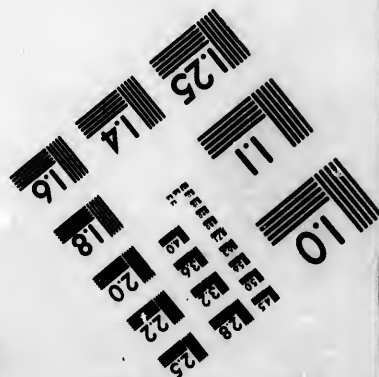
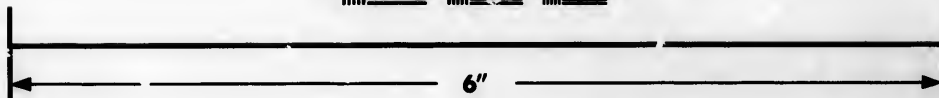
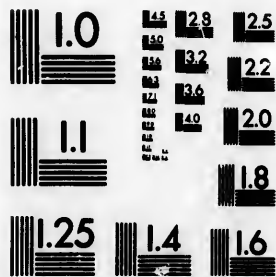


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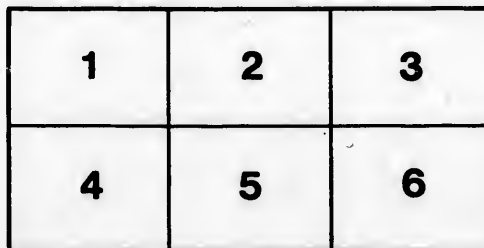
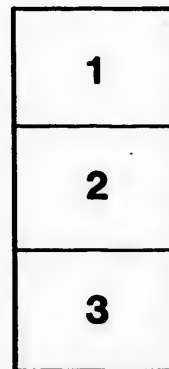
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REPORT
ON
DEEP-SEA DREDGING OPERATIONS
IN THE
GULF OF ST. LAWRENCE,
WITH
NOTES ON THE PRESENT CONDITION OF THE MARINE FISHERIES AND
OYSTER BEDS OF PART OF THAT REGION.
BY J. F. WHITEAVES.

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REPORT

ON FURTHER

DEEP-SEA DREDGING OPERATIONS

IN THE

GULF OF ST. LAWRENCE,

WITH NOTES ON THE PRESENT CONDITION OF THE MARINE FISHERIES
AND OYSTER BEDS OF PART OF THAT REGION.

INTRODUCTORY.

The instructions received from the Department prior to my leaving Montreal were, to use my own judgment as to the selection of points for examination during the early part of the summer, and later on to devote a portion of the time to an investigation into the present condition of the oyster beds of Northumberland Straits and of the coast of New Brunswick.

This being the case, the plan of operations which was ultimately carried out, was to devote a week or two to dredging in the greatest depths between Anticosti and Gaspé, then to make a complete circuit of Prince Edward Island, examining first the entrance to the Bay des Chaleurs, the Orphan and Bradelle Banks, the area between Cape Breton and Prince Edward Island, and, lastly, the whole of Northumberland Straits on both sides, back to the Bay des Chaleurs.

The Government schooner *J. H. Nickerson*, which for nine weeks was exclusively employed in these investigations, is a vessel of some 70 tons burthen. She carried only three sails, and had no flying-jib, staysail, or gaff-topsail. The want of these was often felt in fine weather, when the breeze was very light. Her crew consisted of the captain, six seamen, a carpenter, steward (who also acted as cook), and steward's boy. We were authorized to hire two or three additional hands if required, but did not succeed in getting even one man to strengthen our small crew.

Our apparatus consisted of two dredges, fitted with inner bags of closely netted heavy seine twine, and outer ones of untanned hide; sifters, two deep-sea leads, and between 500 and 600 fathoms of $1\frac{3}{4}$ inch manilla rope. We also constructed rough but tolerably effective towing nets and "tangles," both of which did good service. A small winch would have saved much heavy manual labor, and it would have been better if we had been provided with rope enough to use a dredge and tangles on separate lines at the same time, especially in very deep water. Although the weather was exceptionally stormy, and many other grave disadvantages had to be contended with, the number of specimens collected was much larger than on any previous occasion. This is mainly to be attributed to the circumstance that, for the first time, the schooner and her crew were placed entirely at my disposal during the greater part of the summer.

*

In this report the following order will be observed:—First, an account will be given of the cruises, which were essentially four in number. Unnecessary details will be omitted; and as the number of casts of the dredge was about seventy, no attempt will be made to give full particulars respecting each. The second part will consist of a summary of the zoological results of the expedition; and in the third and last, some notes will be given bearing on the present condition of the valuable marine fisheries of the Gulf, and on that of the oyster beds of Northumberland Straits and of the northern coast of New Brunswick. It may be well to premise that I left Montreal on the 14th of July, 1873, and returned home on the 13th of September following.

PART I.—ABSTRACT OF DIARY OF PROCEEDINGS.

CRUISE I.

At daybreak on Friday, July 18th, we left Gaspé Basin, bound for the centre of the mouth of the river between Anticosti and the Gaspé peninsula. From July 19th to about noon on the 24th we were occupied (Sunday excepted) in dredging in the greatest depths we could find, and with remarkable success. All through these cruises we remained on our ground at night, and often all day on Sundays, so as to lose no time. A little after noon on Thursday, July 21st, a strong northerly breeze sprung up, accompanied with rain, so we tacked ship and stood in towards Gaspé Bay for shelter. From the 25th to the 28th of July, both days included, we were detained in Gaspé Bay by head winds. We managed, however, to do some dredging here, and although I had explored this locality pretty thoroughly in 1867 and 1869, several interesting novelties were collected, especially among the sponges, echinoderms, annelids and crustacea. Set sail again on Monday evening, July 28th, but managed to get only one good day's dredging in the centre of the channel between Anticosti and the south shore, when we were compelled to return to Gaspé Bay by strong northerly breezes and dense fog. We anchored in Gaspé Basin on the evening of July 30th, and remained there two days for supplies.

During this cruise we got 14 more or less successful casts of the dredge, exclusive of three in Gaspé Bay. Of these, Nos. 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13 and 14 were in depths of from 110 to 220 fathoms. Nos. 1 and 5 were in 50 and 40 fathoms respectively. Observations on the temperature of the deep-sea mud gave almost exactly the same results as on previous occasions. The general average temperature is about 38° or 39° Fahr., but near the centre of the mid-channel between Anticosti and the south shore, though nearer to the island than the main land, there are indications of a warmer bottom current. The instruments we had did not enable us either to try and define the limits of this current, or to examine and see if the water was fresh or less salt than usual where the highest reading was registered. The circumstance that there appears to be no difference between the animal life existing at places where the temperature is higher and where it is about the average, seems to be unfavorable to the notion of the existence of a local bottom current of fresh water. During our stay in Gaspé Bay we noticed that mackerel were particularly abundant there.

CRUISE II.

Leaving Gaspé Basin about noon on the 2nd of August, we attempted to beat down the bay; but, owing to an almost dead calm, made little progress, and anchored off Douglstown for the night. The next day, Sunday, August 3rd, we again set sail, but finding that there was a heavy fog outside and a stiff breeze blowing, anchored in Boisbrulé Cove. On Monday, August 4th, we were a little more successful, for although a strong N.N.E. breeze was blowing and there was a heavy sea on, we got outside Gaspé Bay and under the lee of Bonaventure Island. We were bound for the Orphan Bank, but the wind was too high and the sea too heavy to dredge except in sheltered places. The remainder of the day was accordingly devoted to dredging off the northern entrance to the Baie des Chaleurs, between Cape Despair and Grand Pabou, where we got two

hauls, one in 70 fathoms, measured (No. 15), and one (No. 16) in 50 fathoms. A little before midnight, as the sea went down and the breeze moderated, we made for the Orphan Bank, and spent three days (August 5th to 7th, inclusive) dredging on it. On this bank we dredged in ten different places (Nos. 17 to 26 inclusive), and got as good an idea as the dredge would give of its structure and of the animal life upon it. About sunset on Tuesday, August 5th, we got magnificent mackerel fishing on this bank. Cod taken here had herrings, crabs (*Hyas*), shells (*Yoldia limatula*), and *Eritomostracans* in their stomachs. On floating *Laminariae*, probably drifted from shore, fine living specimens of *Paryppa crocea*, Ag. were collected. On Wednesday evening, August 6th, a little before sunset, a strong southerly breeze sprung up, so we tacked ship and stood in for Point Miscou, under the lee of which we re-anchored a little before midnight. Thursday, August 7th, at 9 a.m. the wind veering to the S.W., we hove up the anchor and ran round under the N.E. side of Miscou Island, and anchored there all day in four fathoms water. Noticed 22 American schooners anchored near us. Heavy rain all day; no dredging done. Friday, August 8th, set sail at daybreak for the Bradelle Bank, and on our way got one cast (No. 27) between it and Miscou Island, in 45 fathoms, mud and stones; the temperature of the mud was 42° Fahr. We got one haul of the dredge on Friday and two on Saturday (Nos. 28 to 30 inclusive) on the Bradelle Bank; mackerel fishing on this bank also was excellent. At noon on Saturday, August 9th, the vessel's head was put for the east point of Prince Edward Island. Sunday, August 10th, anchored off Souris, Prince Edward Island, all day, and went ashore in the afternoon. The common edible periwinkle of England (*Littorina littorea*) is common at the mouth of the Colville River; it was subsequently collected also at Charlottetown. Bonaparte's gull was frequent here, as were also terns and various wading birds. Monday, August 11th, left Souris early in the morning bound for Pictou, where we arrived a little after noon. After dinner I went with Mr. M. Campbell to the marine slip at that port. Through the kindness of Mr. James MacPherson, the superintendent of the slip, I had an opportunity of examining the ravages of the ship worm in the cradle of the roller frame. Specimens of what I believe to be *Teredo navalis* were collected boring into black birch. A schooner from Newfoundland, just placed on the slip, had her hull obviously burrowed by a *Teredo*, but of what species could not be ascertained. Mr. MacPherson also gave me specimens of wood burrowed into by ship worms, which originally formed part of the hull of a ship from Sydney, Cape Breton, but as there were no shells or pallets in the burrows the species could not be determined. I did not, however, succeed in getting living ship worms at Pictou, although they appear to be very common, and are believed to be doing much injury to fixed structures as well as to ships in that port. Oysters are said to be occasionally found in the bay, but not in large numbers. In this cruise we got 16 hauls of the dredge (Nos. 15 to 30 inclusive), in depths of from 20 to 70 fathoms.

The Orphan Bank, which is situated off the entrance to the Bay des Chaleurs, is a stony patch, as are most of the inshore fishing banks, many of which are not indicated or defined on the charts. The masses of rock are usually large pieces of a reddish sandstone (often perforated by two species of boring bivalves, the *Saxicava rugosa* and *Zirphæa crispata*), with a small proportion of pieces of Laurentian gneiss, &c. Animal life is profusely abundant here, which is undoubtedly the reason why cod, mackerel, &c., frequent this and similar banks in such enormous numbers. Soft-bodied organisms of various kinds give a special facies to this particular one. These are encrusting sponges; tunicates, of many genera and species, some of unusual size; an *Actinia* (*Metridium*); the common northern *Aleyonium* (*robiferme*); *Aleyonidium gelatinosum*; hydrozoa and polyzoa, in great profusion, &c., &c. Among the harder forms are an abundance of the commoner echinoderms, with a few scarce species; large calcareous polyzoa; and a large number of fine crustacea. Shells were tolerably numerous, though not nearly so much so as on the Bradelle Bank, and annelids were relatively scarce.

The Bradelle Bank is also a stony patch, but the pieces of rock are usually small, and there is a greater admixture of gravel, sand, and mud on this bank than upon the Orphan. Soft-bodied animals appear to be scarce upon the former, and shells occur in

unusual abundance. The assemblage of hydrozoa, echinoderms, polyzoa, and crustacea, is much the same on both banks, though a few peculiar species were found on each. The rarer forms found at these two places will be found catalogued in the second part of this report. While the animal life of the shores of Cape Breton (except in deep water), of those of the Magdalen group and of Prince Edward Island, as well as that of the whole of Northumberland Straits up to the southern entrance to the Baie des Chaleurs, is of an Acadian or southern type, the fauna of the Orphan and Brudelle Banks has a decidedly Arctic or northern character. The Brudelle Bank, in particular, presents the phenomenon of a small patch, tenanted by an assemblage of marine animals which usually inhabit very cold water, and almost entirely surrounded by another series, which are for the most part prevalent where the bottom is warmer and more affected by surface conditions of temperature.

CRUISE III.

Leaving Pictou at daybreak on Wednesday, August 13th, we dredged to the S.W. (No. 31) and S.S.W. (Nos. 32, 33, and 34), of Pictou Island. Off Pictou Island the towing net was very successfully used. Among the specimens taken in this way were a curious crustacean (*Acanthus*) parasitic on the "brit," and three-spined stickleback, young lobsters about half-an-inch long, jelly-fishes of several kinds, *Leptura teronata*, young crabs, and small amphipods. The next day, Thursday, August 14th, we dredged to the N.E. (No. 35) and N.E. by E. (No. 36) of Cape George, N.S., also in several places (Nos. 37 to 40) between Cape George and Port Hood. All the afternoon we were becalmed off Port Hood, Cape Breton, but at sunset a southerly breeze sprung up, so we tacked ship and beat down towards Cape George. On Friday, August 15th, having previously dredged in almost a straight line from Pictou to Port Hood, starting from near the latter place, we made directly for the east point of Prince Edward Island, and on our way got one good cast (No. 41) in the centre. We also got two hauls (Nos. 42 and 43) to the S.S.W. of the east point of Prince Edward Island and one on the Milne Bank. This latter is a small rocky patch, covered with quantities of the common cake urchin (*Echinocarchinus*) and fine zoophytes. We also got one cast on this day (No. 45) about nine miles to the S.S.W. of Souris Head, Prince Edward Island. The morning of Saturday, August 16th, was spent in dredging between Cape Bear and Pictou Island (Nos. 46, 47, and 48) and in the afternoon we made for Pictou, and anchored there in the evening. In this short cruise we got eighteen more or less successful hauls of the dredge. The weather was fine, with the exception of one day, but the wind was often too light for our purposes. From Pictou along the western coast of Cape Breton, the bottom consists of a red clayey mud. Marine worms, of many genera and species, are the prevalent forms in it. In most places the bag of the dredge comes up with tangled masses of tubicolous annelids in handfulls, which constitute three-fourths of the specimens obtained from the mud. The sandy tubes in which these worms live, vary in diameter from the $\frac{1}{16}$ to a quarter of an inch, and in length from an inch or an inch-and-a-half up to nearly eight inches. Naked annelids, often of large size, also occurred with these. Zoophytes, too, are abundant in this red mud, the temperature of which appears to range from 40° to 42° Fahr., at least at depths of more than 25 fathoms. Off the east point of Prince Edward Island the bottom is sandy, and as the places where we dredged are not deeper than 15 or 20 fathoms, the summer temperature at the bottom is probably high. Between Cape Bear and Pictou Island the bottom is sandy, with shells and a few small stones. The area examined in this cruise is tenanted by a somewhat meagre and not very characteristic Acadian fauna, with a slight admixture of subarctic forms. Some of the species collected on this cruise are of considerable interest. Not a trace even of an oyster was observed in any of the localities examined.

CRUISE IV.

Having previously had teeth put on one of our dredges at Pictou, we left that port early on Tuesday, August 19th, intending to try and examine the oyster beds of North-

umberland Straits, and of the New Brunswick coast up to Carraquette. We managed to dredge once (No. 49) to the west of Pictou Island, and were then compelled by stormy weather (and for other reasons) to make for Shediac. Arriving at Point du Chêne early the next morning, we were detained there two days by heavy head winds. We availed ourselves of the opportunity to examine the Shediac oyster beds, and spent one day dredging on them. In the third part of this report, a list will be found of the species met with, associated with the oysters, as well as some account of what we saw of the present condition of the beds.

At day-break on Friday, August 22nd, we left Point du Chêne, dredged from Shediac (Nos. 50, 51, and 52,) to the Egmont Bank, and stood back again to the south shore in the evening.

The Egmont Bank (No. 53) is a small rocky patch to the north-east of Shediac Bay. It is less than ten fathoms deep, and the bottom consists of coarse sand and stones, the latter covered with laminariae and smaller algae. Some of the stones are burrowed into by *Petricola pholidiformis*, and annelids of large size were frequent in the sand, from which also about 12 species of shells were collected.

Early on Saturday morning, August 23rd, we stood over to the Prince Edward Island side, and dredged (Nos. 54, 55, 56, and 57.) from a little above St. Jacques to Sea Cow Head. In the afternoon a falling barometer indicating a heavy storm, we made for Charlottetown, and reached there, only just in time to weather out the memorable gale of Sunday, August 24th.

At Charlottetown we were detained four days, and during the gale our only boat was badly injured by heavy floating logs, but we could not manage to get another although authorized to do so.

Leaving Charlottetown on Thursday, August 28th, we dredged once in Hillsborough Bay (No. 58); then stood over to the opposite side and examined the entrance to Pugwash Harbor, where we got two casts (Nos. 59 and 60.) We then returned to Shediac to transact some necessary business, and were kept at Point du Chêne five days, as when we were ready to leave it blew too heavily outside for us to do any good, even if we could have beat out, which was almost impossible.

We again set sail on Thursday, September 4th, dredged to the N. N. E. of Shediac Island (No. 61), and afterwards (No. 62) in 13 fathoms off the West Cape of Prince Edward Island. The next day, Friday, September 5th, we dredged off Escuminac (No. 63), off Richibucto (No. 64), and lastly (No. 65) between Richibucto and Miramichi Bay. Towards midnight a strong gale rose up, and there was a heavy sea on, so we made the best of our way into Miramichi Bay, and anchored off Chatham (New Brunswick) on Saturday night, September 6th.

As there seemed no prospect of doing any more good work this season, partly on account of the weather, and partly because we had no suitable boat to explore the various oyster beds of the New Brunswick coast in, I determined to cease operations at this point. Accordingly, I left the schooner and took my passage on board the steamship *Secret*, bound up, on Tuesday, September 8th.

Of the four cruises the last was the least successful, although it was by no means barren of results. Most of the time was unfavorable for dredging purposes, so much so indeed that out of 19 days we only managed to work on part of six. Still, on this cruise we got 16 casts of the dredge, and obtained a fair idea not only of the fauna of the greatest depths in Northumberland Straits, but also of that of the oyster beds of that region. I was particularly desirous to try and ascertain if there were oysters living in any parts of Northumberland Straits at greater depths than three or four fathoms. In a St. John's newspaper it was stated that some one had dredged oysters between Richibucto and the West Cape of Prince Edward Island, in 16 fathoms water. We dredged all through Northumberland Straits, in the centre and on each side, especially at the mouths of rivers, and tried also the locality mentioned in the St. John's newspaper, but did not meet with the slightest trace of an oyster. In this region these mollusca seem to be confined to shallow water, less than three fathoms deep, in very sheltered bays. Although we particularly

wished to examine some of these oyster beds minutely, it was found impracticable under the circumstances to work the schooner in such shallow water, and the only boat we had was not only, at its best, very unsuitable for dredging purposes, but was so badly damaged in the gale at Charlottetown as to be quite useless. Some valuable information as to the present condition and prospects of the oyster beds of New Brunswick and Prince Edward Island was, however, obtained from residents upon the coast. To examine the oyster beds of the Gulf of St. Lawrence effectually, steam power would be desirable. In case, however, a sailing vessel is used, she should be provided with a boat of light draught, of tolerable size, and capable of carrying one or two sails. It is also eminently desirable that the captain in charge should be particularly well acquainted with the coast. It happened that the captain in command of the schooner during the last cruise had never navigated the Straits of Northumberland before, and to make matters worse, we had no proper charts on board. The only boat we had was unseaworthy, as well as far too small for dredging purposes. The weather was more or less stormy all the time, and the season being far advanced, after a few unsuccessful attempts at dredging on well known oyster grounds, finding we were only losing time we were reluctantly compelled to desist.

During the first three cruises, Captain J. N. Purdy commanded the schooner, and in the last, Captain M. Graburn took charge of her. To both of these gentlemen my thanks are due for their continued kindness, and for their intelligent co-operation in carrying out the objects I had in view; I am greatly indebted also to the whole crew of the schooner, for their ready assistance in the work in which I was engaged, without which, indeed, many of the specimens collected would have been lost.

PART II.—PROVISIONAL SUMMARY OF THE ZOOLOGICAL RESULTS OF THE EXPEDITION.

As has been stated at the outset, the number of specimens collected last summer is very large. Only a small portion of these have at present been studied. With the exception of a few omitted by accident, all the annelids collected (filling some 80 bottles) have been sent to Dr. W. C. McIntosh, F.L.S., who has kindly promised to examine and report on them separately. To Professors A. E. Verrill and S. J. Smith, I am again indebted for much valuable assistance in the determination of critical species which could not be named here. To save reiteration I have prefixed an * (asterisk) to the species named by Professor Verrill, and a † (dagger) to the crustaceans identified by Professor Smith. A few specimens from former years dredging, which have not been determined before, are included in the following list.

FORAMINIFERA.

The microscopic species have not yet been critically examined. In the deep-sea mud three or more species were noticed which are plainly visible to the naked eye. They are all from 200 to 220 fathoms; one appears to be *Margulinina spinosa*, Sars, another is probably *Triloculina cryptella*, D'Orb. and the last is an arenaceous form new to me. This latter presents three prominent varieties: the first is a simple, unbranched tube, nearly straight, and sometimes fully an inch in length, but always less than a sixteenth in diameter; the second is widely triradiate, not unlike the calcareous spicules of *Grantia*; while the last is irregularly cruciform. These three extreme forms are connected by transitional specimens which seem to shew that the whole are varieties of one species. I am unable to state whether they should be referred to the *Asterorhiza limicola* of Sandahl or not. These organisms, though gregarious, appear to be exceedingly local; they occurred to me in only one locality.

SPONGES.

Probably as many as fifty or sixty species of sponges from the Gulf of St. Lawrence if not more, are represented in the Museums of the Natural History Society of Montreal, and of McGill College. As there is no such thing as an accurately named series of British

species in the Dominion, it is very difficult to ascertain which of the Canadian species are new, and which have been previously described. After a long study of all the specimens accessible to me, the following is a list of the few to which I have ventured to attach a name. In a great number of cases it is difficult even to refer the specimens to any known genus.

Calcispongiae.

Grantia ciliata, O. Fab. Widely spread all through the Gulf, in depths of from twenty to ninety fathoms. It appears to be most abundant where the bottom is rocky. Taken in 1871, 1872 and 1873.

Ascartia fragilis, Haeckel. Brudelle Bank. Professor Verrill, to whom I am indebted for the identification of this species, writes me that it is the *Leucosolenia botryoides* of Professor H. James Clark, but not of European writers.

Silicispongiae.

Thecophora semisuberites, O. Schmidt. Tolerably common in moderate depths (20 to 90 fathoms) throughout the northern part of the Gulf.

Thecophora ibla? Wyville Thompson. A few specimens are occasionally found with the preceding, which differ somewhat from typical *Thecophora semisuberites*, and should probably be referred to this species.

Hyalonema (Stylocordyla) longissima, G. O. Sars. About a dozen specimens of this interesting sponge were dredged last summer in 200 to 220 fathoms between Anticosti and the south shore, with the three following forms.

Cladorhiza abyssicola, G. O. Sars. One specimen of this rare species was taken in 1872 and another in 1873, in depths of from 120 to 220 fathoms. The St. Lawrence specimens have a few pinnæ arranged at right angles to the main plane.

Trichostemma hemisphaericum, G. O. Sars. One example, a little narrow and higher than the type, was dredged last year in the same locality as the *Hyalonema*.

Tethea muricata? Bowerbank. Three specimens of a sponge, which I doubtfully refer to the above species, were brought up by "tangles" in the 220 fathom locality last summer. I have given a short description of this very interesting form in the "American Journal of Science" for March, 1874. Mr. G. T. Kennedy, M.A., of Montreal, had previously detected spicules of this sponge in the *Post pliocene* clays of the environs of that city.

Polymastia mammillaris? Muller. From 160 to 170 fathoms, mud about 15 miles from Cap Rosier. 1872. Two specimens.

Phakellia ventilabrum? Linn. In 75 to 80 fathoms stones, six and a half miles to the E. $\frac{1}{2}$ S. of Cape Gaspé. 1872.

Halichondria (Amorphina) panicea, Pallas. A common shallow water species, of which water worn specimens are often cast ashore. It is seldom taken in a living state owing to its preferring rocky bottoms where the dredge cannot be used. Living examples taken in 1872 from a depth of seven fathoms off Cape Rosier, were of a somewhat bright pea green colour.

Isodictya infundibuliformis, Linn. Principal Dawson finds this species abundant at Murray Bay, Rivière du Loup and Tadoussac. With me it has occurred somewhat rarely in Gaspé Bay and its immediate vicinity.

Sarcospongiae.

Chalina oculata? Pallas. Not unfrequent in the Gulf.

HYDROZOA.

The number of hydroids collected is very large, but only a few of them have been at all critically examined. Many of those from the greatest depths seem to be different from any described British species. Professor Verrill informs me that G. O. Sars has

lately written a monograph or essay on the Norwegian Hydrozoa, and I am awaiting the receipt of this to compare the description or figures with my specimens. It is thought that there are many species new to the Gulf of St. Lawrence in the series collected last summer. In addition to those catalogued in my last report, nearly all of which were also collected in 1873, the following additional ones have been noticed :-

Hydractinia echinata, Flem.

Eudendrium ramosum, Linn.

Parypha crocea, Ag.

**Clytia Johnstoni*, Alder. (Orphan Bank.)

Obelia geniculata, Linn.

Obelia gelatinosa? Pallas.

Lafaea dumosa, Flem.

Sertularella tricuspidata, Alder.

Hydrallmania falcata, Linn.

ACTINOZOA.

Aleyonaria.

Pennatula aculeata, Daniellson, var. *Canadensis*. More sparingly met with in deep water last summer than in 1871.

Virgularia Lyungmanii, Koll. A few good specimens were taken with the preceding.

Aleyonium rubiforme, Ehr. Abundant on the Orphan Bank, and very common throughout the northern portion of the Gulf.

Aleyonium carneum, Ag. Very fine and frequent between Cape Breton and Prince Edward Island.

Aleyonium, (sp.) A supposed third species of this genus, at first referred by Prof. Verrill to *Eunephtya glomerata*, occurs rarely in deep water.

Cornulariella modesta, Verrill. Dredged in 1871 in 220 fathoms, between the East Point of Anticosti and the Bird Rocks.

Zoantharia.

Metridium marginatum, E. and H. Orphan Bank and elsewhere; very common.

Urticina nodosa, Fab. The species catalogued in my last report as *Urticina digitata*, Mull, should be referred to the above.

Urticina crassicornis. Common in many places.

Cerianthus borealis, Verrill. Tubes only, apparently belonging to this kind of sea anemone, have been dredged in very deep water; the animal itself I have not seen.

* *Actinopsis* (near *Actinopsis flava*, Koren and Dan). A single living example was taken in 1873, from a depth of 200 fathoms.

Epizoanthus Americanus, V. One colony of this compound creeping Zoophyte was taken in deep water in 1871 and another in 1872, in each case on a small stone.

ECHINODERMATA.

Astrophyton Agassizii, St. Bradelle Bank.

* *Ophioscolax glacialis*, Mull. and Tr. Two or three living individuals of this northern "brittle star" were dredged in 210 fathoms to the S. W. by S. of the S. W. Point of Anticosti.

Ophiopeltis, near *O. borealis*, G. O. Sars. This species, whose relations have not yet been accurately made out, is one of the most characteristic echinoderms of the deep-sea mud, where it is associated with the preceding, with *Ophiacantha spinulosa*, *Otenodiscus*, and *Schizaster*. Entrance of Gaspé Bay, in 50 fathoms.

Ophiacantha spinulosa, M. and T. Common at all depths.

~~*Ophicoma nigra?* O. F. Mull. Bradelle Bank.~~

Ophioglypha Sarsii, Lutken. Very abundant, and of large size in many places.

Ophioglypha robusta, Ayres. Very sparingly met with.

Ophioglypha nodosa, Lutken, and *Ophiophotis aculeata*, O. F. Mull. The two commonest species in the Gulf.

Otenodiscus crispatus, Retz. One of the most characteristic Asterids of the greatest depths. A large living example was taken in 50 fathoms at the entrance to Gaspé Bay.

* Since described by Prof. Verrill as *Actinopsis Whiteavesii*.

Is the same as *Pentacta calcigera*.

See for description

Pteraster militaris, Mull. Orphan Bank, somewhat plentiful.

Crossaster papposa, Linn. Bradelle Bank; also Gaspé Bay in about a fathom of water.

~~*Leptasterias hispidus*, Wyville Thompson. The *Caberia heystrii* of my last report is this species, which has been lately re-named.~~

Asterias polaris, Mull and Tr. Common at moderate depths.

Asterias Groenlandicus, St. Orphan and Bradelle Banks, &c. *Probably A. littoralis, St.*

Schizaster fragilis, Dub and Kor. Widely distributed in the deep-sea mud.

Psolus phantapus, Linn. Orphan and Bradelle Banks.

**Lophothuria Fabricii*, Lutk. Between Picton Island and Cape Bear.

Cucumaria pentactes, O. F. Muller. Two fine specimens which agree exactly with Prof. E. Forbes' drawings and descriptions of this species, were dredged in 25 fathoms red mud, off Port Hood, C.B.

Pentacta calcigera, Stimps. I have recently detected one specimen of this scarce Helothurian in my 1871 dredgings.

~~*Echinoconus typica*, M. Sars. Three small individuals of this species were dredged in the red mud, about half way between Port Hood and the East Point of Prince Edward Island.~~

Caudina arenata, (Gould). Point du Chêne, N.B., at low water.

Myriostichus Rinkii, St. Entrance to Gaspé Bay, in 50 fathoms; also 50 fathoms, nine and a half miles to the S. E. of Little Pabou.

Some of the commonest species collected are purposely omitted in the above list.

Is *Oligostichus vibans*, Sars.

POLYZOA.

For some years I have devoted much attention to this difficult group. A large quantity of material has accumulated, not only from my last three dredging expeditions, but from collections made by myself in 1869. To this must be added a series of specimens collected by various officers of the Geological Survey several years ago, and now in my possession, which has only been partially studied. Only a few of the more conspicuous of last year's specimens have been carefully examined, and the following species, not in my last year's report, have been noticed so far.

Cheilostomata.

Plastru abyssicola, G. O. Sars. One fine and characteristic specimen of this species was dredged in 220 fathoms, 16 miles to the S.W. by S. of the S.W. Point of Anticosti. New to the American coast.

Escharipora annulata, Fab. Gaspé Bay, in from 30 to 50 fathoms and elsewhere, but always of rare occurrence.

Escharipora punctata, Hassall. With the preceding.

Cellepora scabra, Fab. Common at moderate depths on stony ground, especially in most of the inner banks. Orphan and Bradelle Banks.

Myriozoum crustaceum? Smitt var., or nov. sp.? A single specimen of what at a casual glance would be taken to be an *Eschara*, presents remarkable microscopic characters. The cells have an avicularium on each side of the aperture, and exactly resemble Smitt's drawings and diagnosis of his *M. crustaceum*. It is possible that this latter species may have an *Eschara* form, as well as the one (*Lepralia* like) at present known. For the present I prefer taking this view to encumbering the literature of the subject with a new name, and perhaps increasing the list of synonyms.

Escharoides rosea, Busk. The species to which this name is attached in my last report, is, I believe, *Escharoides Sarsii*, Smitt.

Eschara Steenei, Ell and Sol. All the specimens from the St. Lawrence with this name attached to them, which I have examined, are in my judgment erroneously named. I have not yet seen specimens from the Gulf which exactly agree with the European species.

elegantula, d'Obigny.

Eschara (Cellepora) muricornis, Pallas. Although the *Celleporaria surcularis* of Packard (the *incrassata* of Lamarck) is very different to the above, as Dr. Packard justly observes; both species are profusely abundant in the St. Lawrence, and in most

One of these proves to be *Molpadia oolitea*, Poutalas, & the other two *Coryphus scaber*, Luthen. So reported in Can. Mat. III - 264, but not in Am. See article.

cases occur together. On the Orphan and Bradelle Banks, for example, upwards of 50 fine specimens of each were collected last summer.

Porella (Eschara) lavis, Fleming. Two fine examples of this species were dredged (living) on the Orphan Bank. One specimen was also taken in 56 fathoms, stones and coarse sand, eight miles to the S.E. of Bonaventure Island in 1872.

Escharella (Eschara) palmata, Sars. A rare deep water species, the finest example of which was dredged in 1871 attached to a stone, in 120 fathoms off Bear Head, Anticosti. Smaller specimens were taken last summer in 220 fathoms, between Anticosti and the south shore. New to America.

Cyclostomata.

Mesenteripora meandrina, Wood. Orphan Bank, one living specimen.

Tubulipora penicillata? Fab. Gaspé Bay.

Tubulipora fungia? Couch. Gaspé Bay.

Hornera lichenoides, Linn. (= *H. borealis*, Busk). Two small examples of this interesting species were dredged in 220 fathoms, in the centre of the mouth of the river between Anticosti and the Gaspé Peninsula.

Ctenostomata.

Alcyonidium gelatinosum, Pallas. Very abundant on the Orphan Bank.

TUNICATA.

Most of the species, of which a list is given below, were kindly examined and identified by Prof. Verrill, who has made the study of these animals a specialty. To all these an asterisk is prefixed.

**Boltenia ciliata*, Moll. Orphan Bank and off Cape Bon Ami, in 30 fathoms.

Boltenia Bolteni, Linn. (= *B. clavata*, Fab.) Entrance to Gaspé Bay, and off Cape Bon Ami.

Ascidioopsis complanatus, Fab. In great abundance and of extremely large size on the Orphan Bank. A common species almost everywhere in the Gulf.

**Eugyra pilularis*, V. Exceedingly abundant, but small, 10 miles north of Shediac.

Peloniaia arenifera, St. Common throughout Northumberland Straits, as well as between Cape Breton and Prince Edward Island. Rare in the northern part of the Gulf.

**Molgula pannosa*, V. Orphan Bank, one specimen.

**Molgula littoralis*? V. Between Pictou Island and Cape Bear, Prince Edward Island.

**Molgula producta*, V. In 15 fathoms sand, five miles to the N.N.E. of the east point of Prince Edward Island.

**Molgula papillosa*, V. With the preceding.

**Glandula fibrosa*, St. Off Port Hood, Cape Breton.

**Cynthia monoceros*, Moll. Between Pictou Island and Cape Bear.

**Cynthia carneu*, Ag. With the above.

Cynthia pyriformis, Rathke. With the two preceding; also common on the Orphan Bank.

**Leptoclinum albidum*, V. Between Pictou Island and Cape Bear.

**Amouræcium glabrum*, V. Orphan Bank.

MOLLUSCA.

The number of species of testaceous molluscs collected is somewhat large, and as I have elsewhere (Canadian Naturalist, new series vol. 4, pages 48-57, and 272-73; also vol. 5, page 104) given a tolerably complete catalogue of the mollusca then known to inhabit the Gulf to the north of the Bay des Chaleurs, a list is only given of some of the scarcer forms.

Terebratalia septentrionalis, Couth. Two living specimens were taken in from 200 to 220 fathoms.

Terebratalia Spitzbergensis, Dav. Occasionally taken at depths of from 30 to 90 fathoms. I have collected it at about a dozen different localities. Judging by the unique specimen in the British Museum I doubt the correctness of regarding *T. Labradorica*, Sow., as synonymous with this shell.

Pecten Greenlandicus, Ch. Found in considerable numbers at some localities in the deep-sea mud. I have picked as many as 50 or 60 living specimens at one time from one "tangle," or "swab" as the sailors would call it. It is quite common to find individuals each clasping a single fibre of the tangle between its valves so tightly that it is barely possible to pull it out.

Daerydium vitreum, Moll. Common at depths greater than 100 fathoms.

Yoldia limatula, Say. Very common in Northumberland Straits, also between Cape Breton and Prince Edward Island, but rare in the northern part of the Gulf.

Yoldia sapotilla, Gould. Occasionally met with with the above, of which it is probably a variety.

Portlandia thraciformis, Storer. Rare and small, in the deep-sea mud north of the Bay des Chaleurs; larger, but dead, on the west coast of Cape Breton.

Portlandia lucida, Loven. In muddy bottoms, at depths of from 150 to 313 fathoms; not common. Closely allied to, if not identical with, the *Yoldia obesa* of Stimpson.

Portlandia frigida, Torell. With the preceding.

Arca pectunculoides, Scacchi. A common deep-sea species.

Cyprina Islandica, Linn. Northumberland Straits; also between Cape Breton and Prince Edward Island.

Astarte lactea, Brod. and Sow. Very abundant on the Bradelle Bank; scarce on the Orphan.

Astarte, near to *A. subquilatera*, Sow. A characteristic deep-water form, whose specific relations are obscure. Possibly new to science. *A small form of A. crebricostata.*

Astarte undata, Gould. In Northumberland Straits, and in the area between Cape Breton and Prince Edward Island, this Acadian species takes the place of the northern *A. elliptica*.

Callista convexa, Say. Collected at the same localities as the preceding; also at the Magdalen Islands.

Venus fluctuosa, Gould. Bradelle Bank, large and numerous.

Petricola pholadiformis, and var. *ductylus*. Northumberland Straits.

Mactra solidissima, Chemn. Point du Chêne, low water.

Mactra lateralis, Say. 10 fathoms sand, about 10 miles north of Shediac.

Montacuta elevata, Stimps. 15 fathoms sand, off the east point of Prince Edward Island.

Pandora trilineata, Say. Northumberland Straits; also between Cape Breton and Prince Edward Island.

Thracia Conradi, Couth. Large and rather frequent on the beach at Point du Chêne after a storm. Alive in 12 fathoms off Pictou Island.

Periploma papyracea, Say. Widely distributed throughout the Gulf in moderate depths. *Int. in North Straits*

Teredo navalis, Linn. Pictou, N. S.

Uvulinea solitaria, Say. Beach at Point du Chêne.

Philine quadrata, S. Wood. A few living specimens were collected in very deep water.

Cylichna umbilicata, Mont. In 200 fathoms mud; dredged in 1872 and 1873. New to America.

Siphonodentalium vitreum, Sara. Sparingly taken, living, in the same locality as the preceding and following species.

Dentalium attenuatum, Say. I regard this shell as identical with the *D. dentale* of

ibiticulus (or *Leipiciana* Verrill) *nitidula*, Loven.

Gould, and with the *D. occidentale* of Stimpson; it is also, in my judgment, the same as the *D. abyssorum* of Sars.

Amicula Emersonii, Couth. Fine on the Orphan Bank.

Aemecia abveus, Con. Low water at Point du Chêne.

Orepidula fornicata, Linn., and *C. unguiformis*, Lam. These two species range from the area between Prince Edward Island and Cape Breton, through Northumberland Straits, along the coast of New Brunswick as far to the north as the southern entrance to the Bay des Chaleurs; Carraquette Bay, N.B., seems to be their extreme northern limit.

Margarita argentata, Gould. Taken in several localities.

Littorina littorea, Linn. Observed at Souris and Charlottetown, Prince Edward Island.

C. Jan Meyeni, Fraessl.

Cingula *Biscus carinata*, Michels, and *B. exobicularis*, Moll. A few of each of these diminutive species were dredged in 200 fathoms mud.

Odonotonia trifida, Totten. One specimen, Point du Chêne.

Turbonilla interrupta, Totten. Shediac Bay, frequent.

Lunatia triseriata, Say. Northumberland Straits; also between Prince Edward Island and Cape Breton.

Lunatia immaculata, Totten. Orphan Bank, and between Cape Bear and Pictou Island.

Corithiopsis costulata, Moll. (~~*Bittium arcticum*, Morch.~~) Two living specimens of this rare arctic shell were dredged, one in 110 and the other in 200 fathoms, between Anticosti and the south shore.

Bittium nigrum, Totten. Point du Chêne, N. B., at low water.

Buccinum tenue, Gray. Orphan and Bradelle Banks, fine.

Nassa obovata, Say. Beach at Point du Chêne.

Astyris Holbollii, Beck. Orphan Bank.

Amycla rosacei, Gould. At low water, Point du Chêne.

Tritonofusus Kroyeri, Moll. Orphan Bank.

Tritonofusus latericeus, Moll. Bradelle Bank, one living and adult example.

Neptunea tornata, Gould. Orphan Bank, rare.

Neptunea Spitzbergensis. Orphan Bank, six or seven living specimens.

Voluptosius Norvegicus, Chemn. One living but immature specimen of this very rare shell was dredged on the Bradelle Bank; an adult, but very much water-worn example was taken off Bonaventure Island in 1872.

Trophon craticulatus, Fab. Orphan Bank and off Cape Bon Ami.

Bela harpularia, Couth. 30 fathoms, off Cape Rosier and Bradelle Bank.

Bela violacea, Migh. Off Cape Bon Ami and entrance to Gaspé Bay.

Bela cancellata, Migh. Northumberland Straits.

ANNELIDA.

As has been previously stated, nearly the whole of the annelids collected have been sent to Dr. W. C. M'Intosh for identification.

Priapulus caudatus, Lamarck, was dredged at the entrance of Gaspé Bay, also off Cape George, N.S. A very distinct species of *Priapulus*, probably undescribed, and lacking the strong longitudinal and transverse sulci characteristic of *P. caudatus*, was collected off Port Hood, N.B. A small *Gephyrean*, which inhabits small shells (such as *Natica*,

Bela and especially *Nassa trivittata*), and which Prof. Verrill tells me is *Phascolosoma cæmentarius*, *Quatrefoyes*, is abundant through Northumberland Straits, and to the East of Prince Edward Island.

CRUSTACEA.

Prof. S. J. Smith (of Yale College) has very kindly examined and determined for me most of the critical species in this family. To these a (+) is prefixed. Many of the Canadian marine crustacea are described by Kroyer and other writers, in journals which are

X Since described by Prof. Verrill as *Cerithiella Whiteavesii*, both genus & species being new.

Neptunea tornata, Gould. is *Neptunea despecta*, L.

not to be found even in the largest libraries of the Dominion ; hence it is almost impossible to identify the whole of them here.

Order Pycnogonoidea.

Nymphon, small species. Orphan Bank.

Order Copepoda.

†*Ireneus Patersonii*. Towing net, frequent.

Argulus, sp., near *A. cloacæ*, Gould. On *Gasterosteus biaculeatus* off Pictou Island.

Order Phyllopora.

†*Nebalia bipes*, O. Fab. 220 fathoms, between Anticosti and the South Shore : Bradelle Bank.

Order Isopoda.

Bopyrus, sp. On *Hippolyte spina* and *Pandulus annulicornis*, from the Orphan Bank.

Idotea marmorata, Packard. Orphan Bank.

Idotea phosphorea, Harger. Four-and-a-half fathoms, Egmont Bank.

Idotea irrorata, Say. Towing net, Pictou, N.S., and Point du Chêne : low water. Shediac Bay. Common round the Magdalen Islands.

Epelys montosus, St. In 14 fathoms, off Richibucto, N.B.

Anthura brachiata, St. Common in deep water (200 fathoms) between Anticosti and the main land of Gaspé. Very near to the European *A. gracilis*.

Munopsis typica, M. Sars. Frequent with the preceding.

Limnoria lignorum, Rathke. Dredged by me in water-logged wood in Gaspé Bay, in 1869.

Ega psora, Linn. On Halibut from the North Shore. Collected by Mr. W. Couper, in 1872, and identified by myself.

Order Amphipoda.

†*Pontoporeia femorata*, Kroyer. 70 fathoms, off Cape Despair : 45 fathoms between Miscou Island and the Bradelle Bank : 13 fathoms off Escuminac, N.B.

†*Stegocephalus ampulla*, Phipps. In 110 fathoms, due East of Mal Bay : Northern entrance to the Bay des Chaleurs, in 50 and 70 fathoms : Bradelle Bank.

Phoxus Kroyeri, Stimpson (not of Bate). About 30 miles to the N.E. of Cape Rosier, in 200 fathoms mud.

†*Harpina*, sp. In 220 fathoms, 18 miles East of Cape Gaspé : Bradelle Bank.

†*Metopa glacialis*, Kroyer. Between the inner and outer integuments of *Ascidioopsis complanata*, dredged on the Orphan Bank.

†*Syrrhoë crenulatus*, Goes. In 30 fathoms at the entrance of Gaspé Bay.

†*Eusirus cuspidatus*, Kroyer. Orphan Bank, one very large specimen.

Tritopsis aculeatus, Lep. Orphan and Bradelle Banks : also from 30 fathoms off Cape Bon Ami.

†*Ediceros lynceus*, M. Sars. Bradelle Bank. Between Cape Despair and Little Pabou, in 50 and 70 fathoms.

†*Acanthostephia Malmgreni*, Goes. From 70 fathoms, Cape Despair, bearing South, three-quarters-West, six miles distant.

†*Aceros phyllonyx*, M. Sars. Between Cape Despair and Grand Pabou, at the Northern entrance to the Bay des Chaleurs, in 50 and 70 fathoms.

†*Paramphithoe pulchella*, Bruz. Bradelle Bank, in 25 fathoms.

†*Vertumnus serratus*, Goes. Taken with the above, also from 30 fathoms just inside Gaspé Bay.

Acanthozona cuspidata, Lep. Fine and frequent on the Orphan Bank.

Acanthozone, new species, fide S. J. Smita. Collected at a depth of about 30 fathoms, at the entrance to Gaspé Bay.

Epimeria cornigera, Fab. The most characteristic Amphipod of the greatest depths in the Northern part of the Gulf.

†*Halirages fulvocinctus*, Boeck. Rare in the same station as the preceding, but much more local. 220 fathoms mud.

†*Gammarus ornatus*, Edw. The common "beach flea" of Gaspé and Shediac Bays. Probably abundant everywhere along the coast.

†*Maera*, sp. Off Cape George lighthouse, N. S., in from 22 to 30 fathoms.

Melita dentata, Kroyer. Between Miscou Island and the Bradelle Bank, in 45 fathoms mud and stones.

†*Melita* (near *M. dentata*). Gaspé Bay and off Port Hood, C. B.

†*Melita*, sp. Off Cape Despair, in 70 fathoms.

†*Melphidippa*, sp. Off Richibucto, N. B., in 14 fathoms. 220 fathoms between Anticosti and Gaspé.

†*Ampelisca*, sp. Bradelle Bank (two species): between Cape Bear and Pictou Island: off Sea-Cow Head, P. E. I., and off Pugwash Harbour, N. S.

†*Haploops*, sp. Bradelle Bank: off Cape George, N. S., and off Port Hood, C. B.

†*Byblis Gaimardii*, Kroyer. Northern entrance to the Bay des Chaleurs, Bradelle Bank, and between the latter place and Miscou Island.

†*Ptilocheirus pinquus*, St. Bradelle Bank, and between it and Miscou; between Cape Bear and Pictou Island, and two localities in Northumberland Straits.

†*Amphithoe*, sp. Egmont Bank.

†*Unciola irrovata*, Say. Collected at the same place as the preceding.

Caprella. A large tuberculated species of this genus was common on the Orphan Bank. A smaller and smooth form was frequent also in many localities.

Order Cumacea.

†*Diastylis quadrispinosa*, G. O. Sars. In 22 fathoms red mud, eight miles to the N. E. of Cape George, N. S.

†*Diastylis luciferu*, Kroyer. About 10 miles to the North of Shediac, in 10 fathom sand.

†*Diastylis sculpta*, G. O. Sars. With the preceding species.

†*Diastylis*——? young. 220 fathoms, between Anticosti and the S. shore.

†*Diastylis*, sp. Bradelle Bank.

†*Leucon nasicus*, Kroyer. Cape Despair, S. three-quarters N., six miles distant, 70 fathoms.

†*Eudorellu*, sp. With the above; and 30 fathoms at the entrance to Gaspé Bay.

Order Schizopoda.

†*Thysanopoda neglecta*? Kroyer. Centre of the mouth of the river to the S. of Anticosti, in 210 and 220 fathoms. Between Cape Despair and Grand Pabou, in 50 and 70 fathoms.

†*Thysanopoda*, large species. In 210 fathoms mud, S. of the S. W. Point of Anticosti.

†*Mysidæ* near to *Erythrops* and *Parerythrops*. Between Cape Despair and Grand Pabou, some distance from shore: also half-way between Miscou Island and the Bradelle Bank.

†*Pseudomma roseum*, G. O. Sars. 28 miles to the E. N. E. of Cape Gaspé, in 110 fathoms, also 25 miles E. by N. of Cape Gaspé, in 210 fathoms.

Pseudomma, nov. sp., fide S. J. Smith. Between Cape Despair and Grand Pabou, in 50 and 70 fathoms.

Order Decapoda.

Nectocrangon lar, Owen. Very fine on the Orphan and Bradelle Banks.

Crangon vulgaris, Fab. Common everywhere in shallow water and at low-water mark, on most sandy beaches.

Crangon boreus, Phipps. Orphan Bank and 30 fathoms off Cape Bon Ami.

Hippolyte spina, Sow. Common on stony ground at moderate depths. Orphan and Bradelle Banks.

†*Hippolyte macilenta*, Kroyer. Northern entrance to the Bay des Chaleurs, also between Miscon and the Bradelle Bank.

†*Hippolyte Phippsii*, Kroyer. Orphan Bank.

†*Hippolyte pusiola*, Kroyer. Orphan Bank and off Sea-Cow Head, P. E. I., in 10 fathoms, gravel, stones and broken shells.

Pandalus armulicornis, Leach. One of the commonest shrimps of the Gulf, at depths of from 10 to 90 fathoms.

Calocaris MacAndrewae, Bell. A fine living example of this singular and rare species was dredged in 190 fathoms mud, 20 miles to the S. W. of the S. W. point of Anticosti. The first that has been taken on the American side of the Atlantic.

Eupagurus pubescens, St. Fine on the Orphan Bank.

Eupagurus Kroyeri, St. Widely distributed through the Gulf.

Munidopsis curvirostra, mihi. Four specimens of a crustacean for which I have proposed the new generic and specific names given above, were dredged last summer in the deep sea mud. Like *Pseudomina roseum*, and *Calocaris*, the *Munidopsis* has only rudimentary eyes, without pigment or facets in the cornea. I append the original description from an article in the March number of Silliman's Journal.

**Munidopsis curvirostra*, nov. gen. et sp. External antennæ about equal in length to the carapace and its rostrum; internal ones very short, not reaching further than about one-fourth the length of the beak. Eyes rudimentary, longitudinally oval, light yellowish in color; cornea devoid of facets. Carapace squarish, but longer than broad, with an outwardly directed straight spine on each of the front angles. Upper surface of the carapace granulate, hispid, transversely irregularly plicate. In the centre there are two dorsal spines, placed one above the other, but at some distance apart. These, as are two similar spines on the tail segments, are all exactly in a line with the rostrum, and the whole four point forward. Rostrum simple (without the spine on each side of the base so characteristic of *Munida*), conspicuously curved upward, stout at the base and gradually tapering to a fine point. A single spine in the centre of the first and second tail segments, the rest devoid of any. Anterior pair of legs about as long as, but not longer, than from the apex of the rostrum to the end of the tail, extending a little beyond the tips of the outer antennæ. The following are the measurements of an average and apparently adult female: length, from apex of rostrum to tip of tail, 1.38 inch; of carapace, including the rostrum, .69 inch; of exterior antennæ, .75 inch; of anterior legs, .94. Inhabits the centre of the mouth of the St. Lawrence River, between Anticosti and the south shore, in from 180 to 220 fathoms, and probably burrows in the deep sea mud. From *Munida* it may at once be distinguished by its curved and simple rostrum. In the rudimentary character of its eyes it closely resembles *Calocaris*, but not in many other respects.

Hyas uranea, Linn. Orphan Bank and entrance to Gaspé Bay.

Hyas coarctata, Leach. A very abundant species.

FISHES.

Gasterosteus biaculeatus? Shaw. Very common on the surface, also at low-water mark, throughout the Gulf. I think the common three-spined sea-stickleback should rather be referred to Shaw's species than to the *G. aculeatus* of Linnæus. The American species of this genus seem to require revision.

Liparis, sp. A small fish, probably the young of either *L. vulgaris* or *L. Fabricii*, was dredged in 70 fathoms, six miles off Cape Despair.

Centronotus fasciatus? O. Fab. One fine specimen was taken on the Orphan Bank.

Macrurus rupestris, O. Fab. 25 miles E. by N. of Cape Gaspé, in 210 fathoms, one living example.

Fundulus majalis? Walb. Common at low water in Shediac Bay.

Clupea minima? Storer. A small fish, which may be this species, was frequently taken in the towing net at various localities. By fishermen from the United States and from the maritime provinces, it is locally known as "brit," and is said to form part of the food of the mackerel.

PART 3.—NOTES ON THE MARINE FISHERIES, AND PARTICULARLY ON THE OYSTER BEDS, OF THE GULF OF ST. LAWRENCE.

The following notes are, to a large extent, a compilation of scattered items of information, gathered from various persons residing along the coast. Captain J. N. Purdy, who commanded the *Nickerson* during the first three cruises, and who has had great experience as a fisherman, both in Canada and in the United States, has helped me very considerably in the preparation of this part of my report; and to him I am indebted for most of the facts subjoined. The late M. H. Perley's Report on the Sea and River Fisheries of New Brunswick, published at Fredericton in 1852, contains a valuable amount of local information not to be met with elsewhere. These notes may be looked upon as supplementary to that useful volume. The classification adopted is essentially that of Dr. Gunther's Catalogue of Fishes, in the British Museum. Professor Theodore Gill has published a critical "Synopsis of the Fishes of the Gulf of St. Lawrence and Bay of Fundy," in vol. ii., new series of the "Canadian Naturalist." As this latter paper is probably more accessible than Dr. Gunther's elaborate work, the names given by both authorities are quoted here. References are made only to those fishes or invertebrates which are of some economic importance.

MACKEREL. *Scomber scomber*, Linn., and *S. pneumatophorus*? De La Roche. Gunther. *Scomber grex*, Mitchell, Gill.

For the last four years mackerel have re-appeared in White and Green Bays, on the north-east coast of Newfoundland. They have been caught in Bras d'Or Lake, Cape Breton, with herring nets, in winter; also at Port Hood, Cape Breton, in December. During the first year mackerel grow to five or six inches in length. The "tinker mackerel," spoken of by Perley, are the fry of the common species, which, in the second year, attain a length of 10 inches. In the Bay des Chaleurs mackerel spawn in May and June, and occasionally a few as late as July. This fish prefers a rocky bottom, particularly banks; it does not apparently dislike sandy ground, but seems to avoid muddy bottoms. Ground *Menhaden* are largely used by American fishermen to bring mackerel to the surface. The Lower-Canadian fishermen use first coarse salt, and then ground fresh herring, for the same purpose. French Canadians do not seem to understand the proper mode of curing mackerel. They split them the wrong way, do not soak them enough, or kill them at once. This is unfortunate, as mackerel often abound in the northern part of the Gulf, especially in Gaspé Bay, and these badly-cured fish are quite unfit for the market. It is said that the use of purse *seines* for taking mackerel is a very wasteful mode of fishing, as more are often caught than can be cured, and quantities are killed unnecessarily this way. It might possibly be desirable to prohibit the capture of spawn mackerel.

TUNNY, or HORSE MACKEREL. *Thynnus thynnus*, Linn. Gunther. *Oreymus secundo-dorsalis*, Storer. Gill.

Occasionally eaten on the North Shore and on the Labrador coast. A fish largely cured in the Mediterranean, but never, so far as I can learn, prepared for the market by Canadians.

TAUTOGA, or BLACK FISH. *Tautoga onitis*, Linn. Gunther and Gill.

A delicious table fish, but too rarely found to be of much practical value. Very rarely taken at St. John, New Brunswick, and in the Bay of Fundy.

COD. *Gadus morrhua*, Linn. Gunther and Gill.

Codfish appear to leave shallow soundings and the inshore banks in winter, and go farther out to sea. A large school visits the east coast of Cape Breton, from Chetigan, round by Scatari, in April. Cod appear to spawn all the year round, even in winter. Schools have been taken spawning on Brown and George's Banks, in February and

March, also in November and December in the Bay of Fundy and elsewhere. A few codfish are taken now and then in Gaspé Bay in winter. It is not an uncommon circumstance for a school of cod to follow herring as far as Mahogany Islands, at the entrance of St. John Harbor, New Brunswick, in February and March, where they are taken plentifully with trawls by the inshore fishermen. This school does not apparently strike in shore during the summer, at least not in New Brunswick. A peculiar variety of this fish, "with a dark back and a black ring round the jaws" (Purdy) is taken on the Orphan and Bradelie Banks, as well as on the east coast of Prince Edward Island. They are of a large size and will, it is said, only take the hook *at night*, hence they are known to the fishermen as "night fish." With the exception of haddock, cod is the only fish that is well cured in the northern part of the Gulf. Cod prefer a bottom of stones, gravel, or sand, especially where shells and crabs abound. The season for cod, north of the Bay des Chaleurs, is from about May 15th to November 15th. In Bras d'Or Lake, Cape Breton, also on the north coast of Newfoundland and in the Bay of Islands, cod and herring are caught in winter through holes cut in the ice. The "bull-dog" cod, spoken of by Perley, are supposed to be individuals which have been bitten when young by other fish. A prejudice seems to exist along parts of the coast against the use of "trawls" or bultow lines, but I have not heard of any that appear to me sound arguments against them. It is believed by many experienced fishermen that quantities of young cod are annually destroyed by drag seines, used for bait near shore, but it is not easy to suggest a remedy for this state of things. The clam, of which Perley says the cod are particularly fond, is *Cyrtodaria siliqua*.

HADDOCK. *Gadus eglefinus*, Linn. Gunther. *Melanog rammus eglefinus*, Linn., sp. Gill.

Most plentiful on the south and west coast of Nova Scotia, and on the west coast of New Brunswick, but common throughout the Gulf. This species is taken all the year round, generally in schools alone, but sometimes associated with cod. They frequent clam banks, in from twelve to eight fathoms. A very valuable market fish, and one which will be much more so when the Intercolonial Railway is opened. At Digby, St. Andrew's and Western Isles, "finnan Huddies" are prepared for various markets in Canada and the United States. Haddocks are taken on the west coast of Newfoundland in winter.

POLLACK. *Gadus virens?* Linn. Gunther. *Polluchius carbonarius*, Bon. Gill.

Although this fish is commonly called "pollack" by the fishermen of the lower provinces and by those of the United States, it is not the same as the pollack of Europe. Its proper name is the coal fish, and it is common to both shores of the Atlantic. The species is locally known as the "sea-salmon," and is of somewhat southern distribution. It does not appear to range farther north than the Bay des Chaleurs, if so far, and has never been taken in the waters of the Province of Quebec. The species is most frequent in tideways in Nova Scotia and New Brunswick. As a table fish it is preferred by many to cod. To the north of the North Cape of Prince Edward Island no great business is done in the curing of pollack. They are, exceptionally, caught in winter among cod. They are not often taken on banks, but mostly along the shore. They school like mackerel, and are caught at the surface, to which they are brought by ground bait. Their food is said to consist largely of herring. The livers of this species yield the best oil; it is used for machinery and in making leather. Salted and dried pollack is worth from \$2 to \$3 per quintal.

"OLD ENGLISH HAKE." *Merluccius vulgaris*, Flem. Gunther. *Merluccius bilinearis*, Mitch. Gill.

The fishermen of the lower provinces endorse Dr. Gunther's view that this species is identical with the true hake of Europe. Locally it is called whiting, though the whiting of English authors (*Gadus merlangus*) is a very different fish. Hake are caught in purse seines, also in herring and pogy nets. They are not much used for food, and are rarely if ever cured.

AMERICAN FORKED HAKE. *Phycis Americannus*, Storer. Gunther. *Phycis tenuis*, Gill.

This fish is the "ling" of the Jersey merchants. The species of forked hake in the Gulf require careful examination, as there are as many as three species in that region. On the east and west coast of New Brunswick, and on the north of Nova Scotia, the "ling" is taken from July to November. It is common on muddy bottoms throughout the Gulf; is salted and dried, with very little sun, exported to the United States, and from there to South America.

THE TORSK, TUSK, OR CUSK. *Brosnius brosma?* Linn. Gunther. *Brosnius Americanus?* Gill.

The common cusk of the St. Lawrence is taken all the year round, especially in the Bay of Fundy, where the fish occurs in many localities. Cusks are dried and cured with codfish, and fetch a better price than the latter in the West Indian market. There are two species of cusk in the St. Lawrence, but their geographical range has not yet been accurately defined, and I am not sure which of the two kinds is the one most frequently used.

HALIBUT. *Hippoglossus Groenlandicus?* Gunther. *Hippoglossus Americanus*, Gill.

The Canadian halibut are said to frequent the outer banks in winter and the inshore fishing grounds in spring and summer. They feed on shells, crabs, lobsters, sculpin, &c., and can hardly be caught in quantity except by trawling. They are highly prized by inland consumers, and fetch a comparatively high price. About August halibut are caught in large numbers to the north of Anticosti. They are generally sold by draught (of 224 pounds) and sent to Quebec.

FLOUNDER. *Pleuronectes Americanus* Walb. Gunther. *Pseudopleuronectes Americanus*, Walb., sp. Gill.

A common fish everywhere in the Gulf, and occasionally exposed for sale in the markets at Halifax, Nova Scotia.

SMELT. *Osmerus viridescens*, Lesueur. Gunther. *Osmerus mordax*. Mitchell.

This delicious little fish is, or may be, taken abundantly throughout the Gulf all the year round. In Gaspé Bay smelts are caught in winter like tommy cods, through holes in the ice. In New Brunswick and Nova Scotia smelts are exported to New York and Boston. The species appears to spawn in April and May, and extends up the River St. Lawrence, at least as high as Quebec, in the spring and autumn.

CAPELIN. *Mallotus villosus*, Mull., &c.

The habitual use of this fish as manure, along the coast, is considered objectionable, as it tends to drive the cod further out to sea.

HERRING. *Clupea harengus*, Linn. Gunther. *Clupea elongata*, Lesueur. Gill.

In Gaspé last year the first herring of the season appeared about the 25th of April. The fishing began about the 10th of May and lasted until about the 25th of June, after which capelin struck in for a week or perhaps eight or nine days. The "drifting" season in and just outside of Gaspé Bay usually commences about the middle of June, and lasts to the end of July. At Grand Manan Rips, Captain Purdy informs me, the use of brush weirs has destroyed one of the most valuable herring fisheries in the Gulf. The herrings once caught there were the largest and fattest, and fetched the best price of any in the Dominion. In the opinion of Captain Purdy, the use of drag seines and of brush weirs should be prohibited. At Grand Manan, Campo Bello, and Deer Island, the destruction of young herrings by brush weirs has driven the cod from those localities. The New Brunswick winter fisheries are, or were, an important source of wealth to that province. As many as eighty vessels loaded with fish at West Isles, New Brunswick, for United States Ports, from October, 1872, to April, 1873. In April, 1873, forty sail of United States fishermen came to St. Andrew's Bay, New Brunswick, to buy herring for bait on the inshore bank fisheries. It is feared that the use of purse seines will either destroy or materially injure the herring fishery. In winter the New Brunswick herring frequent river estuaries and harbors with muddy bottoms. The rigorous protection to spawn herring at Grand Manan and St. Andrew's Bay is undoubtedly a great public benefit. For many of these details I am indebted to Captain J. N. Purdy.

MENHADEN, OR "POUY." *Clupea menhaden*, Mitch. Gunther. *Brevortia menhaden*, (Mitchell) Gil. A fish of very rare occurrence in Canadian waters. Of late years none

have been found in New Brunswick or to the north of Grand Manan. Menhaden are largely used as bait for mackerel, cod, and halibut. The head, tail, backbone, and offals of this fish are converted into manure by grinding, pressing, and adding a little salt to them so as to make a kind of guano. In the United States this preparation is worth from \$16 to \$20 per ton. Iceed menhaden is used as bait for cod and halibut, and the meat of the same fish salted and subsequently finely ground is employed to bring mackerel to the surface. The United States method of fishing for mackerel is greatly disliked by fisher men resident along the coast. The effect of it seems to be to draw mackerel further out to sea, and it seems tolerably certain that in many bays, as in some of those of the East coast of Cape Breton, for example, no mackerel are found now where they formerly used to be plentiful. At the same time the use of menhaden is not illegal, and United States fishermen always were allowed to take mackerel (except inshore) before the fishery clauses of the Treaty of Washington came into force. It would be desirable perhaps to try and acclimatize menhaden in British waters. All that would be necessary would be to send a vessel or two, each provided with a well room, to the United States, and liberate the menhaden thence procured, at the mouth of any of the New Brunswick or Nova Scotia Rivers, such as St. Andrew's Bay, L'Etang, Lepreauix, or Musquash, in New Brunswick; or St. Mary's Bay and its tributaries, or Tuskeet River, in Nova Scotia.

The Lobster. *Homarus Americanus*, Edwards. The lobster fisheries of the River and Gulf of St. Lawrence, are of very great economic importance, more especially now that the supply of this popular article of food is not equal to the demand for it in the United States and in Europe. At present large quantities of lobsters are shipped to these countries from New Brunswick and Nova Scotia. In spite of their increased commercial value, it is nevertheless a fact that in some of the northern parts of the Gulf good marketable lobsters are still used to manure the fields! Few can doubt the propriety of at least attempting to discourage a proceeding at once so reprehensible and wasteful. The latest regulation, forbidding the taking of lobsters less than a pound and a half in weight, is much complained of by persons engaged in this fishery. They urge that it would be better to allow lobsters weighing a full pound to be taken, but not any under that weight. Mr. W. S. Brown, who has a lobster canning establishment at Shippegan, has kindly given me an account of some of his experiences during the past summer. He says that a few small red eggs begin to form under the tails of the lobsters early in July, and at the end of September the tails were filled up, and 80 or 90 per cent. of the lobsters taken had eggs attached to them. Late in September these eggs had become nearly the size of B.B. shot, and were very dark in colour. At this time the few that were taken near the shore were mostly males. Mr. Brown thinks that the lobsters leave the shore in October, and go to deposit their eggs in deep water, and that this latter operation is performed sometimes as late as November or December. In July and August, Mr. Brown writes me, "I found that 80 to 90 per cent. of the lobsters had an abundance of eggs, and that 60 to 70 per cent. of them would weigh less than a pound and a half. Five lobsters weighing $1\frac{1}{2}$ lbs each will shell out about one pound of fish, and my average this season has been about four and a half lobsters to the pound or can." "The heavy gale of last August drove more lobsters ashore within five miles of my packing houses than I could make use of during the whole summer." "They formed a row of from one to five feet deep, and I should estimate them at an average of one thousand to every two rods of shore." "The next that came in shore after these were very small, averaging from two to four inches in length, and upwards, and the coast seemed alive with these small lobsters." It might be desirable to establish protected breeding grounds for lobsters in the Gulf, on somewhat the same general principle as oyster beds are formed. The season for lobsters varies with the locality. In Gaspé Bay they are taken in July and the beginning of August, but further south they appear earlier and stay later. In the south part of the Bay des Chaleurs and on the northern New Brunswick coast, they approach the shore late in May, and leave it for deep water more or less late in September. There seems to be a great difference of opinion among the coast fishermen as to the time when lobsters spawn. Very small specimens, always less than an inch in length were frequently taken by the

towing net in July and August at some distance from land, swimming about among floating weed. The Hon. W. H. Pope writes me that lobsters often burrow in the sides of oyster beds during the winter months.

Canadian Oysters. *Ostræa Virginiana*, Lister: and *Ostræa borealis*, Lamarek. It is not necessary or desirable to enter minutely here into the somewhat complicated history of the synonymy of the two Canadian species of oyster. It is sufficient for my present purpose to say that the long and narrow oyster, which is abundant in Virginia, New York Bay, &c., was the first of the oysters known in Europe from the temperate parts of North America. The species was known to Linnæus, and was originally described by Lister as *Ostræa Virginiana*. For the shorter and more rounded form, Lamarek at a later date, proposed the name of *Ostræa borealis*, and gave a short diagnosis of the species. Some varieties of this latter mollusc came so near to specimens of the common British and north European oyster, that it is difficult to distinguish between them. *Ostræa Virginiana* is much the rarer of the two Canadian oysters, but between it and the *O. borealis*, there are so many intermediate varieties and connecting links, that many naturalists doubt the value of the specific relations proposed.

As the geographical range of the two forms is very similar, and as my principal object is to call attention to their economic importance, the two species, or varieties, will be considered together. In the Gulf of St. Lawrence, oysters are usually found in very shallow water, nearly always in depths of less than three fathoms, in sheltered bays or mouths of rivers. In New Brunswick, as has been shewn before by Perley, they range from Caraquette to Baie Verte. Capt. Purdy, informs me that oysters have been taken up on the flukes of anchors, in 7 fathoms water, between Little and Big Caraquette Banks, in the Bay of Chaleurs. On the coasts of Prince Edward Island, oysters are found in suitable localities, from Pinette River to the west point on the Northumberland Straits side; and in Malpeque or Richmond Bay, from Cascumpeque to New London on the northern. In Cape Breton they appear to be confined to Bras d'Or Lake and its tributaries, where the oyster region extends from St. Ann's to Mira River and St. Peter's Bay. The few oysters to be met with off Nova Scotia, occur at Jeddore Head, 20 or 25 miles east of Halifax Harbor, also Country Harbor, St. Mary's River and Lipscomb Harbor, Guysboro' Co., on the outside; and Pictou Harbour, River John, Wallace, Charles River, and Pugwash, in Northumberland Straits. (Purdy.) We did not find traces even of oysters in any part of the area between Cape Breton and Prince Edward Island, nor in any part of Northumberland Straits where the bottom is deeper than five or six fathoms, that is to say not in any of the open parts.

In answer to a letter asking for information on several points connected with the oyster beds of the Gulf, the Hon. W. H. Pope has kindly given me a most interesting and valuable account of the oyster beds of Prince Edward Island, together with many items of practical information on the subject, which no one else is so well qualified to give. The following paragraphs, to which quotation marks are affixed, are extracts from letters received from Mr. Pope, and are printed by his permission.

"Oysters have flourished in every tidal river and bay in Prince Edward Island. At the present time, productive oyster beds are found in Richmond, Cascumpee, and Hillsborough Bays, and in the rivers flowing into these inland waters. I might almost say in these localities alone. The produce of the beds in Hillsborough Bay is very inconsiderable. The official returns of imports and exports to and from Prince Edward Island, for 1872, shew that 9,490 barrels of oysters were shipped from this Island in the previous year."

"From Summerside,	7,572	barrels.	}	(Produce of Richmond Bay.)
"Malpec,	840	"		
"Cascumpec,	718	"	}	" Cascumpec Bay.)
"Charlottetown,	230	"		
"Orwell,	130	"	}	(Chiefly produce of Richmond Bay.)"

"The dredge has never, to my knowledge, been employed in the waters of Prince

Edward Island. Oysters are fished with "tongs," from depths varying from three or four feet to twelve, and even fifteen feet. It is scarcely practicable to fish oysters, with tongs, at a depth greater than fifteen feet."

"I am not aware of the existence of oyster beds in any part of the Straits of Northumberland, or of the sea surrounding the Island. Some years ago I observed a quantity of oyster shells on the sand at the north end of the Tryon Shoals (which are situated on the south side of the Island); they were about a quarter of a mile from the shore. Some of the shells were filled with sand, more compact than much of our sandstone rocks. When I first observed these shells, my opinion was that they had been washed ashore from beds situate in the deep water of the Straits of Northumberland. It has since occurred to me that they are *in situ*, and are the remains of an ancient oyster bed which had been destroyed by the sand. The existence of a soft muddy bottom in the vicinity of these shells supports the supposition that at some period this muddy bottom was more extensive than at present; that the oyster bed was then formed, and was destroyed by the encroachment of the sand forming the Tryon Shoal."

"During the past ten or twelve years, *millions* of tons of oyster shells and mud have been taken up by our farmers, from oyster beds, by means of dredging machines, worked by horses on the ice. In many instances the beds have been cut through, and in some places the deposits of shells have been found to be upwards of twenty feet in thickness. It is probable that many of the oyster beds ceased to be productive of oysters, ages before the settlement of the country by Europeans. Extensive deposits of oyster shells are now found covered by several feet of silt. How were the oysters upon these beds destroyed? The natural process of reproduction and decay would cause the oyster beds formed on the bottom to rise so near to the surface of the water, that the ice would rest on them. The weight of heavy masses of ice upon the beds would injure the oysters, and the moving of the ice, when forced by tide or wind across the bed, would soon destroy them. I have observed the more elevated portions of an oyster bed, over which ice had been thus forced. Several inches of the surface of the bed, including all the living oysters, had been driven before the ice, and the shells and oysters so removed, had been deposited in a miniature *moraine* on the slope of the bed, where the water was sufficiently deep to allow the ice to pass over it. This crushing and grinding process would destroy many of the oysters; some would be crushed and broken, others smothered in the *moraine*. The gradual silting up of the river would prevent the running of the ice, and the oyster beds would, in time, be covered, as we now find them. Deposits of oyster shells (covered with mud), twenty feet in depth, are found in rivers, in the deepest parts of which there are not now fourteen feet of water."

"Oysters thrive on muddy bottoms, but they will not live if imbedded in mud: many oyster beds have been destroyed by mud alone. The annual fishing of oyster beds, if not carried to excess, improves them. In the process of fishing the surface of the bed is broken up, the shells and oysters lifted out of the mud, and a supply of material (cultch), afforded such as the oyster *spat* requires, and without which it must perish.

"Oysters upon natural beds are seldom, if ever, killed by frost. I have known oysters to thrive upon a hard stony bottom, notwithstanding that the ice rested upon them once in every twenty-four hours throughout the winter. Some of these oysters grew adherent to a small flat rock about eight inches in thickness. The oysters on the top of the rock were killed when they attained their second years' growth, I think, by pressure, as those on its edges were never injured by ice or cold."

"Oyster beds in rivers in which sawdust is thrown in large quantities would probably be injured by it. The sawdust would, I think, be carried by the current over the beds, and the roughness of their surfaces would detain some of it. The interstices between the shells and oysters would probably become filled with sawdust and mud. Mud and decomposing sawdust constitute a most offensive compound."

"The area of productive oyster beds in the Dominion is comparatively limited, and altogether inadequate to supply the demand for oysters which is now enormous, and which is increasing every year. Unless the existing beds be protected and improved, and

new beds formed, the day will soon come when the oyster beds of the Dominion will cease to produce. Our neighbours of the United States tell us that Virginia alone possesses more than one-and-a-half millions of acres of oyster beds, and, notwithstanding the fact that oysters increase much more rapidly in the warmer waters of Virginia than they do in this latitude, the authorities of that State have expressed their fears that the oyster beds of Virginia, if left open to the world, and dredged at all seasons of the year, will become extinct."

"The rivers and estuaries of this Island are admirably adapted for the cultivation of oysters. The oysters found in its bays are not to be excelled in flavour, and if fished late in autumn they will keep good for months. I see no reason why hundreds of thousands of acres of oyster beds should not be formed in these bays, which would produce vast quantities of oysters in quality much superior to the oysters of Virginia. The material for the formation of such beds is at hand in the ancient ones; and oysters with which to sow them could be had at little cost during the warm calm days of summer."

"We have a 'close season,' from June until September, but the law prohibiting fishing during this season is openly violated. Oysters are caught and exposed for sale in every month in the year, and salmon are destroyed upon their spawning beds with the utmost impunity. I shall be happy to hear that the Dominion Government have resolved to enforce the laws for the protection of oysters, salmon and trout. We now form part of the Dominion, as you know, and have a right to look for wiser legislation and a better administration of law."

"You inquire—'do you think oysters would thrive in somewhat deeper water than that in which they are now found, if sown there?' I think they would thrive in the deepest part of any inland water, if placed upon suitable ground"

In another letter received later Mr. Pope expresses the hope that the Minister of Marine and Fisheries will think proper to appoint a commission to report upon the oysters and oyster fisheries of the Island, and intimates that in such an event he would have no objection to give his services gratuitously.

The only oyster beds which we were able to examine at all in detail were those in Shediac bay. On these grounds, in very shallow water, the dredge came with the bag more or less full of oysters, or rather of oyster shells (for upwards of ninety per cent. of the specimens were dead), together with some other common kinds of shells, &c., and a little blackish mud, which smelt very offensively. As there is a lumber mill in the bay, this ground is probably an example of the "offensive compound of mud and decomposing sawdust," of which Mr. Pope speaks. In a whole afternoon's dredging we only got two or three living oysters. Being detained a few days at Point du Chêne, I endeavoured to get some idea of the fauna of the bay, at depths of from low-water mark to three fathoms, particularly with the view of ascertaining what kinds of marine animals were associated with the oysters, and how many of them were injurious to that mollusc. The following is a list of the species collected in Shediac Bay; those which are supposed to be more or less inimical to the oyster being italicised:—

CRUSTACEA.

Cancer irroratus. Say.
Crangon vulgaris. Fab:
 †*Gammarus ornatus*. Edw.
Idotea irrorata. Say.

MOLLUSCA.

Ostrea borealis. Lam.
O. Virginiana. Lister.
Mytilus edulis. Linn.
Modiola modiolus. Linn.
Mercenaria violacea. Schum.
Gemma Tottenii, St.
Callista convexa. Say.
Petricola pholadiformis. Lam. and var. *dactylus*. *Astyris lunata*. Say.

Teredo, sp. (in a spruce log).
Haminea solitaria. Say.
Cylichna pertenuis. Mgh.
Acmœa alveus. Conrad.
Crepidula fornicata. Linn.
 " *unguiformis*. Lam.

Paludinella minuta.
Odostomia trifida. Totten.
Turbonilla interrupta. Totten.
Lunatia heros. Say.
Bittium nigrum. Totten.
Nassa obsoleta. Say.
 " *trivittata*. Say.

where, reported in
Can. Nat. 11-VII, 336-349
1874

Mactra solidissima Chemn.

Mya arenaria.

" *truncata*.

Angulus tener. Say.

Thracia Conradi (fine and frequent).

Pandora trilineata? Say.

Solen ensis, v. *Americana*.

ECHINODERMATA.

Asterias vulgaris St.

Cribella sanguinolenta.

Echinarachnius parma.

Echinus Dröbachiensis.

Caudina arenata (Gould).

In addition to these, algae were tolerably plentiful, and a few small annelids and zoophytes were collected. Of course the short catalogue given is by no means offered as a complete list of the fauna of the oyster beds. The chief living enemies of the oyster in its native waters are starfishes, sea eggs (*Echinus*), carnivorous sea snails or whelks (the "drills" of the European oystermen), and mussels. So far as I could see, these do not exist in sufficient abundance in Northumberland Straits to be of any serious disadvantage.

Many once productive beds, in various parts of the Gulf, now yield almost nothing; and there is too much reason to fear that unless precautionary measures are adopted, the oyster fisheries of the eastern part of the Dominion will soon become a thing of the past. The raking of the beds has been palpably excessive and wasteful; no such thing as cleansing the ground and scattering the spat during the close season has ever been practised; the pollution of the grounds by refuse of mills, by silting up, and a variety of other causes, has led to the present state of ruin and decay which we now see. Neglect, waste, and excessive cupidity have almost destroyed these oyster beds, and will ultimately entirely do so unless remedial measures are adopted. Without pretending to have any practical experience of oyster culture, or much local knowledge of the Canadian oyster beds, I would nevertheless venture the following suggestions:—

1. To plant new beds in suitable places throughout the Gulf.

The peculiar conditions under which oysters in Canada make this a very easy matter. No enclosures would be necessary, as in the French "pares," all that would be required would be to select a suitable locality, as near to beds known to be productive as possible, be sure that the bottom selected is scrupulously clean, spread clean cultch over it, plant the oysters, and see that they are not disturbed for at least two or three years. Oysters are of marketable size at four years old, but attain their prime at the fifth. Suitable localities for making new beds are the mouths of rivers throughout Northumberland Straits, on both sides, many places in Prince Edward and Cape Breton Islands and parts of the coast of Nova Scotia and New Brunswick, particularly Buctouche outer bar and Miramichi Inner Bay, in the latter Province. The great object in all oyster culture is to "save the bulk of the spat when free." After expulsion from the parent (as is well known) the fry at once rises and swims about until it meets with a clean hard surface to attach itself to. Unless, however, it is arrested by some object, the spat will either get drifted out to sea, or be devoured by one or other of its many natural enemies. Another object which it is desirable to effect is the separation of the specimens. In a state of nature oysters live one upon the other, in clusters, of all ages and sizes. In the majority of cases (except where they come from beds which are private property, and where oyster culture is practised) for one oyster you eat, a number of immature ones are destroyed. "Bank oysters," as these clustered masses are called by the English oyster-men, are difficult to dredge, and are usually in poor condition. A liberal use of clean cultch, and judicious dredging of the beds, tend to separate the oysters.

It might be desirable to lease portions of the coast to individuals or companies, for practical oyster culture. It would be far wiser to protect capitalists who might wish to try and develop our resources in this direction, under certain regulations, than to allow things to remain as they are.

2. Excessive and wasteful fishing on existing beds should not be permitted.

Few will gainsay the statement, that in many parts of the Gulf, oyster beds, once productive, are now almost exhausted through excessive raking. A certain proportion of the whole should be set aside, in rotation, for a season of rest and recuperation. Certain beds

should be allowed to rest for a definite period, and during this time no oysters should be taken from them for the market. Unless the bottom were foul, or some other agency were at work, it is probable that many beds might again become productive, if the oysters were let alone and allowed to breed. It would probably be still better to dredge over the beds at intervals, and clean them; to supply new culch and spread the oysters more, so as to separate them as much as possible. It is important to understand that oyster spat will not live on a foul or dirty bottom.

Many good authorities say, and the opinion is rapidly gaining ground, that more harm than good is done to the oyster beds by enforcing a close time. In the "Report of the Commission appointed to inquire into the Method of Oyster Culture in the United Kingdom and France, with a View to the Introduction of Improved Methods of cultivation of Oysters in Ireland," dated 1870, a summary is given (which we quote) of the arguments on both sides of this question.

"In favor of the existing system of close time it is urged:

- a. That during close time, the oysters are unfit for food.
- b. That dredging over the beds will crush and destroy the young spat.
- c. That if the oysters are taken while breeding, the supply must soon come to an end."

"But to all these allegations forcible replies are given:"

"a. It is generally agreed that not more than 20 per cent., or thereabouts, of the oysters are ever spawning at once, at least 80 per cent., even at the worst of times, being eatable and in good condition. The celebrated naturalist, Kroyer, who undertook an official examination of the Danish oyster beds, found not more than one oyster in ten spatting, even in July and August."

"b. Those who have been in the habit of dredging for marine animals, and of bringing up the most delicately organized creatures in great abundance alive, will not be disposed to attach much weight to this objection. Every naturalist is aware that the most delicate Corallines and Ascidians may be dredged up roughly, placed in a bucket of sea water, and examined in full health and vigour after an hour's sail homeward under such circumstances."

"The evidence of practical oyster cultivators whom we have examined on this point is worthy of careful attention."

"According to the opinions expressed by "credible "witnesses, not only is no harm done by dredging over the young spat, but positive injury is the result of not dredging over the ground before the spat is deposited."

"But it is rare for the spatting to take place early in May, and if it does, as the young oysters swim about for 20 to 27 days, dredging over the beds cannot possibly do them harm for the greater part if not the whole month of May; while if, as is more usual, the spatting does not occur till June, July, or even August or September, not only may dredging during these months be totally innocuous to the spat on account of its not having settled, but, on the theory that dredging over the spat is injurious, great damage may be done in the two first of the open months."

"Even admitting a certain amount of destruction from dredging over the spat, the question arises whether this destruction is likely to be greater than that which will result from leaving the oyster to the undisputed sway of mussels, star fishes, weeds and mud! This is a question which can only be decided by experience. In the present state of our information, it can only be said that legislative interference is just as likely to do harm as good, and that so far as the present close time is concerned, dredging in May must certainly have less effect upon the brood than dredging in September."

3. The pollution of bays, estuaries, or tidal rivers by the refuse of mills and the like, should not only be prohibited but as far as possible prevented. This practice is not only injurious to the oyster beds, but also to all the other fisheries. Further, it spoils the anchorage in harbors, &c.: instances have been mentioned to me of captains letting their anchors drop on a supposed good bottom, and finding that the flukes had only a few inches of rotten sawdust to hold on to.

I shall conclude this Report with a few extracts from the latest works on oyster culture which I have access to.

The following are taken from the Report of the Irish Commission previously cited. As part of the Commissioners' experience of the French system, they say:

The French Government have assumed "the entire control over all the oyster banks and foreshore." "As occasion may seem to require, an entire bank may, for a certain time, be altogether reserved against dredging operations, or any portion of it." "The general practice seems to be to mark off a third or fourth of a bank each year; the remaining portion being dredged for a specified time by the persons permitted during the number of days allowed for the operation—the reserved portion being also dredged for a few days to clean it of weeds, mud and vermin." "Everything relating to oyster fisheries is decided on by a local Commission." "This Commission is presided over by the local inspector of fisheries, or officer commanding the fishery guard, and is composed as follows:—

"The inspector of fisheries or a syndic.

The officer commanding the fishery guard.

Two gardes maritimes.

One fisherman, being master of a boat."

The following embrace the more important principles laid down for the guidance of the Commission:—

"The beds should not be opened for fishing until the spat has acquired strength to resist the action of the dredge; until the end of January, for example."

"When a bed has well established breeding capacities, a fourth or fifth part of its total area should be set apart as a reserve, and dredging over such part entirely prohibited."

"A fishery guard boat should, wherever practicable, take part in the working of each bed."

"When a bed is foul or encumbered with weeds or other matter noxious to the development or adherence of spat, it should be opened for dredging until cleaned."

"Beds on which there is never any production of spat shall be opened all through the season."

"After the working of any bed is over, it should be carefully inspected, and, if necessary, replenished with proper 'cultch,' stones, shells, &c."

"Trawling is prohibited within 525 yards of any oyster beds. The capture of oysters is strictly forbidden between the 1st May and 31st August, within the three mile limit, and in international waters from June 15th to August 31st."

"Grants of foreshore, or concessions, are made to persons desirous of cultivating oysters, the grants in most instances being much smaller than in Ireland, and not possessing the same advantages as to length of tenure." "Undoubtedly benefit accrues to the small cultivators of the soil from these grants of foreshore, either for breeding or fattening processes, and the Government encourages such enterprises by affording facilities for obtaining stock from the Government reserves, and by occasionally making free grants both of oysters and tiles. Sailors, or the families of sailors, serving, or who have served in the Imperial Marine, are allowed certain advantages over other applicants for such concessions."

"The oyster and other fisheries are under the control of the Minister of Marine Department, forming a special branch under the able administration of M. de Champeaux, assisted by a permanent commission of nine members, of which M. Coste is the head."

"On the coast the Commissaires d'Inscription Maritime are, in addition to their other duties, charged with looking after the fisheries, having under them divisional Inspectors, and occasionally other subordinate employeés. This system, as regards supervision, affording information to fishermen, enforcing regulations, and collecting statistics, appears admirable, and has been productive of vast advantage to the fisheries of France."

After a careful examination of the oyster beds and methods of oyster culture in France and Great Britain, the Irish Commissioners submitted the following recommenda-

tions, for the regulation of the Irish oyster fisheries, to the Lord Lieutenant of that island in 1870 :—

1. "That all regulations with regard to the close time around the Irish coast should be strictly maintained."

2. "That the Inspectors of Irish fisheries should have power, whenever they determine to reserve a bank or any portion thereof from public dredging, for the purpose of recovery, to make such arrangements as may seem desirable for keeping the restricted part free from weeds and vermin."

3. "That there should be procurable at each coastguard station, at a small cost, general information as to oyster culture, and simple instructions as to the best mode of proceeding."

4. "That the Inspectors be empowered to adopt such other means as they may deem necessary, to afford information and instruction to those requiring it with respect to oyster culture."

5. "That having unsizable oysters in possession in places where it is prohibited by any by-law to take oysters from any public beds under a certain size, shall be *prima facie* evidence that such oysters were taken in places so prohibited; such regulation not to apply to private oyster grounds."

6. "That facilities be afforded to the coast population to acquire the use of small portions of foreshore, or sea bottom, for oyster cultivation, and to obtain loans on satisfactory security for the preparation of same, and for the purchase of oysters, collectors, &c."

7. "That landed proprietors desirous of cultivating oysters on the shores adjoining their lauds, be empowered to avail themselves of the provisions of the Irish Land Improvement Acts, for the purpose of oyster cultivation."

In his "Report on the Cultivation of Oysters by Natural and Artificial Methods," published in the Report of the British Association for 1865, Mr. Frank Buckland writes :

"The English system is to catch the spat upon cultch, the French to catch it upon tiles." I have examined both systems, and come to the conclusion that the tiles will (except under certain favourable circumstances) never beat the cultch.

"I have been to the Isle of Ré, and have seen (through the great kindness of Dr. Kemmerer) the whole system; and the long and short of it is this :—For many years the oyster spat in France was totally neglected, and the inhabitants thought nothing about turning their beds to profitable account. The learned pisciculturist, M. Coste, suggested the idea of tiles being placed down, the idea having, I believe, been first suggested by a poor mason, M. Bœuf, with whom I have had a long conversation. The tiles, fascines, &c., were placed down under the patronage of the Government, and they were picked up covered with young oysters. The success was pronounced complete, fascines and tiles were all the rage, and all who had oyster fisheries thought their fortunes were made."

"The fact of the matter is, that the first year these various oyster-catching implements were laid down happened to be a year famous for an exceedingly heavy fall of spat; in other words, a vast majority of the young spat born, lived, thrived, and ultimately adhered to whatever they could find to adhere to. They found the fascines and tiles, and covered them as bees cover the boughs of a tree at swarming time; and the idea was at once started that these fascines and tiles were the means, as it were, of creating the oysters which otherwise would not have been created."

"The first two or three years after these tiles, &c., were laid down happened to be good years for the spat living; but for the last few years the spat has not lived, and the natural consequence has been that they have not been found on the tiles in very large quantities. Oysters, in fact, are just as scarce this year in France, as they are in England. If the artificial system, with tiles, had been such a great success, and had the tiles caught the spat when cultch would not, it would of necessity follow that oysters in France would have been very cheap, whereas, in fact, they are quite as dear as in England, and there are so few of them to be had that French agents are at this moment in this country buying all they can get hold of."

Mr. Buckland thinks that the placing of fascines or faggots, for the use of the young oyster is (to use his own words), "a delusion and a snare." He tells us also that "the spat seems to prefer adhering to a shell that is partially decayed and softened, rather than to a new shell recently placed down."

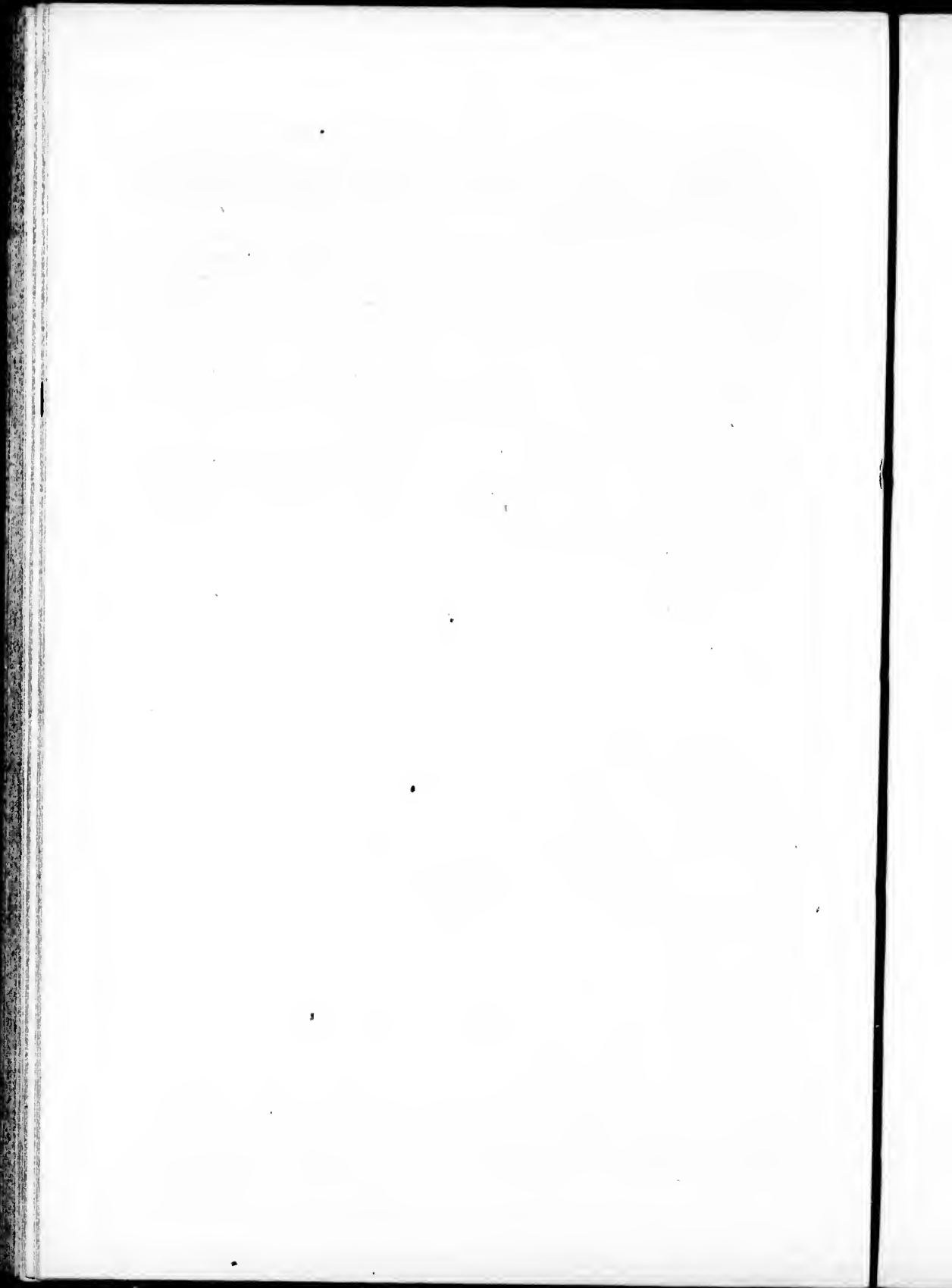
In Canada, oysters exist under somewhat different conditions to what they do in Europe. So far as we know, they are never found so far out to sea in the Gulf of St. Lawrence, as they are in many parts of Europe. Very successful results have already been attained in the cultivation of oysters in the Gulf, by the Hon. Mr. Pope and others, but I have never had the good fortune to visit any place where oyster culture is prosecuted.

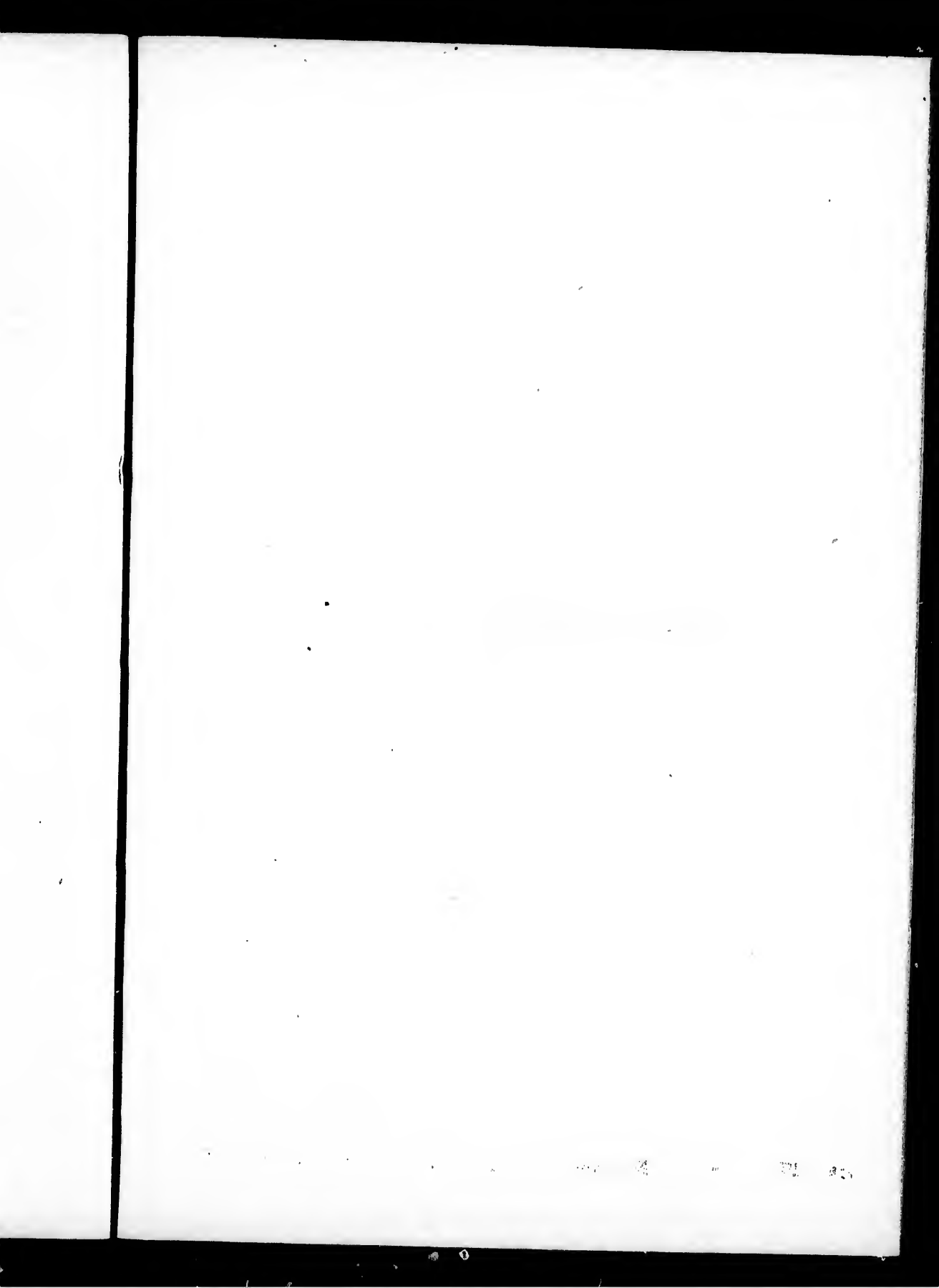
I should have judged that frost would be a serious obstacle to contend with in this country, but Mr. Pope seems to think that Canadian oysters are rarely injured by a very low temperature.

The oyster beds of the Gulf occupy, relatively, but a small area: there are none in the seas of the Province of Quebec; none, so far as we know, round the shores of Newfoundland, of the Magdalen Islands, or in the Bay of Fundy.

As we have already seen, what beds there are have been over-fished, utterly neglected, and in too many cases all but destroyed. Were the Government to follow the example set by other countries, and take prompt measures for the recuperation, protection, and fostering of the valuable oyster and lobster fisheries of the Gulf, there seems to be no reason why the supply of these important articles of food might not be increased to a very large, and perhaps almost unlimited extent.

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