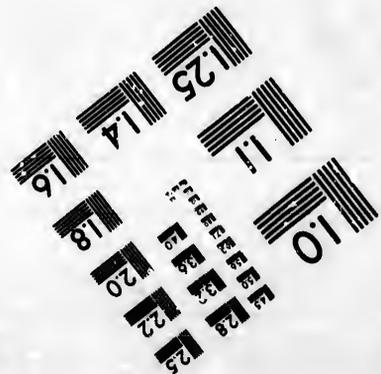
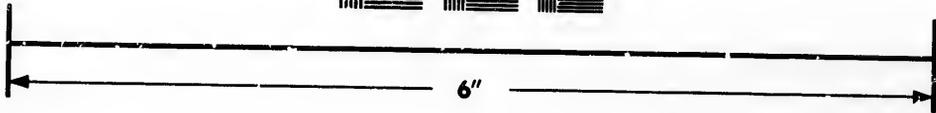
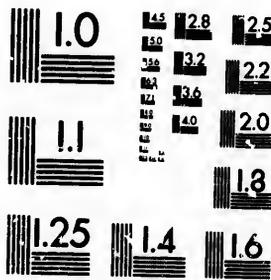


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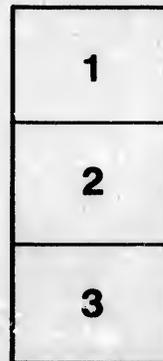
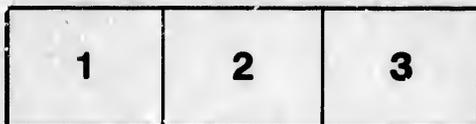
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REPORT OF A SECOND DEEP-SEA
DREDGING EXPEDITION

TO THE GULF OF St. LAWRENCE,

WITH SOME REMARKS ON THE MARINE FISHERIES OF THE
PROVINCE OF QUEBEC.

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REPORT ON A SECOND DEEP-SEA DREDGING EXPEDITION TO THE
GULF OF ST. LAWRENCE, WITH SOME REMARKS ON THE MARINE
FISHERIES OF THE PROVINCE OF QUEBEC.

By *J. F. Whiteaves, F.G.S., &c.*

To the Honorable PETER MITCHELL,
Minister of Marine and Fisheries for the
Dominion of Canada, &c., &c.,

SIR,—I have the honor to submit the following report of a second deep-sea dredging expedition to the Gulf of St. Lawrence, prosecuted by me during the summer of 1872, under the auspices of the Department, and as the representative of the Natural History Society of Montreal.

Your obedient servant,

J. F. WHITEAVES.

INTRODUCTORY.

As soon as the navigation of the St. Lawrence was fairly open in 1872, preparations were set on foot for the summer's operations. A Casella's thermometer and improved deep-sea water bottles were ordered from England; but, unfortunately, I was not able to procure these. Had they been available, it was hoped that much more accurate thermometrical observations could have been recorded, and it might have been possible to ascertain if the chemical characters of the water varied much at different depths. My next step was to try and induce some skilled zoologist or botanist to accompany me and take a share of the work, or, failing this, a practical taxidermist. Every effort was tried, but no naturalist would volunteer to go. At this juncture, my friend, Mr. A. E. Bulger, of Montreal, kindly said that he would be willing to cruise with me, and do his best to work under my supervision. This proposal was gladly accepted; and it is only fair to Mr. Bulger to say that his services were of much value, and that his zeal and industry in the proper preservation of the specimens collected deserve high praise. The necessary preparations for the expedition having been made, it was arranged that we were to meet Captain Lachance at Gaspé Basin, on the 18th July. Previous to starting, after a careful study of the Admiralty charts, I had selected three or four distinct subjects for investigation, either or all of which, it was proposed to adopt, should circumstances admit.

The first of these was to try and ascertain how far up the River St. Lawrence the marine fauna and flora extend. Principal Dawson has collected an extensive and interesting series of arctic marine invertebrates at Murray Bay, and it was thought desirable to examine the centre of the river between that place and Quebec. Opportunities for doing this were not, however, afforded.

To make the second plan of operations proposed intelligible, it is necessary to offer a few explanatory remarks. From a point situated a little to the north of the Island of Cape Breton, a line of sixty fathoms soundings stretches irregularly, but on the whole in a north-westerly direction, to Percé or Gaspé Bay. Inside of this line of soundings, which includes the whole of the Magdalen group, the water is usually very shallow. The

Percé fishermen say that in many places on and near the Miscou Banks, where they fish, the water is less than ten fathoms deep. Submarine elevations of the land, to a greater or less extent, appear to obtain in the area circumscribed by such a line as that of which I have spoken. These form a kind of irregular submerged plateau, of which the Magdalen group and Prince Edward Island form part, outside of which the water deepens rapidly, and in many places quite precipitously. This being the case, such a plateau, it is thought, would form a kind of barrier to the cold arctic currents which sweep through the Strait of Belle Isle, and would tend to deflect them in a bold curve up the River St. Lawrence. It seems also not improbable that this line of sixty fathoms soundings may divide two well-marked assemblages of marine animals in Canada. Outside of it, especially in deep water, the fauna is of a decidedly Arctic and Scandinavian character. The specimens collected by me in 1871 and 1872 shew clearly that a much larger number of species are common to both sides of the Atlantic than American or European naturalists formerly supposed. On the other hand, the seas of New Brunswick, of Prince Edward and Cape Breton Islands contain a more southerly assemblage, a large proportion of the members of which are characteristic New England species. This Acadian fauna, as it has been called, extends at any rate to the south side of the Bay of Chaleurs, and perhaps as far north as Gaspé Bay. In this latter place, although the fauna on the whole is decidedly arctic, one or two stragglers from more southern shores are rarely met with. My object, therefore, was to try and ascertain, by actual investigation on the spot, if the line of sixty fathoms soundings, as given on the charts, forms the line of demarcation in Canada between the arctic and the Acadian faunæ. It was thought that by dredging alternately on both sides of this line, and carefully comparing the specimens collected, much light might be thrown on this particular point.

The third object I proposed to myself was to investigate the animal life of the deepest parts of the Gulf generally. It is not known with any degree of certainty where the most important of the Canadian edible fishes (such as the cod, halibut, mackerel, and herring), go to in winter. Whether they merely retreat to the deepest parts of the Gulf during the cold months, or migrate further south, remains to be ascertained. It was thought that a tolerably careful examination of the animal life of the greatest depths would at least help to shew if plenty of food for such fishes exists on or in the deep sea mud.

Towing-nets were also provided, arranged so as to catch such minute animals as float on or a little below the level of the water. Valuable information as to the food of the herring and mackerel has recently been placed on record by a Danish naturalist, Mr. Axel Boeck. The following abstract of this observer's general conclusions is partly condensed and partly copied from an article in Professor S. F. Baird's "Annual Record of Science and Industry," for 1871. According to Mr. Boeck, the food of herrings consists almost entirely of minute invertebrate animals, and this is divided by the northern fishermen into three classes—the "red," the "yellow," and the "black." These names are derived from the colour of the food when living, or else from its appearance in the stomach of the fish. The "red meat" is the most frequent: it consists mainly of minute copepod crustaceans. These occur on the shores of Norway and other parts of the coast of Northern Europe, at certain periods of summer in such abundance that the sea is coloured by them. School upon school of herrings and mackerel feed upon these; nor are such pigmy crustaceans disdained even by whales. Upon this food both herring and mackerel thrive and grow fat. If herrings are taken with their stomachs full of "red meat" *in an undigested state*, it is said that the animal matter in the stomach begins to spoil before it can be reached by the salt, and decomposition soon sets in. "For this reason, it is required by law to keep herrings three days in the nets in water, that all the contents of the stomach may be completely digested, while the fish is prevented from taking in a fresh supply. Sometimes, however, the winds drift the herring food into the nets, and furnish to the herrings an opportunity which they eagerly embrace, rendering them again able to the difficulty just mentioned." "Yellow meat," which is not so

abundant as the "red," is said to be made up of transparent copepods, together with the swimming larvæ of tape-worms and other annelids. Herring and mackerel feed largely upon these larval worms, and the yellow tint is thought to be derived mainly from the hairs upon the skin of these embryos. "This kind of food is considered to interfere less with the proper curing of the herring, as it is much more quickly digested." "Black meat" is found to be mainly large numbers of the embryonic state of a minute spiral shell, of the genus *Rissoa*, which lives upon sea weed. In their early stage these molluscs have two wing-like expansions, covered with hairs, attached to the body, which they lose when they reach maturity. The substance of the soft parts of the "black meat" is covered with a hard shell, which prevents the digestive fluid of the fish from reaching it, so that only the wing-like processes are consumed, and that part of the body which is inside the shell rapidly decomposes. Herrings that have fed on "black meat" are said to be totally unfit for salting, even when kept in the nets for a much longer time than three days. "The salted fish has an extremely disagreeable smell, even after the stomach, with its contents, have been removed." During the early spring and in the open sea, herring do not seem to feed very largely on animal, or indeed on any other kind of food. It is in the summer and autumn, after the spawning season is over, that they devour these larval or simple forms of animal life in such quantities. From the above statements, it will be seen that it is possible to get much information of practical value, with regard to the food of the surface-feeding fishes, by the use of the towing-net in the first instance, combined with subsequent and careful microscopic study of the specimens thus collected. I was also anxious to try and find out if any Foraminifera or Polycystina (and, if so, which species) float on the surface of the water in the Gulf. A keen scrutiny was also made to try and detect any Radiolarians or Pteropods.

The weather, during the summer of 1872, was exceptionally wet and stormy at the places visited; and not only so, but the facilities afforded on board the *Stella Maris* for the operations contemplated were not nearly so many as last year. The nature of the business on which the schooner was employed was such as to make the prosecution of any definite plan of operations impracticable. Captain Lachance and his officers did every thing in their power to help us; but the cruises were too short, and the intervals spent ashore too frequent, to enable us to do as much as we could have wished. We were absent from Montreal fifty days, from 15th July to 3rd September, 1872. In the first month we had four short cruises, two of which lasted four days; the third, one; and the last, three. No less than fifteen days were spent ashore in the village of Gaspé Basin. Our final cruise for the summer extended from Gaspé Basin to the Magdalen Islands and back. We were absent eleven days; but of these we were storm-bound at Cape Rosier for two days, and spent one at Percé. Last year (1871) we got twenty-three successful hauls of the dredge, of which thirteen were in deep water. This summer (1872) the number of successful hauls was only ten, of which five were in deep water. It is only fair to add, however, that, in addition to the ten successful hauls, we had six unsuccessful casts still, notwithstanding the difficulties and disadvantages we laboured under, a large number of interesting and novel specimens were collected, and many new facts were ascertained with regard to the distribution of the lower animals in the Gulf. If the opportunities we had are fairly estimated, the success of the expedition is quite remarkable.

It is proposed to arrange the following portion of this report under three headings, much as on a previous occasion. In the first of these, an abstract from a diary kept on board the *Stella Maris* will be given. This will be followed by a summary of the zoological results of the expedition; and the report will conclude with some observations on the sea fisheries of the Dominion and on other matters of a practical character.

PART I.

Abstract of a diary, kept for the most part on board the "Stella Maris."

Leaving Montreal on the evening of the 15th July, we arrived at Gaspé Basin on Thursday afternoon, 18th July. Soon after landing we learned that the *Stella Maris* had been ordered to the Island of St. Paul, and was not expected back for some days. We awaited her arrival for about a week, and then got on board on the evening of 26th July, so as to be ready to sail at daybreak the next morning.

Saturday, 27th July, 1872.—Set sail from Gaspé Bay at 6 a.m., a drizzling rain falling during the greater part of the day. Rounded Cape Gaspé about 3 p.m.

Previous to starting, we were informed that the schooner had to be back at Gaspé Basin on Wednesday night, so that we had less than four working days before us on this cruise. Late in the afternoon, the first cast was made, the dredge being thrown over at 5.45 p.m., and hauled up at 7.45. Dredge A. 1, 75 to 80 fathoms,—stones; Cape Rosier, bearing N.-W. by N., nine miles distant; Cape Gaspé, W. $\frac{1}{2}$ N., six and a-half miles distant. As it was nearly dark when the contents of the dredge were emptied on the deck, it was not possible to examine the specimens with any care on this day. As soon as the dredge was hauled up, the vessel was put about for Gaspé Bay.

Sunday, 28th July.—Anchored outside the Peninsula, in Gaspé Bay, the whole day; went ashore in the afternoon; weather fine.

Monday, 29th July.—Set sail at 3 a.m.; rounded Cape Gaspé at 9 a.m. Weather fine during the day, but there was very little wind. The morning was spent in the examination and preservation of the specimens collected on Saturday. Among these were a number of sponges, mostly of large size, and of many species, some of which I had not seen before. Among the echinoderms were *Asterias Groenlandicus*, and large *Ophioglypha Sarsii*; a sipunculus, new to me, and a beautiful amphipod, which Mr. Smith says is *Acanthozone cuspidata*, with many other things, in all about thirty species, were also taken in our first cast. Used a towing-net in the afternoon; caught a number of minute crustaceans, and a small sea-slug (*Doris*) attached to a piece of *Fucus*. In the afternoon we tried a second cast. The dredge was thrown over at 3.30 p.m., and hauled upon deck at 5.30. Dredge A. No. 2, 110 fathoms—coarse sand and stones; Cape Rosier, bearing W. by N., seven miles distant; Cape Gaspé S.-W. by S. Two small species of sponge; ten examples of a heart urchin (*Schizaster fragilis*); four rare species of crustacea (*Munnopsis typica*, *Nymphon giganteum*, *Epimeria coniger*, and *Anthurax brachiata*); also many other scarce forms, including thirteen species of shells and six of echinoderms—altogether, nearly forty species in this haul.

Tuesday, 30th July.—Before breakfast, at 5.30 a.m., the dredge had been thrown over in about 100 fathoms of water, off Griffin's Cove. When hauled in, at about 8 a.m., the bag was found to be quite empty. A couple of deep-sea *Astartes* (a bivalve shell) and several brittle stars (*Ophiacantha spinulosa*) were found adhering to the line. Dense fog and drizzling rain all the forenoon. A towing-net had been lashed astern very early in the morning (about 3 a.m.), as an experiment. Several specimens of the three-spined stickleback (*Gasterosteus aculeatus*? var.) and a quantity of small crustaceans were taken in it. In the afternoon the fog cleared off, and it commenced to rain heavily. Another cast was made at 12.30 p.m., and the dredge was hauled on deck almost empty, at 4.40. Dredge A. 4, between Griffin's Cove and Cape Rosier, 150 fathoms—mud. One sea anemone, two or three sea-pens, a star fish (*Ctenodiscus*), two worms, and a couple of small bivalves (*Astartes*), were all that the bag of the dredge contained. About 5 o'clock, p.m., a heavy gale sprang up: we ran to Mal Bay for shelter, and anchored there at 8 p.m.

Wednesday, 31st July.—Sailed from Mal Bay at 6 a.m., with a stiff N.-W. breeze blowing. Anchored just outside Gaspé Basin at 10.30 a.m.; ashore at 12.15 a.m.

Thursday, August 1st.—Ashore all day in Gaspé Basin.

Friday, 2nd August.—Set sail for Percé, at 2.45 p.m., with very little wind. Commander Lachance and his first and second officer having sailed for Quebec the

previous day, the schooner was left in charge of the third officer. Used a towing-net in Gaspé Bay, soon after we sailed. At the entrance of Gaspé Bay, we caught several three-spined sticklebacks, and a number of land insects of all orders. Many of the smaller Coleoptera and Orthoptera were living. They seem to be able to exist for a long time, floating on the surface. A dead calm in the evening.

Saturday, 3rd August.—Anchored off Percé village, at 7.30 a.m. Went ashore for an hour or two in the morning, and set sail again about 11.15 a.m. Sailing along by the N.-E. side of Bonaventure Island in the afternoon, we observed large numbers of gannets and gulls perched upon inaccessible ledges of rock. In thick weather, the cries of these birds upon the Split Rock at Percé and on Bonaventure Island often (it is said) give timely warning to the mariner of the proximity of land. We tried a cast (Dredge A. 5) in fifty-six fathoms—sand; about one mile and three-quarters to the S.-E. of Bonaventure Island. Although the dredge was allowed to remain on the bottom for two hours it came up empty; the wind was so slight, that the scraper must have anchored the schooner. A towing-net was used in the afternoon, with the usual results, viz., a few small fishes and some minute crustaceans. After the dredge was hauled up, there was a dead calm, and the schooner had to be towed back to Percé by the crews of her two boats—a process which took three hours to accomplish. Anchored off Percé at 8 p.m.

Sunday, 4th August.—Ashore at Percé all day, where we were cordially and hospitably received by Judge Winter and Sheriff Vibert.

Monday, 5th August.—Sailed from Percé at 6.15 a.m., and passed Bonaventure Island about 9.30 a.m. Morning overcast and showery. The dredge was thrown over at 9.45 a.m., and was emptied on deck at 11.50 a.m. Dredge A. 6, sixty fathoms—tough sandy mud; five miles and a-quarter to the E.S.-E. of Bonaventure Island.

On plunging a common but carefully corrected thermometer into this mud, and shading the whole (at once) with a tarpaulin, the mercury sank to 32° Fahr.! The experiment was repeated, but each time with the same results. I heard afterwards that the Strait of Belle Isle had been unusually full of ice during the summer; but this circumstance certainly did not materially affect the temperature in other places examined. About twenty species, exclusive of the worms, came up in this haul. Of these, one of the crustaceans (*Byblis Gaimardii*) and three of the shells were rare forms. In the afternoon, two very successful hauls were made, but not in very deep water. Dredge A. 7, sixty fathoms—coarse sand and stones; about eleven miles from Percé. Temperature of the sand—about 37° Fahr. About twenty-seven species this time, seventeen of which were shells. The most noticeable crustacean was an arctic shrimp (*Sabinea septemcarinata*), and among the hydroids a fine specimen of *Halecium luscinum* was conspicuous. Later in the afternoon we got Dredge A. 8, in fifty-six fathoms—stones and coarse sand; eight miles to the S.-E. of Bonaventure Island. The bag came up full of interesting novelties. Among them were *Boltenias*, eleven inches long, many sponges, annelids, hydrozoa, polyzoa, and molluscs. Besides these there were eight kinds of crustacea, the most interesting of which were *Nectocrangon lar* and *Tritopsis aculeata*, and among the echinoderms *Asterias Groenlandicus* and *Pteraster militaris* occurred. The afternoon and evening, as well as most of the following day, were spent in the examination and preservation of the specimens collected. To-day we learned, for the first time during this cruise, that orders had been left behind that the schooner was to return to Gaspé Basin on Tuesday night.

Tuesday, 6th August.—No dredging done to-day; most of the time was occupied in the preparation of the specimens got on Monday. In the afternoon we sailed for Gaspé Basin; arrived there at 8 p.m., and went ashore.

Wednesday to Friday, August 7th to 9th inclusive.—Ashore in Gaspé Basin. Commander Lachance did not return on Thursday, but his first and second officer did.

Saturday, 10th August.—Sailed from Gaspé Basin, at 9 a.m., with a fair breeze. Rounded Cape Gaspé at 11.45—the first officer commanding during this cruise. In the afternoon, nothing else being feasible, we tried a cast in comparatively shallow water

Dredge A. 8, thirty fathoms—stones and coarse sand; six miles E.N.-E. of Cape Gaspé. A smooth Sipunculus, new to me, and an interesting zoophyte, with a number of common species, were brought up this time. From about 3 p.m. till 6, it rained and blew hard, so we returned to Gaspé Bay for shelter. At 6 p.m. the squall ceased, and was succeeded by a dead calm. We lay off Grand Grève all night. Noticed that three kinds of brittle stars collected during the day were phosphorescent in the dark.

Sunday, 11th August.—Anchored outside Gaspé Basin all day. In the morning saw many transparent medusæ floating in the water; the fishermen round the coast call these mackerel bait. Being much dissatisfied at the waste of time so far, I left a telegram ashore for Newcastle, asking for instructions. Unfortunately, the reply did not reach me in time to act upon it.

Monday, 12th August.—Left Gaspé Basin for the fourth time, early in the morning. As we knew when we started that the schooner must be back on Wednesday, our hopes of success were not high. Our object was to get to deep water as quickly as possible, and then to have as many casts as the time would permit. During the morning it was sunny, with hardly a breath of wind. A towing-net was used, but with no very remarkable results. A slight breeze rising in the afternoon, we got as far as Little Fox River by night. Did not attempt to dredge to-day: our object was to get well out into the centre of the river.

Tuesday, 13th August.—On rising, we found that the dredge had been thrown over at a little before 6 a.m. As there was very little wind, it was decided to allow it to remain on the bottom for some time before it was hauled in. Accordingly, the bag was emptied on deck about 10 o'clock, a.m. Dredge A. 10, 160 to 170 fathoms—mud and stones; about fifteen miles from Cape Rosier; temperature of the mud—about 38° Fahr. Two or three rare sponges, a few sea-pens (five or six), two deep sea star fishes, and six rare species of shells. During the night we had made for the south-west point of Anticosti, and had sighted the lighthouse at 3 a.m., and then put the vessel about. In the afternoon we had another cast in deep water, and made by far the most successful haul of the season. Dredge A. 11, 200 fathoms—mud; thirty miles N.-E. of Cape Rosier; down at 1.20 p.m., up at 3. It was found necessary to defer the examination of the last specimens collected till the next day. I had kept some sea-pens (*Pennatulæ*) alive in salt water till the evening, and on putting them into a perfectly dark place found that they emitted a pale bluish phosphorescent light, when touched. At night we were near Cape Rosier again; the lighthouse could be well made out.

Wednesday, 14th August.—Soon after breakfast we tried to get another deep-water haul before returning, but were disappointed in the results, as almost nothing was brought up. Dredge A. 12, 108 fathoms; off Cape Rosier. Two *Pennatulæ*, one star fish (*Ctenodiscus*), a sea anemone, and three shells, one very rare, were all that the dredge brought up. The morning and part of the afternoon were spent in the examination, &c., of the objects collected on the preceding day. Among the specimens were a new simply pinnate sponge, with an internal axis of spicules; a true coral; several living *Virgulariæ* (a genus then new to America, but since found by Dr. Packard, in 150 fathoms, on St. George's Bank); *Dentalium occidentale* (alive); some very rare shells and other interesting things. At noon we rounded Ship Head, bound for Gaspé Basin, at which place we landed at 5 p.m. For so short a cruise, our success this time was much more encouraging.

Thursday and Friday, 15th and 16th August.—Spent on shore in the "Basin." Captain Lachance returned on Thursday, and at once resumed command of the vessel.

Saturday, 17th August.—Left Gaspé Basin at daybreak; weather fair, wind very light. Dr. Fortin, M.P., &c., and Mr. Tetu came with us part of the way. Rounded Cape Gaspé, at 2 p.m. In the evening we tried to dredge in the deep water off Cape Rosier, but were altogether unsuccessful. Dredge A. 13, 140 fathoms; off Cape Rosier; down at 5.30 p.m., up at 7; quite empty. Another cast was immediately made in the same place, but with an exactly similar result.

Sunday, 18th August.—Anchored off Cape Rosier all day. In the afternoon we went ashore, and were very kindly and hospitably treated by Mr. Trudeau, at the lighthouse. In the evening we attempted to get back to the ship, but the surf was so heavy that we gave it up, and, thanks to Mr. Trudeau, were able to stay ashore all night. A fine and hot day with a very heavy sea on.

Monday, 19th August.—Dense fog and heavy rain all day, the gun at the lighthouse firing at regular intervals. Stayed with Mr. Trudeau all day, and got back to the ship at 10 p.m. At 11 p.m., as it had cleared a little, we set sail for Percé, with a light breeze. During our absence, the steward of the *Stella Maria*, at my suggestion, had tried the effect of drawing a fishing line with a bundle of hooks and a sinker attached to the end, repeatedly along the rocky bottom, near the ship's anchorage, in about seven fathoms of water. Although several hooks and lines were thus lost, quite a number of specimens were in this way obtained. Among these were several large purple sea cucumbers (*Pentacta frondosa*), nearly a foot long, a scarlet Holothurian (*Lophothuria Fabricii*), a ruddy sea peach (*Cynthia*), and a living green sponge, new to me. Besides these more striking specimens, the hooks brought up a quantity of small sea weeds, amongst which were multitudes of scarlet caprellæ (which have been called the monkeys of the crustacean world), parasitic sponges and zoophytes, about six kinds of shells, &c. &c.

Tuesday, 20th August.—Arrived at Percé at 3 a.m. Dr. Fortin and Mr. Tetu left us here. Instructions having been received to look after an American schooner (the *B. A. Baker*), on the Orphan Bank, we left Percé at noon, bound for the former place. On our way, we got a cast on a rough and heavy bottom, which cut the doubly-knotted bags and protecting cowhide of the dredge almost to pieces. Dredge A., 14,50 fathoms—stony and rocky bottom; Bonaventure Island bearing N.N.-W., fifteen miles distant; Point St. Peter N.W., twenty-two miles distant. Many interesting things in this haul; among them a couple of *Boltenias*, nearly two feet long, a dozen or more living *Pectens* (*Islandicus*)—more than twenty species in all, not counting the worms, zoophytes, or crustacea. It was nearly dark when the contents of the bag were emptied out, so that the looking after the specimens had to be deferred till next morning. Weather fair, with a fine breeze all day.

Wednesday, 21st August.—Alongside the *B. A. Baker*, on the Orphan Bank, at 6 a.m. Having transacted the business we had with her, in pursuance of orders received, we sailed for Percé, and arrived there at 11 a.m. Ashore in the afternoon and evening.

Thursday, 22nd August.—Left Percé at 9 a. m., bound for the Magdalen Islands. A dense fog prevailed in the morning which cleared away in the afternoon, and there was a heavy sea on, with a stiff S. W. gale all the day and night.

Friday, 23rd August.—At 2 a.m., sighted Amherst Island, four miles distant. Wind light, W.N.-W.; rain and fog in the morning. At 11 a.m., Deadman's, Grindstone, and Amherst Islands visible; many terns in sight. About noon we tried a cast, but not with much success, as the yarn fastening the two arms of the dredge got cut by rocks, so that the bag came up nearly empty. Dredge A. 15, twenty fathoms—rocky bottom—between Grindstone and Amherst Islands. We looked eagerly to see if there were any southern forms among the things brought up, but the results were purely negative. All of the twenty species observed are particularly common forms, which range from Greenland to Cape Cod. At 4.30 p.m., we saw the lighthouse on Amherst Island. Entry Island was visible at 6 p.m. Anchored off La Demoiselle Hill, on Amherst Island, at 7.50.

Saturday, 24th August.—Anchored in Pleasant Bay, off Amherst Harbour, at 6.45 a.m. Went ashore after breakfast, and took a walk with Mr. J. J. Fox, who shewed us much polite attention. The part of the island where we were is low and sandy, and in some places marshy. Many characteristic swamp plants were noticed, such as *Sarcocolla*, *Ledum*, *Kalmia*, *Kriophorum*, *Drosera*, *Spiranthes*, and (in the shade) *Monotropa uniflora*. The most interesting species (to me) was the "candleberry myrtle" (*Myrica corifera*), the berries of which were formerly boiled down by the inhabitants to make candles, as I

was told by Mr. Fox. The trees were mostly stunted spruce, hemlock, Canada balsam, slder, and low junipers. On the west point of Amherst Harbour are sub-aerial sand dunes, which have choked up and killed the few stunted trees which once grew there. We collected what looked like a promising gathering of diatoms from a lagoon, the water of which was brackish to the taste, but in which fresh-water snails (*Limnea eodes*) were living. Unfortunately, the tide was high, yet we managed to collect six species of shells on the beach. These are *Pecten tenuicostatus*, *Callista convexa*, *Maetra solidissima*, *Machara costata*, *Zirphæa crispata*, and *Lunatia heros*. Of these, *Callista convexa* is a decidedly southern form, and so, in my judgment, is *Maetra solidissima*, although Dr. Packard states that he found this latter rarely in or near the Strait of Belle Isle. We noticed a little magnetic iron in the sand on the shore, and Mr. Fox told us that gypsum and the black oxide of manganese are also found on the island. We were also informed by the same gentleman that ship-worms are often very prevalent in Amherst Harbour. When we had finished our stroll, we went to Mr. Fox's house, and on the way we met Judge Winter, also Captain Brown, commander of the *Peter Mitchell*, who invited us to cruise with him. This last polite offer we were compelled to decline, as it was necessary that we should return to Montreal early in September. After examining the blasting operations for the removal of obstructions to the entrance of the harbour, we endeavoured to do a little shallow-water dredging in one of the ship's boats, but with very little success. We got three hauls in about seven fathoms water. The first brought up a lot of sea-weed only; the second a small crab (*Cancer irroratus*), and four common species of shells (*Tellina tenra*, *Nassa trivittata*, *Lacuna vineta*, and *Margarita helicina*): and the third and last, nothing at all. Ashore again in the evening.

Sunday, 25th August.—Left Pleasant Bay at 6.15 a.m., with a fresh northerly breeze blowing and a heavy sea on. Anchored between Grindstone and Allright Islands at 10.30 a.m. Spent a few hours in the evening on Grindstone Island.

Monday, 26th August.—Set sail at 4 a.m. The whole day was hot, with little or no wind. By seven in the evening we had made only twenty miles. Cape Breton was visible in the distance about 4 p.m. The greater part of the afternoon was employed in using the towing-net on the surface, with more success than usual. Jelly-fishes, of many species and of all sizes, were taken in abundance. Floating sea-weed also gave quite a rich harvest, for, besides the polyzoa and hydrozoa parasitic on them, we got many adult Amphipods and shells, as well as crabs in an early stage of development, and three kinds of fishes. Besides the common stickleback, we collected numerous specimens of the lump-sucker (*Cyclopterus lumpus*), about half an inch long, adhering to the flat fronds of *Fucus* by the sucking disk formed by a union of the ventral fins, and a few small Bleunies. We observed that large fishes (comparatively) follow these masses of drifting sea-weed, amongst which they find plenty of food. In the evening, we tried experiments on some of the living medusæ caught during the day, and found them to emit a palish phosphorescence in the dark when touched. The light on the new lighthouse at the Bird Rock was plainly visible at 9 p.m.

Tuesday, 27th August.—At 9 a.m., the dredge was thrown over in a place which I had long wished to explore carefully. Circumstances, however, were again unfavourable. The sea was so high and the breeze so fresh, that the dredge had to be hauled up before it had been down two hours. Had the sea been quite smooth and the wind light, I should have preferred to let it scrape for at least four. Dredge A. No. 16, and last, 313 fathoms—black mud, with angular and rounded stones; between the east end of Anticosti and the Bird Rocks. Rather more than a bucketful of mud and several large stones came up in this haul. The specimens visible to the naked eye were a few *Triloculina*, nearly a quarter of an inch wide, two or three worms, one shrimp, and an *Amphipod*; one brittle star (*Amphicora*) a small example of the same coral as the one previously collected, and nine species of shells. These last are just the same as had been collected before in from 100 to 200 fathoms. A portion of this mud has been examined microscopically, with the following results:—Concave discs of a large *Coccolithus* are frequent; foraminifera very abundant and interesting; polycystina scarce, and none new

to me; a few *sic-raged* sponge spicules, indicating the existence of the Hexactinellidæ in our waters; and two or three shells of a pteropod, *Heterofusus balca*. From such a hurried attempt at an examination of the deepest spot in the Gulf, with such unpropitious weather, not much was to be expected; nor is to be wondered at that the results were so comparatively barren. To get a fair idea of the animal life existing at this depth, it would be necessary to stay on the ground for at least a week, supposing the weather to be favourable all the time. In the afternoon the breeze increased, and the sea was very heavy. After the dredge was hauled in, we at once made for Gaspé Basin, and at eight o'clock in the evening the day's run was fifty-six miles. About 8.30 p.m. it began to rain, and rained heavily all night.

Wednesday, 28th August.—Still making for Gaspé Basin. The wind had changed from S.-W. to N.-E. During the greater part of the day there was a stiff breeze blowing, with a heavy sea on; but towards sunset the weather changed. Inside Cape Gaspé about 7 p.m. but as the wind was dead ahead after we had rounded Point Peter, little progress was made for some hours.

Thursday, 29th August.—Ashore in Gaspé Basin all day, waiting for the up steamship. In the afternoon a telegram was received (and next morning a letter) from Captain Brown, R.N., commander of the Government schooner, *Peter Mitchell*, pressing us to cruise with him for another fortnight. It was necessary, however, that we should both be back in Montreal early in September, if possible on the 1st. Added to this, all the bags of the dredges had been cut to pieces, and our stock of alcohol and bottles was exhausted. As we could not make up these deficiencies in Gaspé, or get fresh supplies, further cruising would have been useless, even if we could have spared the time. We were accordingly, with great reluctance, compelled to decline Captain Browne's polite and kindly invitation.

Friday, 30th August.—The steamship *Miramichi* being late, we did not leave Gaspé Basin until an early hour in the morning. Arrived in Quebec on Sunday forenoon, so that we were unable to get home before Tuesday, 3rd September.

From the above condensed narrative of our proceedings since we left Montreal, it may be readily seen that anything like systematic dredging was impracticable. Wherever a cast was possible, we availed ourself of the opportunity, thinking it was better to try an unpromising locality than to do nothing at all. When no dredging could be done, and the weather permitted, towing nets were almost invariably used. Circumstances were so much against us the whole time, that it was only the utmost perseverance and a determination to leave no effort untried that prevented the expedition from becoming a total failure. Owing to the want of room on her deck, the *Stella Maris* is not nearly so well suited for dredging operations as *La Canadienne* or the *Peter Mitchell*; and, in addition to this, she was unusually short-handed while we were on board.

PART II.

Provisional Summary of the Zoological results of the Expedition

In order to be able to name the various specimens collected with any degree of certainty, it is necessary to have access to collections and books which are not to be met with in Montreal or in any other city of the Dominion. Descriptions of not a few of the Canadian marine invertebrates are to be found only in Norwegian, Swedish, or German scientific journals, some of which I have been unable to see. What would have been still more useful, viz. a correctly-named series of the various marine animals which inhabit the coasts of Norway and Sweden, none of the Canadian museums possess. Under these circumstances, when all the means at my disposal for the identification of certain species were exhausted, there was no alternative but to send specimens of each to some naturalist who had access to larger libraries and complete collections. To Professor A. E. Verrill and Mr. S. I. Smith (both of Yale College, Newhaven, Conn.) I am indebted for much valuable assistance in the preparation of this portion of my report. The former gentleman

has kindly examined and identified a number of critical species sent to him, especially among the Actinozoa and Tunicates, while the latter has determined for me almost the whole of the crustaceans collected. Most of the marine worms dredged in 1871 and 1872 have been sent to Dr. W. C. McIntosh, F. L. S. (of Murthly, near Perth, Scotland), who has given special attention to this difficult group, and has kindly promised to name those forwarded. To each of these gentlemen my thanks are due for the trouble they have taken and the willingness they have shewn to help me in this matter. The strain upon the eyes, caused by an almost constant use of a triplet lens for several weeks, has prevented me doing as much microscopic work as would otherwise have been desirable, to make this report more complete.

Foraminifera.

Although large numbers of these interesting objects were collected, especially from the 313 fathoms' locality, not many novel forms have as yet been observed among them. The following are the most interesting of the species, or varieties, not enumerated in Mr. G. M. Dawson's paper on the St. Lawrence Foraminifera:—*Marginulina spinosa*, M. Sars; *Cristellaria crepidula*, *Bolivina punctata*, *Nonionina umbilicatulæ*, *Trochammina incerta*, *Valvulina Austriaca*, *Triloculina trigonula*. Very few, if any, truly abyssal forms (such as *Globigerina inflata* and *Pulvinulina Micheliniana* and *elegans*) have as yet been taken in the St. Lawrence. According to Sars, however, some of these are found in 500 fathoms, off the coast of Norway.

Polyostina.

Only a few specimens of this group of animals were collected, and these are exactly the same species as those dredged last year.

Sponges.

Quite a large number of species of sponges were procured, and from all depths. Among these are a simply pinnate sponge with an internal axis of silicious spicules, possibly belonging probably to the genus *Chondrocladia*. Another, of which only fragments were obtained, has true six-rayed spicules, and belongs to the division Hexactinellidæ of Dr. Oscar Schmidt. About fifteen or twenty species were collected, some of them of considerable size. All the families of sponges have now been found in the Gulf, except that which includes those which are of the most commercial value, and which are altogether devoid of spicules. The deep-water species collected are of special interest.

Hydrozoa.

A portion of the Hydrozoa collected in 1871 and 1872 have been microscopically examined, and the following species have been recognized so far:—

(Athecata.)

Coryna pusilla—Gaertner.
Tubularia indivisa—Linn.
" *larynx*—Ellis and Sol.

(Thecaphora.)

Obelia—Two Sp.
Campanularia volubilis—Linn.
" *verticillata*—Linn.
Lafresia fruticosa—Sars, var.
Salacia (Grammatia) abietina—Sars.

Halecium halecinum—Linn.
" *robustum*—Verrill.
" *muricatum*—Ellis and Sol.
Sertularella polyzonias—Linn.
" *rugosa*—Linn.
Sertularia abietina—Linn.
" *filicula*—Ellis and Sol.
" *argentea*—Ellis and Sol.
" *cupressina*—Linn.
Thunaria thuja—Linn.
" *articulata*—Pallas.
Aglyptophœnia myriophyllum (?)—Linn.

Actinozoa.

Besides the two common sea anemones (*Metricium marginatum* and *Urticina crassicornis*), Professor Verrill recognizes two species new to the St. Lawrence among the specimens collected last summer. One is *Urticina digitata* (Muller), and the other an *Actinopsis*, apparently distinct from *A. flava* of Koren and Danielssen.

The Alcyoniums of the Gulf require a careful study. There are apparently three species among those obtained in 1872, one of which is *A. rubiforme*, Ehr.

By far the most interesting among the specimens collected are two examples of *G. trus coral*. These were taken in two localities, about 150 miles apart—one in 200, the other in 313 fathoms. Although several species of coral are known from Norwegian seas, no members of this group have hitherto been recorded from any locality on the American side of the Atlantic, north of the State of Massachusetts; and not only so, but the St. Lawrence coral (if it be an indigenous species) belongs to a division of this order, of which not a solitary example has been taken so far north on the Atlantic coast of America even as New York Bay. The two specimens obtained, though more or less perfect, were dead, and in a very friable and brittle condition. They are eup corals, which, when living, were tenanted each by a single polypite. Although they obviously belong to the family Turbinolidae, the books at my disposal were insufficient even to name the genus to which they should be referred. They are so unlike any arctic or boreal corals of which I have seen either specimens or figures, and have such a tropical or sub-tropical aspect, that at the time they were dredged I thought they might be specimens brought by ships in ballast. Professor Verrill (to whom I sent one of these corals) writes me that it is an undescribed species of *Flabellum*, and adds that he thinks that the specimens are fossil. The latter hypothesis I think very improbable, as there are no older tertiary or cretaceous deposits in Canada from which such fossils could have been washed out. In 200 fathoms, off Cape Rosier, about fifteen living examples of a *Virgularia* ("Sea Rush") were collected. The genus was then new to America, but other examples have been since taken by Dr. Packard on the St. George's Bank. At first, Professor Verrill and myself thought the St. Lawrence *Virgularia* a dwarf and depauperated variety of the European *V. mirabilis*; but the former now refers it to Kolliker's *V. Lyungmanni*, a species previously known only from the Azores. The same gentleman considers the Canadian *Pennatula* to be a well-marked variety of the *Pennatula aculeata* of Danielssen. This latter he regards as specifically distinct from *P. Phosphorea*, but Kolliker is of a different opinion; so that, after all, the St. Lawrence Sea Pen may be one of the many varieties of the common European species. My specimens present such variable characters that the latter view seems by no means improbable. By far the larger number of examples obtained in 1872 were cut in two by the scraper of the dredge, so that only the upper halves of the cœnosarc were found in the bag. This strengthens the idea that these sea pens live with the naked portion of the stem buried in the deep sea mud.

Echinodermata.

Nine specimens of *Schizaster fragilis* were taken in deep water. *Asterias Groenlandicus* Steenstrup occurred in several localities, and *Feraster militaris* in two. An undetermined species of *Eupyrgus* (new to science, *vide* Verrill), was dredged in fifty-six fathoms, off Bonaventure Island. The sea cucumbers (Holothurians), collected in shallow water off Cape Rosier, are the largest I have seen from the seas of the Dominion. The following is as complete a list as is at present possible of the echinodermata of the Gulf of St. Lawrence, north of the Bay of Chaleurs. Those to which an asterisk is affixed were found by Dr. Packard, and not by myself:—

- **Astrophyton eucnemis*.—Mull and Trosch. *Ophiopholis aculeata*.—Mull.
 " *Agassizii*.—Stimps. *Amphiura* (near to *Borealis*, Sars, *vide*
Ophiacantha spinulosa.—Mull and Trosch. Verrill).

- Ophioglypha Sarsii*.—Lutken.
 " *robusta*.—Ayres.
 " *nodosa*.—Lutken.
Otenodiscus crispatus.—Retzius.
Pteraster militaris.—Muller.
Solaster endeca.—Linn (Pr. Dawson).
Crossasier papposa.—Linn.
Colveria hystrix.—W. Thompson.
Cribella sanguinolenta.—Mull.
Asterias Groenlandicus.—Steenstrup.
 " *vulgaris*.—Stimps. († *A. rubens*.—
 M. and T.)
- Asterias polaris*.—Mull and Trosch.
Echinus Drobachiensis.—Mull.
Schizaster fragilis.—Duben and Koren.
Echinarachnius parma.—Gray.
Pentacta frondosa.—Gunner.
 * " *calcigera*.—Stimps.
Psch's phantapus.—Mull.
Lophothuria Fabricii.—Lutken.
 * *Euspyrgus scaber*.—Lutken.
 " *nov. sp.*—Fide Verrill.
 * *Myriotrochus Rinkii*.—Steenstrup.
 * *Chirodota laeve*.—Grube.

Annelida.

Dr. W. C. McIntosh writes to me as follows, respecting the collection of marine worms made in 1871 :—" In No. 15, off Cape Rosie, lighthouse, in 125 fathoms, are the following :—

- Eunoa nodosa*.—Sars.
Ephesia gracilis.—Rathke.
Nothria conchylega.—Sars.
Ammotrypane aulogaster.—Rathke.
 " A bottle, marked 'various localities to the south, north, and east of Anticosti,' in from 100 to 112 fathoms contains :—
Goniada maculata.—Ersted.
Ammotrypane aulogaster.
Amphictene auricoma.—Muller (tube).
Terebellides Stremii.—Sars.
- Trophonia plumosa*.—Mull.
Sabella pavonia.—Savigny.
Amphiporus (Nemertean).—fragment
Thelepus circinatus.—Fabr.
Praxilla gracilis.—Sars.
Trophonia plumosa.
Lineus (Nemertean); small.

" In No. 7 are three species agreeing with the foregoing. In No. 14, 200 fathoms, south of Anticosti, *Lumbrineris fragilis*, Muller, occurred. In addition, there is a specimen of a small *Balanoglossus*, while a *Lepidonotus*, *Nepihys*, *Maldane*, *Praxilla*, and *Nothria* need determination. It is interesting to find many of our old (Shetland) friends on your side of the Atlantic. All the specimens named are comparatively common, but they are none the less valuable on this account, since they give us information about the distribution of the Annelida, a subject requiring much light." Another letter, received after the 1872 collection had come to hand, contains some general comments on the specimens, as follows :—" I find your collection of this year very much more valuable than that of the previous one. The species are more numerous, the specimens in better condition, and the rarities more abundant. This is all I can tell you at present, as I have done nothing further than group the animals according to their genera. I shall write you when I have had time to finish them." Two species belonging to a group of worms (Sipunculids), formerly regarded as aberrant members of the sea cucumber family, were collected in three localities. One of these is *Phascolosoma borealis*, Kef. (taken also from St. George's Bank, in 110 fathoms), and the other "is probably *P. Erstedii*, Kef., but may be new."—(Verrill.)

Crustacea.

The crustaceans collected this year are very numerous, both in genera and species, and many of them are of considerable interest. A number of difficult and critical species have been determined for me by Mr. S. J. Smith. To prevent repetition, an asterisk is prefixed to each of these. The microscopic forms, Copepods and Entomostraca, have not yet been examined. The following is a list of those which have been identified, so far :—

(Decapoda.)

Cancer irroratus, Sars (= *C. Sayii*, Gould; not *C. borealis*: Verrill).—The common crab of the Gulf.

Hyas coarctata, Leach.—Common. A favourite morsel with cod.

Hyas araneus, Linn.—Rare.

Chionocetes opilio, Fabr.—Frequent.

**Eupagurus Kroyeri*, Stimps.—Common in dead shells.

**Sabineca septemcarinata*, Owen. (*Sabine* sp.)—Two localities. "Also from St. George's Bank."—(Smith.)

**Nectocrangon lar*, Brandt. (Owen, Sp.)—"Not known south of the Gulf."—(Smith.)

**Hippolyte spina*, White.—From A. 8 and A. 14.

" *macilenta*, Kroyer.—Four examples.

" *Gaimardii*, Kroyer.—("Also in the Bay of Fundy, sparingly." Smith.)

**Hippolyte Phippsii*, Kroyer

* " *Fabricii*, " } —Taken in 1871, but not in 1872.

* " *polaris*, "

Pandalus annulicornis, Leach.—Common in many places.

(Amphipoda.)

The arrangement adopted in this group is that given in Axel Boeck's *Crustacea amphipoda borealia et arctica*, published in the *Forhandlingar i Videnskabs-Selskabet i Christiania* for 1870.

**Hyperia*, sp. (young)—Towing-net.

**Stegocephalus ampulla*, Bell. (*Phipps*, sp.)—A. 8. "We had one from St. George's Bank." (Smith)

**Phoxus Kroyeri*, Stimpson (not of Bate).—Only one example.

**Eusirus cuspidatus*, Kroyer.—"Not known south of Greenland before."—(Smith.)

**Tritopsis aculeatus*, Boeck. (*Lepechin* sp.)—In fifty-six fathoms, off Bonaventure Island—a local but apparently gregarious species. "We had it from the Banks this summer sparingly." (Smith.)

**Acanthozona cuspidata*, Boeck. (*Lepechin* sp.)—One example, from seventy-five to eighty fathoms, off Cape Rosier—rare. "Not uncommon in the Bay of Fundy." Smith.

**Epimeria cornigera* ? Boeck. (*Fabricius*, sp.)—Frequent, and of large size.

**Calliopius laeviusculus*, Boeck.—Towing-net.

**Melita dentata*, Boeck. (*Kroyer*, sp.)—One specimen. "Common in the Bay of Fundy." (Smith.)

**Byblis Gaimardii*, Boeck. (*Kroyer*, sp.)—Five individuals of this species were taken in sixty fathoms, sand, off Bonaventure Island. "Common in the Bay of Fundy." (Smith.)

Caprella septentrionalis, Kroyer.—Abundant among sea weed, on a stony bottom, in seven fathoms, off Cape Rosier.

(Isopoda.)

**Munnopsis typica*.—M. Sars. A deep-water species, found both in 1871 and 1872.

**Anthura brachyata*.—Stimps. Rare. Two specimens were taken on a stony bottom, in 110 fathoms, off Cape Rosier.

(Pycnogonida.)

Nymphon giganteum.—Goodsir. In deep water, scarce. One example was taken in 1871 and another in 1872.

Pycnogonum littorale.—Strom. (*P. pelagicum*.—Stimpson.) In 212 fathoms, between the east point of Anticosti and the Bird Rocks.

With the exception of the common lobster (which, from its active habits, is rarely taken in the dredge), none of the St. Lawrence crustaceans are of much value as an article of human food. They form, however, a by no means inconsiderable element in that of fishes, and their uses as scavengers of the deep have long been known.

Polysoa.

In the classification of the specimens belonging to this order, I have followed Rev. A. M. Norman (Catalogue of the Shetland Polysoa), in adopting Mr. Busk's latest views. Smitt's valuable papers on the Scandinavian species have been, however, frequently consulted, and the beautiful plates accompanying them have been found particularly useful in the identification of critical forms. Opinions vary much both as to the generic and specific relations of these molluscoid polyps, and the St. Lawrence species have yet to be properly elucidated. The following list of the species collected is very incomplete, not more than one-fourth of the specimens having been examined microscopically:—

(*Cheilostomata.*)

- Scrupocellaria scruposa*, Linn.
Menippea (Cellularia) ternata, Ellis and Solander.
Caberea Ellisii, Fleming.—Fine and frequent.
Bicellaria ciliata, Linn.—Deep water—very rare.
Bugula Murrayana, Bean.—Very common.
Frustra Barleii? Busk. (*F. membranaceo-truncata?* Smitt.)
Acamarchis plumosa, Pallas.
Gemellaria loricata, Linn.
Hippothoa catenularia, Jameson.—A form of *Membranipora membranacea*. (Smitt.)
 " *divaricata*, Lam. = *Mollia (Lepralia) hyalina*, Linn. (Smitt.)
Membranipora lineata, Linn.
 " *Flemingii*, Busk.
 " *pilosa*, Linn.
 " *Americana*, D'Orb.
Lepralia auriculata, Hassell. (According to Smitt an *Escharella*)
variolosa, Busk.
ventricosa, Hassall. } Varieties of *Discorpora coccinea*. (Smitt.)
pertusa, Esper.
producta, Packard.
plana, Dawson.
Bellii, " sp., near to *trispinosa*, Johnston.
Celleporella (Lepralia) hyalina, D'Orb.
Cellepora pumicosa, Linn.
Myriozoum subgracile, D'Orb.
Escharoides rosacea, Busk.
Eschara elegantula, D'Orb.
 " *Skenei*? Ellis and Solander.
Celleporaria incrassata, Lam.
Retepora cellulosa var. *elongata*, Smitt.

(*Cyclostomata.*)

- Crista eburnea*, Linn.
Idmonca Atlantica, Forbes.
 " *serpens*, Linn.
Tubulipora stabellaria, Johnston. (= *T. fimbria*, Lam. Smitt.)

- Diastopora obelia*, Flem.
Patinella patina, Lcm.
Discoportella hispida, Fleming (= *D. verrucaria*, Linn., Smitt.)
Defrancia lucernaria, Sars.

(Ctenostomata.)

Alcyonidium gelatinosum, Pallas*Tunicata.*

Ten species of these curious molluscoids were collected, of which six are simple and four are compound forms. Most of these have been examined by Professor Verrill, who has identified all those to which an asterisk is prefixed. The simple species are:—

Bottenia clavata? Fabr.—Of large size, a few miles distant from Bonaventure Island, in from fifty to sixty fathoms water.

Cynthia pyriformis? Rathke.—In nine fathoms, rocky bottom, off Cape Rosier.

* " *carnea*, Verrill. (= *Ascidia carnea*, Agassiz.)—In one locality.

* *Eugyra pilularis*, Verrill.—This is the species doubtfully referred to *Molgula arenosa*, in my report for 1871.

* *Pelonaiia arenifera*, Stimpson.—Very rare. Only one specimen was collected.

* *Ascid'opsis complanatus*, Verrill. (Fabricius, sp.)—Taken in several localities this year as well as last.

The four compound species, each of which occurred in several localities in more or less abundance, are:—

Botryllus (sp.)

* *Amouræcium pallidum*.

* *Leptoclinium albidum*.

* " " *glabrum*.

Mollusca.

The number of actual novelties among the shells collected is not large; still, several interesting species were collected. Most of the rarer deep-sea shells dredged in 1871 were also taken last summer. The following is a list of the most interesting shells: it includes a few species taken in 1871, but which had not been studied or determined when my previous report was written:—

Macoma inflata, Stimpson, M. S. S.—Taken sparingly in many localities.

Astarte.—The two species of *Astarte*, called in my last report *A. sulcata* var. *minor* and *A. crebricostata*—Forbes—I believe to be distinct and undescribed species. Professor Verrill thinks the *A. sulcata* var. *minor* is a dwarf variety of Stimpson's *Astarte lens*. Both shells were taken sparingly this year.

Nucula (sp.)—A small *Nucula*, taken in deep water, seems to me to differ from any described American species.

Yoldia limatula, Say.—Alive in sixty fathoms, about five miles from Bonaventure Island.

Leda tenuisulcata, Couth.—Typical examples of this shell were taken in 110 fathoms, off Cape Rosier. Perhaps a variety of *Leda pernulla*.

Dacrydium vitreum, Holboll.—Several specimens of this shell occurred with the preceding.

Terebratella Spitzbergensis, Davids.—Sparingly, in four or five localities.

Scaphander puncto-striatus, Mighels. (= *S. librarius*, Loven.)—One fine adult living example, one inch and an eighth long, was dredged in 200 fathoms, between Cape Rosier and the south-west point of Anticosti.

Cylichna strigella? Loven. Alive in deep water, rare.

Dentalium occidentale, Stimps.—Dead but adult specimens of this shell, taken in 1871, were referred by me to *D. abyssorum*, Sars. A series of living examples, of all

ages, collected last summer in deep water, shew that the species is not pentagonal when young, and that it belongs to Stimpson's previously obscure and rare species.

Siphonodentalium vitreum, Sars.—With the preceding: it is the *Dentalium lobatum* of Sowerby.

Rissoa (Paludinella) globulus, Möller.—One specimen, in sixty fathoms, off Bonaventure Island.

Rissoa carinata, Mighels.—In ninety-six fathoms, Trinity Bay, alive and frequent.—1871.

Rissoella eburnea, Stimps.—One living adult, in seventy fathoms, off Moisie village.—1871.

Eulima stenostoma,—Jeffreys.—Another specimen of this rare shell was taken in deep water.

Sipho curtus, Jeffreys.—This is *Sipho Sarsii*, Jeffreys, of my previous report. *S. curtus* seems to be the proper name.

Sipho Spitzbergensis? Reeve.—In sixty fathoms, off Bonaventure Island.

Fasciolaria ligata, Mighels.—Gaspé Bay, thirty fathoms, stones, living.—1871.

Spirialis balea? Möller.—Dead shells of this species were taken from the mud brought up from 313 fathoms. Upwards of 150 species of marine mollusca are now known from the seas of the Province of Quebec.

Fishes.

A solitary specimen of the Saund Launce (*Ammodytes Americanus*) was the only fish brought up by the dredge. On the surface, *Gasterosteus aculeatus*? was always abundant, and many examples of young "lump-suckers" (*Cyclopterus lumpus*) and of a species of Blenny were taken in the towing-net.

From the preceding sketch, it may be seen that the most interesting specimens among the species determined belong to the *Actinozoa* and *Crustacea*. There are many curious and rare forms also among the sponges, Hydrozoa and marine worms collected, but these have yet to be studied. If, notwithstanding the numerous difficulties we had to contend with, so much new information was obtained about the invertebrates inhabiting the river and Gulf of St. Lawrence, what might we not expect from more systematic and extended operations?

In the following and concluding portion of this report, an attempt will be made to shew the practical bearings of the various facts collected during the past summer.

PART III.

Notes on some points relating to the Sea Fisheries of the Province of Quebec, and on other Practical Subjects.

Such remarks as refer exclusively to matters connected with the sea fisheries of the Gulf are offered with much hesitation. My actual experience is limited to five summers' visits to the Lower St. Lawrence, and is doubtless less, in some respects, than that of many, if not of most, of the superintendents or managers of the various large fishing establishments along the coast. Such examinations as I have been enabled to make into the nature of the animal life existing on the sea bottom, or floating on its surface, can hardly, however, fail to throw some light on the habits and food of the most important edible fishes.

The area that I have attempted to explore extends on the North Shore from Point des Monts to a few miles east of Natashquan, and on the South from the Grande Vallée River to the Magdalen group. It embraces a complete circuit around Anticosti and the Magdalen Islands.

In this region, the most important sea fishes (from an economic point of view) are the cod and halibut, the herring and mackerel. The first two of these feed for the most part at the bottom, and the last usually at or near the surface of the sea.

There are many points in connection with the natural history of the cod fish (or fishes) of the St. Lawrence which require elucidation. Whether there are one, two, or even more species is not very clearly ascertained. Dr. Gunther says that the European cod (*Gadus morrhua*, Linn.) ranges from the "coasts of northern Europe, Iceland and Greenland, southwards to New York." On the other hand, Mr. Putnam and Professor Gill state that the cod of the Labrador coast is the American cod, *Gadus arenaeus* of Mitchell, the *Morrhua Americana* of other writers. If the European and American cod are distinct species—a point which, we think, has yet to be decided—it is probable that both are to be found in the Gulf of St. Lawrence.

A few experiments made on the spot, in the depth of winter, would throw much light on what becomes of the cod, and of other kinds of fish also, in the cold months. Whether this species is migratory or not in its habits is quite an open question, so far as facts are concerned. We now know something of the animal life of the deep-sea mud, though not so much as could be wished. Although the invertebrate fauna of the deep sea is tolerably varied, there is a far larger number both of species and individuals in the zone between low-water mark and from sixty to seventy fathoms water, than there is between 100 and 300 fathoms. Such, at least, is my experience, so far. But in Canada it is by no means improbable that many species, especially among the higher crustacea, may live in shallow water in the summer and retire to deeper places in winter. As it is not possible to dredge at this season, we cannot tell whether such is the case or not. The evidence in our possession is at present insufficient to shew more than that a certain amount of food for cod does unquestionably exist in the greatest depths.

The dates at which cod spawn vary much in different seasons and at different places. No kind of animal food seems to come amiss to this fish. It devours greedily herring, capelin, mackerel, lance, squids, crustaceans, mollusca, brittle stars, and even, as Dr. Fortin and others assure me, young individuals of its own species. After the spawning season is over, the adult cod (the "mother fish" of the fishermen) congregate mostly on banks, where they devour crustaceans, molluscs, &c. The young fish, on the other hand, live and feed in shallow water, near the shore. The cod which feed on banks, take only, or almost only, full-grown specimens of crabs, shells, &c. and leave immature ones. As these fish rarely visit the same feeding ground two years in succession, a constant supply of food is thus ensured. The natural enemies of the cod are, fortunately, not very numerous, nor do they seem to affect the value of the fisheries in an appreciable way. The grampus and the various kinds of seal, the osprey, bald eagle, and various sea birds, together with sharks and some other large fishes, undoubtedly destroy great numbers of cod. Far more to be feared than these are the results which can hardly fail to ensue from a wasteful and improvident system of fishing.

The practice of manuring the ground with capelin, herrings, &c. (and doubtless often with young cod also), has often been complained of: it should be discouraged and if possible put a stop to. From the Appendices to the last Report of the Fisheries branch of this Department, I learn that in the year ending 30th June, 1871, 1,457 barrels of herring, 7,848 of capelin, and 260 of smelts, were used as manure!

In Gaspé Bay, complaints have often been made in my hearing of the use of seines along shore (by Americans), for the purpose of catching mackerel or bait. Large quantities of young cod are said to be caught in these seines with the mackerel, and the former are thrown away as useless. It seems desirable to prevent, as far as possible, the capture of cod of a size too small to be of any value for food. Crews of United States' schooners, &c., fishing outside the three-mile limit, clean and salt the fish caught on board their vessels, and almost invariably throw the offal overboard upon the fishing grounds. It is said that this latter proceeding has an injurious effect, and that it tends to drive the cod away from its spawning grounds. This, however, may be local prejudice merely; and in justice to the Americans it must be added, that the law does not, at present, allow

them to clean and prepare their fish ashore. If it is illegal to throw the offal overboard, as I have been informed is the case, what else are they to do?

The utilization of cod-offal is a matter of considerable importance to the residents along our sea coast. If the offensive smell could be cheaply and easily removed, a valuable manure would always be available for agricultural purposes. Many methods for effecting this have been devised, and I venture to suggest that earth is well known to be one of the best deodorizers. In many places on the north shore of the St. Lawrence, visited by me in 1871, the stench from decomposing fish offal spread upon the fields with no previous preparation was almost intolerable. As might have been expected; many cases of fever, etc., were reported at these stations, which Commander Lavoie attributed wholly to the noisome effluvia of this primitive manure. Many intestinal worms are to be found in the stomachs of cod; and as pigs feed largely upon fish-offal, and pork is the principal meat consumed along the coast, it is easy to see that diseases may arise in this way.

With regard to the halibut fishery I have very little practical knowledge. Dr. Storer, in his excellent memoir on the fishes of Massachusetts, states it as his opinion that the American halibut is identical with the European species, the *Hippoglossus vulgaris* of Fleming. Later writers, however, on both sides of the Atlantic, think differently on this point. Dr. Gunther describes the Canadian fish as a distinct and new species, to which he gives the name *Hippoglossus Groenlandicus*. He says that the halibut of Europe "has the lateral line with a strong curve above the pectoral, the depth of the curve being one-fourth its width." In the Canadian species, according to the same writer, "the lateral line descends gently in an oblique straight line above the pectoral, and is not curved." Professor Theodore Gill, in a paper on the fishes of the Bay of Fundy (published in the *Canadian Naturalist*, vol. ii., page 257), gives the name *Hippoglossus Americanus* to the St. Lawrence halibut. In summer, this species appears to feed along the bottom in shallow water; and in winter it probably retires to the deepest places it can find. Few Canadians seem to engage in the halibut fishery: it appears to be at present mainly prosecuted by Americans. In the Montreal retail market, halibut fetches a somewhat high price, ranging from 13 to 20 cents per pound.

It has never been my good fortune to visit any station along the coast where either herring or mackerel is cured for the market; nor have I been able to examine the contents of the stomachs of either.

Many American naturalists, such as Lesueur, Storer, and others, regard the American herring as a distinct species from the European fish. Dr. Gunther and Professor Reinhardt are of a different opinion, and can see no essential difference between the two so-called species. Dr. Gunther also states that all the whitebait he has seen are young herrings. I am aware that this latter statement has been called in question, but, in my judgment, it has not been disproved. If, then, the American and the European herring are conspecific, and whitebait are young herring (both of which Dr. Gunther asserts to be the case), it follows that, in summer, whitebait must be abundant in the Gulf of St. Lawrence. There seems to be no reason why whitebait dinners should not be as feasible at Tadousac, &c. as they are at Richmond, and other places of resort in or near London. The so-called "sardines" of the Lower St. Lawrence are young herrings. The true sardine of the Mediterranean (which appears to be the same species as the pilchard of Cornwall) has not yet, so far as I know, been found in America. In Commander Lavoie's report of the cruise of *La Canadienne* for 1871, it is stated that large quantities of herring are taken at the Magdalen Islands by means of the seine. The following passage is quoted from a lecture on the herring fishery, by M. A. Warren, Esq., the owner of a large fishing establishment on the Labrador coast:—"Of late years, herring seines have been much used on the Labrador coast, almost entirely superseding the use of nets, to the manifest injury of the fishing population."

The common mackerel of our coast is probably the *Scomber scombrus* of Linneus, of which the *S. vernalis* of Mitchell appears to be a synonym. If Dr. Gunther's view be the correct one, the mackerel of Canada and New England is the same as that of Northern

Europe. Mr. Putnam says that "the northern limit of the mackerel is the Strait of Belle Isle;" while, according to Professor Reinhardt, the cod, halibut, and herring are found in Greenland, but the mackerel is not. In the European species there is no air-bladder. Like the cod, the mackerel is very voracious, and seems to take readily all kinds of animal food. Besides devouring small fishes of various kinds, like the herring it feeds also upon such marine animals as float on or near the surface of the water.

By the use of the towing-net during the last summer, a fair general idea of this surface fauna has been gained. These floating animals may conveniently be divided into two groups—those which are purely oceanic, and those which are washed out to sea from the shore. To the first of these divisions belong jelly fishes, of many genera and species, and minute crustaceans. In Gaspé, the fishermen call jelly fishes "mackerel bait," and floating crustaceans "whale bait." The "red" and the "white" herring meat of Mr. Boeck (see page 114 of this report) belong to this group. What is practically the "red" herring (and mackerel) food is abundant in the St. Lawrence, although the genera and species in the two countries may not always be the same. The "white" meat also may be not unfrequent, for the number of marine worms in the Gulf is very large. Our second division includes all those creatures which live on or among the larger sea weeds which originally grow near low-water mark, but which get drifted out to sea. Amongst these weeds may be found small fishes of two or three kinds, the fry of the common sea mussel, and a few species of sea snails, amongst them naked gilled sea slugs of the genus *Doris*. The crustaceans are for the most part the fry of the common crab, and full-grown examples of beach fleas, which belong to the order Amphipoda of zoologists. The weeds are also more or less covered with parasitic barnacles, and zoophytes belonging to the orders Hydrozoa and Polyzoa. The "black" meat previously spoken of has not yet been detected upon algae in the St. Lawrence. In Europe, the species of *Rissoa* are very numerous, and several kinds live in shallow water near the shore. In Canada, only six kinds of *Rissoa* are known north of the Bay of Chaleurs, and five of these are peculiar to comparatively deep water, while the other is not very common. Not a single adult specimen of the latter was observed, although quantities of floating masses of weed brought up in the towing-net were carefully examined. Besides the two groups just described, in which the animals are strictly marine, large numbers of land and fresh-water insects are drifted out to sea in the summer months. These belong to many orders and species, and are not unfrequently taken alive.

It is said that fish which are killed and bled as soon as they are caught are much better than those which are allowed to die a natural death. Some methods of killing fish are stated to offer peculiar advantages. The Dutch plan is to sever the spinal cord and arteries of the neck, just at the back of the head, with a knife. Nothing of the kind is ever dreamt of by the Lower Canadian fishermen, who allow the cod they have caught to suffocate in a lingering way, often under a hot sun.

In a short time, the fishery clauses of the Treaty of Washington will, doubtless, come into practical operation. No opportunity can be more fitting than the present for an examination into the existing laws relating to the fisheries, to see if they are capable of amendment or improvement. It is desirable on the one hand to try and check any waste of the bountiful supplies with which our coasts now periodically teem, and on the other to teach the fishing population the best and most approved methods of preserving the fish they catch. That no little waste of valuable food has hitherto taken place is undeniable, and there is too much reason to fear that this evil may reach to still graver dimensions, and that the fisheries may be exhausted or impoverished, unless precautionary measures be taken to prevent such a calamity to the dwellers along our sea board. It has been recently stated by Montreal merchants, in the daily papers, that the quality of some of the salt fish prepared on the coast is so bad as to make it almost worthless in the market. This circumstance, however, may be attributable to the unusual amount of rainy and wet weather experienced in the Gulf last summer.

It seems desirable that a *Special Commission* should be appointed to investigate into, and from time to time report upon, all matters which affect the sea fisheries of Canada. The commission suggested should have power to make such necessary regulations as other countries have found desirable for the protection and development of their resources in this direction. As great attention has been directed by scientific men in the United States, of late years, to all questions connected with the sea and river fisheries, it would be very desirable to ask some of these gentlemen to form part of the proposed commission, and to give us the benefit of their experience. If this body were composed of an equal number of representatives from Canada and the United States, it is reasonable to infer that the authorities of the neighbouring republic would acquiesce in such measures as the common sense of all might suggest for adoption. Of course, it would be of little use to make a new code of regulations, however excellent these might be in themselves, unless they are to be properly enforced. The present small fleet of Government steamers would be no more than sufficient to see that they are effectually carried out, and to preserve order along such a large extent of coast.

Since my last report was written, I have examined all the ship worms I have been able to procure from Canadian waters. The Gaspé Bay species, dredged by Principal Dawson, in water-logged wood, is *Xylophaga dorsalis* of Turton, a genus new to America. It must be of very rare occurrence at this locality, for I have dredged in upwards of twenty localities in the Bay without finding it. *Teredo navalis*, Linn., occurs at St. John, N. B., and at Pictou, N. S., I have seen specimens from each of these ports. This is the same species which made such ravages among the piles in Holland, in the years 1731 and 1732. Ship worms of large size are said to be found at Halifax; and Mr. J. J. Fox informs me they are frequent in the hulls of vessels anchored among the Magdalen Islands. I shall be glad to examine and report upon any specimens that may be sent to me from any part of the Dominion. The worms may be best preserved in alcohol, or pieces of the wood burrowed into by them may be forwarded. These latter often contain the valves and pallets of the mollusc, which are sufficient to identify the species.

The use of the dredge throws some light on the feasibility or otherwise of a project which has been much talked of, viz.: that of laying submarine telegraph cables in the Gulf of St. Lawrence. A much better idea of the nature of the bottom of the sea can be got by dredging than by merely using sounding lines. As I have elsewhere shown, the deep-sea mud is not unfrequently dotted over with large and often irregular stones, with ragged edges, and these might ultimately chafe and cut such cables. The approximate temperature (in summer) of the deep-sea mud, and of depths varying from 30 to 313 fathoms, has been ascertained as far as possible. It is highly probable that this temperature is pretty uniform throughout the year. And lastly, by means of such investigations as the present, it is quite feasible to ascertain whether such marine animals exist along a given line as might injure a submarine cable, by boring into it or otherwise.

Montreal, 14th January, 1873.

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