The ridge between the eyes formed a simple curve, spread out in front and behind, and thus, though agreeing with Couch's figure, differed from the examples from the west coast, in which the ridge is described as $\sim$ -shaped ‡. The lateral line deviated from the figure of both authors, since, though it inclined a little upward on approaching the pectoral, the abrupt upward curve did not commence till it reached a line falling within the tips of the pectoral rays,

* Proc. Roy. Phys. Soc. Edinb. 1887, p. 362.

† Report Roy. Dubl. Soc.

‡ Proc. Roy. Soc. Edinb. xv. p. 218.

as both authors state in their descriptions. The teeth in the mandible and maxillæ form fine, almost villous rows. None could be made out on the head of the vomer.

The dorsal fin begins distinctly in front of the eye, and the first few rays have no scales. Couch observes that it commences barely in front of the upper eye. About four or five of the terminal rays posteriorly pass to the right (lower) surface, and Couch states that in this and the anal fin the terminal regions on the right are "not so near the caudal as in the other species." The processes certainly appear to be smaller. The longest rays occur about the posterior one-sixth of its course, a feature not shown in Dr. Günther's figure*. The pelvic fins overlap, though they are quite separate from, the commencement of the anal, the longest rays of which occur opposite the longest rays of the dorsal. About the same number of rays pass to the right (lower) side as in the case of the dorsal. The right pectoral is considerably shorter than the left.

The colour of this example was remarkable, since a general roseate hue pervaded the left side, and was visible after six weeks' preservation in spirit. No mention is made of such a hue in previous notices. The entire left side is also marbled with touches of brown of varying shades, some being dark, others light, and no regularity appears to exist in their distribution, except that there is a tendency to transverse bars when the body is viewed obliquely. A marked black band occurs at the base of the tail, with a dark spot beyond it, and both dorsal and anal fins have a series of dark touches. The same exist in the caudal, in which they have a somewhat crescentic arrangement. Couch observes that "the upper surface is yellowish brown, mottled with darker brown over the head, body, and fins, with less tendency to defined spots than in the other species." Günther, again, states that it is "brownish, marbled with darker; a large blotch at the commencement of the straight portion of the lateral line and a transverse band on the tail behind the dorsal and anal fins are the most conspicuous markings. The rays of the vertical fins are irregularly annulated with blackish brown."

The ovarian eggs were small, ranging from 0.34 to 0.152 millim. and under, so that the spawning-period was probably not nearer than July. This conjecture proves to have been near the truth, since Mr. H. C. Williamson on July 6th procured in the Moray Firth another example, in which he noticed more or less ripe transparent eggs.

* Proc. Roy. Soc. Edinb. xv. pl. iv. fig. C.

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