

Faunistic Notes at Plymouth during 1893-4.

With Observations on the Breeding Seasons of Marine Animals, and on the Periodic Changes of the Floating Fauna.

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THE year 1893 was one of exceptional interest to the marine zoologist. During the first two months Plymouth experienced a continuous succession of heavy gales, but towards the middle of March the winds became lighter, and the sea, which had been running remarkably high outside the breakwater, subsided. From that time onwards till the middle of September we enjoyed six months of the most delightful weather,—a period, with scarcely a break, of calm seas and almost cloudless skies. Under the influence of the great heat the temperature of the Channel waters rose continuously, until in August it had attained a point unprecedented for quarter of a century; and it was of the highest interest to observe the effect of this high temperature, and of the prolonged calmness of the sea, upon the floating population of the neighbouring portion of the Channel. Numbers of semi-oceanic forms which rarely reach our shores arrived in remarkable profusion. In June the tow-nets were crowded with Salps, while towards the latter end of August they were almost choked by masses of living Radiolaria.

Even the bottom fauna was influenced, as was shown by the extraordinary abundance in the Sound throughout the spring and

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summer of the Tectibranch *Philine aperta*. *Oscanius membranaceus* also, though to a less extent, was unusually plentiful, penetrating even some distance up the Hamoaze.

Another phenomenon which is probable referable to the same cause, although in a somewhat different manner, is the relatively greater abundance this year (1894) of many of the regular constituents of the bottom fauna. For example, the Hydroids *Tubularia indivisa* and a smaller form which appears to be *Tubularia humilis*, together with *Coryne pusilla* and *Eudendrium ramosum*, have been taken in the Sound this year in unusual quantity. The same remark applies to many Nudibranchs, and especially to the *Æolid Facelina coronata*,* which has been remarkably common this year at Plymouth. I do not doubt that the unusual abundance of these and other forms may be directly attributed to the very favorable physical conditions under which the reproduction of their species took place in the preceding year. The destruction of larval life by physical agencies must then have been considerably less than the normal rate. Indeed, in the case of the oyster, as was attested by Prof. Herdman in a letter to Nature (July, 1893, p. 269), there was undoubtedly an unusually heavy fall of spat on the west coast of France last year, which implies that an unusually large percentage of larvæ were enabled to attach themselves and to pass safely through the critical stages of their metamorphosis; and also, perhaps, that the reproductive activities themselves were rather above the normal.

So much for the general aspects of the fauna during the past eighteen months. Additional facts bearing out the above remarks may be gathered from the body of this paper.

In the three succeeding sections are given—firstly, a list of the principal captures and additions to the fauna made since my last† communication to this journal up to May 30th, 1894, when I left Plymouth; secondly, some observations on the breeding seasons of marine animals at Plymouth; and thirdly, some remarks on the periodic changes in the constitution of the floating fauna.

In several respects, however, I have to regret the incompleteness of my notes. They are compiled directly from my diaries, and are written on foreign soil, where I am without access to some of the appropriate works of reference and to several of my manuscripts. On this account the last two sections especially of this paper are offered simply as preliminary communications upon the interesting

* I showed some years ago that the smaller Nudibranchs are annuals, and require only a year to attain their full growth. The same thing is true of Hydroids and many other Invertebrates (this Journal, 1890, p. 450).

† *Notes on the Marine Invertebrate Fauna of Plymouth for 1892*, vol. ii, 1892, pp. 333 to 339.

subjects of which they treat; I shall endeavour to expand them both in scope and detail when further observations have been made and the time is ripe.

ROSCOFF; June 30th, 1894.

I. FAUNISTIC RECORDS.

HYDROZOA.—Several additional colonies of *Tubiclava cornucopiæ* have been obtained in 15 to 25 fathoms of water south of the Mewstone. In all cases they were growing, like our first specimen, on shells of *Aporrhais* or *Turritella*, tenanted by the Gephyrean *Phoscolion strombi*. Some of the colonies were young, and possessed a reticulate stolon, like Norman's original specimens from the Shetlands—thus confirming my anticipation that the solid carpet-like base of large colonies is not a specific difference, but a senile character (Trans. Devon. Assoc., 1892, pp. 378-9).

Clava cornea (of Hincks) is abundant on the fronds of *Fucus* growing in that branch of the Hamoaze known as the Lynher, or St. German's River.

In tide-pools under the Hoe two species of *Clava* are common, one being *C. multicornis*, and the other a larger and stouter form, which seems to be the *Clava leptostyla* of Hincks's monograph. To prevent confusion, however—since one of the characteristics of our form, at any rate, the purple colour of the gonophores, is nowhere mentioned,—I give its leading features here.—Colonies clustered, attached to stems of algæ and to the floor of limestone pools; polyps very large and stout, tall when extended, of a rich salmon-flesh colour; digestive cavity having a distinctly spiral marking, or even coiled appearance, which is seen when the polyps are fully extended as well as when contracted; gonophores in two, three, four, or rarely five large compact round bunches immediately beneath the tentacles, and of a conspicuous purple colour when mature.

Tubularia indivisa has been dredged occasionally in Millbay Channel. Good colonies were obtained there on April 13th, 1894, but the gonophores were provided with very short stalks, and did not form pendulous racemes. With them were large colonies also of *Tubularia larynx*, crowded with gonophores. On March 9th a small colony of a *Tubularia* was dredged in Barn Pool, growing on some *Ceramium* or *Polysiphonia* attached to a root of *Laminaria*. The stems were without annuli, the tentacles were white, and there was a collar-like expansion below the hydranths, and I inferred the species to be the *T. humilis* of Hincks's monograph. On the 19th, however, I collected some other colonies from tide-pools below the Hoe, and they resembled the preceding in almost all points except

in the absence of a collar. The polypites were white, the stems entirely destitute of annulations or corrugations, and white. The colonies were crowded with gonophores, which each exhibited a red patch. I scarcely doubt that these two forms belong to the same species.

Coryne pusilla has been common in tide-pools below the Hoe, side by side with *Clava multicornis* and *Tubularia humilis*; also on the breakwater, and at Cremyll below the garden battery. Intermediate varieties between the *Coryne pusilla* and *C. fruticosa* of Hincks are common. On July 17th, 1893, I found an extensive colony of another *Coryne* attached to a root of *Laminaria* trawled in the Sound. The stems were slender, branched, and irregularly annulated; the polyps red, much elongated, and provided with fifteen to eighteen tentacles, scattered or irregularly whorled. The colony attained a maximum height of 1½ inches, but was for the most part less than this, and of lax growth. It is undoubtedly allied to Hincks's *C. vermicularis*, and I record it as such; but it should be noted that the colony was certainly not dense, and the tentacles were apparently less numerous than in Hincks's type. As our colony was without gonophores, however, it is possible that these differences may have been due to immaturity.

Eudendrium ramosum has been frequently dredged on the New Grounds and in Millbay Channel.

Garveia nutans was dredged in Millbay Channel several times during April and May, 1894. It is interesting to notice that while this species is common between tide-marks at Hilbre Island at the mouth of the Dee, at Plymouth it is rare, and lives in deep water only (15 to 20 fathoms).

Another Gymnoblaster which I found plentiful on certain stones at Cremyll presents several remarkable features which will justify a separate description: it is now under examination.

During the latter half of February and March, 1893, the tow-nets contained numerous specimens of the Anthomedusa *Rathkea octopunctata*, which is the *Lizzia octopunctata* of Forbes' "Naked-eyed Medusæ," and the *Cytæis octopunctata* of M. Sars. Haeckel has made a mistake in treating these as different forms, and in assigning them to different genera, viz. to *Margellium* and *Rathkea* respectively. In Haeckel's system (System der Medusen, pp. 95 and 97) each of these types possesses eight bundles of tentacles, but in *Rathkea* the bundles are perfectly similar to one another, while in *Margellium* the four perradial bundles contain a greater number of tentacles than the four interradial. The mature *Rathkea* (= *Cytæis*) *octopunctata* of Sars and Haeckel is characterised by having three tentacles to each bundle; but since Sars has shown that the inter-

radials develop later than the perradials, and that the lateral tentacles of each bundle develop later than the median tentacle, a stage is consequently passed through in which the perradial bundles consist of three tentacles and the interradials of only one. On the other hand, *Margellium octopunctatum* is defined by Haeckel as possessing perradial bundles of three tentacles and interradials of two tentacles—apparently on the sole basis of Forbes' figure (loc. cit., pl. xii, fig. 3). In this definition Haeckel has disregarded Forbes' statement that the number of tentacles in the interradial bundles is "either two or three, . . . the number varying in different specimens" (loc. cit., p. 65), and I am able to confirm Forbes fully in this respect. The development of the lateral tentacles in the interradial bundles takes place very irregularly. In some instances I have seen them arising together, one on each side of the median tentacle, and growing at a uniform rate; but in the majority of cases there is an irregularity in the time of their origin, and one of the lateral tentacles may have become considerably developed before the rudiment of the other has appeared. It thus very often happens that individuals may be seen to possess interradial bundles of two tentacles only, and it is this condition which Forbes has figured. It is, however, as I have just shown, simply an instance of temporary asymmetry due to inequality of growth. The species *Margellium octopunctatum* of Haeckel has consequently no existence. The oral tentacles (*Mundgriffel*) of our own specimens show a single bifurcation only (cf. Giard, Bull. Sci. France et Belgique, xix, 1888, pp. 317, 318, pl. xxi), whereas Haeckel gives "Mundgriffel 3—4 mal dichotomisch getheilt" as one of the characteristics of his species,—upon what grounds I do not know. The buds, so characteristic of this medusa, form a longitudinal row on each of the four sides of the manubrium, each row containing from two to four buds, which increase regularly in size from the oral to the umbrellar region of the manubrium. I have not detected the spiral arrangement attested by Giard, although his remarks on the order of their development apply equally well to the specimens I have examined. The medusa was taken in the tow-nets in February and March of this year also, but not in the same abundance as last year. It was succeeded towards the end of April by other Margelid medusæ, *Bougainvillea (Margelis)*, both *principis* and *ramosa* of Haeckel, which seem, indeed, to form only one species.

Other Anthomedusæ that have been taken are *Corymorpha nutans*, which was abundant in May this year; *Sarsia prolifera* and *tubulosa* (rarely), *Podocoryne (Dysmorphosa) carnea*, *Tiara octona*, *Amphinema Titania* (= *Saphenia dinema* of Forbes), and *Amphicodon amphipleurus* of Haeckel. The last-mentioned very remarkable medusa

had numerous buds arising from the tentacle bundle; it was taken on a few occasions only during April of this year.

Among Calyptoblastic Hydroids, I may record that *Diphasia rosacea* is common on stones in Millbay Channel.

The Campanularian medusæ offer great difficulties in the way of satisfactory identification, owing to our ignorance of the limits of growth and modification of which so many of the medusæ are capable after liberation; I will therefore content myself with descriptions in several cases. Several specimens of a large, delicate, and perfectly transparent medusa were dipped up from the boat's side on October 6th, 1892, which I found, upon examination, to be the *Irene pellucida* of Will, redescribed by Claus in the *Arbeiten des Zoologischen Inst. zu Wien*, iv. This medusa is the *Geryonopsis pellucida* of Forbes' monograph (p. 40), but is altogether distinct from the species described by Haeckel under the name *Irene pellucida*. The umbrella was depressed and broad, 2.4 cm. in diameter. The gonads extended 8 mm. from the edge of the umbrella, *i. e.* only two thirds of the radius. There was a distinct peduncle (*Magenstiel*), conical in form, 5 mm. long. The oral lips, four in number, were produced and fimbriated. The tentacles, sixty-four in number, were very regularly disposed (4 + 4 + 8 + 16 + 32). The primary and secondary tentacles were as long as or longer than the oral lips, and the tentacles of the remaining orders diminished regularly in size and length according to their respective orders. Each tentacle consisted of a basal bulb and a terminal filament, often coiled. There was no trace, however, of true "spiral cirri." In addition there was also a variable number of tentacle rudiments, devoid of filaments, in positions which indicated the commencing formation of a sixth order of tentacles, sixty-four in number. Otolithic vesicles were present, usually one between every two adjacent tentacles, never more. Every tentacle was provided with an excretory pore, opening into the umbrellar cavity at the tip of a tubercle placed just above the velum. The species differs from the *Irene pellucida* and *Irene viridula* of Haeckel's monograph in the absence of spiral cirri. From the former it also differs in the fimbriation of the oral lips, in the absence of a conspicuous constriction between peduncle and stomach, in the regularity of the tentacles, and in the distal position of the gonads on the radial canals. From the *Geryonopsis delicatula* of Forbes it differs in the regularity of the tentacles, in the absence of a conspicuous contraction of the peduncle, and in the smaller size of the oral lips and of the velum.

In addition to *Laodice cruciata* (= *Thaumantias pilosella* of Forbes and the "Irene viridula" of Mr. Bles's *Notes on the Plankton of Plymouth*, this Journal, II, 1892, p. 342), which is common at Plymouth every summer, numbers of an *Irene*-like Phialid were taken

in the tow-nets during August, 1893. The tentacles were regular, and sixteen in number. One or generally two otocysts were situated between every two adjacent tentacles. There were no cirri. The mouth had four very short lips, absolutely smooth; and there was no peduncle. The gonads formed four oval swellings almost at the distal extremities of the four radial canals.

Early in February this year I again saw a number of Leptomedusæ resembling those just described in many respects, but approaching more nearly Haeckel's *Phialidium variabile*. The size was in some cases as much as that of a threepenny piece. The tentacles, sixteen in number, were long, and arose from stout pigmented bulbs. There was one otocyst between every two adjacent tentacles, and in one instance I saw two in that position. No peduncle. Radial canals four; gonads oval, elongated, in the distal halves. The species at first suggested to me the *Epenthesis cymbaloidea* of Haeckel, but the occasional occurrence of two otocysts in an inter-tentacular arc, the absence of a distinct ocellus, and the sharp boundary between the basis and filament of the tentacles, eventually inclined me towards *Phialidium variabile*.

Another Leptomedusa which it may be useful to record is the *Thaumantias octona* of Forbes, which I observed on two occasions in February and March, 1894. Haeckel places this medusa in the genus *Eucope*, owing to his belief that the "two vesicles" which Forbes describes and figures in juxtaposition on the edge of the umbrella are the optical expression of an otolithic capsule. These bodies, however, are quite separate from one another, as described by Forbes; and although I am not able to throw any light on their function or fate, I may say that Haeckel's suggestion is devoid of foundation.

The interesting Lucernarian *Depastrum cyathiforme* was twice obtained last year, in March at Drake's Island, and in May at Rame Head. One of the specimens obtained at the latter place exhibited a distinct lateral bud; a phenomenon not hitherto recorded, I believe, among Lucernarians.

CTENOPHORA.—A number of specimens of the lobate Ctenophore *Bolina hydatina* were obtained on several occasions in the Sound during the latter half of May this year. Many of the specimens were of the full size mentioned by Chun in his monograph, viz. up to 4 cm. in length, and were obtained in capital condition in spite of their extreme delicacy. The species was first identified at Plymouth by Mr. Riches, who noticed specimens in the tow-nets towards the end of May, 1892. Its recurrence at exactly the same period this year renders all the more remarkable its apparent absence from Plymouth during the intermediate year, especially when the calmness and warmth of that summer are taken into consideration.

ANTHOZOA.—During May, both in 1893 and 1894, the Leptomedusæ which then abounded in the Sound, and which seemed to be in part the young stages of *Irene pellucida*, and in part *Phialidium variabile*, were infested to a large extent with parasitic Actinian larvæ, which I had little doubt (after external examination only, however) were the young stages of *Halcompa chrysanthellum*.

In my notes on the fauna for 1892 (Journal, 1892, p. 334) I recorded *Bunodes coronata* as occurring at Plymouth. This is perfectly true, but the species which I intended at the time to record was *Bunodes verrucosa* (= *gemmacea* of Gosse). *Chitonactis coronata* (the *Bunodes coronata* of Gosse) has been taken on many occasions in the deeper water outside the Breakwater, as well as once or twice in the deep water of Millbay Channel. I have no doubt that those who are familiar with the recent changes and present state of Actinian nomenclature will forgive my momentary confusion of names, which I now correct.

In my former list I omitted to mention that *Epizoanthus incrustatus** is common at Plymouth on a patch of ground a short distance south of the Mewstone, where it covers the shells tenanted by *Anapagurus lævis*. Another species of Zoanthid, *Epizoanthus couchii*, which is common in the Sound around the Duke Rock, and to a less extent in Millbay Channel, in which localities it may be found forming linear or retiform colonies over stones and shells.

TURBELLARIA.—Mr. Gamble identified as *Fecampia erythrocephala* (Giard) a remarkable Rhabdocoele which he found infesting a large percentage of young shore-crabs (*Carcinus mænas*) in the summer of 1893. I had seen a few specimens previously in basins in which some coralline from tide-pools had been placed; they must have just emerged from the crabs in the coralline. The curious cocoons formed by *Fecampia* are also very plentiful on stones at Plymouth, both on the shore and down to a depth of 5 or 6 fathoms.

CHÆTOPODA.—I am unable to refer to Miss Buchanan's preliminary report on the Polychæta of Plymouth (Brit. Assoc., 1892), but at the risk of repetition will record here a few species which I believe are not mentioned in her list. A single mutilated specimen of *Maldane cristagalli* of Claparède was dredged on a patch of ground, consisting of hard rock and intervals of sand, a short distance south of the Breakwater Fort on December 14th, 1892. It was associated with specimens of *Glycera capitata* and *Eunice Harassii*. The former, however, lives at Plymouth wherever there is abundance of clean coarse shell sand, and *Eunice Harassii* is not uncommon in Millbay Channel and around the Duke Rock, where it lives in holes of stones.

* The nomenclature of Haddon's *Revision of British Actiniaz* (Trans. Roy. Dublin Soc., vol. iv, 1891) is here followed.

It is also sometimes taken on the shore. The much larger Eunicid, *Marphysa sanguinea*, is common both in Rum Bay and at Drake's Island. It inhabits deep crevices of the rocks, and can only be obtained by breaking the latter to pieces by means of a crowbar.

On January 26th, 1893, I noticed among a number of *Phyllodoce maculata*, which emerged from material dredged off the west shore of Drake's Island, two specimens of a charming white *Phyllodoce* with reddish eyes, which I was not able to identify. Each segment except the most anterior ones was provided with a girdle of cilia. The parapodial lamellæ were fan-shaped, and each was marked with a brown, or rather a fawn-coloured spot. The inferior edge of each lamella was also provided with large vibratile cilia. The back of the worm was faintly pigmented with fawn-colour. The small but handsomely marked Syllid, *Proceræa picta* of Ehlers, is fairly common among the stones dredged in Millbay Channel. A species of *Myrianida** is constantly recurring at Plymouth, one or two specimens at a time. I believe it is identical with the *Myrianida maculata* of Claparède, though I cannot at present say whether it is different from the *Myrianida pinnigera* of Montagu, whose original description I have not seen. It is easily recognised by its colour, which is white, with deep orange-red blotches on the back of every third or fourth segment. It is fairly frequent among the roots of *Laminaria*. On one occasion (May 29th, 1893) I found a specimen under a stone at the Breakwater, which was provided with a chain of buds, some of which had detached themselves before my return to the laboratory. *Amblyosyllis* (*Gattiola*) *spectabilis*, I find, is a spongi-coloured form, and can often be obtained in quantity by tearing open the larger sponges, of *Desmacidon*-like texture, dredged in Millbay Channel. A large eyeless *Polydora* (? *flava*, Claparède) is common in Rum Bay, and at Rat Island in St. German's River, where it constructs mud burrows between the layers of shaly rock. In February I have found many of these burrows also containing a long segmented gelatinous egg-string, almost as long as the worm itself (*i. e.* about two inches), lying flat and straight in the burrows. The worm itself possesses a bifid præoral lobe, and the branchiæ commence on the eighth segment (*i. e.* the third after the apodous segment). The dorsal blood-vessel is conspicuous, the blood being crimson. At Rat Island I have also taken specimens of *Scoloplos armiger*, living, like the *Polydora*, in the mud between layers of shale, and also in the dirty sand around. In November, 1892, a single specimen of the

* Good figures of this species are given by Malaquin (*Mem. Soc. des Sciences et des Arts*, Lille, 1893, p. 287, pl. i), who identifies the *Myrianida maculata* of Claparède with the *M. fasciata* of Milne-Edwards.

remarkable *Ammotrypane aulogastra* of Rathke (*non* Johnston) was dredged off the Duke Rock.

Two specimens of the pelagic post-larval stage of *Arenicola* (described in this Journal, III, 1893, p. 48, by Dr. Benham) were again obtained this year in February, but about a fortnight earlier than in 1893.

GEPHYREA.—*Phoronis hippocrepia* has been frequently dredged, especially in Millbay Channel, and I have also taken it on the shore at Cremyll.

MOLLUSCA.—Several specimens of *Lima Loscombi* have been taken alive in about 20 fathoms off Stoke Point and south of the Mewstone. Large specimens of *Arca tetragona* can be obtained in Rum Bay by breaking the rocks there to pieces with a crowbar. They live in deep holes and crevices of the rocks, to which they are permanently attached by their stout operculum-like byssus. In the majority of cases the shells are remarkably abraded and polished by the efforts of the molluscs to enlarge the crevices in which they are fixed, so as to make room for their own increasing size. Not only is their layer of bristles entirely worn away in many cases by this friction of the valves against the surrounding rock, but the rock itself is rubbed away and polished by the incessant friction. In many cases I found the rock to be an almost perfect mould around the mollusc, while the aperture to the crevice by which the larval or young *Arca* had originally entered was not large enough to admit a specimen of even half the bulk to which the mollusc had attained!

A remarkably elongated specimen of *Loligo media* was trawled on April 14th, 1893, eight miles south of the breakwater. I took the following notes of its dimensions:

Maximum length of mantle	136 mm.
„ breadth of fin	27 „
Anterior extremity of fin to apex of body	98 „
Posterior „ „ „ „	43 „

The extraordinary abundance of the Tectibranch *Philine aperta* during 1893 has been already mentioned. Hundreds of specimens could easily be obtained at any time in the eastern portion of the Sound, and the species with its gelatinous egg-masses was so abundant in July as to choke the meshes of the shrimp-trawl when worked in Jennycliff Bay. *Oscanius membranaceus* also, though not so abundant as *Philine*, was unusually plentiful, especially in Millbay Channel and the Hamoaze.

In February of this year I found a single specimen of an apparently undescribed* type of Tectibranchiate mollusc which unites in

* This is the *Colpodaspis pusilla* of Michael Sars, a very rare and interesting form, of which only two specimens have previously been obtained.

