

XXX.—On the Invertebrate Marine Fauna and Fishes of St. Andrews. By W. C. M'INTOSH.

[Continued from p. 145.]

Subkingdom CŒLEENTERATA.

Class HYDROZOA.

The Hydroid Zoophytes of St. Andrews are chiefly procured from the deep water of the bay, though a few appear between tide-marks. Many are found in great profusion. Contrasted with the southern shores, as at Devon and Cornwall*, the majority of the Hydroids are equally common in both localities; some occur more frequently in the one than in the other, while a third series is more characteristic of each area. Thus *Sertularella rugosa*, *Sertularia cupressina*, *Thuiaria thuja*, and *Halecium muricatum* appear to be more abundant at St. Andrews than in the south; on the other hand, *Sertularia argentea* and *Obelia dichotoma* are probably more plentiful in the latter, together with the appearance of *Tubularia* at the extreme margin of low water. The characteristic forms in the south are *Corymorpha nutans*, *Aglao-phenia pluma*, *A. pennatula*, *Ophiodes mirabilis*, *Diphasia pinnata*, and an abundance of the species of *Plumularia*. At St. Andrews *Sertularia filicula*, *S. fusca*, *Tubularia coronata*, *Cuspidella humilis*, and *Halecium labrosum* afford distinguishing features. Moreover, instead of the tufted *Clava squamata*, so common on the littoral Fuci of the western coast, we have *C. multicornis* at St. Andrews on the under surface of stones; the splendid *Corymorpha nutans* of the sandy voes, and the rich tufts of littoral Corynidae and *Gonothyrææ* of the Zetlandic region, are likewise wholly absent. Amongst the Hydromedusæ, *Sarsia prolifera*, Forbes, occurs occasionally, and *Thaumantias pilosella*, Forbes, in great abundance on the surface of the bay in autumn.

The habit of the zoophytes affords many interesting facts, especially in regard to the profusion of parasitic structures. The roots of the polyparies spring from diverse shells, stones, crabs, submerged sticks and branches. One of the most curious examples found by the fishermen in the bay consisted of a stout branch of a thorn-tree, about four feet in height, which had large specimens of *Balanus Hameri* and Ascidians clustered like living fruit on the main trunk and branches,

* J. & R. Q. Couch, in their 'Cornish Fauna;' the elaborate catalogue of the Rev. T. Hincks in the 'Ann. & Mag. Nat. Hist.' 1861-62; and Mr. Parfitt's Devonshire Catalogue published in 1866.

and lobulated and club-shaped masses of *Alcyonium* coating the more slender twigs and overrunning the neighbouring Cirripedes; while *Obelia* fringed most of the branches, here and there giving place to the shorter coating of *Sertularia*, stunted *Tubularia*, or the downy *Clytia*. Hosts of other animals occurred on the congenial site—tubes of *Thelepus* and *Serpula*, *Anomia*, *Saxicava*, *Xylophaga*, *Lepralia*, *Cellepora*, and *Tubulipora* representing the sedentary forms, sessile-eyed Crustaceans and Starfishes the free. Indeed the production formed a compendium of marine zoology that took much time and trouble to investigate. The rapidity of growth of the larger specimens (the *Balani* being as large as walnuts) was shown by the condition of the wood and bark, and the presence of many delicate twigs. This is also seen in the case of slender branches of the common currant-bushes, which are brought to land in good preservation yet densely fringed with *Obelia longissima* and studded with large ascidians. The zoophytes themselves are subject to many parasitic inroads from sponges, Foraminifera, other zoophytes, various Polyzoa, Ascidians, Nudibranchs and their ova, young mussels and *Anomia*, the ova of *Pycnogonum*, Annelids and their tubes (hyaline, gritty, and calcareous), and minute Cirripedes.

In the following list the arrangement and nomenclature of the Rev. T. Hincks in his recent beautiful work on the Hydroida is adopted,

Order I. HYDROIDA.

Suborder I. ATHECATA.

Fam. 1. Clavidæ.

Genus CLAVA, Gmelin.

Clava multicornis, Forskål; Hincks, Brit. Hydroid Zoophytes, vol. i. p. 2.

Frequent under stones in pools near low-water mark, and growing on *Cynthia grossularia* under the cavern roofs; but it is not seen on the littoral seaweeds, as is *Clava squamata* on the shores of the Hebrides and the western and other coasts of Scotland. The tentacles show a slightly enlarged sucker-tip.

Fam. 2. Hydractiniidæ.

Genus HYDRACTINIA, Van Beneden.

Hydractinia echinata, Fleming; Hincks, Brit. H. Z. vol. i. p. 23.

Abundant on *Fusus islandicus*, *Natica*, and other univalve
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shells cast on shore after storms. The outer lip in the shells inhabited by hermit crabs is frequently prolonged into a horny membrane, as mentioned by Dr. Johnston.

Fam. 9. **Eudendriidæ.**

Genus EUDENDRIUM, Ehrenberg.

Eudendrium rameum, Pallas ; Hincks, Brit. H. Z.
vol. i. p. 80.

Plentiful in the deep water of the bay, attached to shells and masses of *Balani* and *Serpulæ*. A fine specimen measured 9 inches high, and the breadth of the branched portion was 8 inches.

Eudendrium capillare, Alder ; Hincks, Brit. H. Z.
vol. i. p. 84.

Fine tufts are occasionally found on the stems of *Antennularia ramosa*, interwoven with other zoophytes, from deep water. The specimens had no short branches ; all were much elongated, and the polyps terminal. Some slight rings existed here and there on the main stems at the base ; those at the origin of each branch are very distinct.

Fam. 11. **Tubulariidæ.**

Genus TUBULARIA, Linnæus.

Tubularia indivisa, L. ; Hincks, Brit. H. Z.
vol. i. p. 115.

Common in deep water. One of the largest specimens springs from an agglutinated basis of the valves of *Pecten opercularis* and gravel, eight inches in diameter, and the gigantic tuft had tubes 11 inches in height. It also sometimes fixes the valves of a living *Mytilus modiolus* so as almost to prevent motion.

Tubularia coronata, Abildgaard ; Hincks, Brit. H. Z.
vol. i. p. 119.

Abundant in deep water. I am obliged to Prof. Allman for discriminating wrinkled specimens of this species, in 1863.

Suborder II. **THECAPHORA.**

Fam. 1. **Campanulariidæ.**

Genus CLYTIA, Lamouroux.

Clytia Johnstoni, Alder ; Hincks, Brit. H. Z. vol. i. p. 143.

Abundant on *Alcyonidium hirsutum* and seaweeds in the

pools near low-water mark, as well as coating the stems of *Laminariæ* with a hairy fringe fully half an inch in height. In a fine example of the latter many of the stems possess one or two branches, and the gonothecæ here and there have a stalk composed of several rings.

Genus OBELIA, Péron & Lesueur.

Obelia geniculata, L.; Hincks, Brit. H. Z. vol. i. p. 149.

Common on laminarian blades thrown on the West Sands after storms, forming a miniature cover amidst which many Nudibranchs find food and shelter. It occurs plentifully also on *Halidrys siliquosa* and other seaweeds near low-water mark, and on crabs. In the interior of many of the gonothecæ are the young of a Pycnogonidian.

Obelia longissima, Pallas; Hincks, Brit. H. Z. vol. i. p. 154.

Abundant in deep water. It bristles on every branch or fragment of wood which has been submerged for some weeks. It appears also in a very interesting condition in the peculiar rounded balls formed by the rolling action of the waves on the beach; these zoophytic masses are either spherical or rounded-oblong, and the fibres are firmly felted together*. In this state the present species is stripped of its minute branches, and feels bristly and crisp. The same rolled masses (also chiefly composed of an *Obelia* allied to the present form) were brought from the shore of a New-Zealand bay by Dr. Lauder Lindsay, who kindly sent them to me. They are formed in a similar manner as the well-known balls in Loch Tay, where the rolling action of the waves produces perfectly round masses, often as large as a spherical shot of thirty or forty pounds, composed of the linear leaves of the larches and pines which shade its margin. Miss M'Leod, of Paible, brought me spherical masses of a similar description from a freshwater lake in South Uist, the species in this case, according to Prof. Dickie, being *Cladophora glomerata*. *O. longissima* affords a favourite site for young mussels.

Obelia dichotoma, L.; Hincks, Brit. H. Z. vol. i. p. 156.

Not common; parasitical upon a piece of seaweed from the laminarian region, and reaching about 3 inches high.

* One of these masses so closely resembled the chignon lately in vogue that it was secretly used by a patient for this purpose, and I learned that it was only the disagreeable abundance of sand in its tissue that saved it from further duty in this respect.

Genus CAMPANULARIA, Lamarck.

Campanularia volubilis, L.; Hincks, Brit. H. Z. vol. i. p. 160.

Common; on crabs, the stems of *Sertularia argentea* and other zoophytes from deep water. It is a smaller and more delicate species than *C. verticillata*. The shape of the cup and the very distinct "spherical ring" below distinguish it when the gonothecæ are absent.

Campanularia Hincksii, Alder; Hincks, Brit. H. Z. vol. i. p. 162.

Occasionally found on the stems of *Antennularia antennina* from the deep water of the bay. This species presents certain variations. In some the stem is nearly smooth from the base to the cup, where there are only a few slight twists; in others there are several distinct though irregular rings or twists at the base, a few about the middle of the stem, and others at the base of the calycle; in almost all there is one very distinct ring at the base of the latter, as Mr. Alder shows in his figure *. There is also a peculiar hollow at the base of the calycle; but this cannot be called a ring.

Campanularia verticillata, L.; Hincks, Brit. H. Z. vol. i. p. 167.

Common in deep water. Many specimens were also found in the stomach of *Echinus esculentus* from the laminarian zone.

Campanularia flexuosa, Hincks, Brit. H. Z. vol. i. p. 168.

Not uncommon on the under surfaces of stones near low-water mark. The peculiar zigzag form of the stem, with the arms of the forks tending in opposite directions, together with the short, broad, and smooth-edged hydrothecæ, are characteristic. The long pedicels of the hydrothecæ had their central smooth portions peculiarly flattened out, so as almost to assume a fusiform aspect.

Campanularia raridentata, Alder; Hincks, Brit. H. Z. vol. i. p. 176.

Occasionally found on *Antennularia antennina* and other zoophytes from the coralline ground. The form agrees in most respects with the published description. The calycle is very narrow and deep, with six to eight large teeth on the margin;

* Catalogue of the Zoophytes of Northumberland and Durham, pl. ii. fig. 9.

stalk rather slender (much more so than in *Clytia Johnstoni*), with several distinct rings below the cup, and many less distinct towards the base. The peculiar slenderness of the stalk, the length of the cup, and the small number of teeth are the characteristic features. Specimens which resemble *Clytia Johnstoni* occasionally grow in proximity; and some intermediate forms occur.

Genus GONOTHYRÆA, Allman.

Gonothyraea Lovéni, Allman; Hincks, Brit. H. Z.
vol. i. p. 181.

Abundant on *Sertularia abietina* and *Diphasia rosacea* from deep water. The exceeding delicacy of the free margins of the hydrothecæ, even in good spirit-preparations, renders it difficult to say whether they are (or were) notched or smooth. It was only by a comparison of observations on many examples that the peculiar crenations were understood, as none showed more than a few, and the majority none at all. The appearance of the gonothecæ, however, is characteristic.

Gonothyraea gracilis, Sars; Hincks, Brit. H. Z. vol. i. p. 183.

Plentiful on *Tubularia indivisa*, from deep water, amongst *Clytia Johnstoni*, on the tests of *Ascidia sordida*, on *Scalpellum vulgare*, *Stenorhynchus rostratus*, and *Cellepora pumicosa*. The capsules are large, translucent, and borne on a ringed stalk. Growing as this did amongst *C. Johnstoni*, it at first seemed to be a branched variety of the latter; but the peculiar nature of the branching and the structure of the gonothecæ, which were chiefly borne on the stems, distinguished it on closer scrutiny. Moreover the hydrothecæ of this species, contrasted with *C. Johnstoni*, are much larger and deeper.

Fam. 2. Campanulinidæ.

Genus OPERCULARELLA, Hincks.

Opercularella lacerata, Johnston; Hincks, Brit. H. Z.
vol. i. p. 194.

Abundant on the stems of *Plumularia pinnata*, *Obelia longissima*, and other zoophytes, and amongst *Clytia Johnstoni* on the stems of *Laminariæ*; Prof. John Reid also found it on *Scrupocellaria scruposa*. This species presents two well-marked varieties, which occur together on the same stem: (a) hydrothecæ on simple stalks of variable length, viz. from three to nine rings; and (b) branched stems of some height, with the alternate stalks of the hydrothecæ composed of from

six to more than a dozen rings. Moreover, in these branched forms it is not uncommon to see more than one pedicel arise at the same fork, so as to cause the observer to fancy he is viewing the *Campanulina turrita* of Prof. Wyville Thomson; only the hydrothecæ are much shorter in proportion to the length of the teeth. Some examples on a laminarian stalk had very long stems. The hydrothecæ in all very closely resembled those on Dr. Allman's *Campanulina repens* (Hincks, Brit. H. Z. vol. i. p. 189, pl. xxxviii. fig. 1). No gonothecæ were observed.

Fam. 4. Lafoëidæ.

Genus LAFOËA, Lamouroux.

Lafoëa dumosa, Fleming; Hincks, Brit. H. Z. vol. i. p. 200.

Common on various zoophytes from deep water. Some varieties of this species have short stalks of one or two whorls supporting the hydrothecæ; but they are not quite so long as those described under *L. fruticosa*, Sars, and the intermediate forms show that they are to be referred to the present species.

Lafoëa fruticosa, Sars; Hincks, Brit. H. Z. vol. i. p. 203.

Occasionally on zoophytes from deep water, especially *Sertularia filicula*. The pedicels of the hydrothecæ have from three to five rings.

Besides the above there are several microscopic forms closely allied, which creep along the stems of various zoophytes. A sessile form is common on *Crisia eburnea*, and a stalked species on *Scrupocellaria scruposa*.

Genus CALYCELLA, Hincks.

Calycella syringa, L.; Hincks, Brit. H. Z. vol. i. p. 206.

Abundant on the stems of *Hydrallmania falcata* and other zoophytes from deep water.

Genus CUSPIDELLA, Hincks.

Cuspidella humilis, Hincks, Brit. H. Z. vol. i. p. 209.

Not uncommon on the tests of *Ascidia sordida*, and on the valves of *Psammobia* and other shells, from deep water. The tests of Ascidians are the seat of a reticulated growth with numerous minute club-shaped processes rising from the creeping stem which is associated with *C. humilis*.

Genus FILELLUM, Hincks.

Filellum serpens, Hassall; Hincks, Brit. H. Z. vol. i. p. 214.

Abundant on the stems of *Sertularia abietina* and *H. falcata* from deep water.

Fam. 6. Coppiniidæ.

Genus COPPINIA, Hassall.

Coppinia arcta, Dalyell; Hincks, Brit. H. Z. vol. i. p. 218.

Common on the stems and branches of *Sertularia abietina* and *Hydrallmania falcata*.

Fam. 7. Haleciidæ.

Genus HALECIUM, Oken.

Halecium halecinum, L.; Hincks, Brit. H. Z. vol. i. p. 221.

Plentiful in deep water, though somewhat less common than the next species. Young specimens under an inch in height sometimes occur, which in spirit quite agree with the Rev. A. M. Norman's description of *H. sessile* (Hincks, l. c. p. 229, pl. xliv. fig. 2), with, of course, the exception of the polyps. In these cases the hydrothecæ do not seem to be fully developed; but they show the row of dots below the margin. Specimens are also seen in which one or two of the hydrothecæ are better developed at the base of the stem, while all the rest are in the condition described by Mr. Norman. It would appear to be doubtful if the mere elongation of the polyps would constitute specific distinction, any more than the fact that the branches are not in the same plane. Some are slightly ringed.

Halecium muricatum, Ellis and Solander; Hincks, Brit. H. Z. vol. i. p. 223.

This is the common *Halecium* from the deep water of the bay. Most of the specimens show a ring or two on the stem above the calyces.

Halecium Beanii, Johnston; Hincks, Brit. H. Z. vol. i. p. 224.

Not uncommon in the coralline region, attached to other zoophytes and to the tests of Ascidians. Young examples have piles of little cups on the hydrothecæ like those on the beautiful southern *H. tenellum*, Hincks.

Halecium labrosum, Alder; Hincks, Brit. H. Z. vol. i. p. 225.

From the deep-sea lines of the fishermen. Rather rare.

Fam. 8. Sertulariidae.

Genus SERTULARELLA, Gray.

Sertularella polyzonias, L. ; Hincks, Brit. H. Z. vol. i. p. 235.

Abundant in the deep water of the bay, generally attached to the roots of other corallines. All the specimens seem true to the description of the species ; at least there is no tendency to wrinkles in the hydrothecæ so far as examined.

Sertularella rugosa, L. ; Hincks, Brit. H. Z. vol. i. p. 241.

Common ; under stones near low-water mark, and thence to deep water, on seaweeds, *Flustra foliacea*, &c.

Sertularella tenella, Alder ; Hincks, Brit. H. Z. vol. i. p. 242.

In profusion on *Sertularia abietina* and other zoophytes from the coralline ground.

Genus DIPHASIA, Agassiz.

Diphasia rosacea, L. ; Hincks, Brit. H. Z. vol. i. p. 245.

Abundant in deep water on other corallines, such as *Hydrallmania falcata*, *Thuiaria thuja*, *Halecium*, &c. The specimens are large and luxuriant. Mr. Hincks is right in stating that the male gonothecæ have eight longitudinal ridges, and not six as Dr. Allman says.

Diphasia tamarisca, L. ; Hincks, Brit. H. Z. vol. i. p. 254.

Not uncommon in deep water attached to shells and stones.

Genus SERTULARIA, Linn.

Sertularia pumila, L. ; Hincks, Brit. H. Z. vol. i. p. 260.

This is the common Sertularian under stones in rock-pools at and near low-water mark at St. Andrews ; but it is less luxuriant than on the Fuci of the western coasts. It forms a miniature forest on the under surface of the stones in quiet places, and is a favourite haunt of *Eolis viridis* and other Nudibranchs. It presents the peculiarity in such situations that the stem is not always contracted above the hydrothecæ, but not unfrequently these follow each other without the constriction. In some preserved specimens the hydrothecæ contained a number of large nucleated cells, having apparently a thickened and regularly crenated cell-wall ; these cells varied in size ; and some also occurred in the centre of the stem.

Sertularia operculata, L.; Hincks, Brit. H. Z. vol. i. p. 263.

Not uncommon; on seaweeds at and beyond low-water mark, but chiefly procured on the West Sands after storms. Its comparative scarcity is in marked contrast with its profusion on our western coasts, where almost every laminarian root and stalk are clothed with dense tufts.

Sertularia flicula, Ellis and Solander; Hincks, Brit. H. Z. vol. i. p. 264.

This, perhaps, is the most abundant Sertularian next to *S. abietina* from deep water. Dried specimens, when carefully laid out, show a somewhat rectangular arrangement of their terminal branches. Good examples have also been procured from the stomach of the cod.

Sertularia abietina, L.; Hincks, Brit. H. Z. vol. i. p. 266.

Very common; and occasionally reaching the height of 9 inches; fine tufts occur on *Mytilus modiolus*. This species is a favourite seat of many parasites, such as other hydroid zoophytes, calcareous corallines, *Spirorbis*, *Alcyonidium*, *Coppinia*, &c. From its attachment to living mollusca (*Anomia* and others) it is not unfrequently swallowed by the cod.

Sertularia argentea, Ellis and Solander; Hincks, Brit. H. Z. vol. i. p. 268.

Not common; from the deep-sea lines of the fishermen. This seems to be a form more characteristic of our southern shores.

Sertularia cupressina, L.; Hincks, Brit. H. Z. vol. i. p. 270.

Very plentiful in the coralline region, and sometimes reaching the length of 18 inches. Besides the ordinary form there are two branched varieties. In the first, numerous secondary polyparies spring from the ordinary dichotomous branches, each twig so burdened being very little thicker than the ordinary forms, and bearing in the usual manner for some distance the hydrothecæ, which gradually become obsolete; this secondary trunk assumes considerable dimensions, with jointed stem and dichotomous branches, like an independent specimen. In the other variety the main stem itself splits into two divisions, or the secondary trunks throughout are directly connected therewith.

Sertularia fusca, Johnst.; Hincks, Brit. H. Z. vol. i. p. 272.

A single fine specimen only has yet been procured, in the

deep water of the bay. Mr. Alder correctly observes that this form leads us to *Thuiaria*.

Genus HYDRALLMANIA, Hincks.

Hydrallmania falcata, L. ; Hincks, Brit. H. Z. vol. i. p. 273.

One of the most abundant hydroid zoophytes from the coralline ground. Its form varies from the elongated spiral to the broadly branched condition, and it is frequently loaded with parasitic zoophytes, both horny and calcareous. It is also a favourite site for Nudibranchiate Mollusca and their ova, and minute Annelids construct their tubes on every convenient bough. Young specimens are plentiful also under stones between tide-marks, where their habit differs considerably from the foregoing, having the form of a simple straight pinna, generally coated with parasitic structures, both animal and vegetable.

Genus THUIARIA, Fleming.

Thuiaria thuja, L. ; Hincks, Brit. H. Z. vol. i. p. 275.

Common ; chiefly frequenting dead valves of *Cyprina*, *Pecten*, and *Tapes*, as well as stones, shooting its long stems upwards (occasionally to the length of 14 inches) amidst masses of the tubes of *Serpula*, *Thelepus*, and other Annelids, and patches of *Alcyonium*. In some examples a short secondary stem branches from the main trunk near the base. Parasitic upon the stems are numerous other corallines, such as *Diphasia rosacea*, which clothes anew the bare zigzag trunk with a more silky fringe than nature originally provided ; rough crusts of *Cellepora* or the spreading *Alcyonium* and *Alcyonidium* entirely surround it ; while occasionally a long tunnel of *Thelepus* is glued from the base to the branching portion. Now and then it occurs in the stomach of the cod.

Fam. 9. Plumulariidæ.

Genus ANTENNULARIA, Lamarck.

Antennularia antennina, L. ; Hincks, Brit. H. Z. vol. i. p. 280.

From the deep water of the bay ; common, but less so than the next species. Fine tufts reach a height of fully 11 inches. In a curious example a number of simple straight stems proceed from the upper edge of a fragment of an old trunk.

Antennularia ramosa, Lamarck ; Hincks, Brit. H. Z.
vol. i. p. 282.

Common in deep water, whence it is usually brought by the fishermen's lines.

Genus PLUMULARIA, Lamarck.

Plumularia pinnata, L.; Hincks, Brit. H. Z. vol. i.
p. 295.

Frequent in deep water, and often reaching the height of 7 inches. A tall variety is found in which no spines are present on the gonothecæ. It sometimes occurs on *Stenorhynchus rostratus* between tide-marks.

Plumularia catharina, Johnst.; Hincks, Brit. H. Z.
vol. i. p. 299.

Common on Ascidians, tubes of *Thelepus*, and the roots of other corallines in deep water.

Plumularia frutescens, Ellis & Solander; Hincks, Brit. H. Z.
vol. i. p. 307.

Occasionally thrown on the West Sands after storms, and also brought in on the deep-sea lines of the fishermen. The smaller specimens are pale. One example is 6 inches in height, and broadly branched.

Order MEDUSIDÆ.

The Medusidæ abound chiefly in autumn in the bay, the most conspicuous amongst the larger forms being *Aurelia* and *Cyanea*, the former often occurring in such numbers as to form a closely packed layer on the surface of the sea over considerable areas; and though not in the dense party-coloured masses of various species occasionally seen in the Hebrides, still they form an interesting feature. At certain points the bay in quiet weather is quite purplish with thousands, many of which are loaded with ova; and through the transparent umbrellas the abdominal feet of the parasitic Hyperidæ are observed in constant vibration. Occasionally, whether from accident or design, one specimen is found adhering to the umbrella of another, and is thus carried through the water. Moreover, on many of the stones at the East and West Rocks, near low-water mark, a "*Hydra tuba*" is found, which may be the hydroid condition of the foregoing. This pretty little white structure, developed from the ova of *Aurelia* and its allies, can be observed in all stages not only throwing out lateral buds like a *Hydra*, but by transverse fission dividing into a series of saucer-shaped bodies which ultimately assume the form of the adult *Aurelia*. This form, it is well known, formed the subject of valuable observations by the late Prof. M. Sars, and afterwards, amongst

others, by the late Dr. John Reid, who obtained his examples at St. Andrews.

On the whole we lack at St. Andrews the splendid profusion of the swimming jellies occasionally met with on our western shores, and especially in the Outer Hebrides, to which a favouring wind and tide sweep them from the warmer area of the Gulf-stream beyond, in company with *Ianthina* and the Pteropods. Amongst these the strange and beautifully tinted *Diphyes* is seen darting hither and thither amongst the brilliant blues of its brethren with its trailing fringes of bright orange polypites; and on the lonely western shores, as at Monach, countless myriads of the little *Velella* are tossed in autumn on the sand.

Mr. Darwin *, referring to the colours of certain Invertebrate animals, thinks that it is doubtful if such serve as a protection; but he goes on to observe that the perfect transparency of the Medusæ, "many floating mollusca, crustacea, and even small oceanic fishes partake of this same glass-like structure," and that "we can hardly doubt that they thus escape the notice of pelagic birds and other enemies." It seems to me somewhat difficult to say what will escape the eye of a pelagic bird, such as gull, guillemot, or hawk-like tern. Their keen eyes distinguish very indistinct objects—for instance, the nucleus of *Salpa runcinata*, and the minute and almost transparent bodies of the young fishes that flit amongst the splendid masses of swimming jellies (Molluscan and Coelenterate) which sometimes throng our western shores. The mere tremor of the water is almost sufficient to attract such acute and skilful marauders. Moreover, the statement of the great naturalist is incomplete without the appendix that many of the Medusæ and Hydromedusæ are brilliantly coloured and, in addition, phosphorescent, the latter property likewise characterizing the translucent *Pyrosoma*, and that my distinguished friend Prof. Wyville Thomson regards the luminosity of marine animals as a provision of nature for attracting their enemies in the abysses of the ocean, or for throwing a flood of light on their own prey. I have already† shown my reasons for believing that the theory of the latter author is open to doubt, and shall make a few further remarks on the subject under the Annelida. If the notion had been promulgated that the sexes in the abysses of the ocean used their light to attract each other, and thus had a better chance of continuing the race, perhaps more might have been said in its favour.

* Descent of Man, &c.

† Ann. & Mag. Nat. Hist. ser. 4, vol. ix. 1872, p. 2.

Genus AURELIA, Pér. & Les.

Aurelia aurita, O. Fabr.

Abundant in autumn and often so late as November.

Genus CYANEA, Pér. & Les.

Cyanea capillata, Eschsch.

Common in autumn.

Order LUCERNARIIDÆ

(*Calycozoa*, R. Leuck.).

Genus LUCERNARIA, O. F. Müller.

Lucernaria auricula, O. Fabr.

Frequent on Fuci near the commencement of the East Rocks, and occasionally at the West Rocks. It is as common as in the south.

Class CTENOPHORÆ.

Two representatives only are found at St. Andrews, viz. a species of Beroid and a *Pleurobrachia*. The former occurs in vast swarms in July, indeed almost as plentifully as in the Zetlandic seas, and is easily procured by the hand-net from the rocks or at sea. The latter is equally abundant from August to the end of autumn, and even in winter, occasionally filling the towing-net or the dredge in the bay, and thrown ashore after storms on the West Sands. Few objects are more engaging than one of these spherical jellies in a clear glass vessel of sufficient size to exhibit the matchless mechanism of its complex tentacles and the splendid iridescence of its locomotive rows.

Order SACCATÆ, Agassiz.

Genus PLEUROBRACHIA, Flem.

Pleurobrachia pileus, Eschsch.

Abundant. It eagerly devours *Carcinus mænas* in the zoëa-stage.

Order BEROIDÆ, Ggbr.

Genus IDYIA, Fréminville.

Idyia cucumis, O. Fabr.

Occasionally in large numbers in July and August.

Class ACTINOZOA.

Though the total number of species of this class at St. Andrews is small, many occur in great abundance, and especially such cosmopolitan forms as *Actinia mesembryanthemum*, *Tealia crassicornis*, and *Actinoloba dianthus*. The frequent occurrence of *Sagartia troglodytes*, again, at St. Andrews, distinguishes it from the shores of the extreme south, as at Guernsey. We have not, moreover, the fine *Anthea cereus* of the west and south, which, for instance, in the quiet creeks of the Outer Hebrides studs the stems and blades of the tangles at the border of the littoral zone, the beautiful greenish purple tentacles gently waving with every swell of the tide; neither is the gaudily tinted *Sagartia parasitica*, so characteristic of some of our southern shores, to be found between tide-marks, nor *Adamsia palliata* in deep water. *Corynactis*, the stony corals, *Zoanthus*, and the northern free-swimming *Arachnactis albida* are entirely absent. The places of these are filled by swarms of the common forms above mentioned, and by some of the rarer types, e. g. *Edwardsia*, *Cerianthus*, and *Peachia*, which seem to be characteristic of sandy beaches. A remarkable example * of the latter turned inside out occurs in my collection. It was mistaken for a curious polyp with beautifully arranged longitudinal and transverse muscular bundles, and was found inserted in a tunnel in the sand in this condition in Cobo Bay, Guernsey. It is simply a large *Peachia* everted.

Amongst the Alcyonarians the phosphorescent *Pennatula* occurs in great beauty, and replaces the *Pavonaria* of the west, while with *Virgularia* it also affords a diagnostic mark from the south. The fine Gorgoniidæ of the latter region, again, have no representatives at St. Andrews.

Order I. ZOANTHARIA.

Suborder ACTINARIA.

Fam. 2. Sagartiadæ, Gosse.

Genus 1. ACTINOLOBA, Blainville.

Actinoloba dianthus, Ellis; Gosse, Brit. Anem. p. 12, pl. 1. fig. 1.

Common in the débris of the fishing-boats, and thrown ashore after storms attached to sticks and shells. Young spe-

* I am indebted to Dr. Cooper, of St. Peter le Port, for the specimen.

cimens occasionally appear on stones at extreme low water, and when very hungry greedily swallow green seaweeds. Some expand the disk like a *Doris* or *Lamellaria*, and float on the surface of the water.

Genus 2. SAGARTIA.

Sagartia troglodytes, Johnston; Gosse, Brit. Anem. p. 88, pl. 1. fig. 3, pl. 2. fig. 5, &c.

Everywhere abundant under stones, and attached to rocks near low-water mark. In regard to the physiology of the digestive sac, Mr. Gosse * states that the walls of this chamber are only separated for the reception of food; but in this species the mouth often expands, and the digestive cavity dilates, so as to be readily viewed as an open and empty sac. The ciliary currents course over the lip and into the stomach; so that minute particles of nutriment might be available, though by no means necessary.

Fam. 4. Actiniadæ.

Genus 1. ACTINIA, L.

Actinia mesembryanthemum, Ellis & Sol.; Gosse, Brit. Anem. p. 175, pl. 6. figs. 1-7.

Very common on stones and rocky ledges between tide-marks.

Fam. 9. Bunodidæ.

Genus 3. TEALIA, Gosse.

Tealia crassicornis, O. F. Müller; Gosse, Brit. Anem. p. 209, pl. 4. fig. 1.

The variety *coriacea* (*Actinia coriacea*, Cuvier) is extremely abundant along the West Rocks at low water, while the other comes in great profusion and of large size from the deep water of the bay. A bifid specimen occurred at the Castle rocks. This species is also found in the stomach of the cod.

Genus 5. STOMPHIA, Gosse.

Stomphia Churchiæ, Gosse, Brit. Anem. p. 222, pl. 8. fig. 5.

Occasionally from deep water.

* Brit. Anem., Introd. p. xvi.

Fam. 6. Ilyanthidæ.

Genus 2. PEACHIA, Gosse.

Peachia hastata, Gosse, Brit. Anem. p. 235, pl. 8. fig. 3.

Thrown ashore on the West Sands after storms in great numbers, and was thus first found in Britain by Dr. John Reid, of St. Andrews, who published a description of his single example in 1848 (Physiological, Anat., and Pathol. Observations, p. 656, pl. 5. f. 21 & 22): his title (*A. cylindrica*) has therefore a prior claim to that of Mr. Gosse. It occurs also in the stomach of the cod.

Genus 4. EDWARDSIA, De Quatrefages.

Edwardsia callimorpha, Gosse, Brit. Anem. p. 255,
pl. 7. fig. 7.

A variety was found on the West Sands after a storm in March, with brown instead of the usual whitish specks. It is an elongated form inhabiting sand.

Edwardsia Allmanni, M'I., Proc. Roy. Soc. Ed. 1864-5.

From a shallow pool on the West Sands after a storm in October. It inhabits a distinct case, and can retract its tentacles and cover them by the external border of the disk. The latter is marked by eight alcyonarian divisions or radii, and has always a ragged border of the investing sheath. The disk has a pale brownish colour.

The tentacles are simple, rather blunt, pale and translucent, with a white streak in the centre; the rim of the mouth is occasionally protruded as a conical process.

This form exhibited none of the "remarkably vigorous and spasmodic contractility" ascribed by Mr. Gosse to the family; for it was comparatively inert.

Edwardsia Goodsiri, M'I., Proc. Roy. Soc. Ed. 1864-5.

Found at the same time and place with the former. Tentacles 15, translucent, longer than the diameter of the oral disk, and not much tapered. A whitish ring occurs at the tip of each, and from the base a white spear-head with a transparent centre reaches more than halfway up. Oral disk streaked with white and brown. It is somewhat allied to *E. Beauteempsii*, De Quatref.*, but is distinguished by the marks on the tentacles, which in the latter only have the tip "d'un beau jaune rougeâtre." The posterior end of the ex-

* Ann. des Sc. Nat. 2^e sér., Zool. xviii. 1842, p. 69, pl. 1. fig. 1.

ample was often fixed to the glass by its ectoderm, which apparently had very minute or granular suckers.

Swarms of an *Edwardsia* occur in the stomach of the flounder.

Genus 6. CERIANTHUS, Delle Chiaje.

Cerianthus Lloydii, Gosse, Brit. Anem. p. 268, pl. 7. fig. 8, and woodcut, p. 269.

Procured at low water from the margin of the East Rocks, and occasionally thrown on the West Sands after storms. A splendid specimen from the latter (measuring $7\frac{1}{2}$ inches long and as thick as a finger) in February discharged a vast number of ova after a week's confinement. The majority of these bodies were rather coarsely granular, ovoid in form; and some had minute papillæ at one end. No cilia were present, so that in all probability they were dead. Both examples had the first series of tentacles of the usual brown colour, with about four faintly marked whitish specks on the inner surface. The second series were uniformly brown.

Order II. ALCYONARIA.

Fam. Pennatulidæ.

Genus PENNATULA, L.

Pennatula phosphorea, L.; Johnst. Brit. Zooph. p. 157, fig. 35.

Abundant on muddy ground in deep water, and often brought up on the lines of the fishermen.

Genus VIRGULARIA, Lamck.

Virgularia mirabilis, L.; Johnst. Brit. Zooph. p. 161, pl. 30. Occasionally in the stomach of the cod.

Fam. Alcyoniadæ.

Genus ALCYONIUM, L.

Alcyonium digitatum, L.; Johnst. Brit. Zooph. p. 174, pl. 34.

Abundant in deep water as well as in small patches on rocks and stones between tide-marks. Often thrown in large quantities on the West Sands after storms, attached to various submarine structures.

[To be continued.]



M'Intosh, William Carmichael. 1874. "XXX.—On the invertebrate marine fauna and fishes of St. Andrews." *The Annals and magazine of natural history; zoology, botany, and geology* 13, 204–221. <https://doi.org/10.1080/00222937408680846>.

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