Francisco, though it is probable that other species will be discovered in the cold waters of the South American coast. The representatives of the group are lovers of cold waters as shown not only by their distribution, but by their habits, for though in the more temperate countries where they are found, as on our own coast, they come to the shore in the cold winter months to leave their eggs, they afterwards retire to deeper and colder waters and in the summer have only been taken on the coast of Massachusetts and Maine by means of the dredge, which is now doing so much in the hands of careful observers in increasing our knowledge of animal life in all its forms.

In relation to the distribution of the Cyclopteridæ and Liparididæ it is interesting to note the distribution of the family of Gobiesocidæ, so long confounded with them, but now separated as a family not only removed from the others on structural grounds but also by its general distribution. While the Cyclopteridæ and Liparididæ have their greatest development in and towards the Arctic regions, the Gobiesocidæ have theirs in and towards the tropics, being found throughout the tropical and temperate regions of the Pacific and Atlantic, and having but one genus with one or two species only extending from the Mediterranean to the British and Scandinavian coasts.

EXPLORATIONS OF CASCO BAY BY THE U. S. FISH COMMISSION, IN 1873. By A. E. VERRILL, of New Haven, Conn.*

SINCE the appointment, in 1871, of Prof. S. F. Baird, U. S. Commissioner of fish and fisheries, he has considered it essential to investigate the invertebrate animals of our coast, with especial reference to their habits, distribution, and importance as food for fishes; to this end extensive dredging operations have been

*An abstract of this paper is published in the "American Journal of Science," vols. vi and vii, Dec., 1873 to Feb., 1874.

undertaken at his request, and with his coöperation, during the three summers, by the writer and several other volunteers, in connection with his investigation of the fishes and fisheries.

In 1871, our operations were carried on in Vineyard Sound and the adjacent waters. The results of the extended operations of that season have been published in the first official report of Professor Baird, with numerous illustrations. In 1872, the headquarters of the Fish Commission, with its large party of volunteers, were established at Eastport, Maine. The adjacent waters of the Bay of Fundy were pretty thoroughly examined with the dredge and other apparatus, and a very large collection was made. In the same year Mr. S. I. Smith, Mr. Oscar Harger, Dr. A. S. Packard and Mr. C. Cooke, made important dredgings in behalf of the Fish Commission, on Saint George's Bank, and in the deep waters to the north and east of that bank, and off the coast of Nova Scotia, while on the U. S. Coast Survey Steamer, "Bache." Preliminary accounts of the results of these explorations were published in the "American Journal of Science."

This year, the party, which has been quite large, located at Peak's Island. This island is situated at the entrance of Portland Harbor, and about four miles from the city. This has proved to be a very favorable locality, on account of its central position, allowing us to dredge in all parts of Casco Bay and the connected bays and fiords, and to visit any of the numerous islands for which Casco Bay is so famous, without too great loss of time; and to take advantage of favorable weather for longer trips to the deeper waters outside the bay. The littoral animals of the island itself, owing to the diversity of the shores and purity of the water, have also proved to be numerous and interesting.

The fishes and the investigations more immediately connected with the fisheries have been attended to by Prof. Baird, aided by his secretary, Mr. Rockwell, Prof. Theodore Gill, Dr. Edw. Palmer, Mr. G. Brown Goode, Mr. Spencer Biddle and others. The dredging operations, the examination of the food of fishes, and all investigations concerning the invertebrate animals generally, have been in charge of the writer and Mr. S. I. Smith, aided by Prof. Wm. N. Rice and Mr. Goode, of Wesleyan University; Prof. J. E. Todd, of Tabor College, Iowa; Prof. H. E. Nelson, of Ohio Wesleyan University; Mr. J. H. Emerton, Salem, Mass.; Mr. J. K. Thacher, of Yale College; Mr. Franklin Benner, Astoria, N. Y.; and for a short time by Dr. P. P. Carpenter, of Montreal; Mr. C. B. Fuller, of Portland; Dr. J. B. Holder, of New York, and several others.*

Much of the success of the expedition is due to the interest taken in such scientific researches by Secretary Robeson, who caused a small U. S. steamer, the "Blue Light" to be specially fitted out for our dredging operations, under commander L. C. Beardsley, U. S. N. This steamer was provided with a steam windlass for hoisting the dredges and trawls, and with other conveniences, which greatly facilitated our operations, and enabled us to make much longer excursions to the outer waters and to do much more work during the summer, than otherwise would have been possible. Captain Beardsley has taken great interest in our investigations and has done all in his power to aid us in various ways. His constant endeavor has been to make the steamer as useful as possible to us. Our thanks are also due to Mr. Cooke, the executive officer, and to all the other officers and men for the hearty goodwill with which they have coöperated in our work and executed all our plans.

Ample wharf privileges were found at "Trefethen's Landing," and a building upon the wharf was speedily converted into a rather rude but comfortable laboratory. An excellent set of apparatus was provided by the Fish Commission, including a large assortment of dredges, rake-dredges, tangles, trawls, towing-nets, seines, sieves of various kinds, and all other kinds of apparatus and improvements which our past experience had proved useful or desirable. Sets of the apparatus such as were used by the English expeditions, on the "Porcupine" and "Challenger," were also imported by Prof. Baird, but were not found to offer any advantages over those which we had used in previous years.

* In consequence of the liberal coöperation of Prof. Pierce, superintendent of the U. S. Coast Survey, and other officers of the Survey, the U. S. Coast Survey steamer Bache was despatched, during the month of September, on several dredging expeditions to the deeper waters and distant banks off the coast of Maine, which we could not well reach with the "Blue Light." The dredges and other apparatus necessary for this work were provided by Prof. Baird, and the dredging on the "Bache" was under the superintendence of Dr. A. S. Packard, of the Peabody Academy of Science, Salem, Mass., aided by Mr. Caleb Cooke, also of the Peabody Academy. They were very successful in these explorations, and made several collections of great interest. A brief account of the results of their investigations has been published in the "American Journal of Science," for April and May, by the writer. Another account of these expeditions was published in the "American Naturalist," vol. viii, p. 145, March, 1874, by Dr. Packard.

The English "accumulator" we found no occasion to use in our work, for a simple "check-stop," devised by Capt. Beardsley, proved equally efficient and far more convenient and simple, as well as quite inexpensive.* This was found to answer every purpose in dredging or trawling at all depths down to 100 fathoms, and undoubtedly would do equally well at far greater depths. With a larger vessel, in heavy weather, or at very great depths, the rubber accumulator would doubtless prove advantageous, but it is quite superfluous for working in less than 500 fathoms, in moderate weather. Therefore, any party undertaking such dredgings as can be carried on with small vessels off our coast, need not encumber themselves with this expensive piece of apparatus, for which a few fathoms of small or weak rope, applied in the form of a "check-stop," may be substituted.

Deep-sea thermometers, water-bottles for obtaining samples of the bottom-waters, and other physical apparatus, were also provided and frequently used.

Mr. Emerton was employed to make drawings of the more interesting new and rare animals, from life. These drawings are remarkably accurate and life-like, and number nearly three hundred. They constitute one of the most valuable results of the expedition. As Mr. Emerton had drawn large numbers of our common marine animals for us during the two previous years, a considerable portion of his time has been devoted during this season to the free-swimming larval stages of crustacea, etc., and to the smaller and less known species in various classes. The soft parts of many species of mollusks have also been well figured. To Mr. S. I. Smith I am specially indebted for the identification of most of the crustacea mentioned in this article, and for other assistance.

Much attention was paid to the determination of the temperature of the water, both at the surface and bottom, in many of the localities where dredgings were made. The more important of these are given in the following tables.

*This arrangement and the dredges, tangles, trawls, rakes and other apparatus used by us, were described and illustrated in several letters to the New York Tribune by Mr. Wm. C. Wyckoff, one of the editors, who spent some time with us at the island, and accompanied us on several excursions. These letters are brought together in the "Tribune Extra," No. 10, Scientific Series, in connection with the daily reports of the meetings of the association.

TEMPERATURES TAKEN IN AND NEAR CASCO BAY, IN FIVE TO SEVENTY-FIVE FATHOMS.

DATE	LOCALITY.	Weather.	Hour.	Tide.	TEMPERATURE. F. Air.	Surface.	Bottom.	Depth in fathoms.	Nature of bottom.
July									
21	Off Cape Elizabeth.		12 M.	2 h. ebb		51°	44½°	24	Gravelly.
22	Off Upper Flag I.	Clear	11 A.M.	1 "		57	50	16	Sandy.
"	Broad Sound.	"	1 P.M.	3 "		52	48	34	Gravel.
24	Luckse's Sound.	"	10.40 A.M.	5 h. flood	80°	56½	46½	12½	Muddy.
"	Broad Sound.	L.Cl'ds	12.10 P.M.	1 h. ebb	84	62	49½	16½	Fine sand.
"	Off Eagle Island.	"	2 P.M.	3 "	80	65	45½	31	Gravel.
26	Broad Sound.	Clear	11 A.M.	5 h. flood	68	56½	47½	16½	Sand.
28	Off Fort Gorges.				65	59	52	11½	Muddy.
30	Broad Sound.				67	60	49½	23	Gravel & sand.
"	" "				66	60	53	9½	Gravel.
"	" "				66	60	53	17	Sand & shells.
31	Off Portland Light.	Cloudy	5 P.M.	1 h. ebb	69	59½	49½	13½	Sandy.
Aug.									
3	Off Crotch Island.	"	11.35 A.M.	l. w. slack	71	61	47	11	Muddy.
"	Mericoneag Sound.		0.50 P.M.	1 h. flood	69	63½	45	12½	"
"	Near Cow Island.	"	2.30 P.M.	3 "	67	62	54½	9	Gravel.
4	N. E. of Cow Island.	Clear	10.25 A.M.	3 h. ebb	70	65	51	12	"
"	Near Inner Green I.	"	11.40 A.M.	4½ "	73	63	48½	12½	"
"	Off Halfway Rock.	"	11.55 A.M.	5 "	75	62	46½	19	Sandy.
"	Off Eagle Island.	"	1.30 P.M.	l. w. slack	74	60	43½	18½	Gravel.
5	West Cod Ledge.	"	11.15 A.M.		72	64	48	13	Sand & rocks.
"	15 m. off C. Elizabeth.	"	2.00 P.M.		65	64	39½	48	Muddy.
6	14 " " "	"	12.00 M.		69	64	38	54½	"
"	15 " " "	"	3.00 P.M.		72	64	37½	48	Mud & rocks.
"	17 " " "	L.Cl'ds	4.15 P.M.		68½	65	36	64	Muddy.
7	Chambers' Cove.	Cloudy	2.20 P.M.	4 h. ebb	70	59	54	7	"
11	Broad Sound.	Clear	12.00 M.	4 h. flood	65	57	47½	25	Gravel.
"	Luckse's Sound.	"	2.20 P.M.	h. w. slack	65	55½	45	15	Muddy.
12	West Cod Ledge.	"	10.00 A.M.		63	61	47	13	Sandy.
"	20 m. off C. Elizabeth.	"	0.45 P.M.		64	62½	38	68	Muddy.
13	West of Seguin Island.	"	11.00 A.M.	1 h. flood	64	52	47	12	Sandy.
"	6 m. E.S.E. of Seguin I.	L.Cl'ds	0.35 P.M.	2½ "	64	57	41½	33	Sand & rocks.
14	Main channel.	Cloudy	12.15 P.M.		62	57	55½	9	Muddy.
"	Off Clapboard Island.		1.10 P.M.		64	55½	54	9	"
20	9 m. S.S.E. of Seguin I.	"	11.35 A.M.		62	59	38	75	"
"	5 m. S. E. of Seguin I.	"	1.40 P.M.		65	58	38½	40	Sand & gravel.
Sept.									
1	Off Witch Rock.	"	11.00 A.M.	5 h. ebb	58	54	50½	14	Rocky.
8	Off Pole I., Quahog B.	Clear	11.45 A.M.	4½ "	63	59½	53	5	Muddy.
"	" " "	"	12.15 A.M.	5 "	63	59	54½	6	"

FAUNA OF THE OUTER WATERS ON MUDDY BOTTOMS.

One of the most interesting regions examined was in the deeper waters outside of Casco Bay, 15 to 30 miles southeast from Cape Elizabeth. To this region we made several excursions, and dredged at depths varying from 40 to 95 fathoms, the depth gradually increasing with the distance from the shore. In these localities the bottom was generally of soft mud, with more or less numerous, scattered bowlders. On one occasion we brought up in the trawl from 65 fathoms an angular bowlder, estimated to weigh over 500 lbs. These bowlders were probably transported from the adjacent coast by shore-ice in spring. They were usually covered with sponges, bryozoa, ascidians, hydroids, *Terebratulina*, etc. The bottom temperature of these waters was remarkably low, varying from 36° to 40° F., while the surface was usually between 60° and 65°, or even higher. The temperatures obtained here are quite as low as those that we obtained in the deeper parts of the Bay of Fundy last year, and the fauna proved to be correspondingly arctic in character, and agrees pretty closely with that at the mouth of the Bay of Fundy, and also with the dredgings made last year, in 85 to 150 fathoms, near St. George's Bank. In fact, these three regions may be regarded as distant parts of one great basin, referred to in a former article as "St. George's Gulf," but named "Gulf of Maine" on some of the Coast Survey charts, and this region is throughout its whole extent bathed in cold water of nearly uniform temperature, at corresponding depths. The deepest parts of this gulf seldom exceed 150 fathoms, and are perhaps nowhere more than 200 fathoms deep. Whether the nearly ice-cold water filling the deeper parts of this cold area can be regarded as constituting a definite current, or offshoot from the great arctic current, flowing southward along our coast in deep water off shore, or whether it be a portion of the great body of cold water filling the ocean basin at great depths, which is brought into this partially closed basin by the powerful tidal currents, is still uncertain. But it is important to have established the fact that this body of cold water approaches so closely to the coast of Maine as to manifest itself most distinctly within 12 or 15 miles of Cape Elizabeth, both by its highly arctic fauna and its icy temperature, even in midsummer. Moreover, there can be no doubt but that the constant admixture of this cold bottom water with the warmer surface waters, by means of the strong tides and local wind currents, causes the remarkably low temperatures observed, both at the surface and bottom, in the shallow waters of these shores,* and even in the smaller bays and harbors along the entire eastern and northern coasts of New England. The surface water in Casco Bay, among the islands, where the water is quite shallow, was usually found to be colder than it was on the same days, outside the bay, where the water was deep. It is also evident that a strong wind blowing from the shore for some time will have the effect to cause an ascending current of cold water along the submerged slope of the shore, to supply the place of the surface-water driven seaward by the wind; while an easterly wind will force the warmer surface water toward the shore, and cause a descending current along the slope, partially forcing the cold water away from the shallows. Our observations, both in Vineyard Sound and Casco Bay, show that such an action does take place, and that the temperature of the water near the shore is rapidly lowered by a westerly or off shore wind, and is as quickly raised by an easterly wind, independently of the temperature of the air.† But the effect is often somewhat masked, in summer, by reason of the much higher temperature of the westerly winds, which quickly warm the water close to the surface. Observations made early in the morning, before the effect of the direct heat of the sun becomes apparent, are the best for detecting the influence of tidal and wind currents.

Among the species obtained on these bottoms, in 50 to 94 fathoms, were several fishes, among which *Raia lævis*, *Sebastes viviparus*, *Pomatopsetta dentata*, and a species of *Phycis* were the most common. Among the more interesting Crustacea were numerous large and fine specimens of the rare *Pandalus borealis*, some of which were eight or ten inches long, dredged in several localities in 50 to 68 fathoms; *Sabinea septemcarinata*, a rare shrimp, dredged in 68 fathoms, and not obtained before on our coast, except in the deeper parts of the Bay of Fundy; *Byblis Gaimardii*

* The temperature of the bottom-waters in the deeper channels among the islands, in 15 to 25 fathoms, was usually from 42° to 52° F.; while the surface was usually between 52° and 62° in July and August.

† See the Report of the U. S. Fish Commission for 1871, p. 436, for a fuller discussion of this subject by the writer. Rev. J. W. Chickering also informs me that he has made series of observations at Hampton Beach, N. H., which establish such a coincidence. The change sometimes amounts to 10° F. in a few hours.

and numerous other Amphipods; two species of Lernæans, parasitic on Annelides, etc. The Annelides were very numerous, and among them were many rare and interesting species, some of which were undescribed, and others new to our coast. Among the more interesting of the Annelides, are *Eunoa nodosa* Malmgren, which was dredged in 68 fathoms, and subsequently by Dr. Packard on Jeffrey's Ledge in 33 fathoms. It differs from the more common *E. Œrstedii*, in its broader body, with broadly reniform scales, on which there are only a few rounded tubercles, near the margin; *Lætmonice filicornis*, a large, oblong, scaly worm, allied to *Aphrodita*, but with the large thin scales more or less exposed, with fewer and stouter setæ, and with long slender antennæ; *Antinoë Sarsii*, a scaly worm with long slender setæ in the lower rami; *Enipo gracilis* V. (Plate 5, fig. 3), a new and very slender species of scaly worms; *Nephthys ingens* Stimpson (Plate 2, fig. 2), which is very common on all the muddy bottoms along the whole New England coast, in 5 to 150 fathoms. It is easily distinguished not only by the peculiar head and proboscis, but by the wide separation and great elongation of the upper and lower rami on the posterior half of the body, by the squarish form of the body posteriorly, and by the blackish color of the setæ. *Ninoë nigripes* V. (Plate 3, fig. 5), *Goniada maculata*, *Anthostoma acutum* V., *Chætozone setosa* Malmgren, *Ammotrypane fimbriata* V. (Plate 2, fig. 3), *Notomastus latericeus* Sars, and several species of *Amphitrite*, were frequently met with; *Nothria opalina* V. (Plate 4, fig. 4), *Pista cristata* Malmgren, *Melinna cristata* M., and *Terebellides Stroemi* were common on all the deep-water muddy bottoms. *Grymæa spiralis* V. (Plate 5, fig. 5), a new species remarkable for its curious tube, composed of sand firmly cemented in the form of a double spiral, the two halves coiling in opposite directions, occurred in both 64 and 94 fathoms, and had previously been dredged by us in the Bay of Fundy, off Grand Menan. *Rhodine Loveni* Malmgren, and *Axiothea catenula* M., are new additions to the American fauna. Among the Sipunculoid worms *Phascolosoma cæmentarium* and *P. tubicola* V. were common; *P. boreale?* was rather rare in 64 fathoms, but was afterwards dredged in abundance on Cashe's Ledge by Dr. Packard; *Chætoderma nitidulum* Loven (Plate 6, fig. 6) was not uncommon in 48 to 64 fathoms.

A remarkable new genus of Nemerteans, was represented by a specimen eight feet long, of a bright orange color. This is the *Macronemertes gigantea* V. (Plate 2, figs. 5, 6). Among the mollusks there were many interesting species, though but few that were new to our coast. *Crenella decussata*, apparently perfectly identical with European specimens, and very distinct from *C. glandula*, was not rare. *Neæra arctica* Loven, of large size, occurred sparingly in most of the deeper dredgings. *Yoldia thraciformis* was common in all the deeper localities, and some of the living specimens were unusually large. *Arca pectunculoides* and *Dacrydium vitreum* occurred in the 94-fathom locality, about thirty miles off Cape Elizabeth; the last is a new addition to the fauna of the United States. *Scaphander puncto-striatus*, of good size, and *Philine quadrata* were not uncommon in most of the deeper hauls. *Dentalium occidentale* occurred in the 94-fathom locality, and with it a species occurred which much resembles *Entalis striolata*, but in the character of the animal (see Plate 1, fig. 3) it agrees better with the *Dentalium agile* of G. O. Sars. *Aporrhais occidentalis*, *Neptunea curta* (Jeff. sp.), *N. pygmæa* (Gould sp.),* *Turritella erosa*, *Pecten Islandicus*, and many other decidedly northern shells were not uncommon. *Octopus Bairdii* V. (Plate 1, figs. 1 and 2) occurred only once, in 68 fathoms; it had been dredged previously only in the deeper parts of the Bay of Fundy, in 1872. Among the Ascidians were fine specimens of *Glandula fibrosa* Stimpson, and *Eugyra pilularis* V.; a large, soft and rather flabby species, *Ascidia mollis* V. (Plate 1, fig. 5), occurred in abundance, associated with several other more common species. A bright purple *Botryllus* was once met with in 64 fathoms. On the scattered bowlders there were several fine species of Bryozoa, such as *Flustra solida* Stimpson, *Tubulipora crates* Stimpson, etc., associated with very large specimens of *Terebratulina septentrionalis*, and numerous sponges.

Of Echinoderms the most abundant species was the starfish, *Ctenodiscus crispatus*, of which we obtained about a thousand in

* An examination of the dentition of this and the preceding species shows that they are true Buccinidæ, and quite different from the *Tritonium Islandicum* of Loven (= *Fusus Berniciensis*, t. Jeffreys), which has been regarded as the type of *Sipho*. Our American shell, usually called *Islandicus*, but which has been named *Fusus curtus* by Jeffreys, is a genuine *Neptunea* closely allied to *N. despecta*, etc. The *pygmæa* differs considerably in its dentition from the typical forms of *Neptunea*, as well as in having a woolly epidermis, and ought to be separated as a distinct genus, or subgenus, which I have elsewhere described under the name of *Neptunella*. (See Report of U. S. Fish Commission, for 1871, p. 639).

one haul with the trawl, but *Ophioglypha Sarsii* and *O. robusta* were also abundant; the little Ophiuran, *Amphipholis tenuispina* Ljung., occurred in 68 fathoms; this is a new addition to the American fauna; *Hippasteria phrygiana* occurred twice; *Ophiacantha spinulosa* and *Schizaster fragilis* were not rare; *Thyone scabra* V., *Molpadia oölitica* and several other interesting species also occurred; *Corymorpha pendula* was abundant in 95 fathoms; among the Anthozoa were *Cerianthus borealis* V., *Edwardsia farinacea* V., *Urticina nodosa* Fabr. sp. (=? *Tealia digitata* Gosse),* *Bolocera Tuediæ* Gosse, very large and fine. The last species had not been known from the American coast before, except from a few detached tentacles dredged last year near St. George's Bank, and *U. nodosa* had not been previously found, except last year, when it was dredged by Mr. Smith, east of St. George's Bank, in 430 fathoms, and by Mr. Whiteaves in the deeper parts of the Gulf of St. Lawrence. The specimens obtained this year are much larger, some of them being 6 inches high and 4 in diameter. Of sponges, several very interesting species occurred; among them a large specimen, two feet broad, of *Phakellia ventilabrum* Gray (the *Halichondria ventilabrum* of the earlier English writers); a species apparently belonging to the genus *Trichostemma* of G. O. Sars; and over twenty specimens of *Hyalonema longissimum* M. Sars, some of them of unusually large size; these were all obtained in 95 fathoms, about 30 miles east-southeast from Cape Elizabeth. This last species had not been dredged before on the American coast, with the exception of a single specimen dredged last year by Messrs. Smith and Harger, off St. George's Bank, in 430 fathoms.†

With the *Hyalonema* an allied species often occurred, consisting of small irregular, elongated, fusiform, compact, white sponge-masses, connected by capillary stolon-like stems, made up of slender spicules twisted together. This species creeps over the bottom, but does not stand erect, like the former.

Several calcareous sponges were also met with; among these was a large and handsome species of *Grantia*, externally hispid,

* It seems to me very doubtful whether the *Actinia digitata* of Müller was actually the species that commonly bears that name in recent European works. The description would apply better to the *Bolocera Tuediæ* of Gosse. The species referred to above is certainly the *A. nodosa* of Fabricius, who well described it in 1780, as from deep water off the Greenland coast.

† Mr. Whiteaves writes me that he has also dredged it in the Gulf of St. Lawrence this summer; and it was also subsequently obtained by Dr. Packard.

with long slender spicula, and with an elegant crown of very long spicules around the terminal orifice. It most resembles *G. arctica* (*Sycandra arctica* Hæckel), but may be an undescribed species.

At another locality, about nine miles south-southeast from Seguin Island, in 75 fathoms, the same kind of bottom was found and the fauna was nearly identical with that described above.

At this place the finest specimen yet observed of *Cerianthus borealis* V. was obtained in good condition, and was kept alive several days, until a colored drawing could be made by Mr. Emerton. This specimen, in extension, was about 20 inches long, and the expanse of its tentacles was over six inches. The color of its body was deep olive-brown. This species was not discovered until last year, but it was met with at several different localities this year, and seems to be not uncommon on muddy bottoms in 20 to 100 fathoms, though seldom obtained of full size by the dredge, owing to its living deeply buried.

LIST OF SPECIES FROM OFF CASCO BAY, MAINE, INHABITING MUDDY BOTTOMS, IN 50 TO 95 FATHOMS.

In the following list the species with an asterisk (*) prefixed belong more properly to the hard bottoms, but occur more or less frequently on the muddy bottoms, adhering to scattered stones, or among broken shells.

The figures affixed to the names give, in fathoms, the greatest depths at which the species have been dredged on the New England coast.

ARTICULATA.

Pycnogonida.

Nymphon giganteum, 82.
*N. grossipes (?), 65.

Crustacea.

*Hyas araneus, 72.
*H. coarctatus, 150.
*Eupagurus pubescens, 150.
*E. Kroyeri, 430.
*E. Bernhardus, 150.
*Hippolyte spina, 72.
*H. Fabricii, 64.
Pandalus borealis, 68, 114.
*P. annulicornis, 430.
Sabinea septemcarinata, 68.
Thysanopoda, large sp., 142, 430.
Mysis, sp., 68.
Diastylis quadrispinosa, 68.
*Paramphithoë cataphracta.
Harpina fusiformis, 110.
Phoxus Kroyeri, 60.
Œdiceros lynceus, 90.
*Melita dentata, 430.
Byblis Gaimardi, 79.
Haploops, sp., 105, 114.
Ampelisca, sp., 142.
Ptilocheirus pinguis, 150.
*Unciola irrorata, 430.
Dulichia, sp., 60.
*Caprella, sp. with spines, 142.
Praniza cerina, 68.
Asellodes alta, 90.
Anthura brachiata, 110.
Lernæan, on Eunoa Œrstedii, 68.
Lernæan, on Terebellides Stroemi, 68.
*Balanus porcatus, 150.

Annelida.

Aphrodita aculeata, 72, 90.
Lætmonice filicornis, 150.
*Eunoa Œrstedii, 72.
*E. nodosa, 68.
*Harmothoë imbricata, 64.
Antinoë Sarsii, 110.
Enipo gracilis V., 80.
Pholoë minuta, 68.
Nephthys ingens, 142.
N. ciliata, 114.
Phyllodoce, sp., 110.
*P. Grœnlandica, 90.
Eteone depressa, 110.
*Nereis pelagica, 142.
Nereis, sp. 68.
Gattiola, sp. 68, 90.
*Leodice vivida, 430.
Nothria opalina, 150.
*N. conchylega, 430.
Ninoë nigripes, 114.
Lumbriconereis fragilis, 430.
Goniada maculata, 150.
Rhynchobolus albus, 110.
Scalibregma inflatum, 150.
*Travisia, sp., 95, 106.
Brada, sp., 90.
Tecturella flaccida, 90.
Trophonia aspera, 150.
Ophelia, sp., 107.
Ammotrypane fimbriata, 114.
Sternaspis fossor, 142.
Scolecolepis cirrata, 150.
Anthostoma acutum V., 64.
Anthostoma, sp.
Chætozone setosa, 106.
*Dodecacerea concharum, 90.
Maldane Sarsii, 150.
Rhodine Loveni, 50.
Axiothea catenula, 54.
Praxilla gracilis, 114.
P. prætermissa, 114.
*Nicomache lumbricalis, 110.
Ammochares, sp., 142.
Notomastus latericeus, 110.
Ancistria capillaris V., 117
*Cistenides granulatus, 90.
Ampharete gracilis, 106.
A. Finmarchica, 110.
Amphicteis Gunneri, 110.
Amage auricula, 150.
Samytha sexcirrata, 110.
Melinna cristata, 150.
Terebellides Stroemi, 142.
Pista cristata, 150.
Grymæa spiralis V., 95.
*Thelepus cincinnatus, 142.
*Amphitrite cirrata, 95.
A. Johnstoni, 64.
A. Grœnlandica, 68.
A. intermedia, 94.
Polycirrus, sp., 110.
*Potamilla oculifera, 90.
Sabella zonalis, 107.
Chone, sp., 95.
Euchone elegans V., 106.
Myxicola Steenstrupii, 72.
*Protula media, 90.
*Vermilia serrula, 106.
*Spirorbis lucidus, 114.
Ichthyobdella (on Raia lævis), 68.

Gephyrea.

*Phascolosoma boreale (?), 64, 90.
P. cæmentarium, 430.
P. tubicola V., 110.
Priapulus, sp., 60.
Chætoderma nitidulum, 110.

Turbellaria.

Nemertes affinis, 110.
Meckelia lurida V., 110.
Macronemertes gigantea V., 68.
Ophionemertes agilis V., 90.

MOLLUSCA.

Cephalopoda.

Octopus Bairdii V., 106.

Gastropoda.

Bela decussata, 64.
B. cancellata, 480.
B. pleurotomaria, 107.
B. turricula, 117.
Admete viridula, 150.
Neptunea curta, 68.
N. decemcostata, 107.
Neptunella pygmæa, 430.
Buccinum undatum, 52.
Natica clausa, 430.
Lunatia Grœnlandica, 430.
L. immaculata, 430.
*Trichotropis borealis, 80.
*Velutina zonata, 150.
*V. lævigata, 110.
Aporrhais occidentalis, 150.
Turritella erosa, 106.
Scalaria Grœnlandica, 85.
Rissoa exarata, 95.
*Margarita obscura, 430.
*M. cinerea, 150.
*Calliostoma occidentale, 82.
*Diadora noachina, 430.
*Lepeta cæca, 110.
Scaphander puncto-striatus, 150.
Cylichna alba, 150.
Utriculus pertenuis, 114.
Philine quadrata, 110.
P. lineolata, 64.
*Polycera Lessoni, 50.
*Doris planulata, 142.
*Trachydermon albus, 150.
Stimpsoniella Emersonii, 60.
*Hanleia mendicaria, 80.
Dentalium occidentale, 150.
Entalis striolata, 150.
E. agilis ?, 95.

Lamellibranchiata.

*Zirphæa crispata, 80.
Mya arenaria (young), 64.
Neæra arctica, 150.
N. pellucida, 142.
*Saxicava arctica, 114.
Panopæa Norvegica, 115, 118.
Thracia myopsis, 150.
T. truncata.
Periploma papyracea, 109.
Macoma sabulosa, 142.
Cyprina Islandica, 72.
Cardium pinnulatum, 150.
C. Islandicum, 117.
Cryptodon Gouldii, 110.
C. obesus, 480.
Lucina filosa, 142.
Astarte lens, 430.
A. undata, 117.
A. quadrans, 150.
Cyclocardia borealis, 107.
C. Novangliæ, 90.
Nucula tenuis, 142.
N. proxima, 60.
N. delphinodonta, 68.
Leda tenuisulcata, 150.
Yoldia obesa, 150.
Y. thraciformis, 142.
Y. sapotilla, 117.
*Arca pectunculoides, 150.
*Modiolaria nigra, 107.
*M. discors, 90.
M. corrugata, 105.
Crenella glandula, 110.
C. decussata, 60.
Dacrydium vitreum, 95, 107, 142.
*Pecten Islandicus, 114.
*P. tenuicostatus, 110.
*Anomia aculeata, 150.

Tunicata.

*Ascidia mollis V., 107.
*Ascidiopsis complanatus, 110.
*Ciona tenella, 64.
Molgula pannosa, 64.
*M. retortiformis, 68.
Eugyra pilularis, 105, 114.
Glandula fibrosa, 95, 106.
*G. arenicola, 150.
*Cynthia echinata, 64, 80.
*C. carnea, 64, 80.
*Botryllus, sp., 64.
*Amarœcium glabrum, 64.
*Leptoclinum albidum, 72.

Brachiopoda.

*Terebratulina septentrionalis, 150.

Plate 1.

Fig. 3.

Fig. 1.

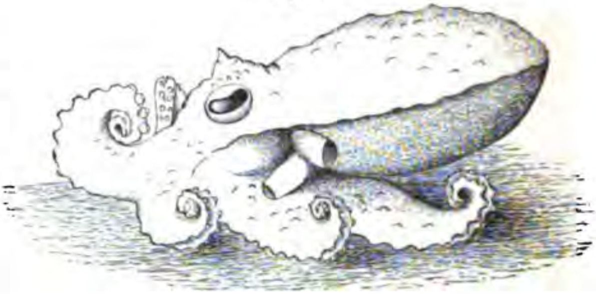

Fig. 4.

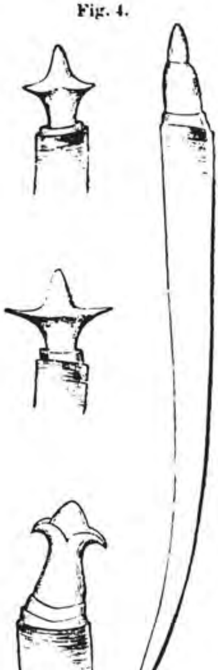

Fig. 2.

Fig. 5.

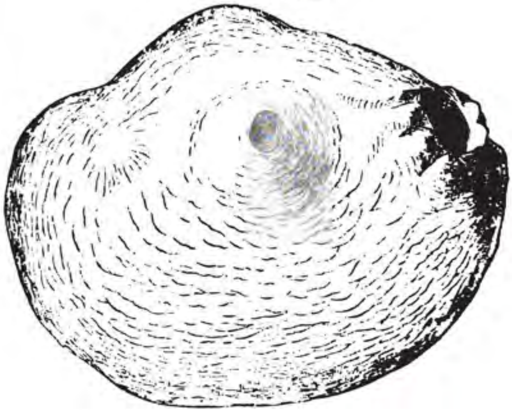

Fig. 6.

Plate 2.

Fig. 1.

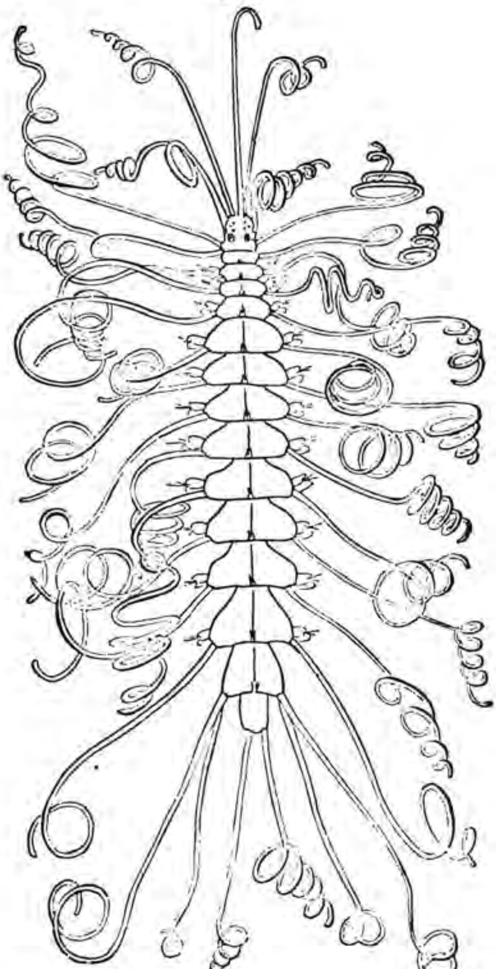

Fig. 2.

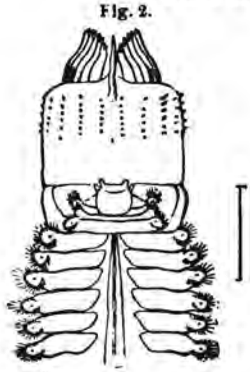

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Polyzoa.

*Crisia eburnea, 117.
*Hornera lichenoides, 150.
*Discoporella verrucaria, 150.
*Idmonea pruinosa, 118.
*Discofascigera lucernaria, 110.
*Flustra solida St., 64.
*Membranipora pilosa, 64.
Gemellaria loricata, 142.
*Cellularia ternata, 150.
*C. scabra, 95.
C. Peachii (?), 150.
Bugula, soft sp., 95, 430.
*B. fastigiata, 150.
Bugula Murrayana, 430.
Caberea Ellisii, 150.
*Anarthropora borealis, 150.
*Cellepora scabra, 150.
*C. ramulosa, var., 150.
*Alcyonidium, sp., 64.

RADIATA.

Echinodermata.

*Lophothuria Fabricii, 110.
*Psolus phantapus, 72.
Pentacta assimilis, 95, 430.
Thyone scabra V., 110, 150.
Stereoderma unisemita, 142.
*Thyonidium productum, 80.
*T. hyalinum, 80.
Molpadia oölitica, 95.
Schizaster fragilis, 430.
*Echinarachnius parma, 430.
*Strongylocentrotus Dröbachiensis, 430.
*Leptasterias compta, 90.
*L. tenera, 65, 142.
*Cribrella sanguinolenta, 90.
*Hippasteria phrygiana, 60, 90.
Ctenodiscus crispatus, 114.
Ophioglypha Sarsii, 430.
O. robusta, 118.
O. affinis, 105, 118, 150.
*Amphipholis elegans, 105.
A. tenuispina, 105.
*Ophiopholis aculeata, 104.
Ophiacantha spinulosa, 150.

Acalephæ.

*Campanularia verticillata, 430.
*Sertularia cupressina, 150.
*Sertularella polyzonias, var., 142.
*S. tricuspidata, 430.
*Lafoëa gracillima, 430.
*Eudendrium ramosum, 430.
*Tubularia indivisa, 430.
Corymorpha pendula, 95.

Anthozoa.

*Cornulariella modesta V., 106.
*Urticina nodosa (Fab. sp.), 430.
*U. crassicornis, 430.
*Bolocera Tuediæ, 150.
Edwardsia farinacea V., 95.
E. sipunculoides, 106.
Cerianthus borealis V., 150.

PROTOZOA (*Spongiæ*).

*Grantia arctica (?), 95.
Hyalonema longissimum, 95.
*Polymastia sp., 117.
*Phakellia ventilabrum, 68.
*Reniera, soft sp., etc.

FAUNA OF THE HARD BOTTOMS IN THE OUTER WATERS.

Very few localities of "hard" bottom have been met with in more than 25 fathoms of water; and consequently we have not obtained so complete a knowledge of the fauna occupying such bottoms, at greater depths off this coast, as of that inhabiting the soft muddy bottoms.* But a considerable number of species belonging properly on rocky bottoms came up attached to the bowlders, already referred to, which we frequently brought up even from the softest mud. Other inhabitants of such bottoms were obtained from the stomachs of fishes, freshly caught. From these and other sources we can now compile a pretty full list of species belonging to the hard bottoms in depths between 50 and 125 fathoms, off the coast between Cape Cod and Mount Desert.

Two of our dredgings, off Seguin Island, in 33 and 45 fathoms respectively, belong to the series of outer and deeper dredgings, rather than among those made in the bays. They are, however, somewhat intermediate in character.

The first named locality was unusually rich in species. I therefore give the entire list obtained at that place, so far as they have been identified. The bottom was generally hard, and in places rocky, but some patches of mud were evidently encountered by the dredge, and consequently there was a considerable number of true mud-dwelling species mixed with those belonging to the hard bottoms. Only one haul of the dredge was made at this locality, owing to unfavorable weather, but over 125 species of animals were obtained.

CONTENTS OF A SINGLE HAUL OF THE DREDGE MADE AUG. 13, 1873, ON HARD BOTTOM, WITH SOME SPOTS OF MUD, IN 33 FATHOMS; LOCALITY, SIX MILES EAST OF SEGUIN ISLAND.

ARTICULATA.

Pycnogonida.

Nymphon, sp.

Crustacea.

Hyas coarctatus.	Hippolyte spina.	Metopa, sp.
Eupagurus Kroyeri.	Unciola irrorata.	Caprella, sp.
Pandalus annulicornis.	Cerapus rubricornis.	Praniza cerina.
Hippolyte pusiola.	Monoculodes, sp.	

* This has, however, been remedied to a considerable extent by some of the subsequent dredgings made by Dr. Packard, when on the Bache.

Annelida.

Harmothoë imbricata.	Nicomache lumbricalis.	Amphitrite Grœnlandica
Phyllodoce catenula V.	Ancistria capillaris V.	Scione lobata.
Nothria conchilega.	Cistenides granulatus.	Chone, sp.
Lumbriconereis fragilis	Ampharete gracilis.	Potamilla oculifera.
Ninoë nigripes V.	Ampharete, sp.	Sabella, sp.
Anthostoma acutum V.	Melinna cristata.	Spirorbis lucidus.
Gattiola, sp.	Thelepus cincinnatus.	Vermilia serrula.
Nereis pelagica.		

Gephyrea.

Phascolosoma cæmentarium. | Phascolosoma tubicola V.

Turbellaria.

Nemertes affinis.

MOLLUSCA.

Gastropoda.

Admete viridula.	Astyris zonalis V.	Lepeta cæca.
Bela turricula.	Trichotropis borealis.	Calliostoma occidentale
Bela harpularia.	Aporrhais occidentalis.	Margarita cinerea.
Bela violacea.	Velutina lævigata.	Diadora noachina.
Buccinum undatum.	Lamellaria perspicua.	Doris planulata.
Neptunea decemcostata	Lunatia Grœnlandica.	Hanleia mendicaria Carp
Neptunella pygmæa.	Turritella erosa.	Entalis striolata.

Lamellibranchiata.

Saxicava arctica.	Astarte elliptica.	Modiolaria corrugata.
Macoma sabulosa.	Astarte lens.	Leda tenuisulcata.
Cardium Islandicum.	Cyclocardia borealis.	Nucula tenuis.
Cardium pinnulatum.	Crenella glandula.	Pecten Islandicus.
Cyprina Islandica.	Modiolaria discors.	Anomia aculeata.
Astarte undata.		

Tunicata.

Ascidiopsis complanatus.	Molgula pannosa.	Amarœcium glabrum.
Glandula arenicola.	Leptoclinum luteolum.	Lissoclinum, sp.
	Leptoclinum albidum.	

Brachiopoda.

Terebratulina septentrionalis.

Polyzoa.

Tubulipora crates.	Crisia eburnea.	Cellularia ternata.
Idmonea pruinosa.	Caberea Ellisii.	Cellepora scabra.
Discofascigera lucernaria.	Gemellaria loricata.	Cellepora ramulosa.
	Flustra solida.	

RADIATA.

Echinodermata.

Lophothuria Fabricii.	Stephanasterias albula Verrill.	Amphipholis elegans.
Strongylocentrotus Dröbachiensis.	Leptasterias compta.	Ophiopholis aculeata.
Solaster endeca.	Cribrella sanguinolenta.	Ophioglypha Sarsii.
Asterias vulgaris.	Ophiacantha spinulosa.	Ophioglypha robusta.

Acalephæ.

Lafoëa fruticosa.	Grammaria abietina.	Sertularella polyzonias.
Lafoëa dumosa.	Sertularia argentea.	Eudendrium capillare.
Halecium muricatum.	Sertularia latiuscula.	

Anthozoa.

Urticina crassicornis.	Cornulariella modesta V., new genus and sp.

PROTOZOA.

Spongiæ.

Tethya hispida.	Reniera, sp.	Grantia ciliata.
Halichondria, several sp		

Foraminifera.

Numerous species.

ALGÆ.

Laminaria longicruris.	Agarum Turneri.	Desmarestia aculeata.

The 45 fathom locality was about five miles southwest from Seguin Island. At this place we dredged many of the species obtained at the place last named, together with a number of additional ones, among which were the following:

ARTICULATA.

Crustacea.

Hippolyte aculeata.	Diastylis quadrispinosa.	Balanus porcatus.
Ptilocheirus pinguis.		

Annelida.

Nephthys ingens.	Trophonia aspera.	Terebellides Stroemi.
Rhynchobolus albus.	Ammochares, sp.	Myxicola Steenstrupii.

MOLLUSCA.

Bela decussata.	Margarita obscura.	Eugyra pilularis.
Natica clausa.	Cylichna alba.	Amarœcium pallidum.
Scalaria Grœnlandica.	Yoldia thraciformis.	

RADIATA.

Cerianthus borealis V.	Eudendrium ramosum.

Farther to the west, off the mouth of Casco Bay, and about two to three miles south of Half-way Rock, in 27 fathoms, we made another haul, very similar to the one in 33 fathoms, described above. The bottom was here composed of coarse sand and gravel, pebbles, small stones, and broken shells, with some mud. A large proportion of the species given in the list for the 33-fathom locality also occurred at this place, with many additional ones, among which were the following:

Crustacea.

Eupagurus Bernhardus.	Cumacea, two sp.	Ampelisca, sp. with red dorsal spots.
Crangon vulgaris.	Œdiceros lynceus.	Ampelisca, small sp.
Hippolyte Fabricii.	Ptilocheirus pinguis.	Anthura brachiata.

Annelida.

Nephthys ingens.	Praxilla zonata V.	Pista cristata.
Ammochares, sp.		Terebellides Stroemi.

Gastropoda.

Bela decussata.	Lunatia immaculata.	Cylichna alba.
Scalaria Grœnlandica.	Margarita obscura.	Philine angulata.
Natica clausa.		

Lamellibranchiata.

Cryptodon Gouldii.	Astarte quadrans.	Modiolaria nigra.
Cyclocardia Novangliæ.	Yoldia sapotilla.	

Echinodermata.

Hippasteria phrygiana, one large specimen.

A number of dredgings were made on and near East and West Cod Ledges, several miles off Cape Elizabeth. The shallower parts of these, in 10 to 15 fathoms, are very rough and rocky, so that in some places the dredge could not be used, and even the tangles suffered seriously by the iron frame becoming caught and jammed among the rocks so firmly that it could not be extricated without using force sufficient to bend and twist the stout iron cross-bar. At somewhat greater depths, in 20 to 30 fathoms, farther away from the crests of these ledges, the bottom was generally stony and gravelly, though often rough, and the dredges were used with good success. Most of the species from these localities have been enumerated in the two preceding lists, and need not be repeated here, but a considerable number of additional ones occurred. The roughest parts of the ledges, in 10 to 15 fathoms, are overgrown with red algæ, and among these the reddish variety of cod, known as "rock-cod," abounds. Here also a large number of interesting crustacea were obtained, most of them having red colors, evidently adapting them for concealment among the algæ.

Several of these occurred also in the previous lists, but are repeated here to show more fully the peculiar character of the fauna of these rough ledges. We ascertained that the cod-fish caught here feed chiefly on these crustacea, their stomachs often being filled with crabs, shrimps, and smaller species named below, together with more or less numerous Mollusca, Holothurians, Ophiurans, etc. The *Ophiopholis aculeata* was a common and important part of their diet, and several specimens of a large *Thyonidium* were taken from the stomach of a cod, at this place, though we did not dredge it at all, either here or elsewhere.

Among the species that occurred on the Cod Ledges, are the following:

Pycnogonida.

Phoxichilidium femoratum.	Nymphon, sp.

Crustacea.

Hyas coarctatus.	H. spina.	Amphithoë, sp.
Cancer irroratus.	H. Phippsii.	Cerapus rubricornis.
Eupagurus Kroyeri.	H. pusiola.	Unciola irrorata.
E. pubescens.	Crangon boreas.	Caprella, sp.
E. Bernhardus.	Pandalus annulicornis.	Praniza cerina.
Hippolyte Fabricii.	Paramphithoë pulchella.	Balanus porcatus, etc.
H. aculeata.		

Annelida.

Eunoa Œrstedii.	Euphrosyne borealis.	Potamilla oculifera.
Lepidonotus squamatus.	Amphitrite cirrata.	Spirorbis lucidus.
Harmothoë imbricata.	Scione lobata.	S. quadrangularis.
Phyllodoce catenula.	Thelepus cincinnatus.	Vermilia serrula.

Gastropoda.

Trophon scalariformis.	Menestho albula.	Trachydermon ruber Carp.
Buccinum undatum.	Margarita obscura.	T. albus Carp.
Neptunea curta.	M. cinerea.	Tonicella marmorea Carp.
Trichotropis borealis.	Lepeta cæca.	
	Doris planulata.	

Lamellibranchiata.

Saxicava arctica.	Cyclocardia borealis.	Modiolaria discors.
Cardium pinnulatum.	C. Novangliæ.	Anomia aculeata.
Astarte undata.	Modiola modiolus.	

Tunicata.

Ascidiopsis complanatus.	Cynthia pyriformis.	Leptoclinum albidum.
	Amarœcium glabrum.	L. luteolum.

Brachiopoda.

Terebratulina septentrionalis.

Polyzoa.

Alcyonidium, red sp.	Tubulipora patina.	Lepralia, several sp.
Crisia eburnea.	Caberea Ellisii.	

Echinodermata.

Lophothuria Fabricii.	Asterias vulgaris.	Cribrella sanguinolenta.
Thyonidium, sp.	Leptasterias, sp.	Ophiopholis aculeata.
Strongylocentrotus Dröbachiensis.	Stephanasterias albula Verrill.	Ophioglypha robusta.

Acalephæ.

Lucernaria quadricornis	Calycella syringa.	Sertularella polyzonias.
Obelia geniculata.	Lafoëa dumosa.	S. tricuspidata.
Campanularia volubilis.	Sertularia pumila?	Halecium muricatum.
C. integra.	S. argentea.	Tubularia indivisa.

Also species of *Grantia*, *Polymastia*, *Halichondria*, *Trichostemma* and numerous other sponges, not determined.

ALGÆ.

The following occurred in 12½ fathoms:

Agarum Turneri.	Euthora cristata.	Corallina officinalis.
Delesseria sinuosa.	Ptilota serrata.	Lithothamnion polymorphum.
D. alata.	Callithamnion Pylaisæi, with tetraspores.	
Calliblepharis ciliata.		

FAUNA OF CASCO BAY, IN SHALLOW WATER.

In Casco Bay, among the islands, in moderately shallow water, there is great diversity in the character of the bottom, and here a large amount of profitable dredging has been done.* Most of the species are decidedly boreal and arctic forms, which we had previously dredged in the Bay of Fundy, and farther north. The depth varied from 3 or 4 to about 30 fathoms. Some of the best localities on hard bottoms were found to be in Hussey Sound; off Cow Island; off the northern end of Peak's Island; off Witch Rock; off the Green Islands; off Whaleboat Island, in Broad Sound; and in the main ship-channel, off Fort Preble, etc. In these localities the bottom was composed of gravel and small stones, and occasionally of rough rocks with broken shells, gravel, etc., overgrown by an abundance of coarse massive sponges, among which were several species of *Reniera*, *Halichondria*, *Suberites*, *Polymastia*, *Tethya hispida* Bowerbank, etc., together with more delicate species belonging to *Chalina*, *Isodictya*, etc.

Several species of calcareous sponges also occurred, among which there were two or three species of *Grantia* (*Sycandra* Hæckel), a small species of *Leucandra*, on algæ; and a species, apparently undescribed (*Leucosolenia cancellata* Ver.), which forms small rounded or irregular cerebriform masses, usually less than an inch in diameter, consisting of an intricate net-work of slender anastomosing tubes, which give the surface a cancellated or pitted character. This is not uncommon on rocks and shells. Another peculiar and elegant species occurred once off Witch Rock, attached to *Terebratulina;* this forms deep goblet-shaped or campanulate cups, with a wide opening and smooth acute rim at the

*Numerous dredgings had also been made previous to our visit in the shallower waters of Casco Bay, by Mr. C. B. Fuller and others, during several years. A large and valuable collection of the shells and other marine invertebrates, mainly collected by Mr. Fuller, contained in the Museum of the Portland Society of Natural History, was burned in the great fire of 1866. Since that time he has accumulated for the Society another valuable collection, in which there are some species not obtained by our party. Dr. J. W. Mighels many years ago made a large collection of the shells of Casco Bay, chiefly from the shores and from fish-stomachs. This collection became the property of the same Society, and was destroyed by the previous fire, in which all its collections were lost. He published a catalogue of the shells of Casco Bay, etc., in the "Boston Journal of Natural History," vol. iv, p. 108, 1843. Professor E. S. Morse also made a choice collection of the shells of Casco Bay, mostly from the shores and shallow waters, previous to 1860. His collection is now in the Museum of Comparative Zoology. In this paper no attempt has been made to compile from these and other sources such species as we did not obtain. All the results given, unless otherwise stated, are based on our own observations, made for the most part this season.

top. In our specimen there are two cups, partially united at the base, nearly an inch high and about a third of an inch in diameter. The surface is even, minutely porous, and but slightly hispid externally. This appears to be a new species of *Leucandra* Hæckel, which I propose to call *L. cyathus*.

Among the more interesting crustacea dredged on such bottoms were numerous beautifully colored shrimp, belonging to six species of *Hippolyte* and the common *Pandalus annulicornis;* also several peculiar Amphipods, among which the *Acanthozone cuspidata* is conspicuous, on account of its numerous spines. An undetermined species of *Mysis* is not uncommon. Of Annelides several new and many rare forms occurred. Among the new species are *Enipo gracilis* (Plate 5, fig. 3), remarkable among the scaly worms for its slenderness and the small size of the scales, which only imperfectly clothe the anterior part of the back; the *Stephanosyllis picta* (Plate 4, fig. 1), a small but handsomely colored worm, belonging to a genus hitherto known only from the Mediterranean; *Procerea gracilis* (Plate 3, fig. 2), another allied species of small size but very active in its movements; *Praxilla zonata* (Plate 5, fig. 4), conspicuous on account of the bright red bands which surround the anterior part of its body. Other interesting species are *Eulalia pistacia* V. (Plate 4, fig. 2), which is usually of a bright epidote-green color and very lively and graceful in its movements; *Phyllodoce catenula*, quite as lively as the last, and more slender, with three rows of brown spots along its back; *Cirratulus cirratus* and *Scione lobata* M., which have not been recorded previously from our coast; *Vermilia serrula* Stimpson (Plate 4, fig. 3), remarkable for the two lateral chambers added to its tube when mature. Numerous interesting Ascidians also occurred, among them the rare *Chelyosoma geometricum* Stimpson (Plate 1, fig. 6), hitherto found only in the Bay of Fundy. This was dredged off Witch Rock, in 18 fathoms. Echinoderms are abundant and are represented by several interesting species, among which are two species of *Thyonidium*, and *Pentacta calcarea*, which were rather rare; *Pentacta frondosa* was only occasionally met with, of large size; good sized specimens of *Lophothuria Fabricii* were occasionally dredged, and the young were not uncommon; *Ophiopholis aculeata*, *Asterias vulgaris*, *Cribrella sanguinolenta* and *Strongylocentrotus Dröbachiensis* were abundant, but *Solaster endeca* and *Pteraster militaris* were comparatively rare and of small size.

The *Astrophyton Agassizii*, so abundant in the Bay of Fundy, and also in some parts of Massachusetts Bay, was not met with.

Hydroids of many kinds were abundant, and among them there are quite a number of species new to our coast. The beautiful *Campanularia integra* occurred in profusion on the fronds of *Agarum Turneri*, with *Obelia geniculata*. *Campanularia angulata* and *C. fragilis*, *Calycella pygmæa*, and *Halecium tenellum* are other interesting additions to our fauna.

LIST OF SPECIES INHABITING HARD BOTTOMS OF CASCO BAY, IN SHALLOW WATER.

The following are some of the more characteristic species dredged on the hard bottoms, in 8 to 30 fathoms:

ARTICULATA.

Crustacea.

Cancer irroratus.	Hippolyte gibba.	Podocerus fucicola.
C. borealis.	H. Phippsii.	Cerapus rubricornis.
Hyas coarctatus.	Pandalus annulicornis.	Ptilocheirus pinguis.
H. araneus.	Mysis, sp.	Unciola irrorata.
Eupagurus Bernhardus.	Diastylis, sp.	Caprella, sp.
E. Kroyeri.	Mœra Danæ.	Praniza cerina.
E. pubescens.	Melita dentata.	Idotea Tuftsii.
Crangon vulgaris.	Vertumnus serratus.	I. phosophorea.
Hippolyte spina.	Acanthozone cuspidata.	Balanus porcatus.
H. Fabricii.	Paramphithoë cataphracta.	B. crenatus.
H. aculeata.		
H. pusiola.		

Annelida.

Lepidonotus squamatus.	Cirratulus cirratus.	Polycirrus, phosphorescent sp.
Eunoa Œrstedii.	Dodecacerea concharum.	Myxicola Steenstrupii.
Harmothoë imbricata.	Praxilla zonata V.	Potamilla oculifera (Leidy).
Enipo gracilis V.	Nicomache lumbricalis.	Sabella zonalis Stimp.
Cryptonota citrina.	Trophonia aspera.	Chone, sp.
Phyllodoce catenula V.	Tecturella flaccida.	Euchone elegans V.
Eulalia pistacia V.	Brada granosa.	Spirorbis lucidus.
Nereis pelagica.	Sternaspis fossor.	S. nautiloides?
Stephanosyllis picta V.	Cistenides granulatus.	S. quadrangularis St.
Procerca gracilis V.	Thelepus cincinnatus.	Vermilia serrula.
Autolytus cornutus.	Scione lobata.	Filigrana implexa.
Autolytus, sp.	Amphitrite cirrata.	
Nothria conchylega.	A. intermedia.	
Polydora, sp. (in shells)		

Gephyrea.

Phascolosoma cæmentarium.	Phascolosoma, sp. nov.

Turbellaria.

Cosmocephala Stimpsoni V.
Nemertes affinis.
Leptoplana ellipsoides.

MOLLUSCA.

Gastropoda.

Bela harpularia.
B. decussata.
B. turricula.
B. pleurotomaria.
Admete viridula.
Trophon clathratus.
Buccinum undatum.
Neptunea decemcostata.
N. curta (Jeffreys' sp.).
Neptunella pygmæa V.
Tritia trivittata.
Astyris zonalis V. (dissimilis St.).
A. rosacea.
Trichotropis borealis.
Lacuna vineta.
L. neritoidea.
Natica clausa.
Lunatia heros.
S. Grœnlandica.
L. immaculata.
Crucibulum striatum.
Velutina zonata.
V. lævigata.
Lamellaria perspicua.
Menestho albula.
Scalaria Grœnlandica.
Margarita obscura.
M. Grœnlandica.
M. cinerea.
M. helicina.
Calliostoma occidentale
Diadora noachina.
Lepeta cæca.
Acmæa testudinalis, var.
Cylichna alba.
Tergipes despectus.
Æolis Mananensis.
Dendronotus arborescens.
Doris planulata.
Onchidoris pallida.
Polycera Lessonii.
Doto coronata.
Tonicella marmorea Carp.
Trachydermon albus Carp.
Trachydermon ruber Carp.
Hanleia mendicaria Carp.
Stimpsoniella Emersonii.

Lamellibranchiata.

Saxicava arctica.
Thracia truncata.
Mya arenaria (young).
Cyprina Islandica.
Cardium pinnulatum.
C. Islandicum.
Cyclocardia borealis.
C. Novangliæ.
Astarte undata.
A. quadrans.
Crenella glandula.
Mytilus edulis.
Modiola modiolus.
Modiolaria nigra.
M. discors (lævigata).
M. corrugata.
Pecten Islandicus.
P. tenuicostatus.
Anomia aculeata.

Tunicata.

Boltenia Bolteni.
Cynthia pyriformis.
C. echinata.
C. carnea.
Ascidiopsis complanatus.
Ciona tenella.
Chelyosoma geometricum St.
Molgula pannosa.
M. retortiformis.
M. papillosa.
Amarœcium glabrum.
A. pallidum.
Lissoclinum, sp.
Leptoclinum albidum.
L. luteolum.

Brachiopoda.

Terebratulina septentrionalis.

Polyzoa.

Idmonea pruinosa.
Crisia eburnea.
Tubulipora crates.
T. flabellaris.
Discoporella verrucosa.
Alcyonidium (red sp., on shells).
Caberea Ellisii.
Bugula Murrayana.
B. fastigiata.
B. avicularia.
Cellularia ternata.
Gemellaria loricata.
Flustra papyracea (?)
Membranipora pilosa.
M. lineata.
Lepralia Pallasiana.
Lepralia, several sp.
Discopora coccinea.
Cellepora scabra.
C. ramulosa.

RADIATA.

Echinodermata.

Pentacta frondosa.	T. hyalinum.	Cribrella sanguinolenta.
P. calcarea.	Strongylocentrotus Dröbachiensis.	Solaster endeca (small).
P. minuta.	Asterias vulgaris.	Pteraster militaris (small).
Lophothuria Fabricii.	A. littoralis (St.).	Ophiopholis aculeata.
Psolus plantapus, young.	Leptasterias, sp.	Ophioglypha robusta.
Thyonidium productum.	Stephanasterias albula.	Amphipholis elegans.

Acalephæ.

Lucernaria quadricornis	C. fragilis.	Sertularia argentea.
Obelia geniculata.	Clytia Johnstoni.	S. cupressina.
O. longissima.	Calycella syringa.	S. latiuscula.
O. dichotoma.	C. pygmæa.	Diphasia fallax.
Gonothyrea hyalina.	Halecium muricatum.	D. rosacea.
G. gracilis.	H. tenellum.	Sertularella polyzonias.
G. Loveni.	H. Beanii.	S. tricuspidata.
Campanularia flexuosa.	H. halecinum.	Hydrallmania falcata.
C. volubilis.	Lafoëa fruticosa.	Coppinia arcta.
C. neglecta.	L. dumosa.	Thamnocnida tenella.
C. integra.	L. gracillima.	Tubularia indivisa.
C. caliculata.	Filellum serpens.	Acaulis primarius.
C. Hincksii.	Grammaria abietina.	Eudendrium capillare.
C. verticillata.	Opercularella lacerata.	E. ramosum.
C. angulata.	Antennularia antennina.	Hydractinia polyclina.

Anthozoa.

Metridium marginatum.	Alcyonium rubiforme.	Alcyonium carneum.
Urticina crassicornis.		

PROTOZOA.

Spongiæ.

Grantia ciliata.	Polymastia, new sp.	Cliona, sp.
Grantia coronata. [V.	Tethya hispida (Bowerbank).	Isodictya, sp.
Leucosolenia cancellata	Halichondria, sp.	I. lobata (Esper sp.).
Leucandra, sp.	H. pannosa.	I. infundibuliformis.
L. cyathus V.	Reniera, several sp.	Chalina oculata.
Polymastia robusta? Bowerbank.	Suberites, sp.	

Besides the species enumerated above, there were many others that have not yet been identified. Many that occurred less frequently on the hard bottoms than on sandy or muddy ones have also been omitted from the list.

Very few genuine sandy bottoms were met with, and these were generally of small extent, so that the sand was nearly always mixed with gravel, pebbles, or mud, when brought up in the dredge, and there was, necessarily, a corresponding mixture of the animals inhabiting these different kinds of bottoms. Most of the species found on such bottoms are included in the preceding list. A number of species occurred, however, on sandy bottoms more frequently or in greater abundance than elsewhere. Among these were the following:

Crangon vulgaris, *Unciola irrorata*, *Idotea Tuftsii*, *Epelys montosus* Harger, *Praxilla zonata* V. (Plate 5, fig. 4), *Clymenella torquata* V., *Cistenides granulatus*, *Tetrastemma*, sp., *Ophionemertes agilis* V. (Plate 2, fig. 4), *Lunatia heros*, *Menestho albula*, *Utriculus pertenuis*, *Cochlodesma Leanum*, *Clidiophora trilineata*, *Lyonsia hyalina*, *L. arenata*, *Mactra polynyma* (*ovalis* Gould), *Astarte castanea*, *A. quadrans*, *Cyprina Islandica*, *Echinarachnius parma*.

FAUNA OF THE MUDDY BOTTOMS IN SHALLOW WATER.

Muddy bottoms of various grades, and at all depths to 40 fathoms, were frequent in Casco Bay, especially in the sheltered coves and channels among the islands, and in the several branches or fiords into which the northeastern portion of the bay is divided. There is considerable diversity in the character of the fauna in the different parts. The deeper localities have a very northern fauna, similar in many respects to that of the muddy bottoms of the deep outer water; while the shallow localities, especially in the inner harbor of Portland and in Back Cove, have a less northern fauna, and even yield a few decidedly southern forms, such as *Libinia canaliculata*, *Limulus Polyphemus*, etc.

In the table on page 344 the temperatures of the water in many of these localities are given.

The following table contains a series of temperatures taken by Commander Beardsley, at the anchorage of the steamer, in "Blue Light Cove," between Peak's Island and Hog Island, which will serve to give a good idea of the average temperature of the shallow waters among the islands in Casco Bay.

TEMPERATURES TAKEN IN SHALLOW WATER IN "BLUE LIGHT COVE."

Date	Locality.	Weather.	Hour.	Tide.	Temperature.			Depth in fathoms.	Nature of bottom.
					Air.	Surface.	Bottom.		
July									
27	Blue Light Cove.	Rainy	8 A.M.	1 h. flood	61°	59°	56°	3	Muddy.
"	" "	"	8 P.M.	½ "	60	59	56	3	"
28	Off Evergreen Landing.	Clear	12 M.	4 "	65	60	56	3	"
"	Blue Light Cove.	"	8 A.M.	l. w. slack	65	60	56	3	"
"	" "	"	8 P.M.	l. w. slack	66	62	58	3	"
29	" "	Rainy	8 A.M.	5 h. ebb	60	58	56	1½	"
"	" "	"	8 P.M.	5½ "	66	60	57	2	"
30	" "		8 A.M.	4 "	68	64	60	1¾	"
"	" "		8 P.M.	4½ "	70	66	61	2	"
31	" "	Clear	8 A.M.	3½ "	71	68	58	2	"
"	" "	"	8 P.M.	3 "	66	62	59	2	"
Aug.									
1	" "	Cloudy	8 A.M.	2½ "	62	60	56	2	"
2	" "	"	8 P.M.	2 "	68	63	57	2	"
3	" "	"	8 A.M.	1½ "	66	61	57	2	"
4	" "	Clear	8 A.M.	1 "	71	68	56	3½	"
"	" "	"	8 P.M.	1½ "	70	62	58	3	"
6	" "	"	8 A.M.		68	63	57	3	"
"	" "	"	8 A.M.		68	62	59	2¾	"
"	" "	"	8 P.M.		64	61	57	2	"
7	" "	Cloudy	8 A.M.		65	61	58	2	"
14	" "	"	8 A.M.		60	58	56	3	"
19	" "	Rainy	8 A.M.		61	56	57	2	"
24	" "	"	8 A.M.		63	61	60	2	"
"	" "	Clear	8 P.M.		62	58	57	2	"
25	" "	"	8 A.M.		61	58	56	2	"
27	" "	"	8 A.M.		60	56	57	2	"
29	" "	"	8 A.M.		66½	61	57	2	"

LIST OF SPECIES INHABITING THE MUDDY BOTTOMS OF CASCO BAY, IN 2 TO 40 FATHOMS.

Pycnogonida.

Nymphon, sp.
Pallene, sp.
Phoxichilidium femoratum.

Crustacea.

Libinia canaliculata.
Hyas coarctatus.
Eupagurus Kroyeri.
E. pubescens.
E. Bernhardus.
Crangon vulgaris.
Pandalus annulicornis.
Hippolyte Gaimardii.
H. pusiola.
H. Fabricii.
Mysis Americana.
M. stenolepis Smith.
Diastylis sculpta.
D. quadrispinosa.
Eudorella hispida.
Œdiceros lynceus.
Unciola irrorata.
Cerapus rubricornis.
Ptilocheirus pinguis.
Byblis Gaimardii.
B. serrata.
Phoxus Kroyeri.
Corophium cylindricum.
Pontoporeia, sp.
Haploops, sp.
Ampelisca, with red spots.
Orchomene, sp.
Limnoria terebrans, in wood, 10 fathoms.
Idotea phosphorea Harg.
Epelys montosus Harg.
Limulus Polyphemus.

Annelida and Gephyrea.

Aphrodite aculeata.
Harmothoë imbricata.
Pholoë minuta.
Nepthys ciliata.
N. ingens St.
Phyllodoce catenula V.
Phyllodoce, sp.
Eulalia pistacia V.
Eteone pusilla.
Nereis pelagica.
Ninoë nigripes V.
Lumbriconereis obtusa V.
L. fragilis.
Goniada maculata.
Rhynchobolus albus.
Polydora, sp., in shells.
Scolecolepis cirrata.
Spio, sp.
Anthostoma acutum V.
Trophonia aspera V.
Ammotrypane fimbriata V.
Oterlia, sp.
Sphenaspis fossor.
Chætozone setosa.
Cirratulus cirratus.
Clymenella torquata.
Rhodine Loveni.
Nicomache lumbricalis.
Maldane Sarsii.
Praxilla, sp.
P. zonata V.
P. gracilis.
Ammochares, sp.
Ancistria capillaris V.
A. acuta V.
Areniella filiformis V.
Cistenides granulatus.
C. Gouldii V.
Ampharete gracilis.
A. Finmarchica?
Amphicteis Gunneri.
Melinna cristata.
Amphitrite brunnea V.
A. intermedia.
A. cirrata.
Scione lobata.
Polycirrus, sp.
Chone, sp.
Euchone elegans V.
Ichthyobdella versipellis Dies (on Cottus).
Chætoderma nitidulum.
Phascolosoma cæmentarium.

Turbellaria.

Cosmocephala, orange sp.
C. Stimpsonii V.
Ophionemertes agilis V.
Tetrastemma, sp.
T. vittata V.
Meckelia lurida V.
Leptoplana ellipsoides.

Gastropoda.

Bela harpularia.
B. turricula.
B. pleurotomaria.
Buccinum undatum (young).
Neptunella pygmæa.
Tritia trivittata.
Lunatia heros, var.
L. immaculata.
L. Grœnlandica.
Aporrhais occidentalis.
Velutina lævigata.
Trichotropis borealis.
Rissoa carinata.
R. exarata.
R. (?) eburnea.
Scalaria Grœnlandica.
Turritella erosa.
T. acicula.
Margarita obscura.
M. cinerea.
Utriculus pertenuis.
Cylichna alba.
Philine quadrata.
P. lineolata.
Entalis striolata.

Lamellibranchiata.

Zirphæa crispata (in wood).
Cyrtodaria siliqua, young.
Neæra pellucida.
Mya arenaria (young).
Saxicava arctica.
Lyonsia hyalina.
Thracia Conradi.
T. myopsis.
T. truncata.
Periploma papyracea.
Ensatella Americana.
Macoma sabulosa.
M. fragilis (fusca).
Callista convexa.
Cyprina Islandica.
Cardium pinnulatum.
C. Islandicum.
Serripes Grœnlandicus.
Lucina filosa.
Cryptodon Gouldii.
Solenomya velum.
Cyclocardia borealis.
C. Novangliæ.
Astarte lens.
A. undata.
Leda tenuisulcata.
Yoldia sapotilla.
Y. myalis.
Y. limatula.
Y. thraciformis.
Y. obesa.
Nucula tenuis.
N. delphinodonta.
N. proxima.
Crenella glandula.
C. decussata.
Modiolaria nigra.
M. discors (lævigata).
M. corrugata.
Mytilus edulis.
Pecten tenuicostatus.

Tunicata.

Molgula pannosa.
Eugyra pilularis.

Echinodermata.

Asterias vulgaris.
Ctenodiscus crispatus.
Ophioglypha Sarsii.
O. robusta.
Ophiopholis aculeata.

Hydroidea.

Corymorpha pendula.
Hydractinia polyclina.
Sertularia argentea (on shells).
Sertularella tricuspidata (on shells).

Anthozoa.

Metridium marginatum (on shells).
Edwardsia farinacea V.
E. sipunculoides.
Cerianthus borealis V.

FAUNA OF THE SHORES.

The shores of the islands and of Cape Elizabeth afford excellent collecting grounds at low-water, owing to their diversified character. Many parts of these shores are abrupt and rocky,

Plate 8.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

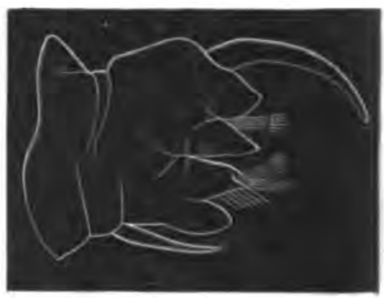

Fig. 5.

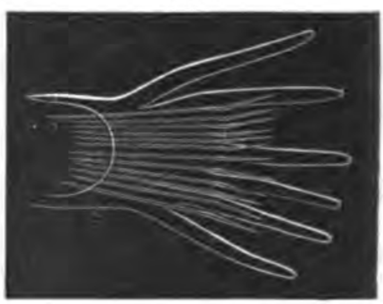

Plate 4.

Fig. 1.

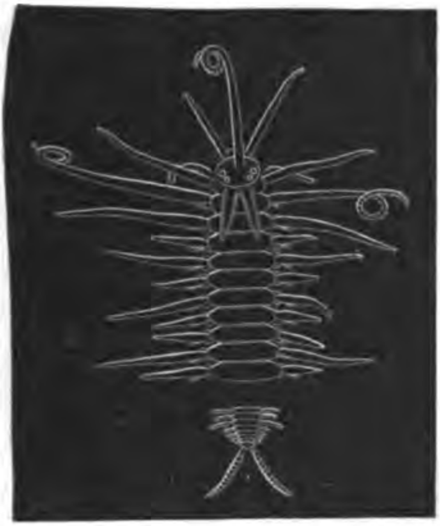

Fig. 2.

Fig. 3.

Fig. 4.

and often formed of broken and precipitous ledges of hard metamorphic slates and thin-bedded grits, or altered sandstones, in some places passing into gneissose rocks, and generally dipping at a high angle. Tide-pools are of frequent occurrence, and often of large size, and afford excellent opportunities for obtaining the shallow-water and littoral species of animals, and many beautiful algæ. One very large pool on Ram Island Ledges is especially rich, and was visited several times with profit. In this pool young lobsters of all sizes are very abundant beneath the stones. Two species of Chitonidæ also occurred here, together with many other species not usually to be found at low-water mark. Hydroids and Bryozoa, of many species, are abundant in this and other similar pools. The shore species obtained upon the islands and outer shores of the bay are nearly all boreal or arctic forms. In the harbor of Portland, on the piles of the wharves, etc., a few more southern species are met with, though the northern ones predominate even there.

Several insects are met with between tides. Among these are *Chironomus oceanicus*, and the larvæ, about two inches long, of a fly, probably an *Eristalis*, which live in small tide-pools, under stones, and extend their long tapering tails up to the surface; the pupæ of a fly allied to *Ephydra;* a species of *Bledius*, and several other beetles. A *Phoxichilidium* and two or three species of mites were also collected between tides. In a pool of brackish water, at high-water mark, among the ledges of Cape Elizabeth, several species of water beetles, the larvæ of a species of mosquito (*Culex*) and other dipterous larvæ were obtained. This pool was filled with green marine algæ (*Enteromorpha*).

LIST OF SPECIES INHABITING THE SHORES OF CASCO BAY, BETWEEN TIDES.

Crustacea.

Cancer borealis.	Hyale littoralis.	Corophium, sp.
C. irroratus.	Talorchestia megalophthalma Smith.	Unciola irrorata.
Hippolyte pusiola.	Orchestia agilis Smith.	Jæra copiosa.
H. spina.	Calliopius læviusculus.	Idotea irrorata.
Crangon vulgaris.	Amathella angulosa (?)	I. phosphorea Harger.
Eupagurus Bernhardus.	Pontogenia inermis.	Erichsonia filiformis Harger.
E. Kroyeri.	Amphithoë maculata.	Balanus balanoides.
Gammarus ornatus.	Cerapus rubricornis.	
Gammarus marinus.		

Annelida.

Lepidonotus squamatus.
Harmothoë imbricata.
Eunoa Œrstedii.
Nephthys cæca.
Eulalia pistacia V.
Eteone, sp.
Phyllodoce catenula V.
Lumbriconereis fragilis
Stephanosyllis ornata Verrill.
Autolytus cornutus.

Proceræa gracilis V.
Nereis virens.
N. pelagica.
Polydora, sp.
Anthostoma fragile V.
Rhynchobolus dibranchiatus.
Cirratulus cirratus.
Nicomache, sp.
Clymenella torquata V.
Notomastus luridus V.

Cistenides granulatus.
Amphitrite brunnea V. (St. sp.).
Polycirrus, sp.
Myxicola Steenstrupii.
Fabricia Leidyi V.
Potamilla oculifera V.
Spirorbis borealis.
Clitellio irrorata V.
Halodrillus littoralis V.

Turbellaria.

Nemertes viridis.
N. socialis.
Borlasia, sp.
Tetrastemma, three sp.

Cosmocephala Stimpsonii V.
Monotus spatulicauda.
Monocelis agilis ?

Dinophilus borealis.
Fovia affinis.
Leptoplana ellipsoides.

MOLLUSCA.

The shore Mollusca are decidedly northern, and the species are not very numerous. Among the most characteristic are the following:

Purpura lapillus.
Buccinum undatum.
Ilyanassa obsoleta.
Tritia trivittata.
Lunatia heros.
Littorina littorea.
L. rudis.
L. palliata.
Lacuna vincta.
L. neritoidea.
Rissoa aculeus.
Littorinella minuta St.
Skenea planorbis.
Acmæa testudinalis.

Trachydermon ruber.
T. albus.
Æolis papillosa.
Tergipes despectus.
Dendronotus arborescens.
Doto coronata.
Polycera Lessonii.
Doris, sp.
Saxicava arctica.
Mya arenaria.
Teredo, sp.
Zirphæa crispata.

Macoma fragilis.
Turtonia minuta.
Mytilus edulis.
Modiola modiolus.
Ascidiopsis complanatus V.
Amarœcium glabrum.
Crisia eburnea.
Alcyonidium hispidum.
A. hirsutum.
Bugula turrita V.
Membranipora pilosa.
M. lineata.

RADIATA.

Strongylocentrotus Dröbachiensis.
Asterias vulgaris.
A. littoralis.
Aurelia flavidula (strobila).

Obelia geniculata.
O. dichotoma.
Campanularia flexuosa.
C. fragilis.
Opercularella lacerata.
Sertularia pumila.

Sertularia argentea.
Sertularella rugosa.
Clava leptostyla.
Metridium marginatum.
Bunodes stella.

Several species of sponges are also common between tides.

On the sheltered muddy bottoms, from just below low-water mark, to the depth of about two fathoms, the eel-grass, *Zostera* *marina*, grows in abundance, and in many places it was thickly covered with delicate Hydroids, among which *Obelia dichotoma* was the most abundant. Among the eel-grass many species of crustacea, worms and mollusks find congenial abodes, and furnish abundant food for the fishes that frequent such localities. Some of these are somewhat southern in character.

Among the Crustacea from the eel-grass were:—*Hippolyte Gaimardi; Crangon vulgaris; Mysis stenolepis* Smith; *M. Americana* Smith; *Calliopius læviusculus;* a new genus with very large epimera, allied to *Metopa;* a new species of *Munna*, a genus of isopod crustacea, new to the American coast; *Idotea irrorata*, etc.

From the piles of the wharves at Portland we obtained a great variety of sponges, hydroids, bryozoa, etc. The slender branched sponge, *Chalina oculata*, is here particularly abundant and fine; also the common large sea-anemone, *Metridium marginatum;* a beautiful Tubularian, in large clusters; and the compound Ascidian, *Amarœcium glabrum* V., with many other northern forms. The *Limnoria lignorum* was found in abundance, destroying the piles and timbers.

Among the more interesting littoral species obtained on the shores of Casco Bay and vicinity are *Littorina littorea* and the *Cancer borealis*. The latter is a large crab which has hitherto been very rare in all collections, and but imperfectly known; this we found in large numbers on the ledges at the northern end of Peak's Island and Pumpkin Knob, in tide-pools, or clinging to the sea-weeds in more exposed situations, but never concealed beneath the rocks with the *Cancer irroratus*, which was there abundant. The carapaces and claws of the former were also found in abundance at considerable distances from the shores, whither they had been carried by the gulls and crows. Owing to the exposed situations in which they live, they must fall an easy prey to rapacious birds. We obtained eighty-five specimens in one morning. The *Littorina littorea* occurs sparingly at various localities on the islands, but was found in great abundance at Scarboro, on the piles of a bridge, by Dr. Edw. Palmer. It has been supposed by several writers that this shell has been recently and accidentally introduced from Europe; but Dr. Dawson informs me that he collected it more than thirty years ago in the Gulf of St. Lawrence. It is abundant at Halifax, and we have other specimens from Kennebunkport, Me., Hampton Beach, N. H., and Provincetown, Mass.

There is really no sufficient evidence that it was not an inhabitant of our shores before the advent of Europeans, but local in its habitats. It may have become more diffused in recent times, by commerce, or it may have been overlooked formerly by collectors.

EXISTENCE OF SOUTHERN COLONIES, AND OTHER EVIDENCES OF FORMER CHANGES OF CLIMATE.

One of the localities, most interesting zoologically, that we visited, is a small shallow and sheltered cove, at the upper end of Quahog Bay, about thirty miles northeast from Portland. This place is well known to be inhabited by the round-clam or "Quahog" (*Venus mercenaria*), which is not found living elsewhere on the coast of Maine, so far as known to me. Indeed, this southern species is rare everywhere north of Cape Cod, on the New England coast, and is probably not to be found living north of Massachusetts Bay, except in the coves connected with Quahog Bay. It is also absent from the Bay of Fundy, but reappears in the southern and shallow parts of the Gulf of St. Lawrence. This anomalous distribution would be curious, even if it happened only in the case of this one species; but our investigation of this locality shows that there is quite a number of other southern species associated with the quahog, which have the same remarkable distribution, being absent along the rest of the northern coast of New England, and reappearing in the Gulf of St. Lawrence. There is, in fact, at this place a genuine colony of southern species, completely isolated from their co-species of the southern coast of New England, and surrounded on both sides by more northern forms. Several of these southern species, like the *Venus mercenaria*, *Crepidula convexa*, *Urosalpinx cinerea*, *Eupagurus longicarpus*, *Gammarus mucronatus*, *Epelys trilobus* Smith, *Nereis limbata*, *Meckelia ingens* Leidy, *Asterias arenicola*, etc., were not even met with among the islands and coves of Casco Bay; while others, such as *Ilyanassa obsoleta*, *Crepidula fornicata*, *C. plana*, *Limulus Polyphemus*, etc., occurred more or less frequently in the most sheltered and shallow waters of Casco Bay, though they are not found on the more exposed shores of Maine and New Hampshire, farther to the south and west, but have their true homes south of Cape Cod. Native oysters also occur, in a similar way, farther eastward than Quahog Bay, near Damariscotta, though it is not probable that they are indigenous elsewhere on the New England coast, north of Cape

Cod,—as they certainly are not north of Massachusetts Bay,—yet they reappear in the Gulf of St. Lawrence, with the other southern forms.

In fact, the southern part of the Gulf of St. Lawrence, from the Bay of Chaleur to Prince Edward Island and Cape Breton Island, is a region of shallow water, occupied by another southern colony, but a much larger one than that of Quahog Bay, and containing, perhaps, a few southern species that do not occur in the latter locality; though owing to the fact that we could spend but a few hours at this place, our collection is doubtless quite incomplete. On the other hand, we have, with the exception of the shells, very imperfect lists of the southern species inhabiting the colony in the Gulf of St. Lawrence, so that a complete comparison cannot be made, at present, except with the shells; these agree very closely, according to the lists given by Dawson, Bell and Whiteaves.

As the existence of these isolated southern colonies has an important bearing upon the question of former changes of climate on our coast, and as other facts, to be mentioned farther on, are intimately connected with them, I give here a list of the species obtained by us, in the cove referred to, so far as they have been identified.

LIST OF SPECIES COLLECTED AT LOW-WATER IN A SMALL COVE AT THE UPPER END OF QUAHOG BAY.

Those with an asterisk prefixed are decidedly southern species, belonging properly to the region south of Cape Cod.

ARTICULATA.

Crustacea.

Cancer irroratus.
*Eupagurus longicarpus
Crangon vulgaris.
*Mysis stenolepis Smith
Gammarus ornatus.
*G. mucronatus.
Amphithoë, sp.
*Epelys trilobus Smith.
Idotea irrorata.
Limnoria lignorum.
*Argulus, sp., on Fundulus pisculentus.
*Limulus Polyphemus.
Balanus balanoides.

Annelida.

Lepidonotus squamatus.
Nephthys ingens.
Eulalia, sp.
Autolytus cornutus.
Nereis virens.
*Nereis limbata.
Fabricia Leidyi.
Spirorbis borealis.
*Rhynchobolus dibranchiatus.

Turbellaria.

*Meckelia ingens.
Tetrastemma (green sp.).
Nemertes viridis.
*Nemertes socialis.
*Planocera, sp.
Procerodes Wheatlandi
*Bdeloura candida (on Limulus).

MOLLUSCA.

Gastropoda.

*Urosalpinx cinerea.	*Crepidula convexa.	Lacuna vincta.
Purpura lapillus.	*C. fornicata.	Rissoa aculeus.
*Ilyanassa obsoleta.	*C. plana (with ova).	Littorinella minuta St.
Tritia trivittata.	Littorina rudis.	Acmæa testudinalis.
Natica heros.	L. palliata.	

Lamellibranchiata.

Saxicava arctica.	Macoma fragilis.	Mytilus edulis.
Mya arenaria.	*Petricola pholadiformis.	*Modiola plicatula.
*Venus mercenaria.		Anomia aculeata.
Tottenia gemma.		

Bryozoa.

Alcyonidium hispidum.	Alcyonidium hirsutum.	Vesicularia, sp.

RADIATA.

Echinodermata.

*Asterias arenicola.

Hydroidea.

Sertularia pumila.	Obelia geniculata.	Hydractinia polyclina.
S. argentea.	Clava leptostyla.	

Anthozoa.

Metridium marginatum.

Although the species in this list, that are not marked as southern, have a continuous range northward to the Gulf of St. Lawrence, and many of them to the Arctic Ocean, North Pacific, and northern Europe, they all extend as far south as Long Island Sound, and several of them even to North Carolina. Most of them are, therefore, northern species having a wide distribution, and their presence in this particular locality has no special significance.

In Quahog Bay itself we found the bottom composed of soft sticky mud, and in this we dredged, in four to six fathoms, a great number of large and fine specimens of *Yoldia limatula*, *Macoma sabulosa*, *Nephthys ingens*, and a number of other common species.

EVIDENCES OF CLIMATIC CHANGES.

That the Quahog Bay colony has formerly, and within the human period, been more extensive than at present, is shown: 1. By the fact that the quahogs have evidently been, at one time, more numerous and more generally diffused than now, for their shells are abundant in the mud, in places where no living ones could be found; 2. By the occurrence of oysters, in great quantities and of large size, in the ancient Indian shell-heaps of this region, and also near Damariscotta, while at present the oysters are found only at the latter place, and are few and small; 3. By the occurrence of the shells of the quahog, of large size, in the Indian shell-heaps on many of the islands in Casco Bay (these heaps consisting mainly of the shells of the "long clam," *Mya arenaria*, with a few bones of fishes, birds and mammals).

That at a more remote period, the marine climate of this region was still warmer,* and the southern species were more abundant than during the period when the Indian shell-heaps were formed, is shown by the occurrence of great beds of oyster-shells a few feet beneath the mud in Portland Harbor, where they are associated with quahogs and several other southern species, among which are *Callista convexa*, *Turbonilla interrupta* and *Pecten irradians*. The latter is not known to live, at present, north of Cape Ann, on the New England coast. It is absent, apparently, from the colony in the Gulf of St. Lawrence, as well as from that of Quahog Bay. It is very rare north of Cape Cod.†

The *Callista convexa* is still found sparingly in shallow, sheltered localities in Casco Bay, and rarely at Eastport, Me., but it is more common in the colony of the Gulf of St. Lawrence, and very common south of Cape Cod. But the oysters (*Ostrea Virginiana*) and "scollops" (*Pecten irradians*) had apparently become extinct in the vicinity of Portland Harbor before the period of the Indian shell-heaps, for neither of these species occurs in the heaps on the adjacent islands, while the quahogs lingered on until that time, but have subsequently died out everywhere

*The evidence here given is probably applicable chiefly to the temperature of the warmer months, or more properly to the reproductive season of the mollusks referred to, for the climatic distribution of most marine animals seems to depend mainly on the temperature of the season at which reproduction takes place.

†Willis includes this species in his nominal list of Nova Scotia shells, but without mentioning the special locality. It may, perhaps, occur in some of the sheltered localities near Halifax, where another southern colony exists.

in this region, except at Quahog Bay. The oysters have survived only in the locality near Damariscotta, though far less abundant there than during the Indian period.

The beds of dead shells of oysters, *Pectens*, etc., were found in making excavations in the harbor with mud-digging machines. These beds extend up to or above low-water mark, and are of great extent. Mr. C. B. Fuller, who has made a good collection of these shells for the Portland Natural History Society, informs me that the farmers have, in some instances, found it profitable to cart away these ancient shells for fertilizing purposes. The position of these beds indicates that no important change in the relative level of the land and water can have occurred in that region since they were formed. These beds are, of course, easily distinguished from the much more ancient Quaternary deposits that occur abundantly in the same region, but extend back several miles from the coast, and occur at all levels, from low-water mark to about 200 feet above high-water mark. The latter are characterized, in that region, by a more arctic assemblage of shells than that now inhabiting the adjacent waters, though most of the species still survive, in deep water, off the coast of Maine.

The facts above presented indicate: 1. That in the Post-pliocene or Champlain period the coast was at a lower level, and the marine climate of Casco Bay was colder than at present, probably about like that of the present Newfoundland and Labrador coasts; 2. That at a subsequent period, when the coast had attained nearly or quite its present level, the marine temperature was considerably higher than at present; 3. That the temperature of these waters has gradually declined, but was still somewhat higher at the period when the Indian shell-heaps were formed than at present.

That the existence and character of the southern colony in the Gulf of Saint Lawrence point to the same conclusion is sufficiently obvious. The survival of the southern species in that region is undoubtedly due to the great expanse of shallow water in that part of the gulf, which becomes well warmed up by the heat of the sun, in summer; and to the absence of tides sufficiently powerful to mix up thoroughly the very cold waters of the northern and deeper portions of the gulf with the warm waters of the southern part. Tides like those of the Bay of Fundy and coast of Maine would undoubtedly diminish at once this contrast in the temperature of the different parts of the gulf, and greatly lessen the temperature of the southern part, by reason of the far greater volume of the cold water.

The *origin* of the southern species in the gulf is a totally different matter. I can explain their presence there in no other way than to suppose that they are survivors from a time when the marine climate of the whole coast, from Cape Cod to Nova Scotia and the Bay of Fundy, was warmer than at present, and these species had a continuous range from southern New England to the Gulf of Saint Lawrence. At that time there may have been a direct shallow passage from the Bay of Fundy across to the Gulf of St. Lawrence, for the land is there narrow and low; but of this we have no direct evidence. A *deep* channel there would act like the Straits of Belle Isle, and admit the cold arctic current to the coast of Maine; this may have been the case in Quaternary times.

The causes of such changes in the temperature of the water may have been entirely local, and due to changes in the relative level of the land and water, in adjacent regions. Thus a rise of the land in the region of Saint George's Bank, to the extent of 250 feet, would produce an island quite as large as the State of Massachusetts, and would thus very materially alter the climatic conditions of the "Gulf of Maine," between it and the New England coast. And it would add a great body of land, now represented by Le Have Bank, etc., to the southern part of Nova Scotia, and thus greatly narrow the channel between those banks and St. George's, as well as make it more shallow; this would doubtless greatly modify the tides, and greatly diminish their force and height on the northern coasts of New England, and in the Bay of Fundy, for the "Gulf of Maine" would then have much resemblance to the Gulf of Saint Lawrence in form and in the character and position of its main channel, and, therefore, its tides would also be similar; the small tides would allow greater differences between the temperatures of the shallow waters and deep waters, and would thus favor the southern species inhabiting shallow water. A rise of the land, of about the same amount, in the region of Newfoundland, would lay bare a great part of the Grand Banks, close up the Straits of Belle Isle, and more than double the size of Newfoundland, which would doubtless produce great climatic changes on the New England coast, as Professor Dana has suggested.

FOOD OF FISHES.

The stomachs of a large number of fishes of various kinds, recently caught in many different localities, have been examined by us, during this and previous seasons, in order to ascertain the precise nature of their food.

In this way a great amount of valuable information has already been accumulated. This subject is not, however, by any means exhausted, for since fishes do not feed upon the same food, in different places and at all seasons, it will be necessary to greatly multiply these observations in many different localities, in order to understand properly the character of their food. The task of identifying the various soft-bodied creatures, taken from the stomachs in a more or less digested condition, is by no means an easy one. Such contents can be best preserved for final examination by placing them at once in strong alcohol. The stomach should be opened as soon as possible after the fish is caught, for digestion goes on very rapidly, even after the death of the fish. Special attention has been paid to the food of the cod, haddock and mackerel this season.

DESCRIPTIONS OF SOME OF THE NEW, OR RECENTLY DESCRIBED SPECIES, FOUND IN CASCO BAY.

ANNELIDA.

Enipo gracilis Verrill. (Plate 5, figure 3.)

American Journal of Science, vol. vii, p. 407, 1874.

Body long and slender, quite narrow, the anterior part of the back only partially covered by small oval, smooth, translucent scales. Head rather elongated, tapering; eyes four, conspicuous. Setæ of the lower rami stout, with the terminal portion broad, short cuspidate, and armed with oblique rows of strong, sharp, ascending, unequal spines; tips naked, acute, curved, the lower ones most so. Length 50^{mm} to 60^{mm}; breadth 3^{mm} to 4^{mm}.

Casco Bay, 15 to 20 fathoms; Jeffrey's Bank, 80 fathoms.

Stephanosyllis ornata V. (Plate 4, figure 1.)

American Journal of Science, vol. vii, p. 132, Feb., 1874.

Body moderately slender, thickest near the middle, tapering slightly anteriorly, and rapidly posteriorly, the caudal portion acuminate, with two slender caudal cirri. Antennæ and tentacular-cirri long, slender, and tapering, slightly and irregularly annulated, or transversely wrinkled; median antenna longest, reaching back to about the tenth segment; lateral antennæ about equal to the upper tentacular cirrus, or reaching to about the sixth body-segment; lower cirrus about half as long; dorsal cirrus of the second segment very long and slender, equalling or exceeding the median antenna; dorsal cirri of the third segment as long as those of the first, or longer, more than twice the diameter of the body; those of the fourth segment less than half as long; those farther back unequal in length. Head rounded in front and behind, broad, the anterior pair of eyes larger and wider apart than the posterior ones; "epaulets" conspicuous, lanceolate, extending back to the fourth segment. Color, in life, pale green, especially beneath and on the sides above; back, bright orange-red, with transverse lines of green at the articulations; setigerous lobes whitish; lateral cirri pale greenish white; antennæ and tentacular-cirri pale salmon, often tipped with pink; epaulets orange, centred with green, and bordered by a line of white, and with a red line along the edge; head pale yellow; eyes black. Length, 12^{mm}; breadth, $0{\cdot}75^{mm}$.

Casco Bay, 6 to 20 fathoms, stony; and in tide-pools at low-water.

Procerœa gracilis V. (Plate 3, figure 2.)

American Journal of Science, vol. vii, p. 132, 1874.

Body very slender, elongated. Head subcordate, longer than broad, rounded in front, posteriorly extending back in two short rounded lobes, not reaching beyond the buccal segment; anterior eyes considerably farther apart than the posterior ones. Antennæ and upper cirri of the first two segments very long and slender, faintly annulated; the median antenna is very much elongated, considerably longer than the lateral ones, and about equal to the dorsal cirri of the second segment; the lateral antennæ are about as long as the upper tentacular-cirri, or about five times the diameter of the body; the dorsal cirri of the third segment are about twice as long as the diameter of the body; the cirri on the succeeding segments are about half as long as the breadth of the body. Color, in life, pale greenish, with a narrow median dorsal line of dark brown, and a less distinct one on each side, at the base of the lateral appendages; eyes black. Length, about 25^{mm}; breadth, 1^{mm}, or less.

Casco Bay, 10 to 20 fathoms; and in tide-pools.

Eulalia pistacia Verrill. (Plate 4, figure 2.)

First Report of the Commissioner of Fish and Fisheries, p. 584.

Body moderately slender, depressed. Head convex, shorter than broad; in preserved specimens, sides well rounded, posterior margin slightly emarginate; median odd antenna small, slender, considerably shorter than the head. Eyes large, brown. Tentacular cirri moderately long; the four posterior ones considerably longer than the others. Branchiæ narrow lanceolate anteriorly; ovate and leaf-like on the middle segments; longer and lanceolate posteriorly. Proboscis long, more or less clavate, smooth, but often showing longitudinal striations, and sometimes with a few very minute scattered papillæ toward the end; the orifice surrounded by a circle of numerous minute papillæ. Color bright yellowish green (epidote-green or pistachio-green), often with obscure darker markings posteriorly, and at the base of the appendages. Length up to 40^{mm}; breadth, $1{\cdot}5^{mm}$.

Vineyard Sound, 6 to 12 fathoms, among compound ascidians; off New Haven, 4 to 5 fathoms, among hydroids; Casco Bay, 8 to 20 fathoms.

Phyllodoce catenula Verrill. (Plate 3, figure 1.)

Op. cit., p. 587.

Head somewhat longer than broad, slightly cordate posteriorly, with the posterior angles well rounded, and the sides full and convex; front broadly rounded, and with a slight emargination in the middle. Eyes large, dark brown, placed on the dorsal surface of the head; antennæ rather long, slender. Tentacular cirri long and slender, the two posterior much longer than the others. Branchiæ of anterior segments broad ovate, with rounded tips; farther back larger and longer, ovate, leaf-like, with acuminate tips. Proboscis with twelve rows of papillæ on the basal portion, which are prominent, somewhat elongated, obtuse, seven or eight in the lateral rows, those in each row close together. Color of body and branchiæ pale green, with a median dorsal row of dark brown spots, one to each segment; and two lateral rows, in which there is a spot at the base of each "foot;" head pale, or greenish white. Length up to 75^{mm}; breadth about $1 \cdot 5^{mm}$.

Watch Hill, Rhode Island, in 4 to 6 fathoms, among rocks and algæ, and in tide-pools; Wood's Hole, at surface, evening, July 3. Casco Bay, 8 to 30 fathoms; very common in the Bay of Fundy, from low-water to 50 fathoms.

This species is closely allied to *P. pulchella* Malmgren, from northern Europe, but differs somewhat in the form of the head, which is shorter and rounder in the latter; the branchiæ also differ in form. It is a very active species, and secretes a large quantity of mucus.

Nothria opalina Verrill. (Plate 4, figure 4.)

American Journal of Science, vol. v, p. 102, 1873.

Body long and slender, narrowed anteriorly, much depressed and of nearly uniform width throughout most of its length; the five anterior segments much longer than the others. Palpi inferior, rather large, hemispherical; antennæ small, ovate, close together, on the front of head. Three central tentacles very long and slender, tapering, acute, the basal portion regularly annulated and thickened for a considerable distance, beyond which the surface is smooth, with an occasional distant annulation; the central odd one is somewhat shorter and more slender than the two adjacent ones, which reach to or beyond the 10th segment; outer pair much shorter, being less than half the length of the central ones. Tentacular cirri small and very slender. Lateral appendages or "feet" of the first six setigerous segments similar in structure but more prominent than the following ones, from which they also differ in having the ventral cirrus well developed, long and tapering, but shorter and thicker on the first segment than on the five following. Those of the first pair have a stout stalk, which terminates in a small, bluntly rounded setigerous lobe, with a long, slender, subterminal cirrus-like lobe above, longer than the stalk; dorsal cirrus arising from near the base, longer and more slender than the terminal cirrus; branchial filament simple, long and very slender, about equalling the dorsal cirrus and united to it above its base; ventral cirrus ovate, tapering, blunt, arising from near the base. The second pair of feet are similar to those of the first, except that in the largest specimens there are two branchial filaments, and the ventral cirrus is longer and more slender. The 3d, 4th, 5th and 6th pairs have essentially the same structure, but the ventral cirrus becomes gradually longer to the 6th, where it is longer than the stalk and nearly equal to the terminal cirrus. The succeeding feet are much shorter; the ventral cirrus is a mere conical papilla, which soon disappears; the terminal cirriform lobe becomes smaller and disappears after the 10th pair; the branchial filament becomes larger and longer to the middle region, where it exceeds in length half the diameter of the body, while the dorsal cirrus at the same time becomes smaller and shorter, until it is less than one-fourth the length of the branchia.

The setæ of the anterior feet consist of slender, acutely pointed, curved ones, mixed with much stouter, blunt pointed compound ones; farther back there are two fascicles of more slender acute setæ, and in the lower bundles a few long, stout, bidentate hooks, with a thin, rounded, terminal expansion.

Color, in alcohol, pale yellowish white, but everywhere very brilliantly iridescent with opaline lustre and colors.

Length, 3 to 5 inches; diameter, ·10 to ·15 of an inch ($2{\cdot}5^{mm}$ to 4^{mm}).

Near St. George's Bank in 110 and 150 fathoms, common; off Casco Bay, 30 to 94 fathoms, common; Jeffrey's Bank, 79 to 105 fathoms. Abundant at all the localities, on muddy bottoms, in deep water, in the Gulf of Maine.

The name "Nothria" was substituted for *Northia* (Johnston) by Malmgren for reasons that are scarcely sufficient. The latter name was, however, previously in use for a genus of shells (Gray, 1847), and must be rejected on that account.

Ninoë nigripes Verrill. (Plate 3, figure 5.)

First Report of Commissioner of Fish and Fisheries, p. 595.

Body elongated, slender, broadest a short distance behind the head, at the middle of the branchiferous segments. Head depressed, elongated, conical, blunt at end, about twice as long as broad. The branchiæ are represented on the first two setigerous segments by a short, flattened lobe, arising from the outer and posterior face of the setigerous lobe. On the two following segments the lobe is divided into two or three parts; on the fifth there are usually three, more elongated, round, and more slender branchiæ, which increase in number and length on the succeeding segments until there are five, six, or more long, slender branchial filaments, which arise from the posterior face of the setigerous lobe, and diverge, forming a somewhat fan-shaped or digitate group; at about the twenty-fourth segment the number rapidly diminishes, and after the twenty-seventh or twenty-eighth there remains but one small branchial process. The setigerous lobe is prominent, obtuse, turned forward. The setæ are numerous on the branchial segments, and rather long, of various shapes, but mostly bent, with an acute lanceolate point; posteriorly they are shorter and fewer, and mostly slender, margined uncini, with hooks at the spatulate end. Body flesh-color; the setæ dark, often blackish; branchiæ bright red. Length of broken specimens, 20^{mm} to 50^{mm}; breadth anteriorly, 2^{mm} to 3^{mm}.

Vineyard Sound and Buzzard's Bay, and waters outside, in eight to twenty-nine fathoms, mud; Casco Bay, ten to sixty-eight fathoms; off the coast of Maine, at various depths to 107 fathoms.

Lumbriconereis obtusa Verrill, sp. nov.

Body slender, terete, tapering posteriorly, strongly annulated. Head nearly as broad as the body, obtusely rounded at the end. Lateral appendages prominent, bilobed, the posterior lobe longer and tapered; the anterior one is short and obtusely rounded. Near the posterior end the appendages are longer than the rest. The first twelve to fourteen segments bear fascicles of rather long setæ of three forms; those of the first three being shorter and less developed; on the fourth to twelfth segments the fascicles contain four to six setæ, of which the two or three upper ones are three or four times as long as the appendages, long, lanceolate, bent and flattened in the middle, with a long tapering tip; two are long slender uncini, narrowly margined and bent toward the end; and one is long and slender, with a very slender setiform tip. From about the fourteenth to about the twenty-fourth segment, the fascicles consist of one long slender seta, with two or three uncini, which are shorter and have more broadly margined tips than those of the preceding segments. On the succeeding segments the slender setæ disappear and two or three uncini remain, similar to the preceding ones, but gradually decrease in length posteriorly. Color of skin bright light green, the interior bright orange-red, showing through the integument. Length about 1 inch; diameter ·03 of an inch ($\cdot75^{mm}$).

Casco Bay, three to ten fathoms, muddy and sandy bottoms.

Anthostoma acutum Verrill.

Op. cit., p. 599.

Body long and quite slender, tapering most toward the head, and very gradually posteriorly. Head very acutely pointed, with two rather indistinct reddish spots above, resembling imperfect ocelli. The branchiæ commence at the eleventh setigerous segment as small dorsal papillæ, and become prominent on the thirteenth; on the succeeding segments they become long and ligulate. Anteriorly the feet are represented by an upper ramus, consisting of a very small tuft of setæ, with a very small papilliform lobe above it; and a lower ramus, consisting of a small prominent papilla, with a fascicle of slender setæ, much larger than the upper one. On the fourteenth and succeeding segments the dorsal cirrus of the upper ramus becomes longer, more slender and ligulate. On the fifteenth segment a small, short, rounded ventral cirrus appears on the lower ramus, and farther back it becomes larger and more prominent, and the setigerous lobe becomes bilobed. Anal segment rounded, obtuse; cirri long and slender. Color light red. Length up to 40^{mm}; diameter, $2{\cdot}5^{mm}$.

Off Gay Head, nineteen fathoms, soft mud; also from the deeper parts of Vineyard Sound; Casco Bay, eight to thirty fathoms.

Praxilla zonalis Verrill. (Plate 5, fig. 4.)

American Journal of Science, vol. vii, p. 505, plate vi, fig. 2, May, 1874.

Body composed of about twenty-five segments, exclusive of the cephalic and anal; of these twenty-two bear fascicles of setæ; two ante-anal segments are destitute of setæ, and each of these is more or less distinctly biannulated, so as often to appear like three or four distinct segments. Cephalic lobe with a rather low and broad median ridge, prolonged in front of head; the end depressed, tapering, obtuse; narrow, lateral, parallel fossæ bound the median ridge; the head is bordered by a thin moderately elevated fold, continuous on each side, or with a very slight, scarcely distinct notch, behind the middle; a slight posterior notch, where the two lateral lobes unite.

The first three setigerous segments are, in ordinary states of contraction, about equal in length, rather longer than broad, tapering backward; the next four are nearly cylindrical, biannulated, in preserved specimens often as broad as long, more elongated when living; the seven succeeding ones are more elongated, nearly

Plate 5.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 6.

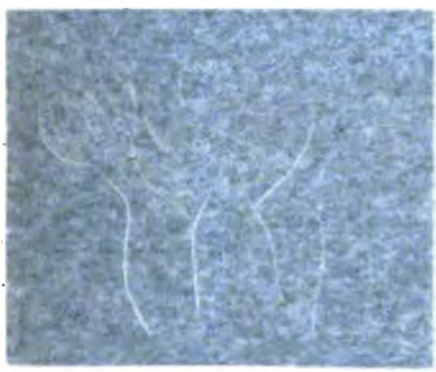

Fig. 5.

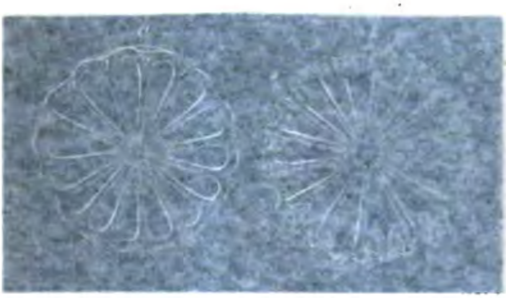

Plate 5.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Plate 6.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

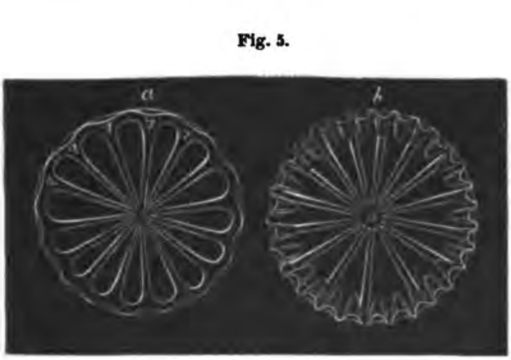

Fig. 6.

cylindrical, and all similar; the following ones become smaller, more elongated, and more or less constricted anteriorly; the last two setigerous ones are shorter than those that precede them. The first three setigerous segments bear an upper fascicle of slender setæ, and a single small, spine-like seta below, on each side; the succeeding segments bear a larger upper fascicle of slender setæ, and a row of numerous uncini below. Anal segment more or less funnel-shaped according to the state of expansion, bordered by a circle of sixteen to twenty slender, subequal papillæ, with one on the ventral side longer, and sometimes nearly twice as long as the rest; occasionally smaller papillæ alternate irregularly with the larger ones, and the ventral papilla may be but little longer than the rest. Color, generally light orange-yellow, slightly iridescent anteriorly, and with bright red vessels; an ill-defined band of dark red covers the fourth, and the posterior part of the third segment; more clearly defined bands of bright red occupy the posterior half of the fifth, sixth and seventh segments, the last being twice as broad as the two preceding; posterior to this the surface is more or less specked with red, and the convoluted bright red dorsal vessel is very distinct; uncigerous lobes pale yellow, centred with yellowish brown or reddish brown. The eggs are pale yellow, regularly oval or elliptical. They were discharged July 29th. Length about two inches, or 50^{mm}; diameter about $1{\cdot}25^{mm}$.

Casco Bay, eight to twenty fathoms, sandy and muddy bottoms.

Ancistria capillaris Verrill, sp. nov.

Body long, very slender, terete, thickest anteriorly, composed of numerous segments. Head small, sub-conical, composed of two segments, depressed, the tip bluntly rounded and slightly turned up. A small proboscis is sometimes protruded forward from the mouth. The first four segments bear fascicles of several slender, acute, curved setæ, above and below; the succeeding ones bear transverse fascicles of elongated uncini, broadly margined on each side; farther back these become shorter and less distinct.

Body flesh-color, with red markings due to the circulating fluid. Diameter $0{\cdot}25^{mm}$ to $0{\cdot}50^{mm}$ (·01 to ·02 of an inch).

The tubes are long, capillary, unattached, tough, flexible, covered with firmly adhering grains of fine sand.

Casco Bay and off the coast of Maine, in thirty to one hundred and fifty fathoms; abundant on muddy bottoms.

Ancistria acuta Verrill.

American Journ. Science, vol. vii, p. 505, plate vi, fig. 3, May, 1874.

Body elongated, terete, slender, but stouter than the preceding, thickest anteriorly, composed of numerous short, distinct segments, of which the anterior ones are biannulated. Head cónical, acute. The seven anterior segments bear fascicles of several long, slender, acute, bent setæ, both above and below. The succeeding segments bear fascicles of elongated uncini. Diameter of body, $0·5^{mm}$ to nearly 1^{mm}.

Broad Sound, Casco Bay, fifteen to twenty fathoms.

ARENIELLA Verrill, gen. nov.

Head acute, conical, mouth beneath. Body slender, terete, composed of numerous similar segments, without any marked division into distinct regions. The upper fascicles on all the segments contain slender, acute, bent setæ, usually mingled with some of different forms anteriorly. The lower fascicles contain shorter, mostly simple setæ anteriorly, and bidendate uncini farther back.

Areniella filiformis Verrill, sp. nov.

Body long, slender, filiform, terete, of nearly uniform width, but sometimes thicker anteriorly, composed of numerous biannulated segments. Head small, acute. Mouth crescent-shaped, bordered posteriorly by the swollen buccal segment. The first seven segments bear three or four short, stout, obtuse setæ in the lower fascicles; in the upper fascicles, much longer and acute setæ, shortest and fewest in the anterior segments; part of these are long, slender, curved and tapering toward the tip, about one-third as long as the diameter of the body; and others are stouter, and only about half as long, spine-like, bent and mostly acute at tips, but sometimes bidentate; these are usually the lowest in each fascicle, but sometimes alternate with the longer ones. The eighth setigerous, and many succeeding segments, have upper fascicles nearly like those of the preceding ones, but with longer and more numerous setæ; the lower fascicles mostly consist each of two elongated, curved, obtuse, bidentate uncini. Posteriorly the setæ of the upper fascicles become much longer and more slender, often exceeding the diameter of the body, and the fascicles are larger. Diameter about ·01 of an inch (0·25^{mm}).

Casco Bay; twenty to forty fathoms, mud.

Grymæa spiralis Verrill. (Plate 5, figure 5.)

American Journal of Science, vol. vii, p. 407, fig. 1, and plate 5, fig. 4, April, 1874.

Body long and slender, spirally coiled, composed of over 150 segments, of which about 120 bear fascicles of slender setæ. Branchiæ long filiform, two or three times the diameter of body, arising in three clusters on each side, easily detached and often partially absent. Setæ on the first six or seven segments a little longer than the following ones. General color dark red. Tube composed of firmly cemented mud and sand, coiled in a double spiral, the two halves revolving in opposite directions.

Off Casco Bay, in ninety fathoms, mud; off Grand Menan I., sixty fathoms; Jeffrey's Bank, eighty fathoms.

GEPHYREA.

Phascolosoma boreale Keferstein (?), Beiträge zur Anat. und syst. Kentniss der Sipunculiden, p. 206.

This species is rather short and thick, obtuse posteriorly, nearly smooth to the naked eye, and destitute of both hooks and distinct suckers, but the skin is minutely wrinkled transversely, and covered with almost microscopic slender papillæ, and is minutely specked with dirty yellowish brown; the retractile portion is more distinctly granulated anteriorly. The tentacles are rather numerous, small and simple.

Off Casco Bay, sixty-four fathoms; Cashe's Ledge, fifty to seventy-two fathoms; near St. George's Bank, 110 fathoms; Gulf of St. Lawrence (Whiteaves).

Phascolosoma cæmentarium Verrill.

First Report of U. S. Comm. of Fish and Fisheries, p. 627, plate xviii, fig. 92.

Sipunculus cæmentarius Quatrefages, Histoire Nat. des Annelés, vol. ii, p. 628, 1866. This is the *Sipunculus Bernhardus* of American writers, but not of Forbes. *P. ramulatum* Packard, Mem. Boston Soc., ii, p. 290, 1867, may be the same species. It is perhaps identical also with *Sipunculus capitatus* Rathke, Fauna Norwegens, p. 143, plate vi, figures 20–23, 1843.

Very common on the coast of New England, from Vineyard Sound northward, in 5 to 430 fathoms, in dead univalve shells.

Phascolosoma tubicola Verrill.

American Journal of Science, vol. v, p. 99, 1873.

Body versatile in form; in contraction short, cylindrical, oval, or fusiform, ·5 to one inch long, ·10 to ·15 in diameter; in full extension the body is more or less fusiform, gradually tapering anteriorly into the long, slender, nearly cylindrical retractile portion, which is longer than the rest of the body and bears, near the end, a circle of about ten to sixteen, simple, slender tentacles, beyond which the terminal portion is often extended into a short proboscis, with the mouth at the end; below the tentacles there is sometimes a dilation, but this is without special spines or granules, and like the rest of the retractile portion in texture. The posterior end of the body is bluntly rounded, and the skin is transversely wrinkled and rough, and covered with small, round, somewhat raised verrucæ or suckers, to which dirt adheres, and at the end nearly always bears from 3 to 8, small, but prominent, peculiar bodies, having a slender pedicel and a clavate or globular head; their nature is doubtful (they may be sense-organs, but should be examined on living specimens). At about the posterior third of the proper body is an irregular zone of numerous, dark brown, hard chitinous hooks, arranged in several rows, broad triangular in form, with acute points directed forward; among the hooks are also a few suckers; the middle region is covered with small, round, slightly raised suckers, which become much more prominent and crowded at the anterior end toward the base of the retractile portion, and have here the form of small, subconical, elevated warts, to which dirt usually adheres firmly; the retractile portion is covered throughout with minute conical verrucæ or papillæ, most prominent toward the base.

In many respects *P. cæmentarium* agrees very closely with this, but it has the posterior end much smoother, and with less conspicuous suckers; the hooks are not so numerous, less acute, and lighter colored; the anterior part of the body has smaller and less prominent suckers or verrucæ; the skin is lighter colored, thinner, and more translucent, and there is a zone bearing several rows of minute, slender, acute, chitinous spinules, a little below the tentacles.

Off Casco Bay, sixty to ninety-four fathoms; near St. George's Bank, eighty-five to one hundred and fifty fathoms.

TURBELLARIA.

Ophionemertes agilis Verrill. (Plate 2, figure 4.)

American Journal of Science, vol. vii, p. 45, plate vii, fig. 1, 1874.

Allied to *Tetrastemma*. Body slender, slightly depressed, with the sides well rounded, thickest in the middle, tapering gradually to the slender, obtuse, posterior end; head somewhat separate from, and wider than the anterior part of the body, changeable in form, often oval, sometimes sub-triangular, generally longer than broad, narrowed anteriorly, obtuse or slightly emarginate, with a terminal orifice. Eyes numerous, forming a long, crowded lateral row or group along each side of the head; the rows are simple and convergent anteriorly, posteriorly they become broad and double. Back of the eyes there is a curved transverse groove or furrow, crossing the back of the head. No lateral fossæ were observed. Color pale ochre-yellow; the intestine slightly reddish; the internal lateral organs lighter yellow, giving a reticulated appearance to the sides. Length 25^{mm} to 40^{mm}; 1·5^{mm} to 2^{mm} in diameter.

Casco Bay, twenty to sixty-five fathoms; Bay of Fundy, forty to ninety fathoms.

Tetrastemma vittata Verrill. (Plate 2, figures 7, 8.)

Op. cit., vol. vii, p. 45, plate vii, figs. 3, a, b, 1874.

Body short and stout, obtuse at both ends, well rounded, little depressed; head not distinct from the body, obtusely rounded. Eyes four, small and not very distinct, the two pairs widely separated, the anterior ones near the anterior end, and nearer together than the others. A well-marked transverse groove or fold is situated between the two pairs of eyes, and extends around to the ventral side; proboscis-orifice terminal. Color of body dark olive-green, greenish brown, or greenish black, often with a light longitudinal dorsal stripe; head greenish, marked with six longitudinal white stripes or vittæ, which radiate from the terminal orifice and extend backward to the transverse furrow, which is bordered by a transverse band of white, often forming a whitish ring around the head; two of the vittæ are dorsal; two ventral; and one lateral, on each side; a less distinct median ventral one is sometimes visible. Length, 25^{mm} to 40^{mm}; diameter, 4^{mm} to 7^{mm}.

Casco Bay, three to twenty fathoms, on muddy bottoms.

Macronemertes gigantea Verrill. (Plate 2, figures 5, 6.)

American Journal of Science, vol. vi, p. 439, pl. vii, figs. 2, a, b, 1873.

Body much elongated, subterete, a little depressed, thickest anteriorly, gradually tapering posteriorly, becoming very slender toward the end. Integument very soft, secreting a large quantity of mucus. Head not distinct from body, obtusely rounded in front, with a terminal pore; upper surface with two longitudinal fossæ; below with two rather indistinct transverse grooves, or fossæ, in advance of the mouth. Ocelli numerous, arranged in six clusters; a pair of large clusters on the anterior lateral border of the head; a pair of smaller lateral clusters farther back; and a pair of small clusters on the dorsal surface, between the longitudinal fossæ. Color, when living, bright orange-red above, flesh-color below. Length, about eight feet, in extension; diameter, anteriorly, ·30 of an inch (7^{mm} to 8^{mm}).

Off Cape Elizabeth, sixty-eight fathoms, soft mud, Aug. 12.

TUNICATA.

Ascidia mollis Verrill. (Plate 1, fig. 5.)

American Journal of Science, vol. vii, p. 409, fig. 2, 1874.

Body large, hemispherical or subglobular, attached obliquely by the left side; integument rather thin, soft and somewhat translucent, with the surface nearly smooth, but more or less wrinkled. Color, pale olive-green. Branchial aperture near one end, large, slightly elevated, surrounded by eight obtusely rounded lobes; anal orifice placed to one side of the middle of the body, little elevated, relatively small, rounded in ordinary expansion. Diameter of body usually one to two inches.

Common in forty-eight to one hundred and seven fathoms, attached to bowlders in many localities off Casco Bay; off Manheigan I.; at Jeffrey's Bank; Cashe's Ledge, etc.

ANTHOZOA.

Cornulariella modesta Verrill. (Plate 6, figs. 2, 3.)

American Journal of Science, vol. vii, p. 40, plate viii, figs. 1, 2.

Allied to *Cornularia* and *Telesto*. Polyps tubular, rising from creeping stolons; the lower part of the polyp-bodies has the walls thickened and stiffened by large numbers of spicula, having interlocking branches or projections, and is more or less eight-ribbed in contraction; upper part of body hour-glass shaped, flexible, translucent, whitish, with fewer white spicula, retractile into the lower part, the eight internal lamellæ showing through. Tentacles large, expanding about 6^{mm}, lanceolate, gradually tapering to the acute tips, flat above, with the short thick pinnæ arranged along the upper edges on the distal half; the lower side of the tentacles is rounded and more or less swollen toward the base. Color of stolons and base of polyps dirty yellowish or brownish; flexible part of polyps and the tentacles translucent white; the latter with central rows of white spicula. Height of polyps, 6^{mm} to 18^{mm}; diameter, 3^{mm}; distance between polyps, 6^{mm} to 25^{mm}; breadth of stolons, about 3^{mm}.

Casco Bay; Bay of Fundy, eighty to one hundred fathoms. Gulf of St. Lawrence, in 220 fathoms (Whiteaves).

Cerianthus borealis Verrill.

Op. cit., vol. v, p. 5, January, 1873.

Body much elongated, tapering gradually to the abactinal opening, the surface smooth but more or less sulcated longitudinally. Marginal tentacles very numerous and unequal, the inner ones longest, in the largest specimens 2·25 inches long, and ·12 in diameter at base, gradually tapering, acute; the outer ones 1 inch and less in length. Oral tentacles numerous, crowded in several rows, in the largest specimens about 1 inch long, slender, acute. Color of body olive-brown or dark chestnut-brown, sometimes pale bluish just below the tentacles; disk pale yellowish brown; space within the oral tentacles, around the mouth, deep brown, with lighter radiating lines; oral tentacles pale chestnut-brown; marginal ones deep salmon or yellowish brown, the longest usually barred transversely with six to eight dark reddish brown spots, each spot partially divided along the median line into two lateral ones.

The two largest specimens, dredged in twenty-eight fathoms, east of Grand Menan, by the writer, measured 5 inches across the disk and tentacles, but their bodies were mutilated. Entire ones of much smaller size were dredged by Dr. Packard and Mr. Cooke in 110 and 150 fathoms, soft mud, near St. George's Bank. The largest of these was eight inches long, and like other species of the genus, inhabited a thick, tough, felt-like, muddy tube.

Casco Bay, seven to ninety-four fathoms; off Seguin Island seventy-five fathoms, of large size (18 inches long, 1·5 in diameter, and 7 inches across the tentacles).

SPONGIÆ.

Leucandra cyathus Verrill, sp. nov.

Sponge deep cup-shaped or goblet-shaped, with a short, thick pedicel and a wide terminal opening, surrounded by an even, acute rim; walls of the sponge rather firm, moderately thin, finely porous; external surface even, sparingly hispid, with the short projecting points of scattered fusiform and tri-radiate spicula; internal surface finely porous, and roughened with small, short points of spicula, directed upward. The external wall is filled with an intricate net-work of moderately large, mostly tri-radiate spicula, part of which are sagittate, with a straight shaft, and two long, slender, widely divergent, slightly curved branches; partly regular, with the angles nearly equal; all have long, moderately slender rays, tapering regularly to a sharp point; in some, one ray is considerably longer than the others. A few straight, fusiform spicula, with acute tips, project from the surface; they are about as large as one of the branches of the tri-radiate ones. The walls of the irregularly divided radiating tubes are supported by the long, straight shafts of tri-radiate sagittate spicula, having their branches widely divergent, curved and mostly imbedded in the outer or inner walls, and usually about half as long as the shaft. The inner wall is supported by tri-radiate spicules, similar to those of the outer wall, and by quadri-radiate sagittate spicula, mostly smaller, and with unequal curved branches, the apical one short, projecting slightly beyond the inner surface, and directed upwards. Height of sponge, 20^{mm} to 25^{mm}; diameter of cups, 8^{mm} to 10^{mm}. Color pale yellowish white.

Casco Bay, off Witch Rock, fifteen fathoms.

Ascortis Clarkii Verrill, sp. nov.

Sponge forming long, slender, regular, subcylindrical tubes, either simple or sparingly branched, with smooth thin and delicate walls; terminal orifice usually small and simple, or surrounded by a short fringe of small spicula. The walls are composed of a close, irregular net-work of slender tri-radiate spicula, which are regular, with long, slender, tapering, subequal, acute rays; usually the angles are nearly equal, but some are more or less sagittate in form, with two of the rays widely divergent and slightly curved. Among the tri-radiate spicula there are many small, very slender, acute, fusiform ones, which are mostly less than half the diameter of one of the rays of the former, and from one-third to two-thirds the length. Length of the sponge-tube, 15^{mm} to 25^{mm}; diameter, $0{\cdot}60^{mm}$ to $0{\cdot}80^{mm}$. Color pure white.

Quahog Bay, at low water, abundant.

This is the most delicate species of calcareous sponges found on our coast and is so translucent as to display very readily the form and structure of the minute zoöids, like those figured by the lamented Professor H. J. Clark in a closely related species (*A. fragilis*, var. *bifida* Hæckel). These can be easily made out even in alcoholic specimens, and are large enough to be visible with a one-inch objective. This species is readily distinguished from *A. fragilis*, both by its long, even, sparingly branched tubes and by having regular spicula instead of the irregular ones characteristic of the latter.

Leucosolenia (*Ascaltis*) *cancellata* Verrill, sp. nov.

Sponge massive, pyriform, hemispherical, subglobular, or irregular, consisting of an intricate mass of small anastomosing tubes, which are more or less coalesced; surface variously cancellated, consisting of small, irregular, mostly angular, deep depressions or pits, separated by thin rounded ridges. The thin walls of the tubes are supported by a net-work of rather small, regular, tri-radiate and quadri-radiate spicula, the two sorts about equal in size. The tri-radiate ones mostly have the rays and angles nearly equal; the rays being nearly straight, long, and tapering but little to near the ends, which are somewhat obtusely pointed; some of the spicula are broadly sagittate, with wide spreading branches. The quadri-radiate spicula have a small, short, acute, straight or curved apical ray, many times shorter than the others, which are similar in size and form to those of the tri-radiate spicula. Diameter of the sponge mass 6^{mm} to 30^{mm}; diameter of component tubes $0{\cdot}5^{mm}$ to 1^{mm}. Color yellowish white to brownish yellow.

Casco Bay, ten to sixty-four fathoms; Cashe's Ledge, fifty-two to seventy fathoms.

This species belongs to the genus *Ascaltis* of Hæckel, which contains the typical species of the old genus *Leucosolenia*.

EXPLANATION OF PLATES.

PLATE 1.

Fig. 1. *Octopus Bairdii* V., male; profile view, natural size.

Fig. 2. The same, dorsal view.

Fig. 3. *Entalis agilis?* G. O. Sars; lateral view of the soft parts, in extension, enlarged about four diameters.

Fig. 4. *Entalis striolata;* several views of animal, with the foot in different states of expansion; enlarged about one and a half diameters.

Fig. 5. *Ascidia mollis* Verrill; natural size.

Fig. 6. *Chelyosoma geometricum* Stimpson; natural size.

[The drawings are by J. H. Emerton.]

PLATE 2.

Fig. 1. *Gattiola cincinnata* Verrill; dorsal view; enlarged about five diameters.

Fig. 2. *Nephthys ingens* Stimpson; dorsal view of anterior part of body and proboscis; enlarged.

Fig. 3. *Ammotrypane fimbriata* Verrill; ventral view; natural size.

Fig. 4. *Ophionemertes agilis* Verrill; dorsal view; enlarged about two diameters.

Fig. 5. *Macronemertes gigantea* Verrill; anterior part of body and head; ventral view; natural size.

Fig. 6. The same; dorsal view.

Fig. 7. *Tetrastemma vittata* Verrill; anterior part of body and head; dorsal view; enlarged about four diameters.

Fig. 8. The same; front view of the head.

[Figures 5 and 6 were drawn by the author, the rest by J. H. Emerton.]

PLATE 3.

Fig. 1. *Phyllodoce catenula* Verrill; dorsal view of anterior part of body and head, and of the extended proboscis; enlarged about four diameters.

Fig. 2. *Proceræa gracilis* Verrill; dorsal view of head and anterior portion of body; enlarged about six diameters.

Fig. 3. *Nereis pelagica*, male and female; natural size.

Fig. 4. The same; one of the lateral appendages of the 54th segment; enlarged about ten diameters.

Fig. 5. *Ninoë nigripes* Verrill; one of the lateral appendages; greatly enlarged.

[Figures 3 and 4 are copied from Ehlers; the rest are by J. H. Emerton, from nature.]

PLATE 4.

Fig. 1. *Stephanosyllis ornata* Verrill; anterior and posterior portions; enlarged eight diameters.

Fig. 2. *Eulalia pistacia* Verrill; anterior and posterior parts of body; enlarged about four diameters.

Fig. 3. *Vermilia serrula* Stimpson; anterior part of tube and expanded branchiæ of an immature specimen; much enlarged.

Fig. 4. *Nothria opalina* Verrill; anterior portion; enlarged about five diameters.

[The figures were drawn by J. H. Emerton.]

PLATE 5.

Fig. 1. *Nereis virens;* head and anterior segments; slightly enlarged.

Fig. 2. The same; lateral appendages; enlarged four diameters; *a*, appendage from the 56th segment; *b*, from the 80th segment.

Fig. 3, *Enipo gracilis* Verrill; setæ enlarged 175 diameters; *a*, one of the inferior setæ of the lower ramus; *b*, one of the superior setæ of the lower ramus; *c*, one of the setæ of the upper ramus.

Fig. 4. *Praxilla zonalis* Verrill; anterior and posterior portions; enlarged about three diameters.

Fig. 5. *Grymæa spiralis* Verrill; lateral view of anterior portion; enlarged about three diameters.

Fig. 6. *Lumbriconereis fragilis;* anterior part of body and head, dorsal view; enlarged about six diameters.

Fig. 7. *Nephthys ciliata;* one of the lateral appendages; enlarged ten diameters.

[Figures 1, 2 and 7 are copied from Ehlers; figure 3 is from nature, by the author; the rest were drawn from living specimens by J. H. Emerton.]

PLATE 6.

Fig. 1. *Edwardsia farinacea* Verrill; lateral view; enlarged about three diameters.

Fig. 2. *Cornulariella modesta* Verrill; two of the zoöids, one in contraction; enlarged about four diameters.

Fig. 3. The same; some of the spicula from the integument of the body; enlarged.

Fig. 4. *Alcyonium carneum* Agassiz; three of the polyps; enlarged about ten diameters.

Fig. 5. *Oligotrochus vitreus* G. O. Sars; two of the plates from the integument of the body of a specimen dredged in 79 fathoms near Jeffrey's Bank; enlarged 140 diameters; *a*, a wheel with the rim not fully developed, but continuous; *b*, a wheel with the rim fully formed.

Fig. 6. *Chætoderma nitidulum* Loven; with the branchiæ retracted; enlarged about five diameters.

[Figure 6 was drawn by J. H. Emerton; the others by the author.]