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A SPRING COLLECTING TRIP.

Notes on New England Nudibranchs II.

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In a recent number of the "Nautilus"¹ I recorded two occurrences of nudibranchs at Cohasset, Mass., indicating marked local condensation of the partly grown Eolid population during the time of a supposed autumn migration of the year's brood to deeper waters.

The condensation of adults at the breeding season is of quite a different order and much more familiar. The supposition is that the year's adults migrate from deep water to the shore, there to spend a brief mating season, spawn, and (for the most part) die. It is well known that early spring is the breeding season for most of the species, while others appear to select late autumn or winter—facts which go far to explain our woeful ignorance of this group in this country. At times, in other countries, these mating forms have been found abundant and gregarious to such an extent as to justify the expression "swarming" for the habit.²

¹ Vol. xxii, No. 2, June, 1908, pp. 13-16. "Two interesting New England Nudibranch Records." The sub-title "Notes on New England Nudibranchs. I." was accidentally omitted by the printer. P. 15, top line, after word "and" insert "T." For other errata see Nautilus, xxii, No. 6, Oct., 1908, p. 60.

² I use the term "swarming" in this paper to indicate a distinct gathering together, in *relatively* great abundance, for breeding.

Eliot ("On some Nudibranchs from East Africa and Zanzibar." Pt. V.; P. Z. S., 1904, ii, p. 87) furnishes a description of such a "swarming" of *Trevelyana crocea*,

From April 26 to 30, 1908, I was able to devote a short vacation exclusively to a minute examination, as exhaustive as time permitted, of the nudibranch life on two short stretches of coast suitable for breeding Eolid nudibranchs. The first was a stretch of granite ledges and piles of broken boulders at Rocky Neck, in Gloucester Harbor; the second a stretch of granite ledges at Brace's Cove, on the outer (eastern) side of Eastern Point, Gloucester, Mass. The localities were quite unlike in biological character, though resembling each other as shore formations. The Rocky Neck locality was bathed by the comparatively warm and still waters of the harbor, thick with larvæ, eggs, spores and organic débris of all kinds. Innumerable small and rather deep pools among the broken boulders, thickly hung and often completely choked with fuci, sheltered abundant animal life, including *Metridium* and hydroids. The Brace's Cove locality was pounded by the eternal surf of the open Atlantic, and the water was noticeably colder and crystal-clear. The pools on the massive ledges were much larger, shallower and more open. Corralines were abundant, hydroids and *Metridium* much fewer.

a Polycerid from Zanzibar, as follows: " * * * this form provided a most striking case of the migration of molluscs in flocks to shallow water for the deposition of spawn. But a few specimens were collected before a certain period of a few days' duration, when the sand of Chuaka Bay just below low-tide mark was occupied by astonishing numbers * * *. These were not washed up by accident, but were all actively crawling on the sand among the weeds, etc. Many were *in coitu*, and when placed in basins of sea-water most of the specimens were soon engaged in copulation or the deposition of yellow egg-ribbons. By-and-by the swarm disappeared to some unknown permanent habitat. If this were in the deeper channels of the bay (1 to 2 fathoms deep at low tide) they must have been found there by dredging. As this was not the case it seems most probable that the migrations of these tiny animals extend to and from the deep sea three or more miles away."

One may be permitted to guess that the "unknown permanent habitat" to which "the swarm disappeared" was that bourne from which no traveler returns! Quite probably the form may be found to be strictly annual with little or no overlap of generations, as I believe is the case with various of our own forms. Either the young escape observation till just about the breeding season (possibly making a very sudden and rapid growth at that time which may be marked by a change in food supply) or else, and more probably, the young straggle back to deep water as they grow stronger, but while still small, and, there attaining their growth, make a sudden descent (or ascent!) upon the shore *en masse* at the next call of the breeding impulse.

No temperatures were taken, for on the face of it the temperature was not the controlling factor at that time and place, the same forms and spawn occurring indifferently in shallow, sun-warmed pools pleasant to the hands, and in deep, unsunned crevices at extreme low tide when one's breath condensed in clouds over the numbing water. This is not to say that temperature may not be the controlling factor in the initiation of the migration impulse or even in the actual deposition of spawn, which latter may perhaps always take place at high water when the temperature conditions of the pools would be equalized.

The section worked at Rocky Neck did not exceed 300 yards in length, and at Brace's Cove about 200. Three days were given to the former and one to the latter. Every day-light tide was worked industriously, and attention was wholly concentrated on nudibranchs.

The "census" was as follows:

Coryphella rufibranchialis mananensis (Stimps.),¹ typical, 43 specimens collected and about 30 more seen—total, say 75. All but 6 at Rocky Neck. All well-grown, if not fully adult, except three or four apparently about half-grown.

Coryphella rufibranchialis chocolata var. nov. Externally not separable by me from the foregoing except by the color of the cores of the cerata and of the body, which is a true chocolate-brown, dark for the cerata, light for the body, as contrasted with the varied reds (varying from pink to ginger, salmon and scarlet) of the typical form. The dentition and internal anatomy have not yet been examined, but as there is undoubtedly intergrading in the color, no very distinctive character should be anticipated. I have seen this form before, but never more than one or two specimens at a time. As a mere color variety (and for all we actually know, a mere physiological phase) it may be thought not worth a name. At the same time the intergrades are few and the series incomplete; and the chocolate forms, in life, occurred markedly segregated from the others. It is at least possible to point out a tangible character by which it differs from typical *mananensis*, which no one has yet done for the differentiation of *mananensis* from *rufibranchialis*. Should *mananensis* prove

¹ So called by me for the present in the provisional belief that Stimpson's form—if separable at all, which I doubt—is only a variety of the European form. Our knowledge, and consequently the nomenclature, of the group of red-gilled Eolids on this coast is in deplorable condition.

a complete synonym (as Gould thought it), or a variety (as I consider it), then *chocolata* should be written as above; but if *mananensis* is a valid species (as Professor Verrill holds), then *chocolata* may be written as its variety pending further knowledge. Ten specimens collected, all at Rocky Neck.

Aeolidiella papillosa (L.). It is a question whether our American form may not be as well worth a varietal name as our form of *Coryphella rufibranchialis*. Both species are, in European waters, noted for their variability, and have enormous synonymies. I think it much the same sort of question as that whether it is worth while to distinguish our form of *Purpura lapillus*—doubtless it is extremely close to the European form, and no one has yet pointed out a constant diagnostic difference, yet an American lot could hardly be confused with a European lot. Our form of the present species, in my experience, runs shorter, stouter, pinker and less variegated than the European form, as shown by the numerous and excellent figures accessible. No diagnostic character has been found in the dentition. Eight specimens collected, of which four at each locality; one a giant of 9 cm., one of an ordinary full adult size of about 6 cm., three smaller adults of 4–5 cm., and one young of about 1 cm.

Cratena veronicae Verrill. One specimen about 1.8 cm. long, taken at Rocky Neck among a thick growth of undetermined hydroids, agreed very closely with Verrill's description of this rare and unfigured species. It was kept alive four days during which colored drawings were made, and then preserved for dissection.

Galvina picta (A. & H.), one specimen, adult. Rocky Neck, on hydroids.

Doto coronata (Gmel.), one specimen, adult. Rocky Neck, on hydroids.

Dendronotus frondosus (Ascanius), three specimens, one large adult of about 6 cm., two about half that size; the latter at Rocky Neck, the former at Brace's Cove.

Acanthodoris pilosa (Müller), one specimen of about 1 cm., at Brace's Cove.

Lamellidoris aspera (A. & H.),¹ eighteen specimens, 5 mm. to 12 mm. long, all but three or four at Brace's Cove, on Corallines.

¹Our knowledge of the difficult and critical group of species centering around *L. aspera* and including a number of quite insufficiently characterized American forms has not reached a point where identifications can be looked on as reliable.

Ancula cristata sulphurea (Stimps.), one young specimen of about 8 mm., at Brace's Cove. It seems best to preserve Stimpson's name at any rate in a varietal sense though Bergh has united it with *cristata*. The differential character of the lower origin of the anterior appendages of the rhinophores is fully confirmed by my observation and seems pretty constant.

Total about 119 individuals, falling into 9 genera and 10 species or varieties.

The picture of local nudibranch life obtained from this bit of intensive collecting is tolerably clear.

Coryphella rufibranchialis mananensis appears to have been "swarming," not in the sense that it was enormously numerous—for the total figures are not impressive—but in the sense that adults were locally gathered together in far greater numbers than normal and with a distinctly gregarious habit, *e. g.*, six or eight in one pool, none in the next, rarely alone. The specimens ran remarkably uniform in size and lent support to the view that the species is an annual. None were seen *in coitu* either in the pools or in three days of captivity, but spawn was abundant and probably mating was about over for the year. Alder and Hancock say of the British form: "met with * * * in April, May and June, when it has attained its full size and is spawning. * * * In August and September the young are found considerably advanced." I believe our form will be found to have a more concentrated breeding season.

What has been said applies equally to the chocolate variety.

Aeolidia papillosa gave some slight indication of "swarming" in that it was considerably more numerous than normal, and gregarious in habit. But this was not nearly as marked as in the foregoing and the sizes were so conspicuously *not* uniform as to look against its being an annual. What I have seen in this and other years would fit well with its being a bi- or tri-annual with a "swarming" habit slightly later than that of *C. mananensis* and not so well marked. The spawn was fairly abundant and *all* of a *deep* rose color whereas Alder and Hancock say of the spawn of the British form that it is "occasionally white, but generally has a pinkish tinge, and is sometimes distinctly rose-colored." They give the breeding season as "spring and summer months."

The other forms taken present no indication of a sexual "swarm-

ing." It is true *Lamellidoris aspera* occurred in some numbers but the individuals varied much in size, were not markedly gregarious, and no spawn or coition was seen. The species seems to be a fairly common one at most times and according to Alder and Hancock breeds in May, June and July,—if indeed our species be identical.

None of the species taken are rarities except the var. *chocolata* (which, however, I have several times seen before) and *Cratena veronicae*, which has not before been publicly reported since its original description, but has been taken a few times by Verrill in comparatively deep water. The present specimen is about three-quarters the size given by Verrill. One may hazard a guess that it will be found to have a shore breeding season sometime in the winter.

The other species are those we have often with us on the shore in very small numbers. While such of them as are hydroid feeders are almost necessarily to some extent gregarious, I know of no account of anything like a "swarming" of any of them except *Ancula cristata*.¹

There is a certain fascination about the mysterious appearances and disappearances of these beautiful wanderers, and the first student fully to master a nudibranch (or at any rate an Eolid) life-history will have an interesting story to tell.

A collecting trip like this gives endless opportunity for alleged "observations" on "protective" and "warning," coloration and the like, which would be worth recording if fishes or other enemies looked with human eyes, from air into water, in full daylight, and *from on top*. Any true advance in this direction must be along the lines of work like Herdman and Clubb's most interesting experiments.²

52 Eliot St., Jamaica Plain, February, 1909.

¹ Herdman and Clubb. Third Report upon the Nudibranchiata of the L. M. B. C. District, Proc. and Trans. Liverpool Biol. Soc., iv, 1890, p. 134. "This species (*A. cristata*) was found * * * in April, 1890, and we took it in extraordinary profusion * * * in March, 1890. On one reef of rocks especially, a little way above low-water mark, there must have been many thousands of specimens present. For yards it was impossible to walk without treading on them, and handfuls were readily collected by scraping the specimens together from the mud-covered rocks." It should be remembered that for some reason the British coast supports nudibranch life in a vastly greater abundance of individuals, as well as of species, than ours does.

² *Loc. cit.*, ante, pp. 150-163.



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