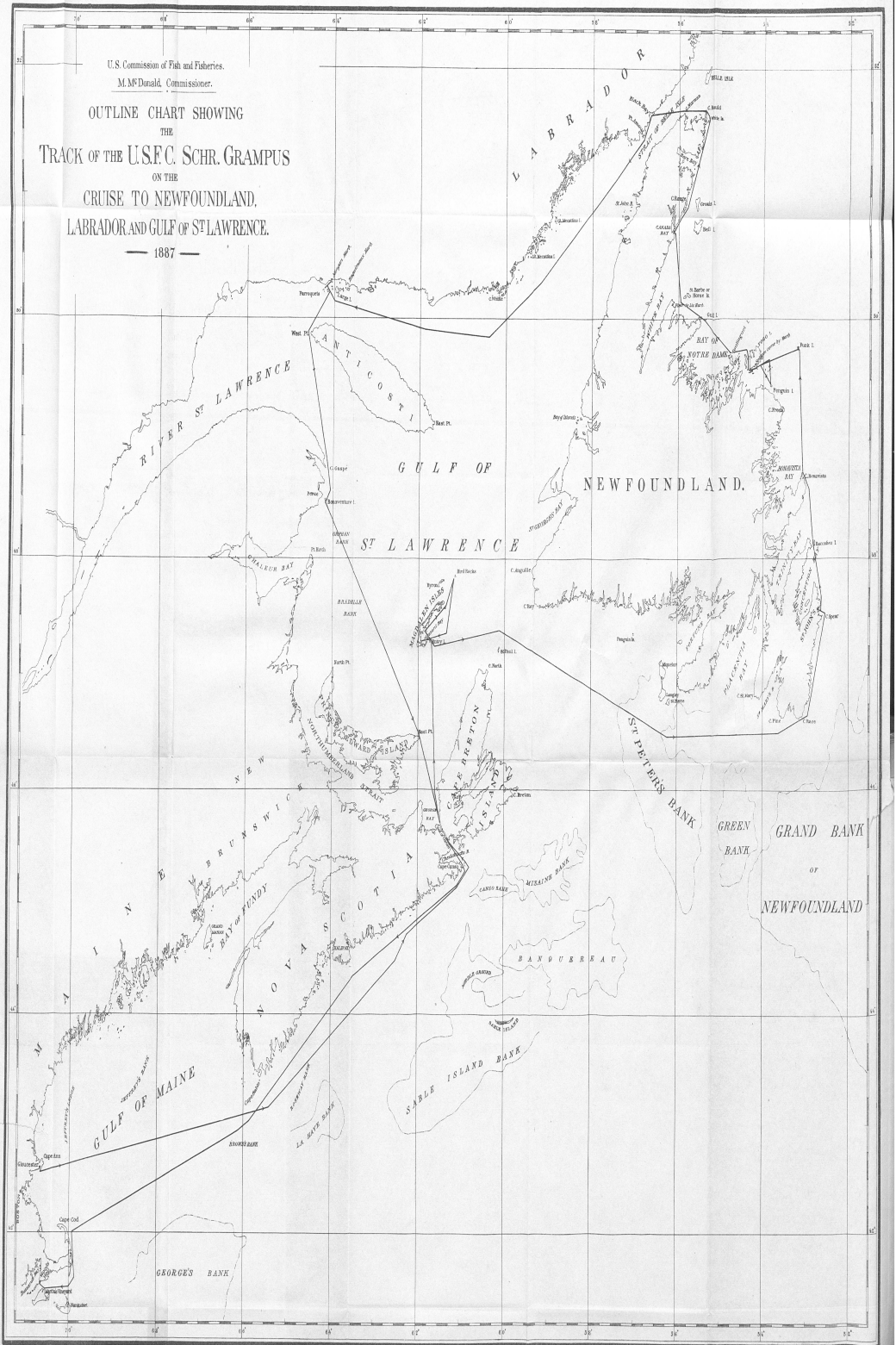
U.S. Commission of Fish and Fisheries.

M. McDonald, Commissioner.

OUTLINE CHART SHOWING THE TRACK OF THE U.S.F.C. SCHR. GRAMPUS ON THE CRUISE TO NEWFOUNDLAND, LABRADOR AND GULF OF St LAWRENCE.

— 1887 —



6.—REPORT UPON THE OPERATIONS OF THE U. S. FISH COMMISSION SCHOONER GRAMPUS FROM MARCH 15, 1887, TO JUNE 30, 1888.

By J. W. Collins and D. E. Collins.

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IV.—Report upon the investigations made by the *Grampus* on the southern mackerel fishing grounds, etc., from March 24 to June 30, 1888, by D. E. Collins.

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I.—INTRODUCTION.

The present report upon the operations and investigations of the *Grampus* covers about sixteen months, from March 15, 1887, to June 30, 1888. The reason for this is found in the fact that, in the Annual Report for 1886, a review of her work was brought down to March 14, 1887, and it is therefore necessary to begin at that date and to extend the present report over the fiscal year ending June 30, 1888, in order that it will harmonize with the general plan of the Annual Report of the Commissioner for that period. Fortunately the cruises of the *Grampus* were so arranged that there is no difficulty in ending the report with the fiscal year.

It has been found necessary, in order to present the result of the work carried on upon the vessel in an intelligent way, to divide the report into three special sections: One of these deals with the investigations made in the spring and summer of 1887 on the mackerel grounds from Hatteras to Labrador, and also covers other researches which were made at the same time; the second section treats of the work of collecting fish and fish-eggs for the coast hatcheries; while the third takes up the investigations relating to the mackerel, menhaden, and other migratory species in the spring of 1888.

It will be evident to the most casual observer that it would be difficult, if not impossible, to discuss all these different investigations and operations in one continuous paper, excepting it take the form of a narrative, which would be far from desirable and would render it less valuable for reference, while the results obtained could not be so clearly shown.

The report of Capt. D. E. Collins upon the operations and investigations carried on by the *Grampus* while under his command in the spring of 1888 is a comprehensive review of the work performed. The fact that no mackerel were met with in the early part of the season is significant, and was a marked indication of the phenomenal scarcity of that species on all the western Atlantic fishing-grounds during the summer of 1888.

The illustrative material has been prepared under the direction of the writer. The map showing the track of the *Grampus* on her summer cruise in 1887 was drawn by Dr. C. E. Gorham, of the U. S. Fish Commission; the "track" shows only the general course of the vessel going and returning, since it was deemed undesirable to follow all the deviations caused by head winds, etc.

J. W. COLLINS.

II.—REPORT UPON THE INVESTIGATIONS MADE BY THE GRAMPUS FROM MARCH 15, 1887, TO SEPTEMBER 16, 1887.

By J. W. COLLINS.

A. STUDY OF THE MIGRATIONS OF MACKEREL, ETC., SPRING OF 1887.

My last report on the work of the *Grampus* closed on March 14, 1887. At that time I was in Washington, D. C., engaged on special duty, to which I had been assigned by the Commissioner. During my absence from the vessel, First Officer D. E. Collins was appointed *pro tem.* to take command of her, and he remained in charge until after the completion of the spring's cruise to the southern mackerel grounds.

After the necessary repairs and preparations for a cruise were made, and certain apparatus which had been used during the winter was stored at Wood's Holl, and other necessary material taken on board instead, the *Grampus* sailed for the mackerel grounds north of Cape Hatteras on April 3. From that time until May 31 the vessel was actively engaged in making researches bearing upon the questions of the migration, abundance, and capture of mackerel, menhaden, and such other pelagic species as were met with. She had the good fortune to make the first capture of mackerel for the season. A few specimens were taken about 60 miles from the capes of the Chesapeake in gill-nets. A little later she was joined by Dr. Tarleton H. Bean, the ichthyologist of the U. S. Fish Commission, who continued on her during the cruise.

Every opportunity was improved to obtain knowledge of the presence and movements of mackerel and menhaden, either by making captures on board of the vessel or by communicating with the fishermen. Valuable service was rendered the fishermen on several occasions by informing them of the presence of schools of fish which had been discovered by the *Grampus*.

Collections of small crustacea which constitute the food of the mackerel were made. Young and immature fish were also obtained. Investigations were carried on to ascertain the presence, in the regions visited, of any of the *Gadidæ* or other valuable food species. Reference is made to the reports of the commanding officer, Dr. Bean, and Mr. Richard Rathbun (vol. VII, Bull. U. S. Fish Commission, pp. 217–267) for a full account of the results of the cruise.

B. INVESTIGATION CONCERNING THE MACKEREL, ETC., SUMMER OF 1887.

The *Grampus* arrived at Gloucester, Mass., on June 4, where I joined her six days later and resumed command. During the remainder of the month the vessel was refitted, repainted, and made ready for a summer cruise to the eastward. On July 2, we sailed from Gloucester on a trip to the Gulf of St. Lawrence, Newfoundland, and Labrador under the following orders from the Commissioner:

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., May 10, 1887.

SIR: As soon as you have finished the explorations in regard to the location and route of travel of the southern school of mackerel and have properly refitted, you will proceed northward with a view to examining the condition of that fish in waters of a higher latitude. You will visit the Gulf of St. Lawrence and the coast of Newfoundland, and especially the eastern coast, where it will be seen that there are important observations to be made of the movements of the mackerel and other fish.

You are authorized to take with you Mr. Lucas and Mr. Palmer as naturalists, and you will give these gentlemen opportunity of making collections of the birds and eggs of the region in question; and also, with their help, make special examinations of any convenient localities for remains of the great auk. These may be sought for on the Funk and Penguin Islands, and wherever else you think the search will return satisfactory results.

I do not think it necessary to obtain any special authority from the Newfoundland government for carrying on the work here suggested; but should you stop at St. John's I would recommend you to see Rev. Mr. Harvey, and ascertain his views in the matter.

Yours truly,

SPENCER F. BAIRD,
Commissioner.

Capt. J. W. COLLINS,
Commanding Schooner Grampus.

1. OBJECTS OF THE CRUISE.

(*a*) *Mackerel.*—The objects of the cruise were various. It was deemed most important to determine the presence or absence of mackerel in certain regions where in former years they had been reported in abundance. These reports usually emanated from trading vessels which had visited regions not frequented by the mackerel fishermen. Accounts often reach the fishermen of the occurrence of immense numbers of mackerel on the coast of Labrador and about Newfoundland.

One of the localities where mackerel had been reported abundant the previous year (1886) was the region between the Bird Rocks (off the Magdalen Islands) and St. Paul's Island.

But, almost without exception, this information has reached the fishermen too late in the season for them to profit by it. Besides, in most cases there was a certain indefiniteness about the reports which left the fishermen in considerable uncertainty as to the correctness of information received. Consequently a cruise could not be made to those regions by fishing vessels unless at considerable financial risk.

It was therefore deemed important that definite information should be obtained as to the correctness of these rumors and reports sufficiently early in the season to enable the fishermen to profit by the knowledge, if mackerel were found within the limit of the cruise planned for the *Grampus*. In case fish were discovered in abundance in any of the waters visited, it was planned that the vessel should immediately sail for the nearest port where telegraphic communication could be had with the United States, when all the information obtained would be sent to the Commissioner, who would give it to the public.

(*b*) *Crustaceans.*—In connection with this search for mackerel it was deemed important that investigations should be made as to the occurrence of minute crustacea and other small forms of marine life upon which the mackerel feeds; and also that observations of the temperature of sea and air should be made.

(*c*) *Halibut.*—The obtaining of halibut in their spawning season, and the bringing of them alive to the United States in order that their eggs may be obtained for the purpose of artificial propagation, have for some years engaged the attention of the U. S. Fish Commission. It was therefore deemed desirable to make the attempt to catch halibut on the return trip somewhere about Labrador or Newfoundland, and bring them to Wood's Holl alive in the vessel's well.

(*d*) *Cod-fishery.*—The condition of the cod-fishery on the coast of Newfoundland and southern Labrador was a matter that deserved some attention, though perhaps of somewhat less consequence to Americans than the investigations relating to mackerel and halibut.

(*e*) *Great auk.*—Besides these researches, which relate specifically to the fisheries, it was (as the orders show) decided that collections should be made of the sea-birds which prey upon fish or are used as bait and

food by fishermen. Also, that their present status in their breeding places should be noted. In connection with this it was considered very important that a collection should be made of the remains of the great auk (*Alca impennis*, a species now extinct), which formerly frequented the islands off the coast of Newfoundland and at one time served an important function in supplying food to the fishermen.

2. DETAIL OF NATURALISTS.

Mr. Frederic A. Lucas, osteologist of the U. S. National Museum, and Mr. William Palmer, modeler and taxidermist, were detailed to accompany the *Grampus* on her trip. Mr. Palmer joined the vessel on June 30, and Mr. Lucas reported on board the following day.

3. NARRATIVE OF THE CRUISE.*

We sailed from Gloucester on the afternoon of July 2, and had a fair and uneventful passage to Canso. When we arrived off Cape Canso, about noon of July 6, the weather was very foggy. We succeeded, however, in passing the numerous outlying ledges without difficulty and ran into Chedabucto Bay. Soon after passing Canso Islands the weather cleared, and remained fine until we anchored at Port Hawksbury, in the Strait of Canso, at 4.45 p. m.

At 9.30 a. m. on July 7 we got under way, and, after leaving Canso and passing Port Hood, Cape Breton, ran for the Magdalen Islands, where we arrived and anchored under Grindstone Island, in Pleasant Bay, shortly after 1 a. m. July 8. We lay at that anchorage waiting for the wind to moderate until 5.35 p. m. on the same day, when we got under way and ran to the eastward, anchoring at 8.50 p. m. northeast of Old Harry Head. During the day collections of birds were obtained by the naturalists and some unsuccessful attempts were made to collect fish.

At 6.50 a. m. on July 9 we got under way at Old Harry Head and ran to the eastward for the Bird Rocks, off which we anchored at 12.50 p. m. The wind in the mean time had died away to a calm. Immediately after anchoring the two naturalists and I (with two seamen to row the dory) started for the smaller of the two Bird Rocks, where we spent the most of the afternoon in obtaining collections of sea birds, eggs, nestlings, etc., returning on board shortly after 5 o'clock.

At the time we returned to the vessel M. Turbid, keeper of the lighthouse on the larger Bird Rock, came off with his assistant and later we went on shore with him. He kindly gave every assistance in his power

* On June 27, while making a short run out of Gloucester Harbor, in order to inspect the new sails which had just been put on the vessel, having on board Mr. E. L. Rowe, maker of the sails, the mate, Mr. D. E. Collins, was so unfortunate as to get his right hand badly jammed with the anchor. He was taken on shore and put under medical treatment, but his condition was such that he was not able to join the vessel and remained on shore during the cruise. The second mate, Mr. Charles H. Griffin, acted as mate during the trip.

in making collections of such birds as were not obtainable on the other rock and also presented us with a full series of eggs of birds that breed at the rocks, which he had secured a short time before our arrival.

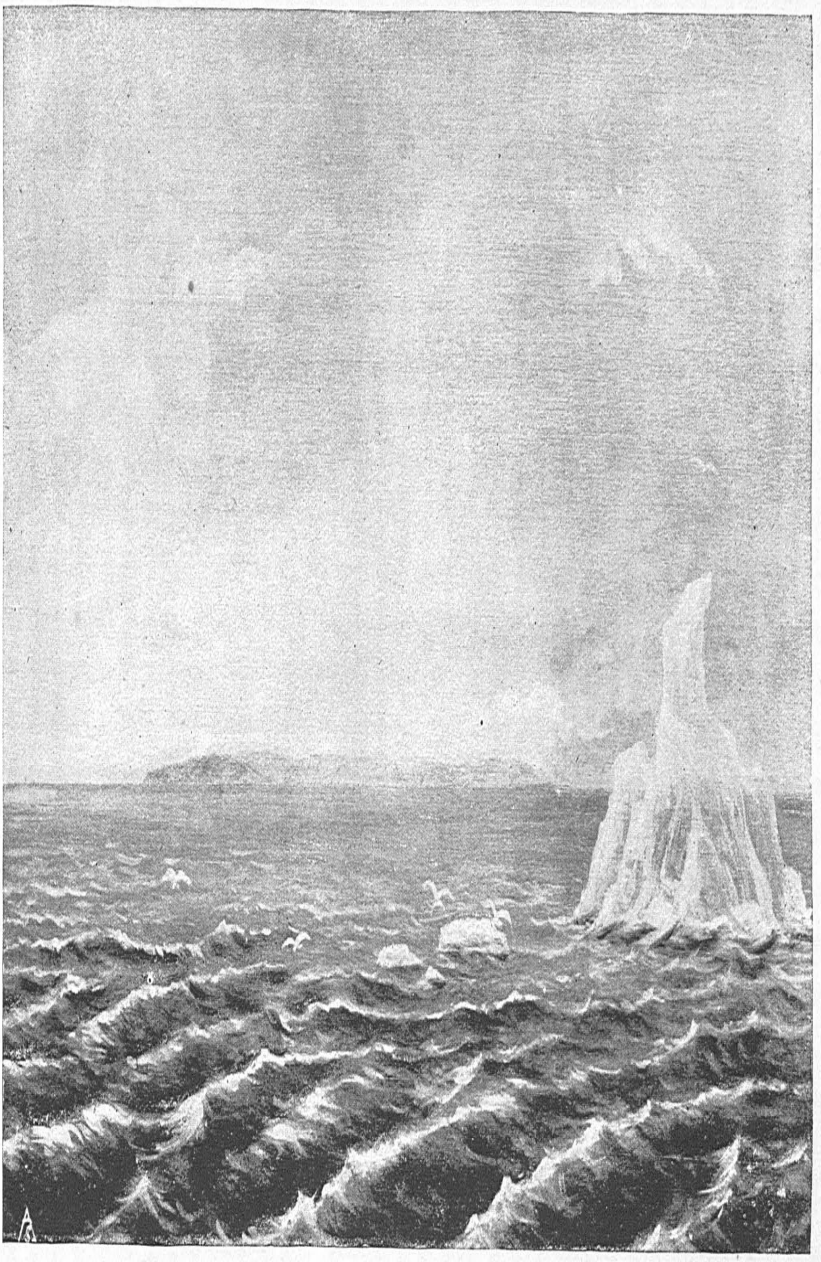
Trials were made during the afternoon and evening for mackerel, but without success.

There was little or no wind until next morning and we lay at our anchorage off the Bird Rocks until 6.30 a. m. on the 10th, when we got under way with a moderate southeast wind. It was proposed to make some trials for mackerel off the Magdalens and toward St. Paul's Island and then to go as direct as possible to St. John's, Newfoundland. The wind increased rapidly, however, and the sky became overcast and threatening. The course was therefore changed to west by north for Entry Island. At 11 a. m., when about 15 miles east by south from Entry Island, we hove to and threw toll-bait for mackerel and put out hand-lines for cod and halibut. Eleven cod, two rusty flounders, and one small halibut were caught. After making this trial we ran into Pleasant Bay, where we anchored at 4.30 p. m. off Amherst Harbor.

Shortly after anchoring, we were visited by the American consular agent, Mr. Leslie, and by two young American naturalists who were making collections of the fauna of the islands.

While at this place a few birds and other specimens of local fauna were collected by our party. On account of stormy weather we lay at our anchorage in Pleasant Bay until 8.30 a. m., on the 13th, when we got under way with a moderate breeze from the east-southeast; weather overcast and stormy looking. The wind, however, did not continue from that direction, and when we were about 4 miles south-southeast from Entry Island it died away nearly calm. At 2 p. m. we hove-to and tried to "raise" mackerel with toll-bait, and at the same time put out hand-lines for bottom fish. Five small cod and one halibut were caught on the lines, but, notwithstanding the fact that we threw toll-bait for upwards of an hour we were unsuccessful in finding any mackerel. A light wind sprung up at 5 p. m. from about northwest by west, but finally became steady from west. We steered a course to pass north of St. Paul's Island.

In the early part of the morning of the 14th there was a moderate breeze from south by east to south-southwest, with an overcast sky and rapidly falling barometer. About day-break the weather became very threatening and squally, with heavy rain showers, and continued so until near noon, when it cleared somewhat. Sighted the west end of St. Paul's Island bearing about west-southwest 8 miles distant. The wind veered suddenly to northwest about 7 a. m. and continued strong and fresh with a rough cross sea on starboard beam; the vessel making a course to clear St. Pierre. At 7.18 on the morning of the 15th St. Pierre bore northeast by north, about 15 miles, and at 7.45 p. m. Cape St. Mary was just in sight bearing northeast by north. The weather was pleasant and generally clear during the 15th, with a light



FUNK ISLAND BEARING N.N.E., FIVE MILES DISTANT. (See page [9].)

From a painting of A. Z. Shindler after sketch by J. W. Collins.

breeze from west around to south. Sea-birds were seen in abundance, and several humpback whales were noticed.*

At 4.23 p. m. set the vessel's signal numbers for the Cape Race light-house station, which we were then passing, but probably on account of the exchange of signals between that place and a steam-ship, ours were not understood, and when asked to repeat them we had gone too far to do so.

Passing Cape Race, we continued on our course for St. John's, encountering a dense fog at 7.40 p. m., when Renewse Head bore north-northwest 3½ miles distant. Towards midnight the weather cleared and we sighted Ferryland Head Light.

The wind continued moderate during the morning of the 17th, with a fog in the early part and clearing weather later. At 2 p. m. passed Cape Spear and at 3.18 anchored in St. John's Harbor. I called on the American consul shortly after anchoring.

In the afternoon, Capt. D. Baxter, who had been engaged as pilot for the Newfoundland coast, reported on board and informed me that he would not be able to start on the cruise until the 20th, since he needed two or three days to arrange his private affairs.

We laid at St. John's until the morning of the 21st, having been detained chiefly by bad weather. During our stay here the vessel was visited every day by the citizens of St. John's, who inspected her and expressed much admiration for the schooner, as well as decided approbation of the objects of the cruise. Collections of the local fauna were made, consisting of plants, birds, fish, etc.

At 10 a. m. on the 21st we got under way and beat out of the harbor, the wind at that time being from the eastward and blowing directly in. After getting clear of the harbor heads we ran up the coast with a stiff breeze from southwest by south. At 8.45 p. m. passed Cape Bonavista and steered for the Funk Islands. At 12.20 p. m. on the next day we ran close to the east end of Funk Island and sent Messrs. Lucas and Palmer on shore in a dory, provided with a full equipment of tent, stores, water, etc., for camping, and tools for digging. The vessel was then headed for a rocky shoal spot 1½ miles east-southeast from the island, where we anchored at 12.53 p. m. Shortly after anchoring I went on shore to assist the naturalists, being accompanied by Pilot Baxter and two seamen.

The group called Funk Islands (see plates II and III) consists of three islets, which are about 30 to 35 miles from Cape Freels. Two of these islets are simply low ledges a few feet above sea-level and washed by the waves when there is a heavy sea. These lie a short distance nearly north from the western end of the larger island of the group. The latter is about three-quarters of a mile in length and perhaps one-third of a mile wide. Its height is put down as 46 feet, but we thought it was higher. It is on the western end of the larger island, where alone

*See special notes for details concerning appearance of birds and whales, pages [35] [36].

there is any soil over the granite rocks and ledges (that elsewhere stand out in bleak nakedness), that the remains of the great auk were found in profusion, a few inches below the surface.

The collections made at this place embraced a large number of bones of the great auk, besides many birds, eggs, fledglings, plants, etc., and were extensive enough to fully satisfy the naturalists, since all or nearly all of the different things that could be obtained on the island were secured.

While the vessel was at anchor in the offing, trials were made with hand-lines for cod and other bottom fish, but with negative results only. We lay at anchor off the "Funks" until the afternoon of the day succeeding our arrival there.

After getting all the collections and collecting party on board, we got under way at 3.30 p. m., on the 23d, and passing Funk Islands our course was laid for the Penguin Islands, which lie northwesterly from Cape Freels. But, since the wind changed and increased considerably in force after we started, it was decided a little later to run for Seldom come-by Harbor, which it was believed we could reach before dark. The wind fell light, however, and drew dead ahead, so that, with an unfavorable current, we could not reach the harbor before nightfall. Therefore, at 10.15 p. m. we anchored 2½ miles southeast from Cann Island Light.

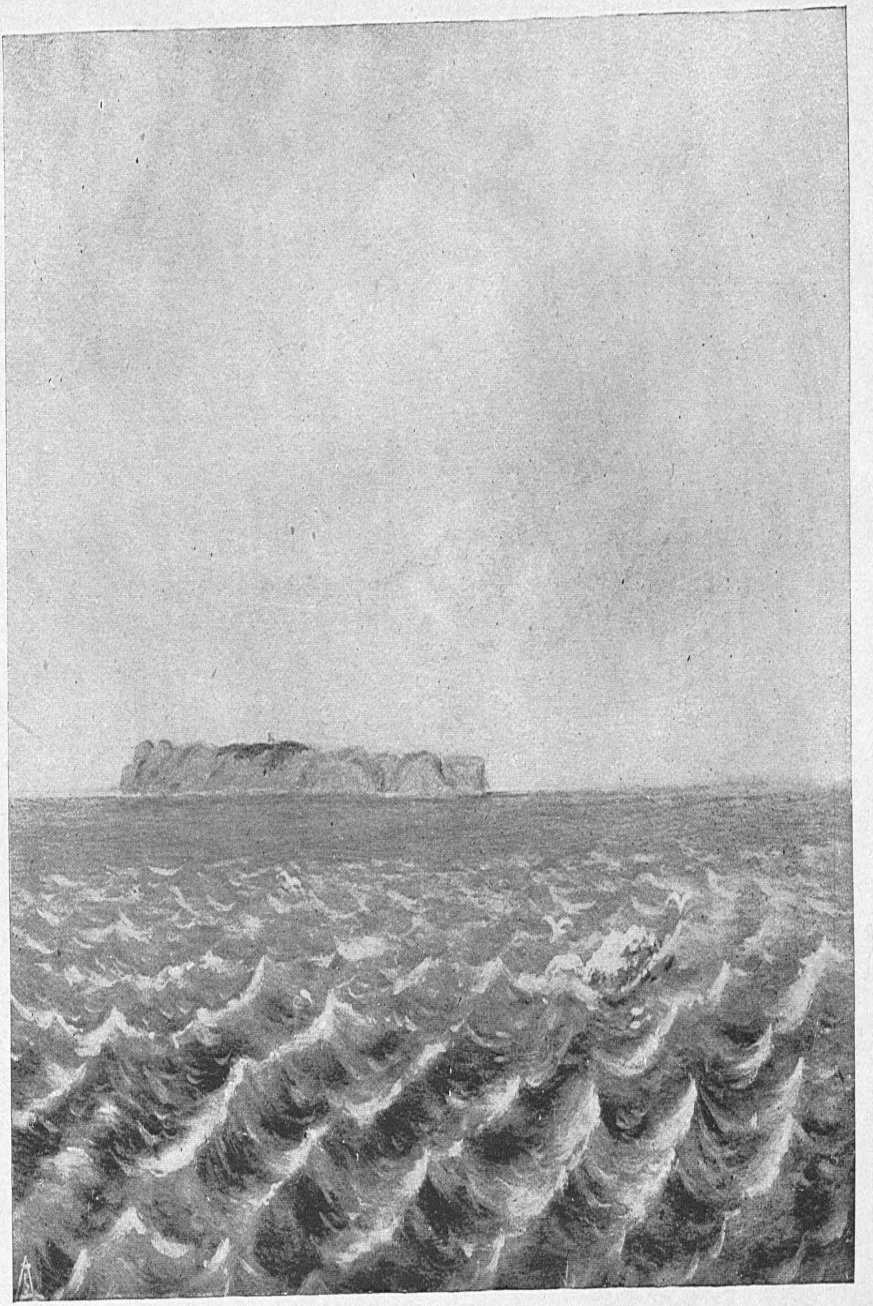
We got under way at 8.25 on the morning of the 24th and ran for the Penguin Islands, through the inner passage, by Copper and Gull Islands. We anchored off the north Penguin Island at 10.50 a. m., and sent a collecting party on shore. The collections made here consisted of small land birds, sand-pipers, petrels, field mice, etc. Excavations were made with the hope of finding remains of the great auk, but nothing was obtained to indicate that it had ever inhabited this island.*

The party soon returned on board and at 2 p. m. we got under way and, passing between Coleman's and Small Islands, beat up to Little Seldom come-by Harbor, anchoring there at 8 p. m.

The next morning Mr. Lucas and I started on an expedition to a small pond about 1½ miles from the harbor, where we were informed it was possible to obtain specimens of trout, gulls, ducks, etc. Seaman Osier accompanied us and assisted in carrying the outfit. After scrambling over rough rocky hills and struggling through a mass of burned and fallen timber we found the pond. Trout were abundant, but, contrary to our expectations, no birds could be obtained; the gulls seen were exceedingly shy and did not venture within gun shot. A limited collection of small land birds was made.

The weather on the 26th was generally clear and fairly pleasant, with a west-northwest wind, which changed to north, veered to the southeast, and finally became steady from the eastward. We got under way

* The name of these islands suggested the possibility that they had formerly been frequented by the great auk, known here as the "pin-win," a corruption of Penguin.



FUNK ISLAND BEARING W.N.W., ONE AND A HALF MILES DISTANT. (See page [9].)

From painting of A. Z. Shindler after sketch by J. W. Collins.

at 8.25 a. m. and started for Toulinguet, going through Stag Harbor Run. We took in tow the boat of the keeper of the light-house at Cann Island, who was going to Fogo. The passage through Stag Harbor Run was made without difficulty, after which we beat up between Fogo and Change Islands until we could lay our course to windward of the latter. Anchored at Toulinguet at 3.50 p. m. The object of visiting this place, which is the largest town on the northeast coast of Newfoundland, was to make inquiries concerning the appearance of mackerel at White Bay and elsewhere along the northeastern coast and to get information which it was important to have concerning other fishery matters in this section.

In the evening we visited the mail-steamer *Plover*, which had just arrived from Labrador, and made inquiries of her captain concerning the abundance of cod, mackerel, etc., at the points he had recently visited. I learned that all the fisheries of Labrador and northeastern Newfoundland had been so utterly unremunerative up to that date that it was feared the fishermen might meet with absolute failure for the entire season.

During our stay at this place many visitors came on board. Information was telegraphed to the Acting Commissioner of our arrival and intended departure the next day. It was, however, impracticable to get away on the 27th as planned, since a calm prevailed during the entire day. Attempts were made to collect specimens of local fauna, but with little or no success.

The wind on the following morning was a gentle southwest to south by west breeze, increasing to a stiff breeze and then decreasing. We filled away and ran out of Toulinguet Harbor at 4.05 in the morning, steering a course to clear Cape St. John's, which point we passed at 11.45 a. m., going between the cape and Gull Island. We then steered for Partridge Point. The wind was light in the afternoon, and at 4 o'clock, when off Bay Verte, we hove-to and threw toll-bait for mackerel; also put out cod hand-lines for bottom fish, but were unsuccessful. While making this trial for fish the trading schooner *Phœnix*, of Toulinguet, was seen standing off-shore towards us. Messrs. Baxter and Lucas boarded her, and learned that no mackerel had been seen in White Bay during the summer.

The news of the absence of mackerel at White Bay caused a change in my plans, and instead of going to Fleur de Lis Harbor, it was determined to run for Canada Bay, where we had been informed mackerel are sometimes seen, and where also it was thought information concerning the cod-fishery might be obtained.

Failing to catch mackerel or cod, we got under way again at 5 p. m., but in less than two hours afterwards the wind fell away to a calm, and light baffling winds and calms continued during the night. All of the morning and early afternoon of the 29th there were light, unsteady cat's-paws and calms, with fog. There were occasional partially clear

intervals, in which the land could be seen, but it was not until 3.15 p. m. that we were able to reach Grevigreux Harbor, where we anchored, the wind dying away to a calm and a dense fog shutting in soon after our arrival.

On account of light winds and heavy fog it was not practicable to leave Grevigreux until August 3rd. During this stay numerous expeditions were made inland, as well as to points in the bay, where attempts were made to capture porpoises and to collect other objects which were considered of interest and value. On the morning of the 30th of July a party, consisting of Pilot Baxter, the two naturalists and one seaman, visited Torrent Cascade, or "Hell's Mouth," as it is locally called, on the opposite side of Canada Bay. The expedition returned at 5.20 in the afternoon, having secured specimens of fish, etc. Several attempts were made to capture porpoises, but they were so shy it was impossible to approach them within gunshot.

On August 2d Messrs. Baxter, Palmer, and one seaman went to Otter Cove and Cloud Hills to make collections. They returned in the evening, having secured two ptarmigan and some smaller land birds, among which were two species not previously obtained. The ptarmigan were especially valuable, since they were the *Lagopus welchii*, and were in their summer plumage, in which this species had not previously been taken by naturalists.

The morning of the 3d was fine and clear, with a light and somewhat unsteady breeze from the southward; the weather continued fine throughout the day, later with the wind southwest by south to southwest, increasing from a light to a moderate breeze. At 8.30 a. m. we left Grevigreux Harbor and ran out of Canada Bay. After we were well past Englee Island we ran up the coast toward the Strait of Belle Isle. At sunset the White Islands were in plain sight, and at 9.24 p. m. we passed them; at 10.15 p. m. we passed Cape Bauld and hauled-to for Cape Norman in the Strait.

At 1.15 a. m., on the 4th, when Cape Norman bore west one-half south, about 2½ miles distant, we hove-to on the port tack with head sails to windward. The object of stopping at this place was to make inquiries of the boat fishermen concerning the occurrence in the vicinity of mackerel and other species of food-fish. Soon after daylight we filled away and stood toward Cape Norman, but hove-to for a few minutes to obtain a supply of ice from fragments of bergs which were drifting near by.

Under the lee of Cape Norman we saw a large fleet of fishing boats at anchor. After we arrived in their vicinity, Pilot Baxter was sent in a dory to make inquiries concerning the fisheries. One of the boats came alongside, however, and her crew of two men reported that they belonged to the schooner *Edward Rich*, of Catalina, Newfoundland. From their statements we learned that the schooner had been at Cape Norman, or near there, since June 25, where she had been engaged in

fishing for cod and herring. These men stayed on board ten or fifteen minutes, and as soon as they departed we filled away to beat through the Strait.

At 8 a. m. the yacht *Sapper*, of Bay of Islands, Newfoundland, passed across our stern, running "winged out" to the eastward. She saluted us by setting the Episcopal Church pennant, the Episcopal bishop of Newfoundland being then on board of her making his annual visit to the churches in his diocese. The salute was returned.

About noon the wind increased to a fresh and strong breeze from west by south to west-southwest, and there were indications of more wind. The tide also began to set to the eastward, making it difficult to beat through the strait against the sharp choppy sea that was running. Therefore we went into Black Bay for shelter, anchoring at the head of the bay at 1.50 p. m. The schooner *Terror*, of Shelbourne, Nova Scotia, lay at anchor there, being engaged in trading on the coast.

Later the wind increased to a strong westerly gale, with heavy squalls and thick weather. The weather remained unfavorable, and detained us in Black Bay until August 8th. On the 5th I went on board of the *Terror*. Capt. J. W. Pitts, who was in command of her, and who had been cruising along the coast from Mingan to Fox Bay, on the Labrador coast, gave me considerable information concerning the abundance or absence of fish in the localities which he had visited.

On the morning of the 5th a party of four went on shore on a collecting expedition. Little success was met with in shooting, only two sand-pipers being bagged in a tramp of several miles. A large collection of plants, among which were numerous species of mosses, was obtained.

Mr. Lucas was very successful in catching trout in a brook which flows into the river that empties into Black Bay. Near the mouth of the brook, which is about 2 miles from the mouth of the river, the fish were small, but farther up the stream, near the rapid, fine trout were abundant. He caught a total of 36 pounds, and two of the largest had a combined weight of 4¾ pounds.

In the early morning of the 8th there was a light northeast wind, which increased to a moderate gale later on, with heavy squalls off the land. At 4.40 a. m. we got under way, under lower sails, and ran out of the Strait. Soon after starting we double-reefed the mainsail and furled it, and ran under whole foresail, jib, and forestay-sail for about two hours, when we set reefed mainsail. At 6.45 a. m. passed Amour Point. Half an hour later the wind came off the land in a squall, blowing heavy; lowered and furled the foresail and jib. The weather became somewhat settled later, and at 9 a. m. we set foresail and jib, and hoisted the flying jib in the afternoon. Little Mecattina Island bore north at 5.30 p. m., when the wind moderated very suddenly from a fresh to quite a light breeze from east by north. Shook reef out of mainsail and set the light sails. Later the wind backed around to the northwest, blowing a gentle breeze.

On the 9th the weather was fine, with some cloudiness and indications of rain, with a gentle to moderate breeze varying from northwest to south-southwest, and brief periods of calms. Between 5.30 and 6.15 a. m. tried for cod with hand-lines baited with fresh capelin; no fish were taken.

At 6.30 a. m. put out ship's dredge in 51 fathoms on the western edge of Natasquan Bank. Little of interest or value was taken in the dredge. The small surface towing net was used several times during the day, but nothing was taken in it.

During the 10th the wind varied from west by north to northwest by west, blowing a moderate breeze in the early part, baffling and unsteady in force, with calms, for the rest of the day. The weather was pleasant but hazy, with a strong mirage in the afternoon which distorted the appearance of the land very much.

Phalaropes were abundant and two were shot in the afternoon. The surface net was towed on several occasions, but nothing was taken in it.

At 3.30 p. m. spoke with a fishing-boat, which was running in for harbor, off Esquimaux Island. We came to anchor shortly before 8 p. m. in 27 fathoms, off the western end of Large Island of the Mingan group, which bore north one-half east, about 4 miles distant. I had wished to reach the Parroquets, of the Mingan group, before anchoring, but as the wind died away to nearly a calm and the tide was making to the eastward, it was decided to anchor and wait for an increase of wind or a change of tide. After anchoring we put out hand-lines baited with capelin, and caught one small codfish.

At 4.15 a. m. on the 11th we got under way with a stiff east-southeast breeze, the weather at the time having a threatening appearance. We ran for Mingan Island, which we left on the port, and stood in for a fishing station on the mainland opposite the island, where we anchored at 5.48 a. m., in twenty fathoms of water, about two-thirds of a mile from shore. The object in anchoring there was to make inquiries concerning the occurrence of halibut in the vicinity of Mingan Island, and also to obtain some information about the gray seal (*Halichœrus grypus*) that frequents this region and which we wished to get specimens of.

Immediately after we anchored two men came off from the shore in a boat and boarded us. One of these gave us much information concerning the seals, halibut, and topography of the region. The latter information was very important, since I had no charts on board of that locality on a scale sufficiently large to be useful.

It was determined to make an effort to obtain some seals that day, since the weather was not suitable for fishing. Therefore, at 7.15 a. m., we got under way and ran over for Mingan Island, where we anchored half an hour later in 25 fathoms, the center of the island bearing southeast about one-half mile distant. Immediately after anchoring, I went on shore, accompanied by Messrs. Lucas and Palmer, with two seamen to look after the boat. Rifles and guns were carried so

that we might be prepared for either small or large game. Seals were seen hauled out on the lee side of the island, but all attempts to secure them failed, owing to their extreme timidity and alertness. Better success was met with in securing specimens of birds.

The threatening condition of the weather made it somewhat risky to remain long on the island, and I determined to beat down to Mingan Harbor before the flood tide made. It was, therefore, arranged that our party, which separated on landing, should assemble at the boat about two hours later to go on board.

A little after 10 a. m., however, the Canadian cruiser *La Canadienne*, which came from the westward, anchored near the *Grampus*, lowered a boat and went on board our vessel. As soon as our party got together we returned on board, where I found Commander William Wakeham, inspector of fisheries for the province of Quebec, who was in command of the cruiser. In conversation with the mate he had learned that we had no suitable charts of Mingan, and he had very courteously sent his boat back to the cruiser for some sheet charts of the region, which he presented to me. He also generously offered to send on board a pilot, or to render any other assistance which was needed. The charts he had furnished were so detailed that I felt safe in going by them without the assistance of a pilot. The *La Canadienne* got under way a little before we did, but steamed along slowly, apparently waiting for us to start. We filled away at 11.30 a. m., under all lower sails and maingaff-topsail, and less than an hour later tacked off the western entrance of Mingan Harbor, and began beating against the flood tide which was running fully 3 knots in the narrows. Shortly after 1 p. m. we anchored in 9 fathoms off the Hudson Bay Company's buildings. About an hour later a collecting party was sent on shore.

On the 12th the weather was thick, with fog and rain, and a moderate breeze from east-southeast to south-southeast. Messrs. Lucas and Palmer and two seamen were on shore collecting most of the day, but aside from botanical specimens little of value was obtained.

In the afternoon Commander Wakeham introduced Mr. Dugay, the Canadian fishery agent at Mingan Harbor, and instructed him to assist us in any way in his power, and particularly to aid in any effort we might make to secure specimens of trout or salmon for our collection.* This was especially important to us, since the river fisheries in this region are leased by the Government to private parties, who will allow no one to fish in them without permission.

Two Indians, who were accustomed to hunting seals, were engaged to go with us as soon as the weather permitted us to visit the western islands of the group, where the haunts of the gray seal are situated.

On the 13th the weather cleared up, and the wind, which was from

* It may be explained that the obtainment of specimens of trout from the regions visited by us was considered important, since they were needed for study by the Commission.

the eastward in the early part of the day, changed to north and northwest later. The *La Canadienne* got under way at 4.30 a. m., and steamed out of the harbor to continue her cruise. Although the weather was clear and fine, and the wind reasonably moderate throughout the day, there was a heavy surf rolling in on the shores. It was the opinion of all familiar with the habits of seals that none would haul out until the sea got smooth, and for that reason it was not advisable for us to leave the harbor to seek them.

Mr. Lucas went up the river after trout, but, although fish were abundant, none could be taken because the recent rains had caused a considerable rise in the river and the water was too muddy for the fish to see the bait or a fly. Messrs. Palmer and Baxter and one seaman went across to the Inner Birch Island on a collecting trip. They returned about 8 p. m., having met with only indifferent success. I made a collecting trip to Harbor Island, but got only two pigeon hawks.

We lay in the harbor all day on the 14th, and nothing of especial moment occurred outside of an unsuccessful attempt to capture a pike whale (*Balœnoptera*) that came near the vessel.

On the 15th the conditions were favorable for seal hunting. As soon as practicable the Indians who were to accompany us were brought on board. They took with them their bark canoe, guns, and seal-skin jackets for disguise. At 8.25 a. m. we got under way with a northwesterly wind and beat down for the Parroquet Islands. When a little to the westward of Mingan Island we hove-to for a short time, the wind being fresh with a choppy sea getting up. It was finally decided to anchor to the leeward of Mingan Island, which we did at 11.45 a. m., in 30 fathoms of water. About a half-mile to the southward of us a herd of seals was seen hauled out on a long, rocky point. An unsuccessful attempt was made to shoot some of the seals during the afternoon.

While the party was on shore hunting seals, toll-bait was thrown for mackerel, but without successful result. An attempt was made to catch squid during the night watches, as on previous nights, but none were taken.

We lay at Mingan Island during the night, and before daylight on the morning of the 16th a party went on shore hunting seals, but failed to accomplish anything. Another attempt was made to "raise" mackerel in the early morning with the same result as on the previous day.

At 8.40 a. m. we got under way and beat over to the Parroquets. When to the westward of Mingan Island Messrs. Palmer and Baxter, with one seaman, left the vessel in a dory and landed on the island to hunt for birds. Later we anchored in 34 fathoms northwest from Eastern Dry Reef, about one-fourth of a mile distant. Seals were seen in abundance swimming around the reef, but owing to the tide being flood, and therefore deemed unfavorable by the Indians, an attempt to shoot seals was deferred until the middle of the afternoon. The animals, however, were so excessively shy that all efforts to secure one failed.

The weather was threatening the latter part of the afternoon, with a low barometer. We therefore got under way at 6.40 p. m. to run for Mingan Harbor, and less than a half hour later picked up the dory with Palmer and Baxter. There was a brisk breeze when we started, but when we were about a mile distant from the entrance to Mingan Harbor the wind suddenly fell away to a calm, so that we were compelled to anchor and lay there for the night.

On the following day the weather was threatening and rainy. We got under way at 6 a. m., and ran into Mingan Harbor, where we were detained by unfavorable weather until the 20th.

Collecting parties went out every day, and repeated attempts were also made to obtain enough bait to enable us to set our trawl-lines for halibut. There were, however, practically no squid at Mingan, and capelin, which had been abundant before our arrival, were exceedingly scarce and difficult to catch. The surf on the beach, resulting from fresh winds, made it specially difficult to catch capelin, which otherwise might have been taken in small quantities. By hard work we succeeded in getting enough to bait 1,000 halibut hooks on the afternoon of the 18th, on which occasion the gear was put in order to set as soon as the weather permitted us to leave the harbor.

We got under way at 4.25 a. m., on the 20th, with a gentle breeze from the west-northwest, and started for the halibut grounds outside of the group of islands. The wind increased very rapidly, however, and by the time we reached the fishing-grounds it blew fresh, with a choppy and rough sea; the swift current caused the water to break and tumble in heavy rips that were dangerous for small boats to go into. When we stood out of the passage-way between Birch and Mingan Islands, finding it too rough to attempt trawl-line fishing, we hove-to for awhile on the port tack waiting to see if the wind and sea would moderate. There were no indications, however, that there would be any decrease in the wind, and since our bait was already in a poor condition and it would be unfit for use on the following day, I concluded to abandon the idea of setting the trawl-lines for halibut, more especially as there was small probability of getting another supply of bait. It was therefore determined to run to Percé, where it had been decided to make a brief stop. Accordingly we stood across for Anticosti Island. We had rather a hard beat against a strong wind and choppy sea, but at 3.18 p. m. we passed the western point of Anticosti and steered for Cape Rosier.

A little before 7 a. m. on the 21st we hove-to and tried for mackerel in a depth of 50 fathoms, Cape Gaspé bearing north and Bonaventura Island west-northwest. Cod hand-lines baited with capelin were put out; no fish were caught. After lying-to for an hour we kept off for Bonaventura Island. We arrived off the southeast end of the island at 9.15 a. m., and lay to with head-sails to windward, while Messrs. Palmer and Lucas, with two seamen, left the vessel in a dory to investigate

the bird rookeries on the cliffs at Bonaventura. The party returned on board a little before noon, and soon after we filled away and stood into Percé Harbor, where we anchored at 1 p. m., to the eastward of Percé Rock.

We lay at Percé until the next noon. In the meantime collections were made of birds, etc., and considerable information was obtained concerning the local fisheries and the occurrence of mackerel.

Leaving Percé Harbor about noon on the 22d, we steered straight for East Point, Prince Edward Island, where we arrived early in the afternoon of the following day. Off East Point we saw a fleet of upwards of thirty sail of American mackerel schooners. The first of these we met was the schooner *Matthew M. Murray*, of Gloucester, Mass. She was about 7 or 8 miles northwesterly from the point. As we approached she steered to intercept us, seeing which we hove-to with jibs to windward. We spoke with the captain, who was anxious to learn the news concerning mackerel along the "north shore" and in the other regions we had visited. At the time we spoke to the *Murray* another schooner was noticed standing down the island, inshore of us, with all light sails set, and evidently trying to intercept us. We therefore kept off to meet the schooner, and as soon as we did so she began shortening sail and soon after hove-to. As we approached a dory was seen pulling to meet us. We therefore hove-to, at 12.44 p. m., for the boat to come alongside. She contained Capt. Loring Nauss and two of the crew of the schooner *Moro Castle*, of Gloucester. He had recognized the *Grampus*, and was very anxious to learn what information we had obtained about mackerel on our cruise. Captain Nauss remained on board nearly half an hour, and from him I learned much concerning the mackerel fishery by American vessels in the Gulf and of the catch by boats belonging at Prince Edward Island. As soon as he left we kept off to run past East Point. Several of the mackerel fleet intercepted and spoke with us to learn what news we had to tell them. Among these were the following schooners: *A. M. Burnham*, *Governor Butler*, *Nellie E. Davis*, *Maud M. Story*, *Howard Holbrook*, of Gloucester, and *Lucy Jenkins*, of Wellfleet. All of these were furnished with such information as we had to impart.

We passed Henry Island, off Port Hood, at 6 p. m., after which the wind gradually grew light until it was almost a calm. Shortly after 9 p. m. we anchored off Cape Jack Light at the northern entrance of the Strait of Canso, the tide having turned to the northward and there not being wind enough to make any way against it.

We lay at anchor until 4.25 on the following morning (24th), when we got under way with a light breeze and beat through the Strait, anchoring at Port Hawksbury (at 7 a. m.) where we stopped to get our mail, fill water, and purchase some necessary supplies.

Here I saw an account in a Boston newspaper of the death of the late U. S. Commissioner of Fish and Fisheries, Prof. Spencer F. Baird. The flag was set at half-mast.

During the forenoon I met Commander Wakeham, of the *La Canadienne*, and Lieutenant Gordon, R. N., commanding the Canadian steam cruiser *Acadia*, and a little later both gentlemen came on board to visit the *Grampus*.

At 4 p. m. the yacht *Ruth*, of New York, homeward bound from a cruise in the Gulf of St. Lawrence, anchored near us. Soon after we got under way and beat to the southward through the Strait, the tide at this time being favorable. Toward sunset the wind decreased and the sky had a threatening appearance, which indicated a storm. Therefore, as the wind was ahead, we anchored at 7.15 p. m. under Eddy Point near the light-house, and laid there for the night. The schooner *Pioneer*, of Gloucester, which was also homeward bound, anchored near us and two of her crew came on board.

On the morning of the 25th the wind was fresh from east-southeast with thick rain and indications of a heavy gale.* At 5.15 a. m. got under way and ran to Port Hawksbury, where we anchored at 7 a. m.

In the harbor lay several American mackerel seiners which had come there for shelter. During the forenoon Captain Whitman, of the schooner *Gracie C. Young*, of Rockland, Me., came on board to learn the news about mackerel in northern waters.

The weather remained unfavorable until the 27th, when we got under way at 6.45 a. m. and ran across to Canso Harbor, where we anchored at 9.30 a. m. In the harbor was a fleet of forty or fifty fishing vessels, among them many American mackerel schooners bound home. The sea resulting from the recent gale was excessively heavy along the coast and broke with tremendous force on the ledges outside of Canso Harbor. This kept the fleet from leaving, though the wind was fresh from west-northwest. In the afternoon the wind veered to the northwest, still blowing a fresh breeze. We got under way at 12.45 p. m., and ran out of the harbor, passing Roaring Bull Ledge at 1.40 p. m. Outside, the sea was high and steep, causing the vessel to pitch somewhat heavily as she headed directly into it. Several of the fishing schooners left about the same time, and the yacht *Ruth* started a little later. Before we reached the vicinity of White Head we ran out of the northwest wind and into a light unsteady breeze from southwest to west-southwest.

The passage home was uneventful. We arrived at Wood's Holl at 7.14 p. m. on September 1, and anchored off the Fish Commission wharf for the night. On the following day the vessel was moored alongside the wharf and the collections were taken on shore and packed for shipment. I telegraphed Mate D. E. Collins, who was at Gloucester, to join the vessel, which he did that evening.

On September 3 I went to Gloucester, where I remained until the 7th.

* During the day a heavy hurricane occurred off the southern coast of Nova Scotia, but, while it blew strong in the Strait of Canso, the wind did not reach hurricane velocity.

While there I met many owners of fishing vessels, who were desirous of learning the facts concerning the fishery investigations made by the *Grampus*, and were also anxious to obtain my opinion as to whether mackerel were most likely to be abundant in the Gulf of St. Lawrence or off the New England coast.*

On September 9 Pilot Baxter, who had been engaged only to make the trip with us, was discharged and left the vessel. The *Grampus* lay at Wood's Holl until September 14, when we left for Gloucester to clean and paint the vessel and make some necessary repairs. We got under way at 4.22 p. m., with a light northwesterly breeze; when off East Chop the wind was very light with the ebb-tide just beginning to run from the eastward; we went into Vineyard Haven and anchored for the night. Got under way at 5 a. m. on the 15th, with a light northwest by north breeze, but on account of the continuous light baffling winds, we did not reach Gloucester until the next day, where we anchored at 8.18 a. m.

4. COURTESIES RECEIVED.

It is proper that due acknowledgment should be made for numerous courtesies received from both official and private sources, which materially aided the successful issue of the expedition and evidenced the kindly interest of those concerned in the success of the investigation.

Foremost amongst these should be mentioned the action of the Dominion Government. By order of His Excellency, the Governor-General of the Dominion, a circular letter was sent to customs and fishery officials at Dominion ports which the *Grampus* might visit, and a copy of the document was transmitted to the Commissioner.

The courtesy thus extended by the Dominion Government was important, since it dispensed with the necessity of reporting at custom-houses on entering and leaving port, and also relieved the vessel from the payment of customary harbor dues. Following is the letter:

Ottawa, June 22, 1887.

To Collectors and Officers of Customs
and Fishery Officers of the Dominion:

GENTLEMEN: You are hereby advised that Capt. J. W. Collins, of the United States Fishery Commission schooner *Grampus*, is about proceeding to Labrador on a scientific mission for his Government, and by order of His Excellency, the Governor-General in council, the vessel named is to be relieved from the observance of any of the usual customs requirements in the direction of reporting inwards or clearing outwards or the payment of any fees ordinarily collected from foreign vessels when calling at Canadian ports.

* For further details concerning this, see notes on food of mackerel, pages [29] [30].

It is the desire of the ministers of customs and marine and fisheries that you shall individually extend to Captain Collins all the information and assistance in your power and in every way facilitate the accomplishment of the mission in your locality.

We have the honor to be, gentlemen,

J. JOHNSON,
Commissioner of Customs.
JOHN TILTON,
Deputy Minister of Fisheries.

Special acknowledgements are due Rev. M. Harvey, of St. John's, Newfoundland, for courtesies and assistance extended to the officers and naturalists on the *Grampus*. His kindly aid and intelligent interest in the attempt to secure a collection of the remains of the great auk contributed materially to the successful issue of that important undertaking.

The American consul at St. John's, Mr. Thomas N. Molloy, gave information concerning the Funk Islands and the condition of the fisheries about Newfoundland.

At St. John's it was necessary for us to refill our water-tanks, and to do this the vessel had to be taken alongside of a wharf. The water is supplied by the city and is charged for at a stated price. The city authorities, however, very generously remitted the customary charge, and allowed us to take all the water we needed free of cost. Messrs. Job Brothers & Co. kindly permitted us to haul into their wharf to fill the water-tanks, and also sent their steam-launch to tow the *Grampus* to the dock.

A Mr. Emerson, who has some ponds filled with trout in the suburbs of St. John's, permitted our naturalists to take as many specimens as they desired to obtain.

I am indebted to Capt. J. W. Pitts, of the schooner *Terror*, of Shelbourne, N. S., whom we met at Black Bay on August 5th, for information concerning the fish and fisheries along that part of the coast which he had visited, and also for the following letter of introduction to the collector of customs at Esquimaux Point, that he gave me, but which circumstances prevented me from using:

Pinivare, August 6, 1887.

DEAR SIR: My friend, Capt. J. W. Collins, intends visiting Esquimaux Point and Mingan in aid of scientific discovery. You will please give him all the information you can. Also give the Captain an introduction to the agent at Mingan.

By doing so you will confer a favor on,

Yours, etc.,

JOHN W. PITTS.

D. B. MCGEE, Esq.,
Collector of Customs, Esquimaux Point.

M. Turbid, the light-keeper at the Bird Rocks, assisted us very materially in obtaining collections of birds. He also gave us a full series of eggs of all the species that breed there.

Acknowledgements are due Commander William Wakeham, commanding the Canadian cruiser *La Canadienne*, for presenting me with sheet charts of the region about Mingan, a matter of much importance, since our charts were on a scale too small to show the local dangers, and navigating with them as my only guide was extremely hazardous. He also assisted us in other ways, and to his interest and courteous treatment much of the success we had at Mingan is due.

Messrs. H. W. Embree & Sons, boat-builders at Port Hawksbury, C. B., kindly gave me the lines and detailed plans of a "Canso boat" built by them in 1883, and exhibited at the International Fisheries Exhibition at London. This courtesy was specially appreciated, since the plans were valuable for illustrating this type of fishing boat, which has been described in a work on fishing vessels of the world, prepared by the writer, that is now in manuscript form.

5. COLLECTIONS.

Reference is made to the reports published under the auspices of the National Museum for a detailed account of the collections secured other than the fishes and invertebrates. The results of the observations made, and which have been embodied in the reports referred to, must prove valuable contributions to the knowledge of the subjects discussed. The fishes obtained on the cruise have been identified by Dr. Tarleton H. Bean, ichthyologist of the Commission.

The marine invertebrates—chiefly forms upon which the mackerel feeds—have not yet been identified. It is, therefore, not practicable to speak definitely of the species collected. I believe it will be sufficient, however, for the purposes of this report, to show in a general way the relative abundance, in the different localities visited, of those forms which constitute the favorite food of the mackerel.

The collections of land birds, insects, botanical and geological specimens, etc., were obtained incidentally, as opportunity offered, and in several instances were of exceptional importance. Among those specially noteworthy were the rock ptarmigans (male and female), elsewhere mentioned, and some rare and new species of ferns and mosses. A complete collection, made at Funk Island, of insects, plants, geological specimens, etc., can not but prove valuable additions to our knowledge of this interesting spot.

But, considered from the stand-point of the fisheries, the collections of various species of sea-birds that prey upon fish or serve as food or bait for the fishermen were most valuable. The observations made upon the present condition of the rookeries that were examined may, however, fairly be considered even more important than the specimens obtained, since they furnish information upon which may be based

opinions as to the extermination, or otherwise, of certain species which have special relations to the prosperity of the fisheries.

Aside from the interest that may be felt by the naturalist in preventing the extinction of races of sea-birds, zoologically important and interesting, the matter of preserving their breeding-places from destruction is one of no small moment to the fisherman.

It is a well-known fact that for many years cod-fishermen upon the great ocean banks depended to a considerable extent upon birds for a bait supply. Among those thus utilized were gulls, terns, and other species that breed on the northern coasts.

It is not, perhaps, so well understood that fishermen often are benefited by that instinct that sea-birds possess in a high degree, and which enables them to quickly detect the presence of such fish as they prey upon. The writer is familiar with the fact that fishermen are careful observers of the movements of birds. The mackerel fisherman keenly watches the actions of the gannet; notes its success when diving; draws conclusions from the gathering flock as to the abundance of fish, and is governed accordingly. Many a good catch of mackerel has been due to information of the presence of large schools of that species thus imparted to the fisherman.

The little "sea-goose" (*Phalaropus*) is also an object of interest to the fisherman, who, though he may not have inquired why, has learned that large flocks of this genus appearing on the fishing-ground may be considered a "good sign" of the presence of mackerel. The "sign" is due to the fact that the phalarope, which feeds largely upon copepods and other small forms of marine life that constitute the favorite food of mackerel, is liable to be where there is an abundance to eat, hence the connection between the presence of birds and fish.

No fisher-lad is too young not to have learned the meaning of unusual noisy activity among sea-gulls and terns. There is no surer indication of the approach to the coast of the long-watched-for schools of capelin, herring, or mackerel, the van-guards of which are thus heralded by winged attendants.

Sea-birds are often a source of food supply to the fishermen. This was formerly much more frequently the case than now, for the wanton destruction of both birds and eggs has materially reduced the production of the most important rookeries.

No bird, perhaps no animal, held a more important relation in this respect to the early American fisheries than the great auk. Indiscriminately slaughtered by thousands, it made an important addition to the fisherman's larder, until at last it yielded to the rapacious and destructive agencies it was not fitted to withstand, and a most interesting species was totally wiped out of existence.

All that remains to-day in America of a once immensely abundant gigantic sea fowl is its burial-ground, and a few specimens of its eggs and mounted skins that naturalists obtained before its annihilation.

But so suddenly, so unexpectedly, and so thoroughly was it obliterated that in all the museums of the United States there was only one skeleton—more properly a dried mummified specimen—of *Alca impennis*. And with few exceptions the museums of Europe, as well as those of this country, were without any osteological remains of the species. A few bones dug from shell heaps, or accidentally found in out-of-the-way places were considered valuable prizes.

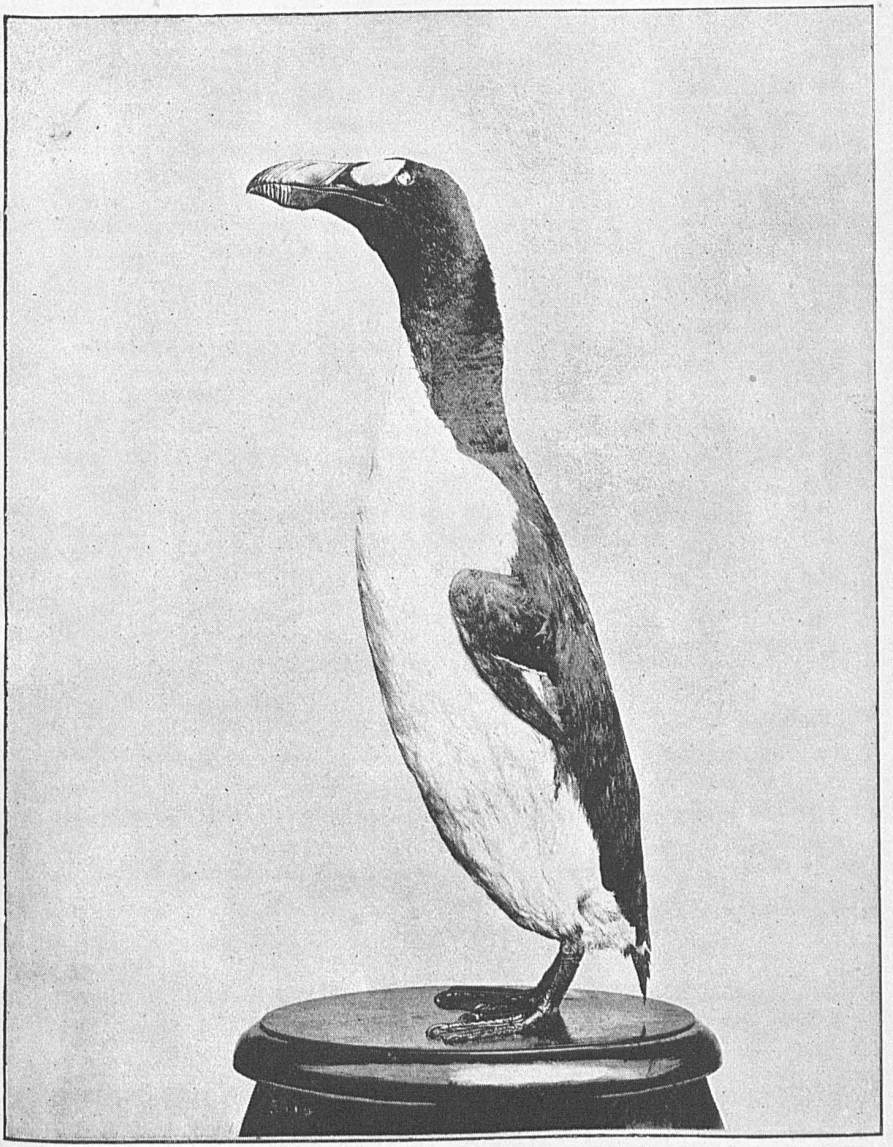
It will thus be seen that the procurement of a large collection of the remains of the great auk was a matter of special importance, whether considered from the stand-point of science or the more practical bearing of the historical relation of the species to the fisheries. The details of the magnitude of this collection, as well as many interesting facts relating to the obtainment of it, and the history of the great auk, are given in the National Museum publications for 1887–8 and need not be repeated here.

It may, perhaps, suffice to say that the collection of remains of the great auk exceeds in magnitude all others. Several skeletons have already been mounted, and Mr. Lucas is authority for stating that probably ten in all will be made. Leg and wing bones were obtained of more than 700 birds.

Among the species of sea-birds collected which are most important, so far as the fisheries are concerned, the following may be mentioned here:

Gannet (*Sula bassana*).
A large and full series, consisting of eggs, embryos, nestlings, and adults.
Arctic Tern (*Sterna paradisæa*).
A series similar to the above, with the addition of nests of various forms.
Kittiwake Gull (*Rissa tridactyla*).
A full series, including nests.
Herring Gull (*Larus argentatus smithsonianus*).
Nestlings and adults.
Bonaparte's Gull (*Larus philadelphiæ*).
Young and adults.
Razor-billed Auk (*Alca torda*).
A full series; eggs, embryos, young, and adults.
Murre (*Uria troile* and *lomvia*).
A full series; eggs, embryos, young, and adults.
Puffin (*Fratercula arctica*).
A full series as above.
Red Phalarope (*Phalaropus fulicarius*).
Adults.
Common Hagdon or Great Shearwater (*Puffinus major*).
Adults.
Black Guillemot (*Cepphus grylle*).
Young in first plumage and adults.

Besides the above, several other varieties were obtained, and in all cases, including the species above mentioned, enough specimens were secured to have a series of skins and skeletons made of all adult birds.



THE GREAT AUK (*Alca impennis*).

From mounted specimen in the Smithsonian Institution.

The following is a list of the fishes collected, as identified by Dr. T. H. Bean, who says: "Among the trout I find some interesting specimens, particularly the brook trout with hyoid teeth. The *fontinalis* usually has no hyoids, but some of these specimens have them well developed:"

Smelt (*Osmerus mordax*).
Cunner (*Ctenolabrus adspersus*).
Flounder (*Pleuronectes americanus*).
18-Spined Sculpin (*Cottus 18-spinosus*).
Brook trout (*Salvelinus fontinalis*).
Atlantic Salmon (*Salmo salar*).
Butterfish (*Muræenoides gunnellus*).
Stickleback (*Gasterosteus aculeatus*).
Cod (*Gadus ogac*).
Daddy Sculpin (*Cottus grænlandicus*).

6. NOTES UPON VARIOUS SPECIES OF FISH, ETC.

(*f*) *Mackerel.*—As has been stated, the principal object of the cruise of the *Grampus* was to investigate the matter of the occurrence of mackerel in certain places little frequented by those who fish for that species. It was also deemed important to determine, if possible, the presence or absence in the regions visited of those forms upon which the mackerel feeds.

The plan adopted to obtain information concerning the presence of mackerel was to make trials with toll-bait, and to inquire of every one liable to possess any definite knowledge of its occurrence in localities they were familiar with. The presence of minute crustacea (called "red seed" or "cayenne" by fishermen), or other small forms of surface-swimming marine animals upon which the mackerel feeds, was determined by towing small surface nets. The temperature of water and air was systematically taken at short intervals, which supplies the data for determining whether the conditions in certain localities are suitable for this species.

The first objective point was the Bird Rocks, which lie off the east end of the Magdalen Islands, in the Gulf of St. Lawrence. In former years, when hook and line fishing for mackerel was in vogue, large catches were frequently made in the near vicinity of the Bird Rocks. But this locality has been seldom visited by mackerelmen in recent years. Reports have also been circulated of the recent occurrence of schools of mackerel between the Bird Rocks and St. Paul's Island. It was, therefore, important that these localities should be visited and an effort made to determine the presence or absence of the species in that vicinity.

On the afternoon of July 9 toll-bait was thrown for several hours (long trials being made with it at intervals from noon to about 7 p. m.) a little more than a mile to the westward of the largest Bird Rock, but no mackerel were seen or taken.

M. Turbid, the keeper of the light, said he had seen no indication of the presence of mackerel about the rocks during the summer. Large mackerel were abundant in 1885, but since that date have generally been scarce, and most of the time either rare or entirely absent.

On July 10 a trial was made with toll-bait 15 miles east by north from Entry Island. No mackerel were seen or taken.

July 13 another trial was made south-southeast 4 miles distant from Entry Island without result.

As mentioned elsewhere, the conditions of the weather were unfavorable for making a comprehensive investigation between the Bird Rocks and St. Paul's Island, without delaying the trip to Newfoundland longer than was thought desirable. However, a lookout was kept for indications of mackerel, but nothing was seen which gave reason to think that any fish of that species were in the region mentioned. If mackerel had been there in any abundance, it is probable that schools of them would have been seen at night, when the presence of fish can generally be easily detected by the phosphoresence they cause in the water.

While at the Magdalens I learned that the gill-net fishermen had found mackerel exceptionally scarce during the early part of the season, and very few were obtained.

There have been for many years traditions among the fishermen of the occasional abundance of mackerel in White Bay and adjacent waters on the northeastern coast of Newfoundland. It was, therefore, deemed important to obtain as complete information as could be secured concerning the occurrence of mackerel in that region. The statements given below are based upon the recollections of various people who were interviewed, and who have been associated with the fisheries of that region for many years. The result of the inquiries made can be briefly summarized as follows:

About 1870 to 1875, and occasionally in previous years, mackerel were found at times in considerable abundance at White Bay and at Canada Bay. One or two fishermen remembered that individuals had been taken as far east as Fogo Island, but their recollection was not clear enough to make any definite statements. A marked characteristic of the mackerel taken in this region is that they are invariably poor in flesh and inferior as food. One fisherman said they are "dry as sticks."

Mackerel had seldom been seen about White Bay and vicinity for twelve years, though occasionally a specimen has been taken in the herring-nets.

On July 26 Capt. George Manuel, of the mail steamer *Plover*, who had just arrived from his trip along the Labrador coast and the "French shore" of Newfoundland, stated that he had not heard of the occurrence of mackerel on the coast of Newfoundland at any time during the summer.

The captain of a schooner which had recently arrived at Toulinguet

from White Bay, reported no mackerel having been seen in the latter locality or the adjacent coast waters.

The captain of the schooner *Phœnix*, which had just left White Bay, also reported that no mackerel had been seen in White Bay or vicinity during the summer. We hove-to off Bay Verte and tried for mackerel with toll-bait for about an hour, but without result.

We did not learn of the recent occurrence of mackerel at Canada Bay. The inhabitants seemed to have no definite recollection of mackerel having been there.

On August 4, when near Cape Norman, in the Strait of Belle Isle, we were boarded by two of the crew of the schooner *Edward Rich*, of Catalina, Newfoundland, and they said that their vessel had been in that vicinity since June 25 and had taken no mackerel, nor had they heard of any being taken, neither had they seen anything that would indicate the presence of mackerel in the Strait. One of them said that he had fished in the Strait for several successive summers, but had never known of mackerel being abundant there. Two or three years previous, he remembered that a few mackerel had been taken about Cape Norman in herring gill-nets, but they were not plentiful.

Capt. J. W. Pitts, of the schooner *Terror*, of Shelbourne, N. S., whom I met at Black Bay on August 5, said that he had cruised along the Labrador coast from the Mingan Islands to Fox Bay, beginning his cruise at the former place on May 18. He had not learned of the presence of mackerel this year in any of the localities he visited, and he had the impression that mackerel had not been abundant anywhere along that coast in many years.

In previous years he had caught mackerel with hook and line about the middle of August, in the vicinity of Esquimaux Point, at Mingan. In 1886 a few mackerel were caught at Natasquan, but he had heard of none being taken in the Strait of Belle Isle. In 1885 large but poor mackerel were fairly abundant in the strait, and Captain Pitts purchased a quantity at Red Bay of the local fishermen who caught the fish in 2¾-inch-mesh herring gill-nets. Only a comparatively small amount of mackerel were taken by the fishermen at Red Bay, and few or none at other points in the strait.

The fishermen of Black Bay, Strait of Belle Isle, agreed in saying that mackerel were abundant in the summer of 1885, from about the middle to the last of August. One skipper of a seining gang told me that he could have hauled a vessel load in one drag-seine at the head of the bay. But there was no market for them, and the few barrels which were taken from time to time could not be sold, or the price received was too low to pay for the work of curing the fish, not to speak of the labor of catching them.

Here, as on the "French shore" of Newfoundland, there was a remarkable consensus of statement to the effect that the mackerel taken are generally of large size, but always poor in flesh and of little value as food.

Mr. W. A. Stearns makes the following record of the appearance of mackerel on the Labrador coast:

"Seldom taken at all on the Labrador coast, except as isolated individuals or by twos or threes. One person at Triangle Harbor took eight while we were there, but said that he had not taken as many before in as many years." *

When at Perce, on August 21, I learned that there had been no body of mackerel in that vicinity during the summer. Occasionally a single individual had been taken in the herring gill-nets, but none were seen schooling, and the scattering specimens caught only emphasized the absence of the species from this region, which was formerly an excellent fishing-ground.

Off East Point, Prince Edward Island, we were intercepted by the schooner *Moro Castle*, of Gloucester, Mass., the captain of which was anxious to learn what news we had of mackerel on the "north shore." I learned from him that his vessel had taken 140 barrels of mackerel, chiefly on Bank Bradley, soon after his arrival in the Gulf of St. Lawrence, but for four weeks he had not caught a fish. Some of the small boats were doing fairly well at hook and line mackerel fishing close inshore, on the north side of Prince Edward Island, and at Cheticamp, Cape Breton. Canadian vessels had, however, been no more fortunate than American schooners. None of the seiners had met with any success for several weeks. Altogether the season had been a very unprofitable one for mackerel fishermen.

The negative results obtained in our investigation relating to the mackerel along the east coast of Newfoundland and the shore of Labrador, proved beyond question that there were no mackerel in those regions in the summer of 1887, up to the time that we visited the coast. There is also reason to think that mackerel occur there less frequently and in less abundance than is generally believed. In view of the fact that all evidence goes to prove that the species is remarkably poor in northern waters, it would seem to be a non-profitable undertaking to pursue them thither even were there a greater probability of finding fish plentiful. The cause of their poor condition is probably due to the fact that the temperature of the water is lower than it is on the grounds where mackerel fatten rapidly, and it is possible that they find in those regions comparatively little food which is suited to them.

There is a popular belief that when mackerel are scarce off the shores of the United States and in the Gulf of St. Lawrence they must be abundant elsewhere. This belief may be well founded in the abstract, but there is no evidence to prove that the scarcity of fish in the Gulf of St. Lawrence is any indication that they may be found farther north. As a matter of fact, mackerel were exceptionally scarce on the gulf fishing-grounds during the summer of 1887. Commander William

*Proc. U. S. National Museum, Vol. VI, 1883, p. 124. "Notes on the Natural History of Labrador."

Wakeham, inspector of fisheries for the Province of Quebec, states that "mackerel were scarce all over this division, although a few of very fine quality were caught at Magdalen Islands; the bulk of the mackerel schools kept about Prince Edward Island and Cape Breton never coming northward across the gulf."

The inspector of fisheries for the Province of New Brunswick, Mr. W. H. Venning, reports "that this fishery was a failure. From 17,868 barrels and 70,128 cans last year, the catch has fallen to 3,607 barrels and 44,278 cans this year." The inspector of fisheries for the Province of Nova Scotia stated in his report that the catch of mackerel in that province had been some 10,000 barrels less than the previous season. The catch at Prince Edward Island was 3,872 barrels less than in 1886.

(*g*) *Food of mackerel.*—The presence of mackerel in any particular locality is doubtless due to a considerable extent to the abundance of food which is specially attractive to them. As is well known, the mackerel feeds with avidity upon small copepods, generally of a pinkish tint, and for this reason frequently called "red seed" or "cayenne" by the fishermen. All observations made hitherto have led to the belief that this form of life is the food which the mackerel is particularly fond of.

From the time the *Grampus* left Gloucester until she returned attempts were made to ascertain the presence or absence of crustacea, or other small forms of life at the surface of the water, by towing a small fine-meshed net specially designed for collecting minute animals. Elsewhere the results of these towings are tabulated and specifically set forth; here I intend only to consider in a general way the bearings upon the fisheries of the results obtained. Practically without exception, nothing was taken in the towing nets which could serve as food for mackerel from the time we entered the Gulf of St. Lawrence until we passed through Canso on our way home. The gulf, the coast of Newfoundland, and the waters along the shores of Labrador appeared to be utterly barren of such minute forms of life as the mackerel feeds upon, though it may be mentioned that a few specimens of crabs in their larval stages were taken off the northeastern coast of Newfoundland. But in the Gulf of Maine, and along the south coast of Nova Scotia, small crustacea were found in considerable abundance, and frequently in great numbers. On our return voyage we found them specially numerous in the Gulf of Maine. This led me to believe that mackerel would be more abundant in the fall off the New England coast than in the Gulf of St. Lawrence, especially as Captain Nauss, of the *Moro Castle*, had stated that he had seldom seen any food in the stomachs of the mackerel taken in the last-mentioned locality during the early part of the season.

Upon my arrival at Gloucester after completing the cruise, I was interviewed by Wm. H. Jordan, of the firm of Rowe & Jordan, who own several mackerel schooners, as to the probability of their vessel, which was then in provincial waters, getting a good catch of mackerel.

In reply to his inquiries I ventured the opinion that fish would, in all probability, be caught off our own coast in greater numbers than in the Gulf of St. Lawrence. The correctness of this opinion may, perhaps, best be shown by the following letter from the firm, which explains itself:

GLOUCESTER, MASS., *September* 29, 1887.

SIR: You may remember about the first of the month we asked you if you could give any information about the prospect of finding mackerel in or about the Gulf of St. Lawrence and adjacent waters. You said during your trip there in the schooner *Grampus*, from which you had just returned, you had observed very carefully all signs tending to show the presence of mackerel in any considerable quantity, and had not found any, and furthermore, you had kept a drag-net out all the time you were sailing and had found absolutely no food for mackerel until upon your return trip you had got nearly home, on Brown's Bank or this side of it, and there you found food in large quantities, which you considered to be a reasonably sure prospect, if mackerel were caught at all, they would be caught upon our own shores; which judgment has proved accurate and very valuable. On the 7th of September, a few days after our conversation with you, we received a dispatch from Captain Cameron, of our schooner *Gatherer*, at Souris, Prince Edward Island, asking for instructions how to proceed, saying the prospect looked to be fair there. Acting upon your opinion, we directed our captain to come home immediately. He started seven days later and caught 350 barrels of mackerel 8 miles from Eastern Point, in Massachusetts Bay, and they were sold for $18 per barrel; the 130 barrels he had on board, caught in Bay St. Lawrence, were sold for $13.50 per barrel, and he had been ten weeks catching them.

* * * * * * *

Truly yours,

ROWE & JORDAN.

Capt. J. W. COLLINS,
U. S. Fish Commission, Washington, D. C.

(*h*) *Cod.*—As has been stated elsewhere, the obtainment of information concerning the cod, and the fishery which is based upon it, in the regions visited, was thought to be of secondary importance. However, occasional trials for cod were made with hand-lines, and inquiry was made concerning the cod-fishery at the places visited. At the end of this chapter, and in Table II, may be found a summation of the trials with hand-lines and the results obtained, so far as cod are concerned. Also, in "Notes concerning the Newfoundland cod-fishery," the reader will find details of vessels, apparatus, methods, etc. Here I propose to discuss the condition of the fishery in a general way, giving in substance the result of our investigations, so far as they bear upon the status of this industry in 1887, at the places visited by the *Grampus*.

In former years there was an important cod-fishery about the Magdalen Islands, which, in addition to a numerous fleet of boats that sailed from various harbors, also drew thither a fleet of vessels of greater or less proportions. Most of these vessels were from British provincial ports, some that sailed under the French flag came from Miquelon, and not unfrequently American schooners formed a portion of the fleet. Usually these vessels fished "at a drift" on the shallow rocky spots about the islands, and generally they were successful.

In recent years the fishery has materially declined in importance. A fleet of boats is still employed from the islands, but it appears that fewer vessels now visit that region to fish for cod.

In the various trials we had with hand-lines about the Magdalens the results obtained showed that cod were very scarce. M. Turbid said they have not been abundant at the Bird Rocks in recent years. This statement was verified by three of the crew of a cod-fishing schooner whom I met on the smaller Bird Rock, which they had visited to shoot birds for food. Their vessel lay in the offing "drifting" for fish on a shallow spot between the Bird Rocks and Byron Island. They had tried for fish on nearly all the grounds around the Magdalens, they said, and without exception had found cod very scarce. Indeed, they were emphatic in declaring that unless they were more fortunate than they had been their voyage would be a failure.

The shore cod-fishery on the coast of Newfoundland, from St. John's around to the Strait of Belle Isle, has been in an unsatisfactory condition for several years. In many of the bays, where an extensive and remunerative cod-fishery was formerly maintained, the cod has been so scarce in recent years that only meager results could be obtained, and the coast fishermen have been reduced almost to starvation in some localities.

During the summer of 1887 the cod-fishery was in a very deplorable condition on the northeast coast of Newfoundland. In the region from Fogo Island to Canada Bay many of the fishermen had obtained little more than enough fish for their own tables.

On July 25 a fisherman at Seldom come-by Harbor told me that he had not caught, up to that date, more than one-half quintal of cod. Similar statements were made by others. At Toulinguet I was informed that a gang of four men operating a trap had taken only 3 quintals of cod. A few small fish were generally the result of a day's fishing for a man, the amount being scarcely enough for the consumption of his own family. At Canada Bay the same story was told. The fishermen were disheartened. Day after day they went to the fishing grounds with their boats and still no results. They had experienced a year or two of special privation on account of the scarcity of cod, and as fish is their only dependence they were next to hopeless. A French schooner that lay in one of the coves in Canada Bay, about 5 miles from where we anchored, had been fishing all summer and getting next to nothing. We made several trials with hand-lines, but caught no fish.

What this exceptional scarcity of cod is due to no one seems able to tell. Various causes are assigned, but they are generally without proper foundation. The fishermen, at least those who have any knowledge of fish culture, hope that some remedy may be found in the artificial propagation of cod.

The scarcity of cod around the coast of Newfoundland in recent years has led to a considerable change in the fishery. Instead of depending almost entirely upon inshore fishing, the tendency in recent years has been to engage more extensively in the offshore bank fishery, and this has also lately come to supersede, to some extent, the Labrador coast fishery. As a matter of fact, the condition of the Labrador cod-fishery has been nearly as bad as that on the northeast coast of Newfoundland.

On July 26, when I met Captain Manuel at Toulinguet, he reported that the catch of cod on the Labrador coast, up to that time, had been very meagre. The fleet had not got beyond Battle Harbor on account of ice, and there was much anxiety felt by all concerned in the fisheries as to the outcome for the season. Many feared that the cod-fishery would be almost a total failure. In the early part of August, when we were at the Strait of Belle Isle, the prospect was little if any better.

It is possible that in future years the cod fishery of the Labrador coast and eastern Newfoundland may regain something of its former importance. But there is reason to believe that, at least for many years, it will not be of sufficient proportions to offer any inducement for American fishermen to engage in it, if, indeed, the catch is sufficient to maintain the coast population and prevent semi-starvation.

The cod-fishery at Mingan and adjacent localities had been fairly prosperous, though the fishermen had met some difficulty in obtaining a full supply of bait. The fishermen at Perce were disposed to complain somewhat of a scarcity of cod, but from all that could be learned I inferred that the season's catch had been pretty well up to the average. The conclusion arrived at is sustained by the following, extracted from the report on the fisheries of the province of Quebec, by Commander Wakeham:

"Cod-fishing began late, it being the 10th of June before the fish struck in. The yield was about the same as in 1886, with a difference of 3,050 cwts. in favor of this season. The catch was large about the end of June and beginning of July, and every one looked forward to an unusually successful fishery, but during August and September bait became uncertain, and in October and November the weather was so rough that it became impossible to carry on the fishery. When the weather was fine and the boats could go out, fish were found abundant everywhere. It was noticed this year that cod went higher up Bay des Chaleurs, and in greater quantities than for many years past. The same fact was noticed on the north shore; for many years, say fifteen at least, no cod has been taken above Point des Monts; this season fish were abundant right up to the Manicouagan. It is generally

conceded that cod were never more abundant inshore than they were this year. On the upper part of the south shore, from Cape Magdalen to Cape Chatte, cod-fishing was again spoiled by the appearance of white porpoises, which came down the river during the summer months and drove the cod from that part of the coast.

"The catch of cod on the Labrador coast was again small, only 22,717 cwts. having been taken below Natashquan. The fish keep in deep water offshore, and were all caught with hook and line, nothing being done with 'twine,' which is an expression used to indicate the fishery carried on with seines, traps, and gill-nets.

"On the upper north shore, from Mingan to Point des Monts, the summer fishery was fair, the large rooms at St. Johns, Magpie, and Sheldrake making better returns than for some years past."

(*i*) *List of trials for cod.*—July 6. A trial with hand-lines was made off White Head, N. S. (White Head bearing northeast about 5 miles distant), and four small cod were taken on one line in an hour's fishing.

July 9. Tried for cod southwest by west ½ west 1¼ miles from the larger Bird Rock, but caught no fish.

July 10. Put out hand-lines 15 miles east by north from Entry Island. Caught eleven cod, one small halibut, and two flounders.

July 13. Tried with hand-lines south-southeast from Entry Island about 4 miles distant. Caught five small codfish and one small halibut in about an hour.

July 22 and 23. Tried with hand-lines on the shoal east-southeast about one-half mile from Funk Island, Newfoundland. Caught nothing.

July 28. Southern end of Pigeon Island, Newfoundland, bearing southwest by west ½ west, about 5 miles distant, put out hand-lines and tried for nearly an hour and caught no fish.

August 9. On northwestern part of Natashquan Bank (lat. 49° 52′ N., long. 60° 21′ W.) in 51 fathoms of water, tried with hand-lines for cod. No fish were taken.

August 10. Off Mingan Islands, the large island bearing north one-half east, about 4 miles distant. Put out hand-lines and caught one cod.

August 21. Cape Gaspé bearing north, Percé bearing west-northwest. Tried with hand-lines for cod in 50 fathoms of water. Nothing was caught.

August 30. Seal Island ground (lat. 42° 58′ N., long. 66° 06′ W.) in 60 fathoms of water. Tried with hand-lines and caught one cod and one cusk.

(*j*) *Swordfish.*—There is reason to believe that swordfish sometimes find their way even as far north as eastern Newfoundland. Mr. Andrew Linfield, of Toulinguet, stated that swordfish have occasionally been seen along that coast. The capture of a fish of this species is, however, considered a remarkable occurrence.

(*k*) *Halibut.*—It was my original intention to make a series of trials for halibut in depths varying from 100 to 200 fathoms off the northeast coast of Newfoundland, and especially to the eastward of Belle Isle and Cape Bauld, but the detention at Canada Bay, the probability of the occurrence of fog, and the fact that numerous icebergs were drifting about in the vicinity deterred me from carrying out this part of the plan. As will be seen by reference to the narrative of the voyage, it would have been impracticable to carry on any fishing for several days after we reached the Strait of Belle Isle, where we were detained by a gale.

The prevalence of unfavorable weather, the difficulties attending the obtainment of a supply of bait, and the time occupied in an effort to obtain specimens of the gray seal at Mingan, prevented the investigation and trials for halibut which I contemplated making in the vicinity of the Mingan Islands. It is to be regretted that the advance of the season and the consequent uncertainty of the weather offered little encouragement for a longer stay.

It is worthy of mention, however, that experiments made in keeping halibut alive in the well were satisfactory, and there is reason to believe that no special difficulty would be experienced in bringing halibut alive to Wood's Holl from the Gulf of St. Lawrence unless they should die from change of temperature. The two small halibut taken off the Magdalen Islands on the 10th and 13th of July, each lived in the well for several days. When they were taken out for cooking, about a week after they were put in the well, they seemed as vigorous as when they were put in and there were no indications of injury.

(*l*) *Capelin.*—So far as could be learned capelin occurred in their usual abundance along the shore of Newfoundland and Labrador, where they are extensively used for bait, and also for food, being dried or salted in greater or less quantities by the fishermen for winter use. They are also fed to hogs. The capelin season was practically over when we reached the coast. While we were at Mingan, on August 18, an attempt was made to collect capelin to bait our halibut trawls. The spawning season was over and they were daily growing less abundant along the shore. Occasionally a few would run in near the surf. We obtained about 1½ bushels, of which mention is made elsewhere. At the time of our arrival at Mingan, on August 11, capelin were moderately abundant, sufficiently so for the fishermen to get all the bait they wanted.

(*m*) *Lobsters.*—The lobster fishery is an important industry in several places which we visited. There are a number of canneries on the Magdalen Islands, where the packing of lobsters has been carried on for several years. There is, however, a complaint of the growing scarcity of this highly-prized crustacean, and, judging from what I was told, the fishery will soon decline unless some means are adopted to prevent over-fishing. A gentleman at Grindstone Island, who is the manager of a lobster cannery there, stated that lobsters had decreased in size

and abundance very rapidly within the previous two years. He thought this was true generally of the Magdalen Islands.

Another, who operated a cannery at Amherst Harbor, said his pack for 1887 would not exceed one-quarter of the amount which he put up three years previously. He thought the outlook for the lobster fishery very discouraging unless something was done to check over-fishing. He stated that the catch of lobsters was of the greatest consequence to the fishermen of the Magdalen Islands, for the reason that cod were scarce, that the spring mackerel-fishery had been a failure, and that, although spring herring were abundant, there had been little demand for them.

Lobsters appeared to be plentiful on the east and northeast coasts of Newfoundland. Numbers of fine ones were brought alongside the *Grampus* at Seldom-come-by Harbor, which the fishermen were glad to sell at a nominal price. I learned that there was a cannery at Fogo Harbor, but it had not sufficient capacity to utilize all the lobsters that could be easily obtained there. Canneries have been erected at other points along the coast south of Fogo, but we did not learn of the existence of any west and north of that place.

Mr. John Holmes, light-keeper at Seldom come-by Harbor, said that lobsters were abundant and of large size at that place, but that the fishermen could find no market for them, since the cannery at Fogo received its supply from the fishermen at that harbor.

So far as could be ascertained, the northern limit of distribution for the lobster appears to be about the Strait of Belle Isle. I was told that occasionally a lobster would be taken on the south side of the Strait, but that one was seldom or never seen on the north side.

It is reported that lobsters are abundant on the west and southwest coasts of Newfoundland. If the reports are true, it is very possible that a profitable industry might be carried on by American vessels on that part of the coast where they have a treaty right to fish in littoral waters. The lobsters could be brought alive to the United States in welled smacks, or they could be canned on board a vessel, which might be fitted up temporarily as a floating cannery.

(*n*) *Whales.*—On July 16 eight humpback whales were seen; two of them to the southwest of Cape Pine; two between Cape Pine and Cape Race, and four others to the northeast of the latter point.

Several whales were seen off Canada Head on July 29.

A small finback came into the harbor near the vessel on several occasions while we lay in Canada Bay, usually making its appearance near sunset.

North of Groais Island and Cape Rouge, on August 3, and between that point and Cape Bauld, humpback and finback whales were seen in abundance.

During the afternoon of August 10, while off Mingan, a number of whales were seen; their appearance being particularly noticeable on account of their closeness inshore.

A pike whale (*Balænoptera?*) was feeding near the vessel in Mingan Harbor on August 14. An attempt was made to capture it; a bomb-lance was fired at it, but going wide of its mark only frightened the animal so that it soon left the harbor.

(*o*) *Porpoises.*—Porpoises appeared to be abundant off northeastern Newfoundland, but no effort has been made by the local fishermen to capture them for commercial purposes. Among those noticed were the dolphin or common "sea porpoise" (*Delphinus delphis*), the porpoise (*Tursiops tursio*), and puffing pig (*Phocæna communis*). We saw them off a long stretch of coast, and they appeared to be specially numerous at Canada Bay and vicinity. They were very shy, however, and it was impossible to approach them close enough to secure them by harpooning or shooting. I think there would be no difficulty in securing them if the proper means were adopted. But the fishermen said that there is no demand either for porpoise-oil or skins, and therefore there was no inducement for them to make an effort to catch them.

We made numerous attempts to capture specimens, but without avail. At 6.30 a. m. on July 22, about 15 miles southwest of Funk Island, a school of porpoises came around the vessel. One was harpooned, but the iron did not get a good hold, and pulled out before the vessel could be brought to the wind.

On July 29 we saw a great number of porpoises outside of Canada Head, but they avoided the vessel, and seemed to be intent chiefly on chasing squid or capelin. Almost every day, while we lay at Canada Bay, porpoises were seen in the bay and harbor. We went out in boats and tried to harpoon or shoot them, but their extreme shyness prevented us from getting near enough to make any captures.

On August 3 porpoises were abundant north of Groais Island and Cape Rouge, and were also seen between those points and Cape Bauld.

(*p*) *Giant squid.*—Mr. Andrew Linfield states that a giant squid was captured in 1885 between Chance Island and Toulinguet by the fishermen at Herring Neck. The captors, not knowing that the animal had any value except for bait or manure, destroyed it before any one better-informed knew it had been taken.

7. NOTES UPON THE OCCURRENCE OF HAGDONS.

On July 16, when off Cape St. Mary and Cape Pine, we fell in with numerous large flocks of hagdons (*Puffinus major* and *P. stricklandi*) setting upon the water. The sooty shearwater, or black hagdon, was here in much greater relative abundance than I have ever previously seen it. In most cases it seemed fully as numerous as the great shearwater (*P. major*), and occasionally even more abundant. It will probably not be incorrect to say that nearly 50 per cent. of the birds seen during the day, from Cape Pine to Cape Race, were of the black variety.

The day was fine with light wind, varied by periods of calms, thus

NEWFOUNDLAND FISHING-SCHOONERS. THE GALLOPER ZEPHYR AT THE WHARF. (See page [40].)

Drawn by E. I. Rogers.

affording an excellent opportunity to note the flocks of hagdons and the relative numbers of each species.

The birds appeared to be gorged with food, which was probably the case, since they had doubtless been feeding to repletion on capelin that were abundant along the coast. With rare exceptions, the flocks sat quietly upon the water, unless disturbed by the approach of the vessel. But I noted that the birds were exceptionally shy. This was remarkable, for the hagdon, especially *P. major*, is generally easy to approach, and when hungry is quite indifferent to the presence of man or boat, at least it will venture within a few feet of either. On this occasion, finding it difficult to get within gunshot with the vessel, the attempt was made to approach the flocks in a boat, but this failed, as did the effort to attract the birds with cod-livers. It was, therefore, evident that the "hags" were sated with food, and the fact was demonstrated beyond doubt that these species, which are among the most daring and venturesome of all wild fowl when prompted by a desire for food, appreciate the danger of the near approach of man and grow circumspect, if not timid, in exact proportion as their stomachs become filled.

Hagdons were quite frequently seen from Cape Race to the Strait of Belle Isle, but nowhere in such abundance as between Cape Race and Cape Pine; indeed, they were generally scarce and sometimes rare. In all cases, however, the black hagdons seemed proportionately more numerous than I have ever seen them on the banks, and the inference would be that this species prefers to remain near the coast.

8. ICEBERGS.

On July 16 an iceberg was seen about 5 miles to the southward of Cape Pine, apparently aground. I estimated that it was about 50 feet high above the water.

On July 20 a large berg was seen north of Baccalieu Island. The same evening two large bergs were passed about 2 or 3 miles north of Gull Island off Cape Bonavista. These bergs were estimated to be about 50 to 60 feet high, and apparently were grounded. There were evidences that one had recently rolled over, as there were marks of the bottom upon its sides, and masses of broken ice drifting to leeward. Several small bergs were seen the same day off Catalina Harbor.

On July 22 and 23 several small bergs were seen in the vicinity of Funk Island, north of it, and one or two between Funk Islands and Fogo Island. The height of these was estimated to vary from 15 to 40 feet.

Between July 26 and 29 scattering bergs were seen between Fogo Island and Canada Bay. On the morning that we left Toulinguet, July 28, we passed two icebergs off West Shag Rock, and later passed another and larger berg north-northwest (mag.) from Toulinguet light. Saw a moderate-sized berg east-northeast from Cape St. John's. It was close inshore and apparently aground.

There was a small berg in Canada Bay when we entered, opposite Otter Cove, and it remained there until we left, though its size had apparently decreased in the mean time. It was probably 20 feet high.

On the afternoon of August 3 three icebergs were seen between Belle Isle and Groais Island. Later on the same day a large berg was seen northeast of the northern end of Groais Island. I estimated that it was fully 500 feet long at the water's edge and 100 feet high. It was apparently smooth and level on top, and had no pinnacles around its edges. Other scattering bergs were also seen north of Cape Rouge, and between that and Cape Bauld.

On August 4 we saw eight icebergs off Cape Norman in the Strait of Belle Isle. These were generally of small size, varying from 15 to 40 feet in height. While beating through the strait we counted in all twenty-two bergs from Belle Isle to Black Bay. None were seen to the westward of that point.

9. NOTES REGARDING THE USE OF THE CLUB-TOPSAIL.

The question of improvement in the build and rig of fishing vessels is one that has demanded the earnest attention of the Fish Commission for several years. For this reason it was deemed important that a club gaff-topsail should be made for the *Grampus*, and tried on her summer cruise to the eastward, in order that an opportunity might be afforded to study its effect upon the vessel, and from which conclusions could be drawn as to its utility for sailing schooners engaged in the market fishery. There was, of course, an additional reason (and one that deserves consideration) for having the sail, namely: The fact that the *Grampus* was going on a cruise in regions where fogs are prevalent and where some of the harbors are not lighted and are unprovided with other guides for approach. It is, therefore, of the greatest importance for a vessel cruising there to be provided with large light sails in order that she may make a port and thus complete her passage before she is overtaken by fog or by darkness, since it is dangerous and sometimes absolutely impracticable to enter many harbors at Newfoundland or Labrador after night or during the prevalence of dense fogs.

The club-topsail was frequently used, and was found to be of great service, so far as increasing the speed of the vessel in light winds was concerned, either when running free or close-hauled, and its use on several occasions enabled us to make a harbor when otherwise it would have been impracticable.

There was a little difficulty at first in handling the sail, because of the lack of experience on the part of the crew, but when the men had become more skilled in the manipulation of the sail this difficulty disappeared.

The conclusion reached is that a properly made club gaff-topsail would be of great service to vessels engaged in the fresh-fish market fishery in summer, when they are constantly making passages from the fishing

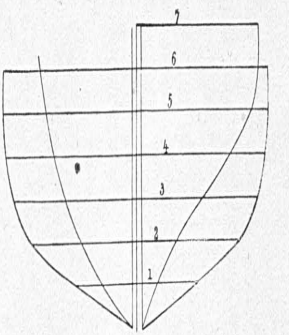


Fig 1.

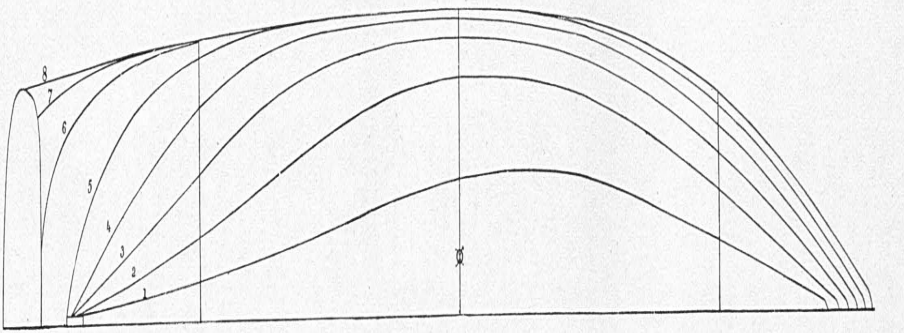


Fig 2.

PLANS OF SCHOONER MITCHIE. (See page [42].)

FIG. 1. Body plan.

FIG. 2. Half-breadth plan.

Drawn by Josiah Manuel

grounds to port in light winds and with perishable cargoes on board. It goes without saying that such a sail is not so easily managed as a working gaff-topsail. But with the large crews carried by fishing vessels there could be little trouble experienced in handling a club-topsail as soon as the men became skilled in its management. It is also probable that a spinnaker would be found very serviceable on market fishing vessels in summer, since such a sail would unquestionably increase the speed when running free in light winds.

10. NOTES CONCERNING THE NEWFOUNDLAND COD-FISHERY, ETC.

The notes here presented, though they were gathered in a more or less random manner, as circumstances permitted, may, perhaps, prove interesting to the extent that they throw some light on the craft engaged in the cod-fishery, and the methods in vogue at the places visited by the *Grampus*. They are, to a large extent, supplementary to the observations concerning the cod, etc., in a preceding paragraph.

(*q*) *Vessels and boats.*

(1) *Schooners.*—Practically all the vessels employed in the cod-fishery of Newfoundland are schooner-rigged. Many of the old-style "jacks" and "gallopers" or "western boats" are still seen fishing near the land, and these sometimes go to the Labrador coast for a fare of cod. We met one at Canada Bay of only about 15 tons, that was on her way to Labrador. The bank fleet is composed of a different class of vessels, some of which have been purchased from the United States and Nova Scotia, while others have been built in Newfoundland.

The jack and galloper differ chiefly in size. The jack varies from 5 to 15 tons; is schooner-rigged, carrying three sails as a rule, and occasionally having an additional flying stay-sail that sets from the mast-heads, there being no top-mast. It is a full-bowed, clumsy-looking keel craft, with long rounded floor, short run, and heavy, square stern without any overhang, the rudder being outside and operated by a tiller. There is no billet-head or gammon-knee; the construction is rough and the hull is often covered with coal-tar instead of paint. The largest jacks are usually decked, with a little trunk-cabin aft, but the smaller ones have a raised half-deck forward, under which is a diminutive cuddy, dark and dingy,—a veritable "black-hole,"—aft of which are standing-rooms or "pits" where the fishermen stand to fish. The middle space is usually decked or loosely covered, and this is the fish-room, aft and forward of which the "pits" are located.

The masts are often not supported except by the jib-stay. Even the larger galloper seldom has more than a single shroud on a side to each mast, and that is usually slack, the fishermen being prejudiced against having the standing rigging taut. The masts generally rake a good deal, particularly the mainmast, which, not being supported by a stay,

bends aft considerably at the head so that it often has a very marked curve. The sails are baggy, often made of hemp duck, but cotton canvas is coming into more general use. A jack of 30 feet in length will be about 10 feet wide and 4 feet deep.

The following are the details of a so-called galloper, the *Zephyr* (built at Placentia Bay in 1878), which was seen by the writer lying alongside a wharf at St. John's (see plate V).

She is a carvel-built, decked, keel craft, with a rather full bow above water, but finer below; raking curved stem, a sharp floor, round bilge, rather easy lines aft, no overhang to counter, and a raking heart-shaped, square stern; the rudder is hung outside and is worked by a short tiller. She has a good sheer, is flush-decked, with bulwarks and rail. Her general appearance, so far as the hull is concerned, indicates good sea-going qualities, and a fair amount of speed. With the addition of a more graceful rig, a projecting cut-water or head, and an overhanging and well-formed stern, she would compare not unfavorably with many of the small vessels built in the United States a few years ago, and would doubtless surpass them in some highly requisite qualities.*

She has a windlass just abaft the foremast, which is worked by a crank. Under deck, forward, is the forecastle, a rudely constructed apartment, unpainted, with three bunks. The fire-place and chimney are built in the most primitive manner of slabs of rock, so discolored now by soot and smoke that it is difficult to tell the character of the material. The chimney is surmounted on deck by a large wooden funnel, and on each side of this is a hatch (3½ by 3½ feet) which serves as an entrance to the forecastle, the lee hatch being generally closed and the weather one used when the vessel is at sea. The coamings of these are only 3 inches above deck, and in rough weather it is probable that the forecastle is anything but dry and comfortable. There are numerous hatches, which afford entrance to different parts of the hold, where are stowed various kinds of fish, bait, etc. The main hatch (5 by 4½ feet) is situated between the masts. Immediately abaft the mainmast is a double hatch, its total length being 5 feet 8 inches, and width 3 feet 10 inches. Aft of this and just forward of the trunk is a large hatch extending almost the whole width of the deck, it being 10 feet long athwartships, and 2 feet 9 inches fore and aft. Many of these boats also have another small hatch on the port side of the mainmast, through which entrance is gained to the bait-pen, where herring, etc., are kept,

* This little schooner enjoys a good reputation, not only for sail-carrying power and safety in a sea-way, but also for speed, if we accept the statements of her skipper, who claims to have made some rather quick runs in her along the coast when, of course, the conditions were favorable. On one occasion he states he ran from St. John's harbor to Cape Race—a distance of about 58 miles—in six and one-half hours, and another time from St. John's to Baccalieu—a distance of about 31 miles—in four hours.

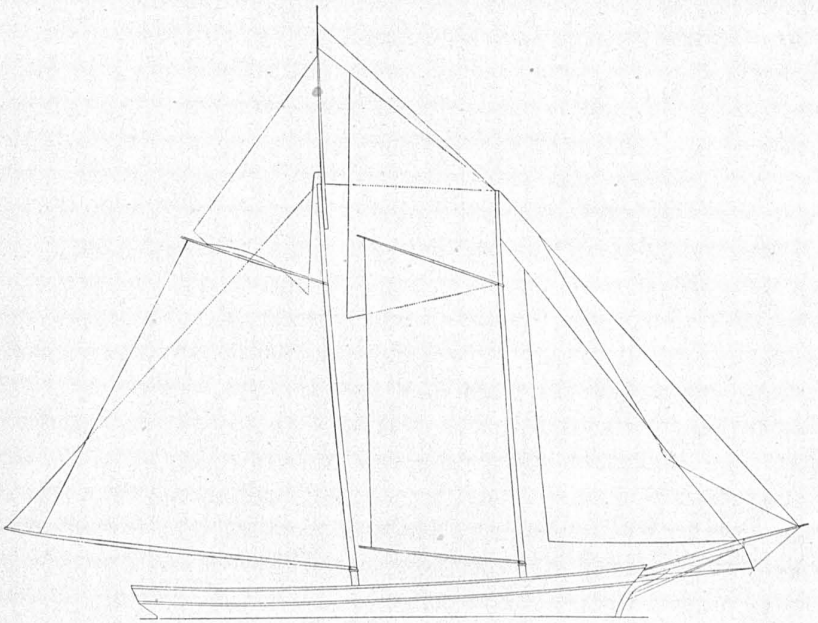


FIG. 1. SAIL PLAN OF SCHOONER MITCHIE. (See page [42].)
Drawn by Josiah Manuel.

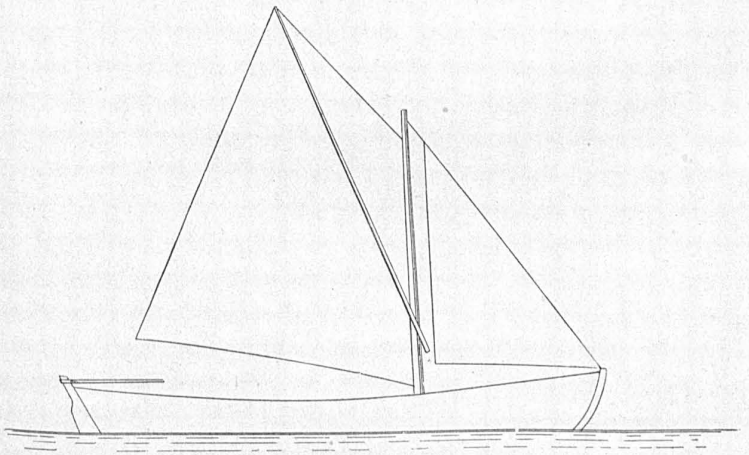


FIG. 2. SAIL PLAN OF TOULINGUET BOAT. (See page [49].)
Drawn by J. W. Collins.

either iced or salted. There is a small trunk-cabin aft, with two berths. It is a small unpainted apartment, dingy, and not specially inviting. The bunks are cased up and each has an oblong hole for an entrance, very much after the style of berths on English fishing smacks. The trunk is 5 feet 4 inches forward of the taffrail; it is 6 feet long, 6 feet 4 inches wide at forward end, 5 feet 9 inches wide at after end, and about 15 inches high. There are two wooden pumps just abaft the after-hatch, between it and the long hatch forward of the trunk. Ordinary iron-stocked anchors are used, these weighing 175 and 400 pounds respectively. This vessel has chain cables.

The *Zephyr* is schooner-rigged, with long, round mastheads, no topmasts, and a single jib. There are two shrouds of hemp on a side to each mast, but the masts are loosely stayed and curve aft. A boom and gaff mainsail and foresail and a single jib are carried. These sails are hemp, generally oiled or barked, and are, usually, on all craft of this kind—jacks and western boats—very baggy and untidy looking, with hollow leaches and peaks at varying angles. There are three reefs in the mainsail and foresail and one reef in the jib. Old style, rope-strapped, wooden-bush blocks are used.

The following are additional details of construction: The frames are made of birch and spruce. The floor timbers mould about 6 to 7 inches. Birch plank 2 inches thick are used on the outside and for the ceiling, white pine for deck, spruce for spars. The vessel is fastened with black iron and juniper treenails.

Her dimensions are: Tonnage 29½ tons; carrying capacity 400 quintals of fish;* length, over all, 51 feet 6 inches; outside the knight-heads to foremast, 9 feet; between masts, 18 feet 9 inches; mainmast to after part of taffrail, 21 feet 6 inches; beam, 15 feet; width of stern, 9 feet; depth in hold, 6 feet 8 inches; bowsprit, outside of knight-heads (it extends inboard nearly to foremast), 16 feet 8 inches; foremast, above deck, 40 feet (head about 6 feet), 14 inches diameter at deck; mainmast above deck, 42 feet 6 inches; same diameter as foremast; foreboom, 18 feet 9 inches; foregaff, 18 feet 5 inches; main boom, 34 feet 4 inches; main-gaff, 19 feet 9 inches; tiller, 4 feet.

Vessels of this size and class are employed in the fisheries along the west coast of Newfoundland, and to a less extent elsewhere. They are manned by 5 to 7 men and boys.

The modern home-built fishing schooner of Newfoundland is generally designed in imitation of the clipper vessels of New England. It differs from the latter, however, in usually being wider and somewhat deeper in proportion to length, in being built of inferior wood, with a rough finish, and in having sails not so well cut and tidy looking. The size varies from 25 to 60 or 70 tons.

* I give the tonnage, carrying capacity, and some other data, particularly that relating to the materials used in construction, on the authority of the captain from whom I obtained these statements. The other dimensions are from actual measurements made by myself.

The schooner *Mitchie*, built at Exploits Bay, is a representative of the most modern and approved type of vessels employed from Newfoundland in the Bank and Labrador cod-fisheries.

The following details of the above-mentioned vessel have been furnished by her builder, Mr. Josiah Manuel:

The outside planking and ceiling are birch and juniper, 2½ inches thick on bottom and 3 inches thick on top side. The deck planking is white pine. The frames (or "body timbers") are birch, spruce, and juniper, sided 8½ inches at throat, 7 inches in bilge, tapering to 5 inches at head; moulded 8, 9, and 10 inches. The beams side from 8 to 10 inches, and mould 8½ inches in center and 6 inches at ends; keel 8½ inches wide.

The principal part of the standing rigging—all the heaviest stays and shrouds—is hemp; the small stays are wire rope.

The sails are cotton duck, of American manufacture. The mainsail, foresail, and forestay-sail are No. 2 canvas, but the other sails are made of lighter material.

The principal dimensions are as follows:

	Ft.	In.
Length:		
Over all	64	4
On keel	59	0
Beam, extreme	20	0
Width of stern	16	0
Depth of hold	8	0
Draught of water:		
Light, aft	7	0
Light, forward	3	6
Loaded, aft	11	0
Loaded, forward	5	8
Tonnage	61 tons.	

(2) *Seine-boat.*—The boats used at Newfoundland for seining cod, herring, and capelin are essentially of one class. There are variations, due to local ideas or other causes, but so far as our observation extends the following description of a St. John's seine-boat will apply equally well to craft used for a similar purpose at Fortune Bay, Conception Bay, and along the coast from St. John's to Cape Ray.

The St. John's seine-boat has a round moderately sharp bow, a raking curved stem, round easy bilge, long convex floor, short run, and a wide V-shaped square stern. It is a keel craft, and heavily built. It has only a moderate sheer. Inside, at the bow, there is a platform on a level with the thwarts; which is about 5 feet long fore and aft. Aft of this, in the body of the boat, are three thwarts for the six rowers, who sit "double-banked," two on each thwart. This part of the boat is ceiled. In the after part of the boat are two other thwarts, the aftermost one being 4 feet from the stern. Between these thwarts, on a platform, is stowed the seine, and at the extreme stern is a smaller platform for the steersman to stand on; this is about 3 inches higher than the other. Here also, in the bottom of the boat, is sometimes

SEINE-BOAT. (See page [42].)

Drawn by E. I. Rogers.

placed a glass light, for the purpose of seeing schools of fish the boat may be passing over. This is, however, as in this case, frequently omitted, the water-glass being used instead whenever the surface water may be agitated by the wind. The skipper often stands at the bow, and his experience enables him to detect the presence of fish by indications which would escape the notice of any but those trained to this work.

The thwarts are made of 1½-inch thick spruce plank, and are strongly kneed. A stout piece of hardwood plank, about 10 inches wide, is nailed to the inside of the stern, above which it rises a few inches. The top end of this is scored or scooped out like a boom-crutch, and this serves for a scull-hole or for holding the steering oar.

The boat is propelled wholly by six roughly-made spruce oars, each with a peg near its handle. These oars are 22 feet long. A similar oar is used by the "boss of the gang" to steer with. Boats of this class are generally built in a rude manner, very little care being expended in elaboration of finish. They are sometimes painted, but are more commonly heavily coated with coal-tar. The sole objects are to get a boat that will be adapted to the work, will stand rough usage and which can be built for the least possible expense. Wooden tholes are used, two for each oar, and these are usually made of spruce branches, which are tough and not easily worn out.

The following are the details of the material used in building a boat of this kind. The frames, twenty-seven in number, are of birch and spruce 2 by 2 inches, or 2 by 1¾ inches; plank of pine, 1 inch thick; gunwales of birch, 3 to 5 inches wide, three-quarters of an inch thick; black wrought-iron nails are used for fastening.

The dimensions are as follows:

	Ft.	In.
Length, over all	31	6
Beam	7	7
Depth, gunwale to top of garboard ceiling	2	3
Width of stern	5	9
Depth of stern	2	1
Distance between after thwarts	6	3

A boat of this size and class is manned by seven men, one (the skipper) to look for fish and six to row. When setting the seine only four men row, two throw the seine, and the skipper steers the boat.

A cod seine, of the kind used by such a crew, is 130 fathoms long, 76 feet deep in the bunt, and 61 feet deep in the "bridles," or at the ends. The size of the mesh varies from 3½ inches (stretch measure) in the bunt to 4 inches on the arms and 5 inches near and at the ends. Sometimes the catch is taken in the seine boat, which will carry enough green fish to make 15 quintals of dry cod.

(3) *St. John's Trap-Boat.*—A peculiar style of boat is used at St. John's and vicinity for hauling the cod traps set along the coast, and because of its special work is locally called a "trap boat." One of

these which was examined was a carvel-built keel craft, entirely open, with a medium sheer, sharp bow, slightly concave water-line forward, a raking, curved stem, considerable rise to floor, a round side, rather long run, and raking, heart-shaped, square stern, in which was a large scull-hole. This boat had five thwarts, the after one being adjustable and the forward one forming a part of the bow platform, or, in other words, the after end of the platform rests upon it. There is a wide seat across the stern, and one on each side extending from the after thwart to the stern seat. The boat is ceiled amidships up to within 10 inches of the thwarts on either side; and there is a platform forward and another aft.

Boats of this type are generally propelled with large spruce oars; sails are not much used.

The material used in construction is the same as that employed in building the seine boat.

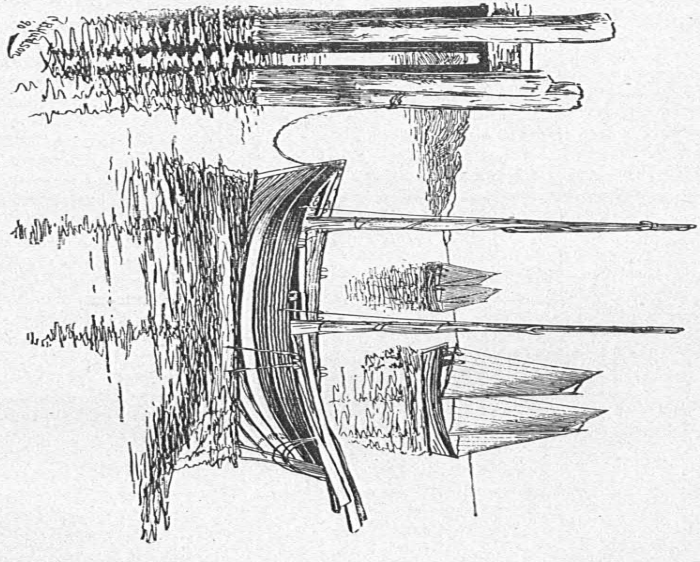
The following are the principal dimensions of the trap boat above described:

	Ft.	In.
Length, over all	27	9
Beam	6	4
Depth, ceiling to top of gunwale	2	5

(4) *Newfoundland Pinkie Boats.*—Sharp-sterned, clinker-built, keel boats—often called "whale-boats"—in form resembling those of the New England coast, are used to a considerable extent in the fisheries of Newfoundland. These boats are usually entirely open, with curved stem, straight stern-post, sharp bow, concave water-lines, round bilge, clean run, and rudder hung outside. They are commonly schooner-rigged, carrying two gaff-sails, and often a jib. They are excellent sea boats, sail well, and row easily.

The following notes on this type of Newfoundland fishing boat have been obtained by the writer from a study of the small craft on the south and east coasts of that island.

A favorite type of fishing boat in use at St. John's, and also on other parts of the Newfoundland coast, is of New England origin. There is more or less variation in the shape of these, corresponding to the differences between the so-called "Hampton boat" of Massachusetts and the "pinkie boat" of Maine. The latter, however, is most generally preferred, being considered the ablest in heavy winds and safest in a rough sea. We were told in all candor by a fisherman of St. John's that these boats had frequently beat to windward in an off-shore gale and entered harbor when decked vessels of 30 to 70 tons could not make any way against the wind. This might seem incredible were it not vouched for by similar statements from fishermen in other localities. Many if not most of these boats have been built in New England. They are strongly constructed, of pine plank and juniper frame, and are copper fastened; consequently they wear well with good usage, and it is not uncommon to find one twenty years old or more. One was pointed



PINKIE BOATS. (See page [44].)
Drawn by C. B. Hudson.

out to us that was about forty years old—"built before the fire in '46," the owner told us—though it had been partly rebuilt. The model and style of construction has, however, been imitated very closely by the native fishermen, who, having found a boat excellently well adapted to their wants, have had the good sense to adopt it.

The following is a description of a Newfoundland-built boat of this kind which we saw at St. John's, and which forms the subject of the illustration:

It is a clinker-built keel craft, with a rising floor, round easy bilge, side flaring slightly above water, sharp bow and stern, the former somewhat the fullest, and having convex lines above and moderately concave lines at and below the load-water line. The stem and stern-post both have a strong rake, the former being curved and the latter straight. It has a strong sheer and a rather low freeboard amidships. On top of the gunwale, however, is firmly and permanently secured a water-tight wash-streak—locally called "wash-board"—that extends from stem to stern, being 8 inches high in the middle and 5 to 6 inches high at the ends. This, of course, adds materially to the freeboard, and makes the boat correspondingly dry and safe in a sea-way. A similar wash-board is used on the Block Island boats, though it is adjustable, and does not extend quite to the stem and stern.

The interior is divided as follows: At the bow is a sort of cuddy, 3 feet 10 inches long fore and aft. This is decked, and has a bulk-head on the after side, in which is a door. This cuddy is used for general storage purposes; the foremast steps in the after part of it. Aft of the cuddy is a standing-room, platformed at the bottom, 2 feet long fore and aft, and extending from side to side of the boat. In this one man stands to fish. Immediately abaft the standing-room is the forward fish-pen, locally called "fish-room." This is 4 feet 6 inches long fore and aft, and is covered by boards loosely laid on top from one thwart to the other. The space immediately around and just forward of the mainmast holds the stone ballast, and over this is a platform a few inches below the level of the thwarts, leaving an open space or standing room forward of the mast about 15 inches fore and aft, and, like all the other divisions, extending from one side of the boat to the other. In this one man stands to fish when 3 men are carried, which is often the case on boats of this type. The after fish-room is situated aft of the mainmast, and is 2 feet 6 inches long. The after cuddy, at the extreme stern, is about 4 feet long. In this are stowed food and fishing gear. In front of this, extending from side to side, is a seat, about 9 inches wide, for the steersman to sit on. Between the after fish-room and the stern cuddy is a standing-room 2 feet 6 inches long, in which the skipper stands to fish. This is platformed, and beneath it is the bailing well, access to which is had through a small trap-door in the platform. Each boat is provided with two or more adjustable stools for the oarsmen to sit on whenever it is necessary to row. These stools

are made by nailing together at right angles two pieces of board about 7 or 8 inches wide and 12 to 18 inches long, these being stayed or strengthened by narrow pieces fastened diagonally across the angle. One end of this rude contrivance rests on a cleat nailed to the boat's side, and the other on top of one of the thwarts, or the boards which cover the "fish-room." These boats are ceiled to the thwarts.

Boats of this class are schooner-rigged, and generally carry a "lug-footed" gaff foresail and mainsail, and a small jib. A few boats, however, have sprit-sails. The spread of canvas is small, for several reasons; first, the land is high and steep, and squalls are frequent when the wind blows from the hills; second, the nearness of the fishing grounds to the "stages" renders it unnecessary to have large sails; and, third, the fishermen are generally poor, and can not afford any expense that is not actually required.

The sails are usually made of hemp canvas or cotton drilling, and invariably have some preservative applied to them. They are most commonly daubed over with cod-fish oil or the cheaper blubber, and with this is often mixed coal tar; sometimes the sails are tanned. Tanning makes the sails a reddish brown, but the oil and tar stains them a dirty black. There are two outriggers aft, to which the mainsheet trims, one of these projecting from each quarter a little abaft the rudder. The sails are commonly attached to the masts by wooden hoops—sometimes by ropes—and may be hoisted or lowered, but they are generally furled on the mast. Three or more long roughly-made spruce oars, and one or two shorter ones, are carried for use in calm weather. They have a peg in the butt of the handle—a characteristic feature of Newfoundland oars. A five-pronged iron anchor of about 25 pounds' weight is used. This is attached to a coir rope-cable, the end of the rope being made fast to a piece of chain 7 fathoms long, that in turn is secured to the crown of the anchor, while a few turns of line hold it to the anchor ring. If caught in the rocky bottom the line breaks, and the anchor may be pulled up by its crown. Coir rope is used for painter, cable, etc., because it is cheaper than manilla or hemp, and also more elastic than either.

The material used in construction is generally as follows: American pine, three-fourths inch thick, for outside planking and ceiling; oak or juniper for frames, gunwales, etc.; spruce for thwarts, and copper for fastening.

A boat will cost from $85 to $100 ready for use, but this is usually exclusive of more or less work done by the fishermen, who ballast their craft with stones, and generally make the oars, masts, etc., even if they hire the hull built.

The following are the dimensions:

	Ft.	In.
Length, over all	25	0
Keel	20	0
Beam	7	4½

	Ft.	In.
Depth, top of upper strake to ceiling	3	5½
Top strake, depth	0	8
Outriggers for mainsheet, each	2	5
Mainmast, total length	21	0
Foremast	23	0
Fore and main gaff, each	7	2
Bowsprit, outside	3	0
Oars, three	24	0
Oars, two	13	6
Area of canvas (22-inch duck)	45 yards	

These boats have two or three men in a crew. They are usually painted outside and in, white, with black top streaks being the most favorite colors above water; the bottom is coated with metallic paint. They can carry 12 quintals of fish, besides about 1 ton of ballast, fishing gear, etc.

(5) *Newfoundland fishing skiff.*—A clumsy, clinker-built, keel boat, locally known as a "skiff," broad and moderately deep, with square stern and rather full rounding bow, is more exclusively used in the Newfoundland inshore fisheries than any other. These vary from about 15 to 30 feet in length and from 5 to 8 feet in width. The smaller ones are generally propelled with oars, assisted by a single sprit-sail, but the larger ones usually have two small sprit-sails and a jib, and occasionally a "jigger" sail at the stern. The seine boats used for shooting cod and herring seines are a modification of the skiff, being somewhat longer in proportion and very broad aft, though it should be said that ordinary skiffs are extensively employed for setting seines. Some of the boats intended especially for cod seining, and perhaps some of those which are used for catching herring, have a piece of glass fitted in the bottom near the stern, just beneath the steerman's feet, this glass enabling the skipper or seine-master to see the fish some distance beneath the surface of the water as the boat is rowed along by its crew. Others use the "fish-spyer," a metal tube with glass bottom.

At St. John's, and elsewhere in many of the adjacent harbors along the coast, one type of square-stern fishing "skiffs" is in very general use. There are certain differences in size, etc., but boats of this class are generally very uniform in shape. They resemble in form the boats used on the sealing ships, and are commonly called "sealing-punts," though they may never have been used for catching seals. In the localities where the fishermen seldom engage in the seal fisheries, as, for instance, the harbors in Fortune Bay, a craft of this class is simply called a "punt" or a "skiff." Many of those used in the localities last mentioned are larger than the St. John's boats of the same type, and frequently have a somewhat different rig. The most noticeable, and perhaps the most common, difference in the rig is a small sprit-sail carried at the extreme stern, the mast being stepped as far aft as possible, and the sheet of the sail trimming to the end of an outrigger or to the weather quarter. This sail is called a "driver" or "jigger," and has

probably been introduced by former residents of the Channel Islands—Jersey and Guernsey—who, coming here to fish, have brought with them the ideas of rig they have formerly been most accustomed to.

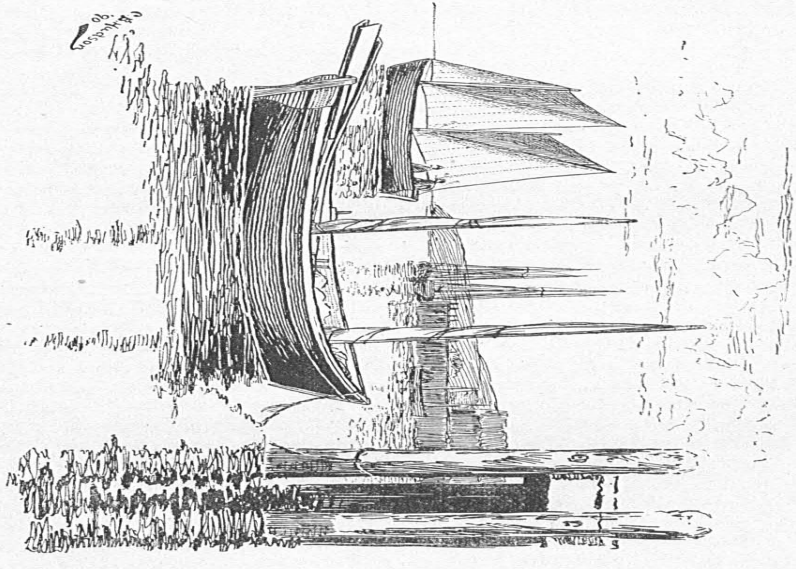
The following are the details of a St. John's boat of this type (see plate X), which may be taken as a fair representative of the class to which she belongs: This is a carvel-built keel boat, open, with a moderate sheer, sharp bow, raking curved stern, considerable rise to floor, round easy bilge, side flaring slightly above water, a good run, no overhang to counters, and a heart shaped, raking, square stern, with rudder hung outside. She is rather roughly built, of spruce chiefly, has 19 sets of timbers, 1½ by 1½ inches, and is fastened with black wrought-iron nails. Like the so called "Yankee boat," this also has a wash-strake, above the gunwale, which is 6 inches high in the middle. Inside of the upper edge of this are fastened 3 large, clumsily made spruce rowlocks (each 18 inches long, 4 inches deep, 1¾ inches thick in the middle, and chamfered at ends), and into these are shipped square-cornered rowlocks, shaped something like the figure 4. This style of rowlock seems to be preferred by the St. John's fishermen, for I noticed that it was almost exclusively used, except, perhaps, on the seine or trap boats. The "scull-hole" in this boat is unique, being simply two round wooden tholes stuck in the stern, on the port side, so as to steady the oar.

The interior of the boat is divided into standing rooms, fish rooms, and lockers, on the same general plan as on the larger sharp-sterned craft. Aft is a locker 4 feet 3 inches long, covered with loose boards 6 or 7 inches below the top of the wash-strake, or just beneath the gunwale. Forward of this is the after standing room, 15 inches fore and aft, next the fish room, which is loosely covered with boards laid from one thwart to another. In this is stowed the stone ballast, around the mainmast, which is stepped in the thwart at its forward end. A second standing room, 14 inches fore and aft, is immediately forward of the mainmast; then comes a fish room (3 feet 6 inches), and next the forward standing room (17 inches). There is a cuddy at the bow, with a fixed deck and bulk-head; a door or hole in the latter serves as an entrance, and the foremast is stepped close to the after end of the cuddy, which is 3 feet 6 inches long. In this are stowed lines, food, etc.

Two small sprit-sails and a diminutive jib are carried, the latter tacking down to the stem head. The sails are coated with a mixture of coal-tar and cod oil, and no booms are used; the single part of the mainsheet reeves through a thimble, one of which is secured to either side of the stern by a rope becket. The anchor and anchor-line are the same as those in the larger sharp-sterned boats, though possibly a little smaller; and the oars differ only in size.

The following are the principal dimensions:

	Ft.	In.
Length, over all	19	0
Beam, extreme	5	0
Width of stern	3	2



FISHING-SKIFFS. (See page [47].)

Drawn by C. B. Hudson.

	Ft.	In.
Depth, top of wash-strake to keelson	2	3½
Length of foremast, above thwarts	9	6
Mainmast above thwart	7	9
Oars, 2	17	6
Oar, 1	14	0
Tiller	4	3

A boat of this kind costs from $20 to $25 as a rule, but is often built by the fishermen at a less expense. They do not, however, last nearly so long as the "Yankee-built" boats, and, though available to a poor fisherman who could not afford the more expensive craft, they are, nevertheless, not so cheap in the end. They are manned by two or three persons, one of whom is often a lad of twelve to sixteen years, and they are employed chiefly in the shore cod-fisheries, though occasionally they may engage in the capture of squid, herring, or other species which frequent the coast. These boats are usually coated with coal-tar. They are built "by the eye," as, indeed, are nearly all of the Newfoundland fishing boats. No model or lines are used; the keel, stem, stern-post, and stern are laid down, two or three frames erected, and battens nailed to these; the other frames are made to correspond more or less closely to the shape of the battens. After these are set up the boat is planked. Necessity inspires ingenuity, and here, as elsewhere, the fisherman must build his boat in most cases, or go without one, the consequence being that he soon acquires sufficient skill for this purpose, and, if he have a natural aptitude for such work, he may produce excellent craft, and ultimately acquire local renown and something more than the rudiments of a boat-builder's trade.

(6) *Toulinguet fishing boats.*—Toulinguet is the most northern village of any importance on the east coast of Newfoundland, and, like all other towns of that province, depends solely on the fisheries. In the spring the inhabitants engage in the seal fishery, going out in small, lightly built boats upon the fields of ice that crowd in against the coast at this season, to hunt for herds of seals, which are often found on the ice packs. In summer the cod-fishery occupies the attention of the fishermen.

But the boats which are used for hunting the seal are also employed in the cod-fishery. Certain qualities are required in a sealing skiff, which must be dragged for miles over the ice, and, since the light, strong, swift boat needed by the sealer is also well adapted to the cod-fishery of this locality, it is not surprising to find that larger craft, built especially for cod fishing, have the same form of hull and style of construction as the skiffs that are built for seal-hunting.

Therefore the boats used at Toulinguet are of one type, a highly specialized form of sealing punt, resembling somewhat the punts carried on the sealing vessels sailing from St. John's, but much more symmetrical than the latter and constructed in a superior manner.

In building these boats for the seal fishery the special object sought

is to make them adapted to use on the ice. The lighter they are the easier they can be moved, and they require much strength and elasticity to withstand the rough usage they must get, while the curved and sloping stem and stern-post and the smooth planking facilitate their passage over ice-floes.

The difference in the size of the boats at Toulinguet depends chiefly on the work they have to do. Those employed in the trap and seine cod-fishery are the largest, and average 28 feet in length over all; the hand-line boats range from 18 to 20 feet over all, while the sealing-punt (which is also used for line cod-fishing) averages about 16 feet in length.

As a rule, the boats of all sizes are provided with sails and oars. The rig varies a good deal, however, and apparently depends entirely upon the fancy of the boatmen. Some of the boats are sloop-rigged, with the mast a little forward of amidships; they carry a loose-footed sprit mainsail and jib, the latter tacking down to the stem-head (see plate VII). The schooner-rig is in favor. Sometimes only two sprit-sails are carried, but perhaps as often a boat will have three sails, a small jib being set on a short bowsprit. Some boats are also rigged as yawls, with the mainmast short and well forward, a small jib, and a diminutive sprit and boom jigger-sail (or "driver") set on a little mast which is stepped at the extreme stern.

The following are the details of construction, etc., of one of the Toulinguet boats used for cod-fishing (see plates VII and XI for lines and sail plan):

She was a carvel-built, open, keel boat, with sharp bow, raking curved stem, rising floor and flaring sides, long easy run, heart-shaped, raking square stern, and no overhang to counter. She had three thwarts and a seat across the stern. These were 6 inches below the gunwale and rested upon a ribband 1½ by ½ inches, which extended from stem to stern of the boat. She had two sets of oak rowlocks, each having a single thole-pin in its after end.* There was a small platform aft, a keelson piece (or foot-rest) 3 inches wide, three battens or ribbands on each side, each 2 inches wide and separated about their width from each other. There were twenty-one frames, spaced 9 inches from center to center. The keel was shod with iron to facilitate its passage over the ice, and also to protect it from injury.

The material used in construction is as follows: Timbers, keel, stem, stern-post, gunwales, and thwarts of spruce; planking of pine; fastenings of black wrought iron.

Dimensions.

	Ft.	In.
Length, over all	17	9½
Keel	14	6
Beam	4	9
Moulded depth, amidships	1	10
Width of stern	3	3

*The rowlocks are commonly made of birch. But occasionally the staves of an oak cask are used, as was the case when the boat above described was built.

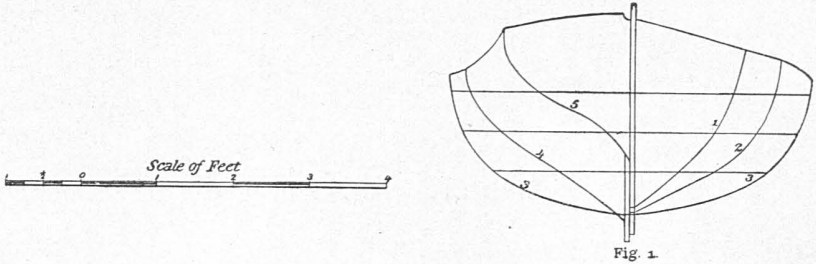


Fig. 1.

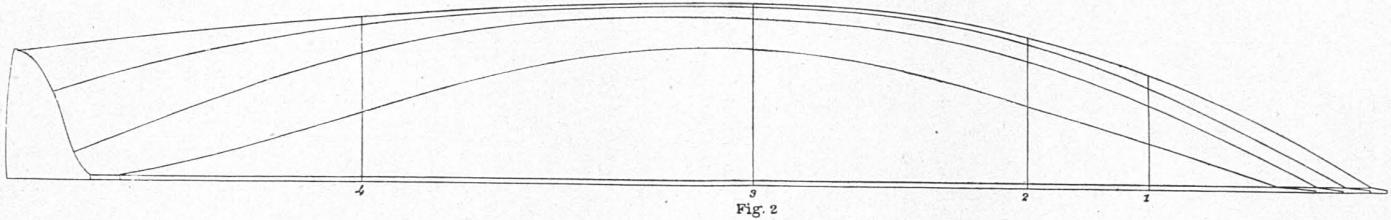


Fig. 2

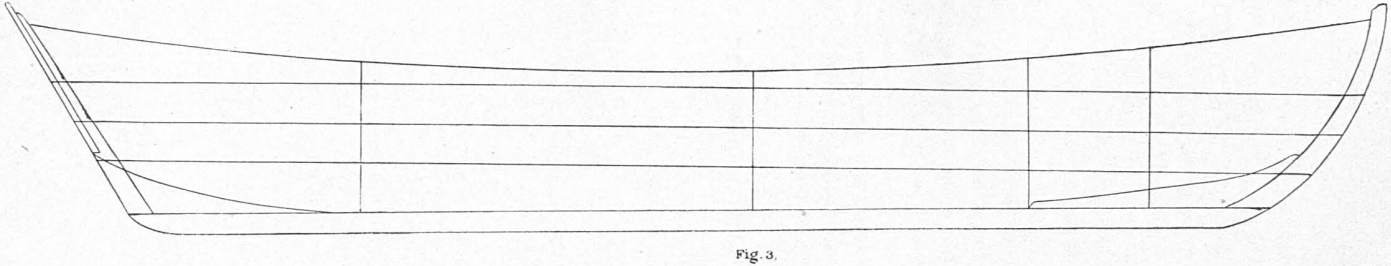


Fig. 3.

TOULINGUET FISHING-BOAT. (See page [49].)

FIG. 1. Body plan.

FIG. 2. Half-breadth plan.

FIG. 3. Sheer plan.

Drawn by J. W. Collins.

	Ft.	In.
Width of stern-seat	0	8
Width of thwarts	0	7
Gunwales	2 in. by 1¼ in.	
Timbers	⅝ in. by ¾ in.	
Plank*	¼ in. thick	
Length of thole-pins	9 inches	
Length of oars, each	8 to 9 feet	

The oars are made of spruce, of the ordinary pattern. They are each provided with a grommet strap to hold them to the thole-pins. These straps are made by twisting together flexible spruce withes. In the loom of each oar, about 15 inches from the end of the handle, is a stout wooden peg with projecting ends, its purpose being to prevent the beckets slipping off the oar.

The Toulinguet fishermen say that it is essential to their success in the seal fishery that a boat should be propelled as quietly as possible. Oars fitted with beckets can be used with very little noise, and the seals can be approached when the clanking of the oars in the ordinary rowlocks would frighten the animals and render their capture impracticable.

(7) *Boats of Fogo Island, Newfoundland.*—At Seldom-come-by Harbor, on the southern side of Fogo Island, a style of fishing-boat is used that differs in model and rig from any other boat I have seen on the Newfoundland coast. It is an open, carvel-built, keel craft, deep and rather beamy, with sharp bow, rising floor, slight flare to top side, a rather fine run, and square stern. Some have a little overhang to their counter, but, as a rule, there is no overhang, and the rudder is hung outside.

There is a moderate rake to the stern-post and stem, and the latter often has a reflex curve like the stem of an American clipper schooner.

These boats are usually built of spruce or juniper; the planking is seven-eighths of an inch thick; they vary from 18 to 28 feet in length and from 6 to 8½ feet beam.

With few exceptions the boats are sloop-rigged, the mainmast being stepped amidships and the jib-stay set up at the stem-head. In some cases a bowsprit, a foot or two in length, is used. Occasionally, also, a small mast is stepped at the extreme stern and a diminutive sprit-sail is carried on it, the sheet trimming to an outrigger which projects from the stern. The mainsail is generally a boom-and-gaff-sail, but sometimes a sprit is used instead of a gaff on the smaller boats.

(8) *Labrador Fishing-boats.*—The boats employed in the Labrador fisheries are similar to those of Newfoundland or Nova Scotia. A sharp-sterned boat, usually called a "barge," is the same as that used at St. John's, and originated in the United States. The other most common form of fishing-boat has been introduced by the fisher-

* The planks, of which there are six strakes on each side, are three-fourths inch thick in the rough, as obtained by the builder, who planes them to one-half inch.

men of Nova Scotia who visit the Labrador coast in summer in pursuit of cod and herring. This, because of its origin, is called a "novie" or "nova"—a name that not only defines the type of boat, but designates the country from which it was first taken to Labrador.

Mr. Stearns, in writing of the Labrador fisheries, makes the following remarks concerning the boats employed in that region:

"The boats used in the ordinary fishing are of two kinds: Those called "novies," or Nova Scotia boats, being long and narrow, shallow, and carrying no ballast, which, should she overturn, it would be impossible to sink her, since she would immediately right again even if full of water; and those called "Yankee barges," or boats brought here from the States or made here, but to a similar pattern. These are very wide for their length, and correspondingly deep. With the barges the seats are so arranged that they form five partitions. The center one is heavily ballasted with rocks. Of course, should one of these boats be upset or filled with water, it would immediately sink to the bottom. Strange to say, the barges are in more demand than the novies, from the fact that while the former hold 8 quintals of fish freshly caught, the latter hold only 4, or one-half the quantity. The men choose to risk their lives rather than lose their fish, and principally for this reason, that when the fish bite well they can load their boat without stopping to run several miles home in a calm, pulling at the oars all the way, to unload and return, often to find the fish gone or darkness approaching."*

(r) *Apparatus.*

(9) *In general.*—Trawl-lines are used almost exclusively, if not entirely, by the bank fishermen. Both hand-lines and seines are employed on the Labrador coast. Hand-lines, trawl-lines ("bultows" or "boulters" in the local vernacular), gill-nets, seines, and traps are operated in the coast fisheries.

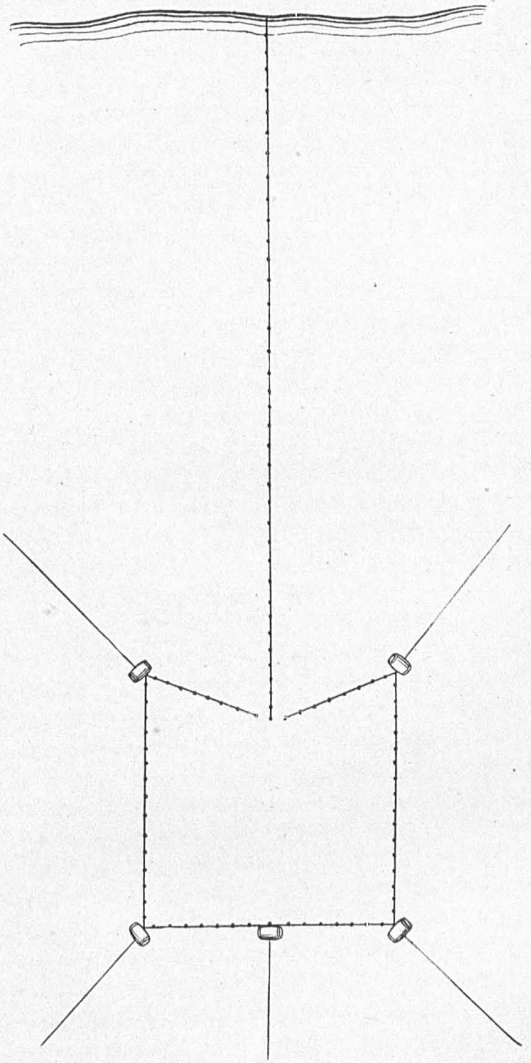
(10) *Trawls and hand-lines.*—The trawl-lines are essentially the same as those used by the New England fishermen. The hand-lines are usually rigged with a rough, home-made sinker or "lead," to which are attached the snoods and hooks. When the cod school at and near the surface, as they generally do when capelin are on the coast, so-called "float-lines" are used, these being rigged by simply fastening a hook to the end of each line.

(11) *Gill-nets.*—Gill-nets are set at the surface when cod are schooling, but at other times are moored close to the bottom.

(12) *Haul-seines.*—Haul-seines are still extensively used. These vary considerably in dimensions.

(13) *Cod-traps.*—In recent years traps have been introduced, and in many places have been very effective in taking cod. The statement is

* "The Labrador Fisheries," by W. A. Stearns. Bulletin of the U. S. Fish Commission, Vol. V, p. 8.



PLAN OF COD-TRAP. (See page [52].)
Drawn by J. W. Collins.

made, however, that in localities where traps have been used for two or three years the results obtained are far below what they were when this form of apparatus was first set. Mr. James Vinecomb, of St. John's, told me that he believed no traps would be used in six or seven years.

The Newfoundland cod-trap (see plate XII) is very simple in its construction. The trap or "crib" is box-shaped, nearly square in plan, of a depth suitable to the locality, and set floating, with corks along the upper edge, buoys at the angles, and a buoy at the middle of the "back," or side farthest from the shore, to support the top of the trap where the mooring lines are fastened. The trap is held in place by an anchor, or "killick," attached to each corner and the center of the back by lines that vary in length according to the depth of water. The leader extends from the mouth of the trap to the shore, its length being governed entirely by local conditions.

The diameter of an average cod-trap varies from 40 to 50 feet, and the width of the entrance or "mouth" on each side of the leader is 5 feet.

(*s*) *Methods of Fishing.*

(14) *General Observations.*—In the bank cod-fisheries the American dory is used and the same methods are employed as are in favor among the New England fishermen. It is chiefly in the shore fishing that these methods are in any manner peculiar to Newfoundland, and these vary considerably in different parts of the island. It will be practicable here to consider only those most commonly employed.

(15) *Trawl-line fishing.*—On some parts of the island trawl-lines are set at the surface for cod when capelin are on the coast, the lines so set being called "floating bultows" or "boulters." The lines are set so that the hooks attached to them will be about 7 or 8 feet from the surface of the water. A "mooring," grapnel or anchor, is put out with a buoy-line attached. The end of the ground-line of the bultow is then bent around the buoy-line in such a way that it will easily slide up and down upon the latter. A short piece of line 6 or 8 feet long is made fast to the buoy and its other end is bent to the ground-line so that the latter shall not go below a certain depth. The ground-line with the hooks attached is then payed out and its last end is made fast to a mooring in the same manner as the first. If necessary, additional floats or buoys are attached to the lines at suitable intervals. This method of fishing is adopted because the cod generally school "up in the water" when they are chasing capelin. As soon as capelin leave the coast the cod no longer rise so near the surface and the trawl-lines must be set near the bottom.

(16) *Hand-line fishing.*—In hand-line fishing at the bottom, the boats are usually anchored and the lines are put out on each side. The crew varies from one to three, or more. At St. John's two men and a boy usually go in one of the "pinkie" boats. When there are three in a

crew, one (the skipper) stands aft and uses three lines, the boy amidships has two lines and the other man at the bow three lines.

The lines are "tried" by pulling in a few feet very often, the fisherman thus determining whether a fish is on or not. If so, he pulls in the line, unhooks the fish, rebaits, and throws out the gear. While the line is running out (the weight of the lead taking it to the bottom), the fisherman turns his attention to the other lines which he tries and pulls in, or waits for a bite if a fish is not on.

(17) *Float-line fishing.*—When fishing with "float-lines," a whole capelin is put on a hook which, when baited, is thrown out several fathoms from the boat. The hooks—locally called "floats"—rarely sink more than 3 or 4 feet below the surface before the fish take them.

As a rule, the boat fishermen prefer to fish during the day and return to harbor at night; but sometimes they remain out over night. In either case a rude attempt at cooking is often made, though little regard is had for neatness. The cooking consists simply of boiling potatoes and fish, and sometimes heating a pot of tea. The arrangements for building a fire and cooking are very primitive. A rude fire-place is made on the ballast amidship. Sometimes this may be only a section of huge kettle that has been broken, or a smaller superannuated pot, or, perhaps, simply a lot of beach gravel spread over the coarser boulders to prevent the fire getting through to the planking.

The boy builds the fire, the man forward cleans the fish that is to be cooked, and the skipper attends to the cooking. When the meal is done, the pot is taken off the fire and its contents turned out onto the rough "gang board" and eaten.

(18) *Bait.*—Herring, capelin, and squid are used for bait. Capelin are taken at Conception Bay about two weeks earlier than at St. John's. The St. John's fishermen employ boats, built especially for the purpose, to obtain bait from Conception Bay or elsewhere. Each cod boat pays a stated sum per season for bait thus secured.

In some localities it is difficult to get bait until the capelin schools come in, and recourse is had to fishing with a leaden jig cast to resemble a fish. The lines are then kept in constant motion to give the jigs the appearance of small fishes darting up and down, and also that the cod which may thus be attracted will be caught by the hooks, several of which are attached to each jig.

(19) *Gill-net fishing.*—The methods employed in the gill-net cod fishery are very simple, consisting mainly of setting the nets at night and lifting them next day.

(20) *Cod seining.*—In seining cod the boat is slowly rowed along near the shore, the skipper or seine-master watching carefully for the appearance of a school of fish by looking through a water telescope or through a glass in the boat's bottom. When fish are seen, and their course noted, one end of the seine is landed and the boat is rapidly rowed around in a semi-circle so as to inclose the fish and bring the other end

SEINING COD ON NEWFOUNDLAND COAST. (See page [54].)

of the net to the shore. As soon as the boat touches the shore all hands spring out and hastily haul in upon the ends of the seine until the fish are gathered in a compact mass in the bunt of the net. The cod are then taken out and carried to the dressing "stage" and the seine is again placed in position in the boat ready for another "shot." Occasionally a "big haul" is secured, and then the seine is "moored" to the shore until the catch can be removed, the object being to keep the fish alive in the net until they can be dressed and salted, only as many being taken out from time to time as can be handled before they begin to deteriorate.

In trap-fishing the crib or bowl is lifted in the same manner that a pound-net is handled. The fish are taken out and carried to the curing stages in boats.

(*l*) *Fish curing.*

(See plates XIV and XV.)

As a rule, much care is exercised in curing codfish in Newfoundland, due largely to the fact that the fish are culled into different grades for market, and the best cured fish demand the highest price. Special attention is paid to splitting the fish, since any neglect in this particular will injure the product. New England fishermen are often less careful about splitting cod, for the reason that the fish are not dried so hard as at Newfoundland, are less liable to be broken, and also because large quantities are made into "boneless cod," and packed into boxes before being placed on the market. The markets of the United States demand large white fish, and perhaps less is thought of the splitting, and more of washing, etc.; while in Newfoundland the conditions are reversed. A fish packer at St. John's rather tersely explained his view of it as follows:

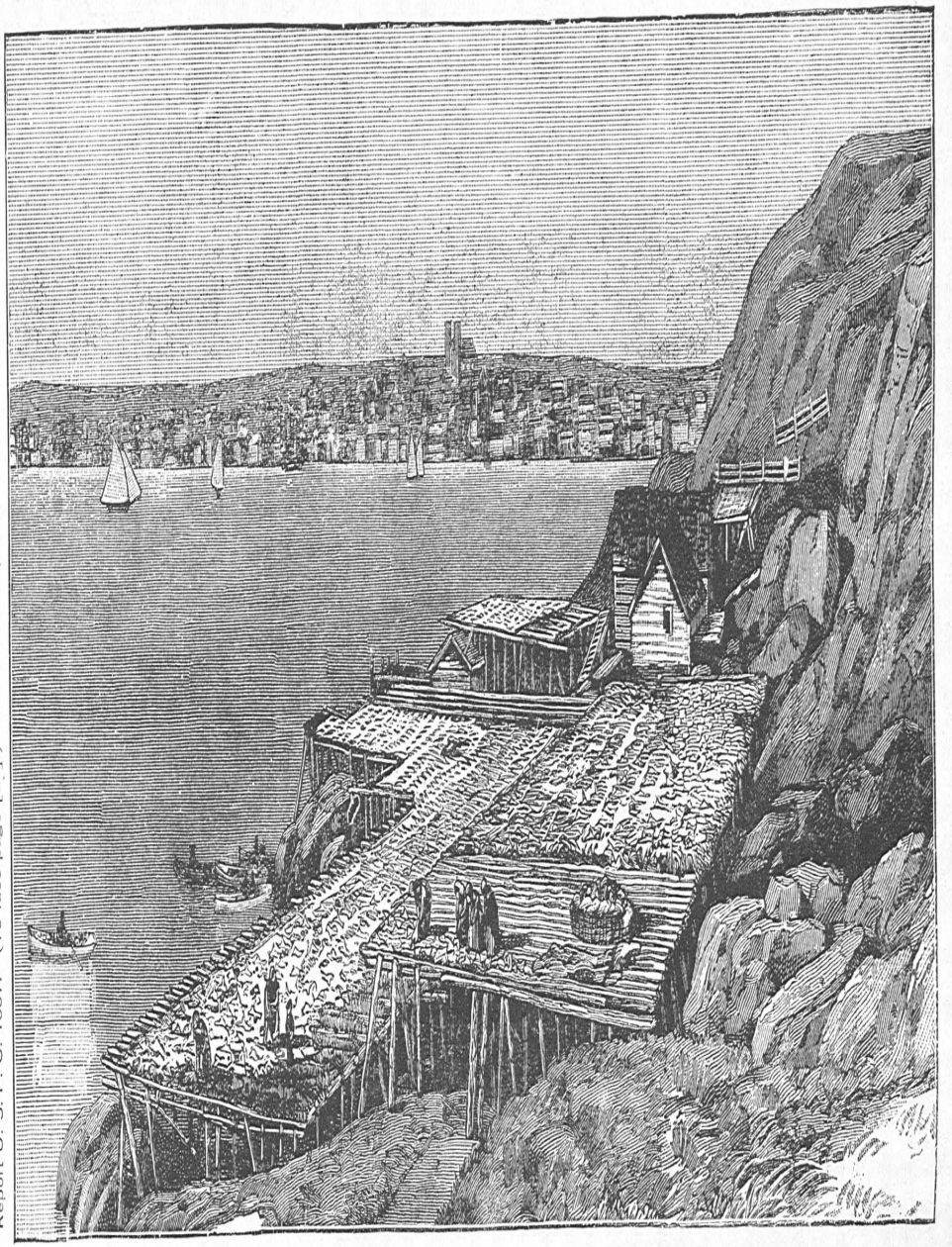
"The Americans don't take as much care in dressing their fish as we do. They think to have large fish and white ones is all that's required. We use all—large or small—and pay but little attention to beauty. The beauty of the fish is not what is most looked for here; it's the quality."

The Newfoundland cod are culled into three grades, West India, Madeira, and Merchantable; the prices for which (in 1885) were respectively 13, 17, and 20 shillings. The "merchantable fish" are usually shipped to Brazil, where they are in high favor; they are small shore cod that have been cured with special care and dried very hard. The pickle cured are generally intended for the United States. When cod are salted in casks for pickle curing, seven hogsheads of salt are put upon one hundred quintals of fish, but ten hogsheads of salt are used on the same quantity of bank cod if they are "bulked" or salted in kench. Cod that are intended for shipment to tropical or semi-tropical countries are "hard cured." They are first dried about three weeks in good weather, then stacked in piles for a greater or less length of

time (the period depending upon the condition of the weather, etc.), after which they are spread on the flakes to dry again for one or more days, when they are ready to ship.

The work of curing cod is done almost wholly by women. In many cases a women has sole charge of this work of curing the fares of bankers or vessels from the Labrador coast, and is called "master of the voyage." Being employed in curing fish from childhood, many of the women acquire great skill in this special work, and their weather wisdom, judgment regarding the proper time to spread fish, etc., are often remarkable. Married women are generally appointed "masters of the voyage," and unmarried women from fifteen to thirty years of age are employed as assistants or laborers. The girls are hired either by the season or employed in a more transient manner by the day. At St. John's the former receive about $100 or upwards for six months' labor, while the latter are generally paid 50 cents per day. If occasion calls for extra effort, and it often does, the girls are expected to work from daybreak till night, about sixteen or seventeen hours of continuous hard labor out of twenty-four. One would think this work of carrying, lifting, spreading, and piling fish would break down the health of young girls, but they seem to thrive on it, and though not remarkable, as a class, for their beauty, these "flake wallopers," as they are called, are nevertheless healthy and strong, while it is not uncommon to find those who have regular and pleasing features.

The flakes are generally built on a steep hill-side, propped up on posts, except at one side where they rest on the ground. The frame-work of the top, usually rough trunks of small trees with the bark on, is covered with boughs of the spruce and fir, and upon these the fish are spread and piled as occasion demands. Near by are the store-houses, the shanties for trying-out oil, the wharf or stage, and the other accessories of a Newfoundland curing establishment. The illustration (plate XV) shows a curing stand at St. John's. But at the out-of-the-way fishing stations along the coast the curing of cod is carried on in a very primitive manner by the fishermen, who barter their "catch" with the traders that go about from port to port in schooners to pick up all the fish they can in exchange for supplies.



CURING COD AT NEWFOUNDLAND. WOMEN AT WORK ON FLAKE-YARD AT ST. JOHN'S. (See page [55].)

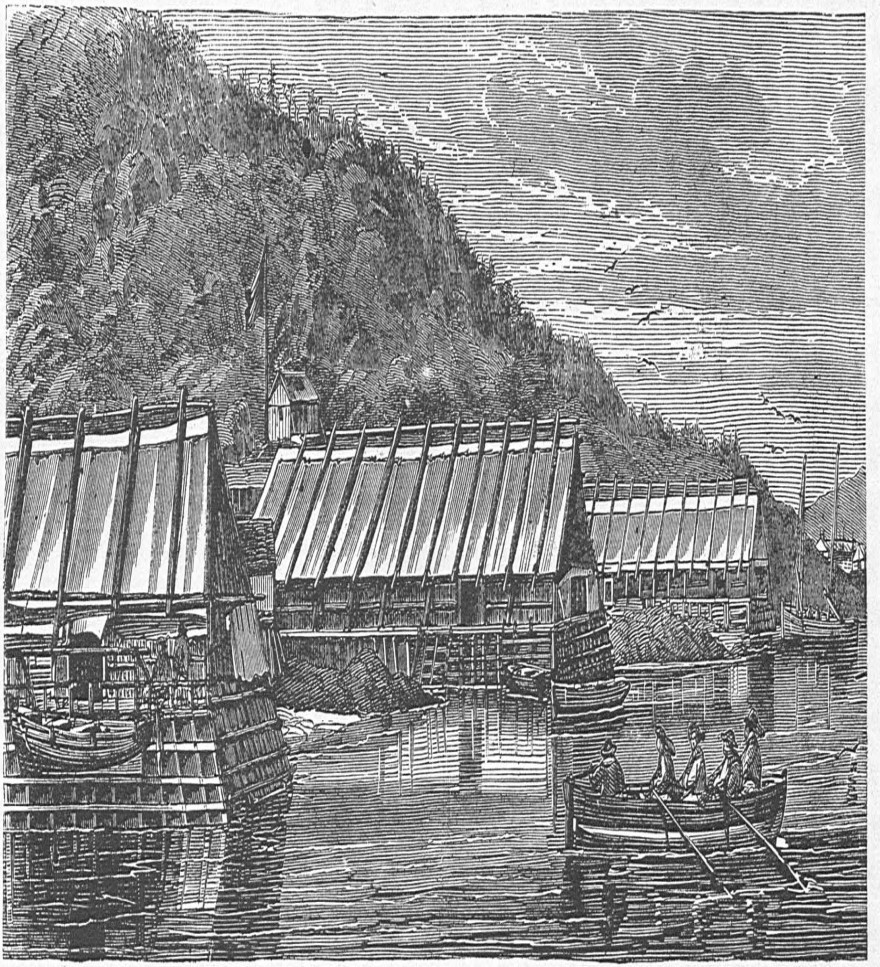
From photograph taken by N. B. Miller

11.—*Table showing air and surface-water temperatures taken on board schooner Grampus July 3 to September 1, 1887.*

Date.	Hour. A. M.	Hour. P. M.	Locality. Lat. N.	Locality. Long. W.	Temperatures. Air.	Temperatures. Water.	Direction of wind.
1887.			° ′ ″	° ′ ″	°	°	
July 3	Noon		42 47 33	67 45 06	67	58	W. by S.
4	Noon		43 09 30	65 25 00	58	50	W. SW.
5	Noon		44 29 28	62 29 30	63	56	W.
6	Noon		45 19 30	60 57 00	58	51	SW.
6		3.23	45 32 00	61 14 00	60	48.5	W. SW.
6		4.40	45 36 15	61 20 00	70	54	W. SW.
7	9.00		45 36 15	61 20 00	70	55	W.
7	11.16		45 44 30	61 20 00	70	57	W. by S.
7		1.15	46 00 00	61 28 00	70	58	W.
8	1.12		47 25 00	61 34 00	58	53	NW.
8	Noon		47 25 00	61 52 30	65	51	NW.
9		1.00	47 50 00	61 52 30	56	54	N.
9		3.00	47 50 00	61 20 00	56	54	N.
9		8.00	47 50 00	61 20 00	55	54	Calm.
10	6.00		47 50 00	61 20 00	55	55.5	SE.
10		4.30	47 17 30	61 20 00	58	55	E. SE.
11	7.00		47 17 30	61 51 00	56	56	E. SE.
11	Noon		47 17 30	61 51 00	58	56	E. SE.
12	6.00		47 17 30	61 51 00	56	56	E. by S.
12		1.00	47 17 30	61 51 00	56	56	E.
13	11.30		47 19 00	61 42 00	55	55	E. SE.
13		6.00	47 14 00	61 40 00	57	56	NW. by N.
14	7.15		47 19 00	59 58 00	56	55	NW.
14	Noon		47 15 30	59 20 45	58	54	NW. by W.
15	Noon		46 20 30	55 31 00	55	52	SW.
15		3.49	46 26 00	54 52 45	54	51	SW. by S.
16	8.00		46 28 00	53 41 00	53	50.5	SW.
16	11.40		46 35 00	53 15 20	54	51	S. SW.
16		4.23	46 39 00	53 04 00	56	51	S. SW.
17	6.00		47 16 30	52 34 00	48	50	Variable.
17		1.57	47 30 00	52 34 25	55	50	SW.
17		3.00	47 31 00	52 41 00	58	50	SW.
17		6.00	47 33 30	52 42 15	63	52	W. SW.
18	7.00		47 33 30	52 42 15	58	51	W. SW.
18	Noon		47 33 30	52 42 15	60	54	S. SW.
18		3.00	47 33 30	52 42 15	60	52	S. SW.
19	8.00		St. John's Harbor		57	53	SE.
19	Noon		do		60	54	Variable.
19		4.00	do		68	53	N. NW.
20	8.00		do		57	54	SE.
20	Noon		do		58	55	E.
20		4.00	do		60	55	E.
21	10.38		47 34 00	52 41 00	60	54	SE.
21		3.40	48 09 12	52 51 00	58	52	SW. by S.
21		8.45	48 42 40	53 05 35	54	52	SW. by S.
21		10.00	48 55 30	53 16 00	55	52	SW. by S.
22		12.20	49 45 30	53 10 00	56	51	S.
22		3.00	49 45 30	53 09 00	54	50	S. by W.
22		9.00	49 45 30	53 09 00	52	50	S.
23	4.00		49 45 30	53 09 00	52	50	SW.
23	11.00		49 45 30	53 09 00	54	50	W. NW.
23		5.20	49 36 40	53 45 00	57	54	S. by W.
24	10.50		49 27 00	53 47 20	64	53	W.
24		2.00	49 27 00	53 47 20	65	54	NW.
24		8.00	49 36 05	54 12 00	62	54	Variable.
25	7.00		49 36 05	54 12 00	63	54	NW.
25	11.00		49 36 05	54 12 00	63	55	N. NW.
25		6.00	49 36 05	54 12 00	58	52	SE. by E.
26		12.30	49 42 30	54 23 30	57	56	N.
26		3.00	49 42 30	54 45 00	55	56	E. SE.
27	8.00		Twillingate Harbor		55	56	N.
27	Noon		do		60	56	Variable.
27		4.00	do		65	56	Variable.
28	4.30		49 42 00	54 47 00	56	56	SW. by W.
28	11.45		50 02 30	55 18 00	60	54	SW.
29			50 42 30	56 04 05	50	48	NE.
29			50 42 30	56 04 05	55	46	Variable.
29			50 41 40	56 05 30	58	49	SE.
29			50 41 40	56 05 30	55	49	Calm.
30	8.00		Grevigrieux Harbor		55	49	NE.
30	Noon		do		58	49	SE.
30		4.00	do		60	49	S.
31	8.00		do		52	49.5	S.
31	Noon		do		58	49.5	S. by W.
31		4.00	do		65	50	Variable.

11.—*Table showing air and surface-water temperature, etc.*—Continued.

Date.	Hour.		Locality.		Temperatures.		Direction of wind.
	A. M.	P. M.	Lat. N.	Long. W.	Air.	Water.	
1887.			° ′ ″	° ′ ″	°	°	
Aug. 1	7.00		Grevigrieux Harbor		55	52	Variable.
2	8.00		do		55	51	Variable.
2	Noon		do		57	51	Variable.
2		4.00	do		58	51	E.
3		2.30	50 55 50	55 49 00	56	51	SW.
3		9.24	51 30 40	55 19 40	49	46	SW. by S.
4			51 41 30	55 48 30	49	46	S. by W.
4			51 37 40	56 41 00	58	40	W.
5	Noon		51 37 40	56 41 00	50	39	S.
5		9.00	51 37 40	56 41 00	55	39	W.
6	6.00		51 37 40	56 41 00	55	37	W.
6		1.00	51 37 40	56 41 00	56	37	W.
7	8.00		Black Bay, Labrador		57	38	Variable.
7	Noon		do		51	39	Variable.
7		4.00	do		46	39.5	SE. by E.
8	8.13		51 22 50	57 06 30	50	55	NE.
8		5.30	50 28 30	59 11 45	47	51	N. NE.
9	6.30		49 52 00	60 21 00	56	57	W. by S.
10		7.48	50 10 12	64 00 00	52	40	Variable.
11	7.45		50 13 00	64 08 00	48	38	E. SE.
11		1.05	50 17 58	64 03 30	50	48	E. SE.
12	8.00		Mingan Harbor		53	42	E. SE.
12	Noon		do		55	48	E. SE.
12		4.00	do		53	45	E. SE.
13	8.00		do		50	46	W.
13	Noon		do		53	48	W.
13		4.00	do		55	46	W.
14	Noon		50 17 58	64 03 30	57	44	N.
15	8.00		Mingan Harbor		48	43	W.
15	Noon		do		54	44	W. NW.
15		4.00	do		55	44	NW.
16	10.00		50 13 30	64 13 30	50	42	NW.
17	8.00		Mingan Harbor		50	42	N.
17	Noon		do		48	42	W. NW.
17		4.00	do		49	42	W. by N.
18	8.00		do		48	42	E. by S.
18	Noon		do		55	45	E. SE.
18		4.00	do		61	46	S. by E.
19	8.00		do		55	42	E.
19	Noon		do		50	42	E.
19		4.00	do		50	42	E.
20		3.00	49 47 40	64 35 00	55	50	W. by N.
20		8.00	49 11 00	64 07 30	52	49	N. NW.
21	9.23		48 32 00	64 09 00	57	54	N. NE.
21		1.30	48 32 00	64 15 00	59	56	NE.
22	8.00		Off Percé Rock		58	56	Variable.
22	Noon				61	57	SW.
22		4.00			62	59	W.
23		1.10	46 28 00	61 55 00	62	63	NE.
23		9.05	45 42 00	61 28 00	59	61	NE.
24	9.00		45 36 30	61 21 50	65	63	Variable.
25	Noon		45 36 30	61 21 50	62	60	E. SE.
26	8.00		Port Hawksbury		62	60	E. SE.
26	Noon		do		62	60	E. SE.
26		4.00	do		63	60	N.
27		4.30	45 11 00	61 08 00	64	60	NW. by N.
28		6.50	44 33 00	63 00 00	62	62	W. NW.
29		7.00	43 26 00	65 15 00	59	61	E. by S.
30	8.00				60	55	Variable.
30	Noon		43 02 00	65 52 00	64	56	Variable.
30		4.00			60	54	SW.
31	Noon		42 35 06	66 53 45	60	52	E. by N.
Sept. 1	10.30		41 32 28	69 55 00	62	60	N. NE.



CURING-STAGES AT NEWFOUNDLAND. (See page [55].)

From London Illustrated News.

12.—*Table showing localities, results, etc., of trials for fish with "toll bait," hand-lines, etc.*

Date.	Hour. A. M.	Hour. P. M.	Approximate position.	Lat. N.	Long. W.	Apparatus used.	Surface water.	Results.
1887.				° ′	° ′		°	
July 6	8.30	.....	Off White Head	.....	.....	Hand-lines	51	4 codfish.
8	9.45	.....	Grindstone Island shore.	.....	.....	Baird seine	.....	Nothing.
9	.....	1.00	Small Bird Rock	.....	.....	Toll-bait	54	Do.
9	.....	1.00	....do	.....	.....	Hand-lines	54	Do.
10	11.00	.....	Off Entry Island	.....	.....	Toll-bait	54	Do.
10	11.00	.....	... do	.....	.....	Hand-lines	54	11 cod, 1 halibut, 2 flounders.
10	.....	4.30	Amherst Harbor	.....	.....	..do	55	Small local fish.
13	.....	2.00	S. SE. Entry Island	.....	.....	Toll-bait	55	5 cod, 1 halibut.
28	.....	4.00	Off Bay Verte	.....	.....	....do	55	Nothing.
Aug. 9	5.30	.....	Off Eastern St. Mary's Island.	.....	.....	Hand-lines	53	Do.
10	.....	7.48	Off Largo Island, Mingan group.	.....	.....	....do	40	1 cod.
15	.....	1.00	Off Mingan Island	.....	.....	Toll-bait	44	Nothing.
15	.....	8.00	....do	.....	.....	Squid jigs	44	Do.
16	8.00	.....	....do	.....	.....	Toll-bait	45	Do.
21	6.50	.....	Off Percé	.....	.....	....do	54	Do.
21	6.50	.....	Cape Gaspé, North Percé Mountain, W. NW.	.....	.....	Hand-lines	54	Do.
30	.....	4.00	At sea	42 58	66 06	....do	.....	1 cod, 1 cusk.

13.—*Table showing positions, etc., where small surface towing-net was used.*

Date.	Hour. A. M.	Hour. P. M.	Approximate position.	Lat. N.	Long. W.	Length of towing.	Surface water.	Results.
1887.				° ′	° ′	*Min.*	°	
July 3	.....	7.00	Gulf of Maine	.....	67 25	60	58	Small crustaceans and insect larvæ.
6	8.30	.....	Off White Head	.....	.....	90	51	Small crustaceans and fish eggs.
29	6.30	.....	Off Canada Head	.....	.....	60	48	Crabs in larval stages.
Aug. 5	10.00	.....	Off Cape Whittle	49 52	60 21	60	57	Medusæ.
10	8.00	.....	Off Mingan Island	.....	.....	60	55	Nothing.
21	8.00	.....	Off Bonaventure Island	.....	.....	.....	.....	Do.
23	7.00	.....	Gulf of St. Lawrence	.....	.....	40	.....	Do.
30	8.00	.....	Off Cape Sable	43 02	65 51	120	55	Do.
30	.....	4.00	Near Brown's Bank	42 58	66 06	60	54	Small crustaceans.

III.—REPORT UPON THE OPERATIONS OF THE GRAMPUS FROM SEPTEMBER 16, 1887, TO MARCH 24, 1888.

By J. W. COLLINS.

A.—REFITTING AND COPPERING THE VESSEL, ETC.

The previous report upon the operations of the *Grampus* concluded September 16, 1887; at that date she arrived at Gloucester to refit for her winter's work of collecting live cod and allied species, as well as the eggs of the *Gadidæ*, for the purpose of propagation. This section will, therefore, be a review of her winter's work.

Soon after the arrival of the vessel at Gloucester, certain necessary alterations were made in the new sails, which had been bent for the trip to Newfoundland and Labrador. The winter sails were put in order for service, the vessel was painted, and all available time was utilized for putting the rigging into proper shape.

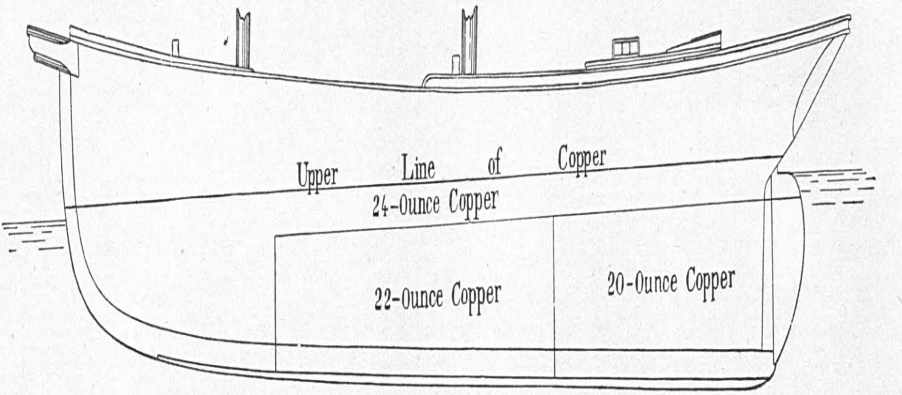
It was deemed very important that the vessel's bottom and the interior of the well should be coppered, to obviate the danger of injury to the plank from being worm-eaten. The Commissioner, Prof. G. Brown Goode, had the matter under consideration early in September, but owing to various causes, among which was my absence from the vessel, no definite action was immediately taken.

In the mean time, soon after the arrival of the *Grampus* at Gloucester, I was ordered to Washington to superintend the preparation of a series of large maps showing the distribution of the principal food-fishes along the Atlantic coast from Hatteras to Labrador, and the grounds usually resorted to by the fishermen when in pursuit of those species. These maps, which also showed the principal fishing towns, the limits in Canadian waters from which American fishermen are excluded by the treaty of 1818, etc., were prepared for the use of the International Fisheries Commission, which met in the winter of 1887–'88 at Washington, to negotiate a new fisheries treaty. The Commissioner also deemed it important that I should be in Washington for consultation in reference to fishery matters bearing upon the negotiations.

Having ordered the first officer to assume command of the vessel during my absence, I left Gloucester on September 20, and reached Washington the following day. As soon as the work of the preparation of the maps was organized, I left Washington (on the 27th of September) under orders from the Commissioner to return to Gloucester and prepare specifications and obtain bids for coppering the *Grampus*.

The following bids were received and opened on November 1:

Messrs. William F. Green & Son, Boston, Mass	$1,250
Messrs. Bliss Brothers, Boston, Mass	1,290
E. A. Costigan, Boston, Mass	1,750
Messrs. Burnham Brothers, Gloucester, Mass	1,594



SHEER PLAN OF SCHOONER GRAMPUS, SHOWING AREA COVERED WITH COPPER SHEATHING, ETC.

Drawn by E. I. Rogers.

The bid of William F. Green & Son proved to be the most advantageous to the Government, and accordingly the contract was awarded them.

Having completed and sent out the specifications and invitations for bids for coppering the vessel, I left Gloucester on October 15 for Washington, in compliance with instructions from the Commissioner. As is usual before leaving the vessel, I placed her under the command of the first officer, with instructions to act in accordance with orders sent him from Washington from time to time.

Mention may be made that, while at Gloucester on the 6th of October, I made an examination of Ten Pound Island, in compliance with the request of Col. Marshall McDonald, and reported to him on October 7 the condition of the island and its suitability as a site for a hatchery for marine fishes, and suggested that the northeast part of the island would be the most suitable location for a hatchery.

On November 9 I was again ordered to proceed to Gloucester, in company with Colonel McDonald, for special duty in connection with the establishment of a fish hatchery at Ten Pound Island, after which I was to return to Washington.

The *Grampus* left Gloucester on November 12 to go to Boston for the purpose of being coppered. She was taken on the marine railway at East Boston on the 14th. On the same day I went to Boston for the purpose of inspecting the vessel before the work of coppering her was begun. Having made satisfactory arrangements and given instructions to the contractors, I left Boston the same afternoon and arrived in Washington the following day.

The contractors finished coppering the vessel on November 18, and immediately after she went to Gloucester, arriving there on the afternoon of that day.

The schooner remained at Gloucester until the 21st, when she sailed for Wood's Holl, which place she reached on the 23d. She lay at Wood's Holl until November 26. In the mean time the summer suit of sails was unbent and the winter sails put in their place; the foretopmast was sent down and various other changes were made in her outfit and equipment. As soon as this necessary work had been performed the vessel left Wood's Holl for Gloucester, where she arrived on the afternoon of November 27.

B.—COLLECTING LIVE FISH.

It was intended that the *Grampus* should at once enter upon the work of collecting live codfish for the purpose of propagation. But, because of the scarcity of bait, she was unable to commence active operations until the 4th of December. In the interim every effort was made to obtain bait from other towns, but none could be secured until the evening of December 3, when a supply was received from Provincetown.

She began fishing with hand-lines on the rocky shoals 4 or 5 miles distant from Eastern Point, and continued this work whenever the weather permitted until the end of the month. In the mean time some live-cars had been built and moored near Ten Pound Island, and the cod were on suitable occasions transferred from the well to the cars.*

As usual on the New England coast, the weather was rough and windy throughout December, and as a consequence there were only twelve days that were suitable for fishing; on one of these an anchor was lost, and, as the wind blew up strong soon after, the vessel returned to port.

Notwithstanding the adverse conditions, a total of 946 cod and 6 pollock were taken on handlines, of which, however, 357 cod and 5 pollock died in the well or in the live-cars before the close of the month, leaving 589 cod and 1 pollock alive as a result of the fishing in December.

Between Christmas and the 1st of January the cod apparently moved off the rocky shoals into deeper water, and it became necessary to use trawl lines. Trawls were set for the first time on January 2 and hauled on the next day, with indifferent success, only 21 cod, 2 hake, and 1 haddock being taken. Fishing with trawls was continued until the 6th of January, but comparatively few fish were taken.

In compliance with orders from the Commissioner, I left Washington on December 20, in company with Colonel McDonald, who went to make a final inspection of Ten Pound Island Hatchery, and to make any additional arrangements that might seem necessary for supplying it with fish eggs during the winter. We reached Gloucester on December 21, and on the next day made a trip to the fishing grounds on the *Grampus*. I remained in Gloucester until January 4, when I left there and arrived in Washington on the following day.

Soon after this, however, the weather became much colder, and the temperature of the water in the harbor fell so low that ice began to form, and shortly all the fish in the well of the *Grampus* and those that had been placed in the live cars died. Unfortunately, too, this occurred before the hatchery was fully completed, and thus the eggs which might otherwise have been obtained from the live fish were not secured.

C.—COLLECTING FISH EGGS.

Since the weather continued very cold and the harbor was frozen over to a greater or less extent, it was evidently of no use to catch live fish, for they would die as soon as the vessel entered the harbor. In a letter dated January 5, Mr. Robinson, superintendent of the hatchery, made the following suggestion for collecting cod eggs from the fishermen:

"I am sure that we can secure more eggs by keeping some of our force on the *Grampus* to collect the spawn than by catching the fish and penning them. Capt. D. E. Collins is of the same opinion."

* For details see Table 1.

This method had been adopted the previous year with good success, and there was reason to anticipate that excellent results might be obtained.

The first trip for collecting eggs was made on January 14, and on that occasion 7,056,000 cod eggs were obtained. This method of supplying the hatchery was continued during the remainder of the season.

The total number of fish taken, the dates upon which fishing was carried on, etc., and also the aggregate number of eggs collected during the season, are shown in Tables 1 and 2. The temperature of the sea and air is shown in Table 3.*

Reference is made to the report upon the construction and equipment of the *Grampus*, for a description of the methods employed in obtaining fish and eggs on board the vessel.

D.—DIFFICULTIES ENCOUNTERED IN THE WORK.

The weather throughout the winter continued exceptionally severe, and it was frequently difficult to obtain eggs, even when fish were caught, owing to the low temperature, which chilled the ova before they could be taken on board the *Grampus*, although the utmost care was observed. The following mention, taken from the log-book under date of January 24, will illustrate the difficulties often met with:

"From 8 a. m. to 12 m.: Wind northwest, increasing from a stiff breeze to a moderate gale; weather clear and cold. One spawn-taker boarded schooner *Hector*, but nothing could be done in the way of collecting eggs, as the fish would freeze in a very short time after being taken from the water."

Outside of the frequent recurrence of such difficulties, no incident demanding special attention seems to have occurred, excepting on the 15th of February. On that date the *Grampus*, as usual, left Gloucester in the early morning. There was a stiff breeze off the land, but a promise of a fairly good day for fishing. Reaching the grounds, about 12 miles from the land, two dories were sent on board the fishing schooners to collect eggs. Shortly before noon the wind piped up sharply from the northwest, promising a hard thrash to windward to reach Gloucester. At the same time the temperature fell rapidly, and the vessel's deck and rigging were soon covered with ice, since the flying spray froze wherever it fell.

One dory, with her crew of two seamen, returned on board the *Grampus*, leaving the spawn-taker on board the fishing vessel, where he preferred to stay rather than take the risk of making a passage in a small boat from one vessel to the other with such a gale blowing. The *Grampus* then stood along to pick up her other dory. But before she arrived near the schooner, astern of which the boat was towing, the painter parted and the dory was set adrift. By skillful maneuvering

* Bottom temperatures were not observed previous to March 9.

the boat was picked up by the *Grampus* and hoisted on board, but it was then so rough, and the wind was increasing so rapidly, that it was not considered quite safe to send for the two men then on board the fishing schooner, who it was supposed would reach Gloucester Harbor without special difficulty. This expectation was not realized, however, for the schooner upon which the two men were was unable to reach Gloucester in the teeth of the gale then blowing. She, therefore, kept off for Provincetown, but in running across Massachusetts Bay the sea broke upon her to such an extent as to completely fill her decks, rendering it necessary to knock off her bulwarks to prevent her from foundering. At the same time she sprung aleak, and it was with great difficulty that she was kept afloat until she reached the shelter of Provincetown Harbor, where she had to remain two or three days before she could return to Gloucester. Capt. D. E. Collins briefly reported the return of these men as follows:

"Our men got back from Provincetown Sunday, at 12:30 a. m. They had a rough time getting over to Provincetown and came near swamping before reaching there."

This simple statement will give some idea of the severity of the gale.

Fortunately, the mainsail of the *Grampus* was single-reefed when she left the harbor; for she was so short-handed, owing to the absence of two out of five of her seamen, that it was believed to be impracticable to reef the sails, which were coated with ice and stiff as sheets of iron. And, even if the mainsail could have been double-reefed, there was not sufficient force to hoist it. It was evident that the single-reefed mainsail must not be lowered, if the vessel could possibly stand up under it, with the jib and forestaysail set. "There was too much wind for comfort under that sail," wrote Captain Collins, and the fact that he stood at the wheel for six hours, not daring to leave it in the hands of another until anchor was dropped in Gloucester Harbor, is evidence of the lack of comfort, particularly as his face was badly frost-bitten on both cheeks, and his clothing was covered with sheets of ice.

In reviewing the winter's work it seems desirable to call attention to various causes which operated against the obtainment of complete success. In the first place, much time was lost in the fall when there was a good school of cod on the shore grounds, while the vessel was waiting to be coppered. Secondly, the delay in completing the hatchery at Ten Pound Island, and the death of the fish in the live cars, prevented the Commission from reaping benefits which it otherwise would have derived from the live cod that were collected. The work was again very much interfered with and retarded by the fact that the density of the sea water in Gloucester Harbor decreased so materially during March and April (presumably as a result of the melting snows) that, although quantities of eggs were collected, they would not float, and consequently most of them died on the bottom of the hatching boxes.

E.—COMPLETION OF THE WINTER WORK.

On March 24, in compliance with orders from the Commissioner, the work of collecting cod eggs ceased, and the vessel was re-fitted for a cruise of investigation to the southern mackerel grounds, of which an account is given in the succeeding section of this report.

F.—TABULATED STATEMENTS.

TABLE 1.—*Showing time occupied in line fishing, fishing grounds resorted to, results, etc., December 4, 1887, to January 6, 1888.*

Date.	Fishing grounds.	Bait.	No. fish caught.		No. fish dead.		Depth of water—fathoms.	Time occupied.*	Remarks.
			Cod.	Pollock.	Cod.	Pollock.			
1887.								*h. m.*	
Dec. 4	Thatcher's Id. NE. by N., Eastern Point N. by E.	Herring ..	112	3	19	3	26	6 40	
6	Thatcher's Id. N. ½ E., 3½ miles distant.	... do	33	1	.....	.....	30	6	
7	Eastern Point N. by E. ½ E., Baker's Id. WNW.	.....	70	2	24	2	.....	6	
9	Eastern Point N., Baker's Id. W. by N. ½ N.	Clams and spurling.	113	.....	35	.....	27½	7	
12	Eastern Point N. by E. ½ E., Baker's Id. W. by N. ½ N.	Squid and herring.	126	.....	48	.....	23	6	
13	Honey pinks	Herring ..	72	.....	38	.....	25	5 25	
14	Eastern Point N. by E. ½ E., Baker's Id. WNW.	....do	21	.....	50	.....	26	6	Transferred 153 live cod to cars.
15	Honey pinks	....do	65	.....	91	.....	26	5	
20	Eastern Point N. by E. ½ E., Baker's Id. W. by N. ½ N.	Sea clams.	134	.....	20	.....	25	5	Transferred 113 live cod to cars on 17th; transferred 90 live cod to cars on 21st.
22	Buff coasts.....	....do	75	.....	14	.....	25½	3	Took 15 dead cod from well on 21st.
23	Eastern Point N. by E., Baker's Id. W NW.	....do	125	.....	18	.....	25	5	
24	Western Brown's Bank.	Herring ..	.....	.....	.....	.....	.....	.....	Lost anchor and immediately returned.
1888									
Jan. 2	Eastern Point N. ½ E., Baker's Id. N. W. by W.	.....	24	(†)	19	.....	.....	(§)	
4	Lazy Bottom.....	Herring ..	24	.....	19	.....	30	(§)	Transferred 125 live cod to cars.
6	Western Brown's Bank.	....do	29	.....	.....	.....	.....	(§)	
	Totals	.....	1,020	(‖)	395	5	.....	.....	

* Actual time spent on fishing grounds.
† Using trawls; gear hauled following day.
‡ 2 hake, 1 haddock.
§ All night.
‖ 2 hake, 1 haddock, 6 pollock.

TABLE 2.—*Showing number of eggs collected, dates of collection, and temperatures.*

Date.	Cod eggs.	Temperatures.* Air.	Surface water.	Bottom water.†	Date.	Cod eggs.	Temperatures.* Air.	Surface water.	Bottom water.†
1888.		°	°	°	1888.		°	°	°
Jan. 3	750,000	30	40	.....	Feb. 21	758,160	40	35	.....
6	180,000	30	40	.....	22	871,520	37	35	.....
7	300,000	32	40	.....	23	1,958,480	35	36	.....
14	7,056,000	35	38	.....	24	189,540	35	36	.....
Feb. 1	1,178,793	24	35	.....	27	379,080	.....	.....	.....
3	841,995	31	35	.....	Mar. 1	1,979,610	25	34	.....
4	463,320	30	35	.....	3	63,180	27	34	.....
6	942,400	32	37	.....	10	800,280	36	32.5	34.5
7	884,520	32	34	.....	11	716,040	36	34	.....
13	379,080	38	34	.....	16	736,920	35	33.5	35.6
14	‡2,059,525	40	34	.....	19	189,540	28	34	34.8
15	1,453,500	36	33	.....	20	84,240	39	33.5	35
19	2,105,980	30	34	.....	22	589,540	40	34	36

Total number cod eggs collected on fishing grounds	28,814,273
Haddock eggs collected on fishing grounds	75,000
Cod eggs taken from fish in live cars§	2,540,000
Total number of eggs for season	31,429,273

* Temperatures given in Fahrenheit degrees.
† Bottom temperatures were not observed until March 9.
‡ 75,000 haddock eggs.
§ Eggs taken from fish caught by vessel and penned in live cars.

TABLE 3.—*Record of temperature of air, surface and bottom water, observed on schooner Grampus from November 18, 1887, to April 2, 1888.*

Date.	Approximate position. Lat. N.	Long. W.	Hour. A. M.	P. M.	Temperatures F. Air.	Surface water.	Bottom water.*	Depth of water.
1887.	° ′ ″	° ′ ″			°	°	°	*Feet.*
Nov. 18	42 21	70 54	.....	1.45	48	45	.....	.....
18	42 34 30	70 40 05	.....	4.30	41	45	.....	.....
18	42 37	70 40	.....	7	40	44	.....	.....
19	42 37	70 40	4	.....	40	44	.....	.....
19	42 37	70 40	12 m	.....	50	44	.....	.....
19	42 37	70 40	.....	8	.....	.....	.....	.....
20	42 37	70 40	4	.....	46	44	.....	.....
20	42 37	70 40	12 m	.....	50	45	.....	.....
20	42 37	70 40	.....	8	35	45	.....	.....
21	42 37	70 40	4	.....	27	43	.....	.....
21	42 37	70 40	12 m	.....	35	45	.....	.....
22	41 31 20	69 53 30	6.30	.....	38	46	.....	.....
22	41 27	70 17 15	11	.....	40	46	.....	.....
22	41 28	70 35	.....	5	40	47	.....	.....
23	41 28	70 35	4	.....	37	46	.....	.....
23	41 31 10	70 40 05	12 m	.....	50	45	.....	.....
23	41 31 10	70 40 05	.....	8	46	45	.....	.....
24	41 31 10	70 40 05	4	.....	45	45	.....	.....
24	41 31 10	70 40 05	12 m	.....	45	45	.....	.....
24	41 31 10	70 40 05	.....	8	40	45	.....	.....
25	41 31 10	70 40 05	4	.....	42	45	.....	.....
25	41 31 10	70 40 05	12 m	.....	50	45	.....	.....
25	41 31 10	70 40 05	.....	8	45	45	.....	.....
26	41 31 10	70 40 05	4	.....	50	45	.....	.....
26	41 28 40	70 34	9.25	.....	58	47	.....	.....
26	42 03	70 01	.....	6.10	49	47	.....	.....
27	42 24	70 25	4	.....	45	47	.....	.....
27	42 34 30	70 40 05	.....	2.30	56	45	.....	.....
27	42 37	70 40	.....	8	48	45	.....	.....
28	42 37	70 40	4	.....	49	45	.....	.....
28	42 37	70 40	12 m	.....	54	45	.....	.....
28	42 37	70 40	.....	8	40	45	.....	.....
29	42 37	70 40	4	.....	32	44	.....	.....
29	42 37	70 40	12 m	.....	38	45	.....	.....
29	42 37	70 40	.....	8	26	45	.....	.....
30	42 37	70 40	4	.....	23	43	.....	.....
30	42 37	70 40	12 m	.....	30	44.5	.....	.....

* Not recorded until March 9, 1888.

TABLE 3.—*Record of temperature of air, surface and bottom water, etc.*—Continued.

Date.	Approximate position.		Hour.		Temperatures F.			Depth of water.
	Lat. N.	Long. W.	A. M.	P. M.	Air.	Surface water.	Bottom water.*	
1887.	° ′ ″	° ′ ″			°	°	°	*Feet.*
Nov. 30	42 37	70 40		8	17	44		
Dec. 1	42 37	70 40	4		15	42		
1	42 37	70 40	12 m		18	42		
1	42 37	70 40		8	20	42		
2	42 37	70 40	4		14	40		
2	42 37	70 40	12 m		29	41		
3	Gloucester Harbor		4		40	40		
3	do		12 m		45	42		
3	do			8	34	42		
4	do		3		40	41		
4	42 25 30	70 39	7		40	44		
4	42 25 30	70 39	12 m		43	45		
5	Gloucester Harbor		4		42	41		
5	do		12 m		44	41		
5	do			8	39	41		
6	42 35	70 33 10	7.30		31	44		
6	42 35	70 33 10	12 m		34	43		
6	Gloucester Harbor			7	36	40		
7	do		4		28	41		
7	42 31	70 40	6.40		34	44		
7	42 31	70 40	12 m		42	44		
7	Gloucester Harbor			7	38	42		
8	do		4		39	41		
8	do		12 m		47	41		
8	do			8	36	41		
9	do		4		36	41		
9	42 31 10	70 40	7		35	44		
9	Gloucester Harbor			8	30	41		
10	do		4		38	41		
10	do		12 m		45	41		
10	do			8	42	41		
11	do		4		45	42		
11	do		12 m		48	42		
11	do			8	48	42		
12	do		4		43	41		
12	42 31	70 40	7.15		45	45		
12	42 31	70 40	12 m		51	45		
13	42 28	70 38 30	7.15		36	45		
13	42 38	70 38 30	12 m		40	45		
13	Gloucester Harbor			8	34	42		
14	do		4		30	40		
14	42 31 20	70 40	6.45		30	44		
14	42 31 20	70 40	12 m		47	45		
15	42 32	70 37	7.35		41	43		
15	42 32	70 37	12 m		45	44		
15	Gloucester Harbor			7	38	43		
16	do		4		35	43		
16	do		12 m		35	43		
16	do			5	33	42		
17	do		4		28	41		
17	do		12 m		40	42		
17	do			7	34	41		
18	do		5		38	41		
18	do		11		35	41		
18	do			6	32	41		
19	do		4		31	40		
19	do		12 m		40	41		
19	do			8	30	41		
20	do		4		29	40		
20	42 31 00	70 36 10	12 m		45	43		
20	Gloucester Harbor			4	37	42		
21	do		4		35	40		
21	do		12 m		35	42		
21	do			8	35	42		
22	do		4		29	40		
22	42 33 00	70 34 40	10		34	42		
22	Gloucester Harbor			4	25	41		
23	do		4		15	40		
23	42 31 00	70 36 00	12 m		28	42		
23	Gloucester Harbor			7	17	40		
24	do		4		18	34		
24	42 31 00	70 36 00	8		27	42		
25	Gloucester Harbor		4		32	40		
25	do		12 m		32	40		
25	do			8	28	40		
26	do		4		28	39		

* Not recorded until March 9, 1888.

TABLE 3.—*Record of temperature of air, surface and bottom water, etc.*—Continued.

Date.	Approximate position.		Hour.		Temperatures F.			Depth of water.
	Lat. N.	Long. W.	A. M.	P. M.	Air.	Surface water.	Bottom water.*	
1887.					°	°	°	*Feet.*
Dec. 26	Gloucester Harbor		12 m		31	39		
26	do			8	32	39		
27	do		6		25	38.5		
27	do		12 m		24	38.5		
27	do			8	18	38		
28	do		4		20	35		
28	42 31 00	70 39 05	8		39	41		
28	Gloucester Harbor		12 m		40	37		
28	do			8	45	38		
29	do		4		20	38		
29	do		12 m		25	37		
29	do			4	16	37		
29	do			7	10	37		
30	do		4		09	34		
30	do		12 m		08	34		
30	do			4	11	34		
30	do			8	10	34		
31	do		4		03	33		
31	do		12 m		13	34		
31	do			6	14	32		
1888.								
Jan. 1	do		4		34	34		
1	do		12 m		40	34		
1	do			4	41	34		
2	do		4		41	35		
2	42 32 10	70 40 00	10.45		40	39		
2	Gloucester Harbor			4	32	35		
3	do		4		25	34		
3	42 32 10	70 40 00	10		30	40		
3	Gloucester Harbor			4	26	34		
4	do		4		22	33		
4	42 31 30	70 40 00	11		25	40		
4	Gloucester Harbor			4	28	35		
5	do		5		20	40		
5	42 31 30	70 40 00	9		22	40		
5	Gloucester Harbor			4	22	35		
6	do		4		04	34		
6	42 31 30	70 40 00	10.30		26	40		
6	Gloucester Harbor			6	32	34		
7	do		5		38	35		
7	42 31 30	70 40 00	10		32	40		
7	Gloucester Harbor			4	35	35		
8	do		6		33	34		
8	do		12 m		32	34		
8	do			4	34	35		
9	do		4		18	34		
9	do		12 m		21	34		
9	do			4	23	34		
10	do		4		20	35		
10	do		12 m		25	34		
10	do			4	22	34		
11	do		4		20	34		
11	42 30 20	70 38 00	7		21	38		
11	Gloucester Harbor		12 m		25	34		
12	do		4		05	34		
12	do		12 m		11	34		
12	do			4	15	34		
13	42 31 10	70 36 00	8		16	38		
13	Gloucester Harbor		12 m		28	34		
13	do			4	35	34		
13	do			7	36	34		
14	do		4		31	34		
14	42 31 20	70 32 30	7.30		35	38		
14	Gloucester Harbor		12 m		35	35		
15	do		4		35	34		
15	do		12 m		37	34		
15	do			4	33	34		
16	do		4		09	32		
16	do		12 m		14	33		
16	do			4	13	33		
17	do		5		06	30		
17	do		12 m		20	30		
17	do			5	26	32		
18	do		4		20	32		
18	do		12 m		25	32		
18	do			5	20	32		

* Not recorded until March 9, 1888.

TABLE 3.—*Record of temperature of air, surface and bottom water, etc.*—Continued.

Date.	Approximate position.		Hour.		Temperatures F.			Depth of water.
	Lat. N.	Long. W.	A. M.	P. M.	Air.	Surface water.	Bottom water.*	
1888.					°	°	°	*Feet.*
Jan. 19	Gloucester Harbor		4		12	32		
19	do		12 m		17	33		
19	do			8	15	34		
20	do		4		12	31		
20	do		12 m		18	32		
20	do			7	14	32		
21	do		4		07	31		
21	do		12 m		11	32		
21	do			4	08	32		
22	do		4		−02	30		
22	do		12 m		09	30		
22	do			4	09	30		
23	do		4		01	30		
23	do		12 m		15	30		
23	do			4	17	30		
24	do		4		14	30		
24	42 32 00	70 31 05	7.15		18	37		
24	Gloucester Harbor		12 m		20	29.5		
25	do		4		−05	29.5		
25	do		12 m		01	29.5		
25	do			4	17	29.5		
26	do		4		38	30		
26	do		12 m		25	30		
26	do			4	26	30		
27	do		4		05	30.5		
27	do		12 m		09	31		
27	do			6	05	31		
28	do		4		−05	30		
28	do		12 m		03	30		
28	do			8	−02	30		
29	do		4		−05	29		
29	do		12 m		10	29		
29	do			4	13	29		
30	do		4		12	29		
30	do		12 m		25	29		
30	do			8	21	29		
31	do		4		15	29		
31	42 34 30	70 39 30	8		23	35		
31	Gloucester Harbor			4	25	29		
Feb. 1	do		4		17	29		
1	42 34 00	70 39 00	8		18	34		
1	Gloucester Harbor			4	26	29		
2	do		4		17	29		
2	42 34 00	70 39 00	7		20	35		
2	Gloucester Harbor			4	28	29.5		
3	42 27 00	70 37 00	7		27	35		
3	Gloucester Harbor		12 m		32	30		
3	do			4	32	29.5		
4	do		5		23	30		
4	42 30 20	70 27 00	7		26	35		
4	42 30 20	70 27 00	10		30	35		
5	Gloucester Harbor		4		35	29		
5	do		12 m		45	30		
5	do			4	42	32		
6	do		5		34	30		
6	42 39 20	70 34 30	7.15		36	34		
6	42 48 00	70 36 00	12 m		32	35		
7	Gloucester Harbor		5		27	30		
7	42 35 20	70 32 00	8		35	34		
7	42 34 40	70 42 00	2.35		30	34		
8	Gloucester Harbor		4		31	32		
8	do		12 m		34	31		
8	do			4	35	31		
9	42 31 00	70 27 00	4		17	33		
9	42 31 00	70 27 00	12 m		20	33		
9	Gloucester Harbor			4	20	31		
10	do		4		03	30		
10	do		12 m		15	30		
10	do			4	18	30		
11	do		5		20	32		
11	do		12 m		24	32		
11	do			4	24	32		
12	42 28 00	70 20 00	8		25	36		
12	42 28 00	70 20 00	12 m		30	36		
12	Gloucester Harbor			4	30	32		
13	do		4		25	32		

* Not recorded until March 9, 1888.

TABLE 3.—*Record of temperature of air, surface and bottom water, etc.*—Continued.

Date.	Approximate position.		Hour.		Temperatures F.			Depth of water.
	Lat. N.	Long. W.	A. M.	P. M.	Air	Surface water.	Bottom water.*	
1888.	° ′ ″	° ′ ″			°	°	°	*Feet.*
Feb. 13	42 28 00	70 20 00	12 m		36	34		
13	Gloucester Harbor			6	32	32		
14	42 34 00	70 40 00	5.45		32	34		
14	42 31 00	70 32 00	7		34	34		
14	Gloucester Harbor			6	42	32		
15	42 27 00	70 20 00	8		36	33		
15	42 27 00	70 20 00	10		32	33		
15	Gloucester Harbor			5	11	32		
16	do		4		−01	30		
16	do		12 m		09	30		
16	do			8	11	30		
17	do		4		20	30		
17	do		12 m		34	30		
17	do			4	31	30		
18	do		4		21	30		
18	do		12 m		34	30		
18	do			4	32	30		
19	42 40 00	70 22 00	7		27	34		
19	42 40 00	70 22 00	10.15		30	34		
19	Gloucester Harbor			4	30	31.5		
20	do		5		35	32		
20	do		12 m		37	32		
20	do			7	38	32		
21	do		4		42	43		
21	42 27 00	70 35 00	11		40	35		
21	42 27 00	70 35 00		2	40	35		
22	42 26 00	70 23 30	9		35	35		
22	42 26 00	70 23 30	12 m		36	35		
22	Gloucester Harbor			6	35	32		
23	40 32 00	70 35 00	5		20	36		
23	40 26 30	70 31 00	10		33	36		
23	Gloucester Harbor			5	35	34		
24	40 32 00	70 35 00	8		35	36		
24	40 32 00	70 35 00	12 m		35	36		
24	Gloucester Harbor			8	32	35		
25	42 20 00	70 20 00	8		36	36		
25	Gloucester Harbor		10		36	35		
25	do			4	36	35		
26	do		5		34	35		
26	do		12 m		42	35		
26	do			4	41	35		
27	do		4		29	34		
27	do		12 m		33	34		
27	do			4	33	34		
28	do		4		13	34		
28	do		12 m		14	34		
28	do			7	10	34		
29	do		4		09	32		
29	42 32 00	70 34 00	12 m		22	35		
29	42 33 30	70 41 00	6.15		24	35		
Mar. 1	42 27 30	70 28 00	8		35	34		
1	42 27 30	70 28 00	10		25	34		
1	Gloucester Harbor			3	32	34		
2	42 35 00	70 30 00	8		22	34		
2	Gloucester Harbor			1	26	33		
2	do			4	32	33		
3	do		4		26	33		
3	42 27 40	70 22 30	10		28	34		
3	Gloucester Harbor			4	30	34		
4	do		4		15	32		
4	do		12 m		26	32		
4	do			4	28	32		
5	do		4		16	32		
5	do		12 m		28	32		
5	do			4	32	33		
6	42 35 20	70 30 00	8		25	33.5		
6	42 35 20	70 30 00	10.30		23	33.5		
6	Gloucester Harbor			4	27	33		
7	42 38 00	70 32 00	5.10		16	33.5		
7	42 55 00	70 35 00		12.20	25	34		
7	Gloucester Harbor			4	26	33		
8	42 36 00	70 34 30	7		22	33		
8	42 34 40	70 29 30	9		26	35		
8	Gloucester Harbor			2	35	32		
8	do			5	34	32		
9	42 34 10	70 36 00	7.40		31	33	35.6	35

* Not recorded until March 9, 1889.

TABLE 3.—*Record of temperature of air, surface and bottom water, etc.*—Continued.

Date.	Approximate position.		Hour.		Temperatures F.			Depth of water.
	Lat. N.	Long. W.	A. M.	P. M.	Air.	Surface water.	Bottom water.*	
1887.	° ′ ″	° ′ ″			°	°	°	*Feet.*
Mar. 9	Gloucester Harbor		12 m		40	34		
9	do			5	38	34		
10	42 40 00	70 26 00	4.15		35	34		
10	42 48 20	70 41 00	10.55		36	32.5	36	
10							34.5	
10	42 50 00	70 34 30		1.30	35	33		
11	Gloucester Harbor		4		30	34		
11	do		8		36	34		
11	42 31 00	70 30 00	12 m		36	34		
12	Gloucester Harbor		4		34	34.5		
12	do		12 m		34	34.5		
12	do			4	33	34		
13	do		4		31	33		
13	do		12 m		28	33		
13	do			4	28	33		
14	do		4		34	33.5		
14	do		12 m		35	33.5		
14	do			4	36	33.5		
15	do		4		31	34		
15	do		12 m		45	34		
15	do			4	46	34		
16	42 39 00	70 33 00	4		35	33		
16	42 52 30	70 42 00	9.30		38	33		
16	42 51 30	70 39 00	11.20		35	33.5	35.6	45
17	42 40 00	70 39 00	6.30		30	33		
17	Gloucester Harbor		12		28	33		
17	do			4	26	33		
18	do		5		15	33		
18	do		12 m		34	33		
18	do			4	29	34		
19	42 40 00	70 27 00	1.40		20	34		
19	42 46 30	70 34 00	10.15		27	34	34.8	
19	42 44 00	70 36 00		12.45	28	34		
20	42 36 00	70 31 30	8		35	33.5		
20	42 39 00	70 27 00	10		38	33.5	35	45
20	Gloucester Harbor			4	43	34		
21	do		4		40	34		
21	do		12 m		41	34		
21	do			4	45	34		
22	do		4		35	34		
22	42 22 30	70 22 00	11.10		40	34	36	58
22	Gloucester Harbor			9	32	34		
23	do		5		19	34		
23	do		12 m		25	34		
23	do			4	26	34		
24	do		4		12	33		
24	do		12 m		19	33		
24	do			4	25	33		
25	do		6		12	33		
25	do		12 m		25	33		
25	do			4	31	33.5		
26	do		5		25	33		
26	do		12 m		35	33.5		
26	do			4	33	34		
27	do		5		38	34		
27	do		12 m		38	34		
27	do			4	36	34		
28	do		5		34	34		
28	do		12 m		38	34		
28	do			4	43	34.5		
29	do		6		34	34		
29	do		12 m		46	34		
29	do			4	45	34		
30	do		5		33	34		
30	do		12 m		45	34.5		
30	do			4	46	35		
31	do		5		38	35		
31	do		12 m		50	25		
31	do			4	35	35		
Apr. 1	do		5		27	35.5		
1	do		12 m		45	35.5		
1	do			4	46	35.5		
2	do		5		35	35		
2	do		12 m		36	36		
2	do			4	37	36		

* Not recorded until March 9, 1888.

IV.—REPORT UPON THE INVESTIGATIONS MADE BY THE GRAMPUS ON THE SOUTHERN MACKEREL FISHING GROUNDS, ETC., FROM MARCH 24 TO JUNE 30, 1888.

By D. E. Collins.

A.—BEGINNING OF CRUISE; INSTRUCTIONS FOR MAKING INVESTIGATIONS.

Having made all necessary repairs and preparations for the spring cruise of observation, I telegraphed to headquarters my intention of sailing from Gloucester for Wood's Holl, Mass., to take on board the additional equipment necessary to pursue the contemplated investigation. Accordingly, we got under way at 9.10 p. m., on April 2, and left Gloucester for Wood's Holl, where we arrived at 5.37 p. m., the next day. Our arrival was immediately telegraphed to Washington, and I received the following telegraphic orders in reply:

U. S. Commission of Fish and Fisheries,
Washington, D. C., April 3, 1888.

When ready, sail from Wood's Holl for Hampton Roads. Make such observations and collections as practicable on passage. Telegraph arrival. Instructions and additional equipment will be sent you at Fortress Monroe.

J. W. Collins.

Capt. D. E. Collins,
Schooner Grampus, Wood's Holl, Mass.

We remained at Wood's Holl until the morning of the 7th, when we sailed from there, in accordance with the above instructions. We had a fair run and anchored in Hampton Roads at 7.05 a. m., on April 10. During the passage we saw no indications of the presence of mackerel, excepting a few sea-geese (*Phalaropus*) at sundown on the 9th, and later in the evening several "pods" of fish were seen from the mast-head, in latitude 37° 27′ N., longitude 74° 48′ W.*

At Hampton Roads the following orders were received in reference to the cruise of observation between Cape Hatteras and Nantucket:

U. S. Commission of Fish and Fisheries,
Washington, D. C., April 9, 1888.

Sir: I am directed by the Commissioner to send you the following instructions for your guidance on the cruise which you are about to make for observing the habits, abundance, and movements of the migratory pelagic species which approach the coast north of Hatteras

* The term "pod," as used here, means a small body of fish seen at the surface of the water; it is synonymous with a small school.

during the spring months, and among which the mackerel, menhaden, and bluefish are especially noteworthy.

I will first say that you will take on board at Fortress Monroe certain apparatus which has been sent you from Washington. Among this material are two shad gill-nets that you will use as circumstances may dictate. There is also a device for developing eggs which you may obtain from surface dredging or otherwise, and the use of which will be shown either to you or the expert who may accompany you on the voyage.

Your cruising ground will be, generally, north of Cape Hatteras, though, if occasion seems to demand it, you will feel at liberty to go southward of Hatteras, if by so doing you think you can obtain fuller information in regard to the more important species of migratory fishes.

There will not, as you know, be any mackerel fleet cruising in those waters this year, and, in the absence of fishing vessels, it will be desirable that you should get as much information as practicable from communicating with passing merchant vessels. Should you meet with such, and have the opportunity, you will make inquiries of the masters of the vessels as to whether they have observed fish schooling or not.

In general, your work will be carried on in a manner similar to that pursued by you last year when making observations in the same localities, and you must depend largely upon your own judgment as to the region to be cruised over, and the methods and appliances to be used for the capture of fish or other specimens. I will suggest, however, that during the month of April it is probable that the best results may be obtained between Hatteras and the capes of the Delaware; and, as the season advances, you will probably find it necessary to work farther north in order to keep track of the advancing schools of fish.

In carrying on your work it is important that you should observe, so far as practicable, the following methods:

(1) Make trials with toll-bait during the day, when the weather permits, and as frequently as may seem desirable, say at distances of 15 or 25 miles apart.

(2) Efforts should be made to collect young fish, fish eggs, and other material which can be taken near the surface of the water by the use of towing nets. These should be quite constantly employed during the day, whenever the conditions are favorable.

(3) Gill-nets of various kinds, and with different sizes of mesh, should be set at night whenever practicable.

I send you, herewith, a drawing showing what, in my opinion, is the best method of setting gill-nets. This method is extensively used in Europe, and has this advantage, that if the nets are set from the port side or from the bow, you can, if the weather is too rough to go out in the boats, take them in by passing the warp through a snatch-block and heave them in by means of the windlass, thus relieving your men from the great labor of hauling them in by hand.

(4) Keep careful notes of the number of fish of different species taken in the nets, and also in what part of the net they are caught, whether near the top or at the bottom.

(5) Keep records of temperature, height of barometer, condition of the weather, state of the sea, direction of the wind, etc., as you have usually done when engaged in cruising.

(6) If practicable, it will be well to take bottom temperatures, say two or three times a day, and in every case note the location of the vessel, depth of water, etc.

(7) If any fish are seen schooling, whether at night or day, make a note of it and their abundance. It is especially desirable that the appearance and abundance of mackerel, menhaden, and bluefish should be noted, and type specimens of any of the fish captured should be saved in alcohol.

(8) Note the appearance and approximate numbers of sea birds, such as gulls, gannets, hagdons, jaegers, etc., which generally accompany migratory fish.

(9) You will make trials with hand-lines from comparatively shallow water down to 150 fathoms or more, keeping a record of the investigations made in this manner, together with the position of the vessel, depth of water, number of lines used, kind of bait, and time spent in fishing.

(10) If you have a good opportunity to collect porpoises or other cetaceans, it will be well to get specimens. If you can not preserve the bodies, cut off the heads so that the skulls can be saved.

(11) All material collected should be carefully preserved in bottles, jars, or tanks, in alcohol or otherwise, as circumstances may demand.

(12) If you have an opportunity, it will be well to try the ship's dredge occasionally in moderate depths, and in towing this be very careful to note if there are any adhesive fish eggs among the material which is taken from the bottom. Should there be such, have them placed immediately in your apparatus for developing eggs, and, if possible, carry on the development to the point of hatching out the young fish, in order that we may determine the species.

(13) The Commissioner is very desirous that collections of floating fish eggs may be taken whenever opportunity offers, and in case small quantities are taken they can be placed in the hatching apparatus and developed, if practicable, until the young fish hatch out; and, if possible, should be kept alive at least some days, so that we can determine the species.

(14) In the event that you secure suitable quantities of floating fish eggs, which I assume is altogether possible, judging from the results obtained last spring, it is especially desirable that the collections thus made should be taken to Wood's Holl with as much dispatch as possible, in order that the eggs may be put into the hatching boxes at that station. You will, of course, in case you secure such collections, take all possible precautions to keep the eggs alive in pans, tubs, or other

apparatus you may have on board the vessel, and by frequently changing the water on them.

(15) In all of this work of collecting specimens and fish eggs, as well as in the matter of caring for the material, you will be assisted by a specialist, who will join the vessel as soon as practicable. It is now expected that Dr. Tarleton H. Bean will be able to go with you within one or two weeks, and, if circumstances are favorable, it will be well for you to report at Fortress Monroe or Delaware Breakwater, so that he may meet you after you have made your preliminary cruise.

(16) Always telegraph your arrival in port, and if you have any valuable specimens on board wire the facts. Should you obtain any important information relative to the movements or abundance of fish, give all the facts to the Associated Press agent in any port you may visit.

(17) About the 20th of May you will return to Wood's Holl and take on board the purse seine and seine-boat, after which you will cruise in search of mackerel. If possible, you will surround a school with the seine and take as many live fish in the vessel's well as it may be practicable to carry to Wood's Holl station. The Commissioner deems it very important that we secure a quantity of live mackerel during their spawning season, in order that experiments may be made in artificially propagating that species.

(18) If you succeed in catching any specimens in your gill-nets, or by hook and line, you will be able to judge pretty accurately as to the development of the ovaries and spermaries in the fish, and you will then know about what is the best time to make preparations for proceeding on your cruise for the same.

(19) Report briefly by mail the results of your work.

Very respectfully,

J. W. COLLINS,
Assistant, U. S. Fish Commission.

Capt. D. E. COLLINS,
Commanding, pro tem.,
U. S. Fish Commission Schooner Grampus,
Hampton Roads, Va.

I was also directed to make certain collections for the Department of Agriculture, as follows:*

MEMORANDUM TO CAPT. D. E. COLLINS.

In case you have an opportunity to obtain the livers or oil of various species of fish during your cruise, for instance, such as haddock, pollock, cod, menhaden, etc., it is very desirable that specimens of the oil may be saved as pure as possible by trying it out by means of heat or otherwise. Dr. Taylor, of the Department of Agriculture, who has

* No opportunity was afforded to carry out these instructions.

been making some very interesting experiments with fats and oils, is desirous of getting specimens of fish oil in as fresh and pure a condition as possible. If you can, without inconvenience, obtain such specimens and forward them at the first opportunity, I shall be very glad to have you do so.

Any and all forms of oils from fish or cetaceans should be properly labeled with the name of the species, the locality where it was taken, and date.

J. W. COLLINS.

Dr. Tarleton H. Bean, who intended to meet the vessel at Old Point Comfort, and to make the cruise as naturalist of the expedition, could not join us there on account of illness. Pending his recovery, Col. Marshall McDonald, U. S. Commissioner of Fish and Fisheries, determined to visit the vessel for the purpose of conferring about the proposed investigation, but more particularly to consider the best methods for keeping alive and transporting any floating fish eggs that might be procured. It was also decided that Capt. J. W. Collins should make a visit of inspection, and bring with him to the vessel various forms of apparatus which we were to take for preserving collections, and also a device to be used for developing floating fish eggs. It was not, however, practicable for either the Commissioner or Captain Collins to visit us immediately, and since it was deemed important that a somewhat extended inquiry should be made into the condition of the pound-net fisheries of Chesapeake Bay, with special reference to the catch of shad, I received the following orders to make the investigation, pending the arrival at Old Point Comfort of the Commissioner and Captain Collins:

B.—INVESTIGATION OF THE POUND-NET FISHERIES OF CHESAPEAKE BAY.

1. ORDERS.

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., April 9, 1888.

SIR: It is the present purpose of the Commissioner to go to Fortress Monroe the last of this week to meet you. I think it possible that he will leave Washington Friday evening, and reach Fortress Monroe Saturday morning. If any contrary decision is arrived at, I will wire you as soon as I learn the fact definitely.

The Commissioner directs me to say that, in the event of your arrival at Fortress Monroe within a day or two, you are to leave there and make a cruise along the east shore of the Chesapeake, as far as Tangier Sound and vicinity, to obtain all the information you can relative to the fisheries now being prosecuted in pounds in that region. After reaching the vicinity of Tangier, you will cross the bay to the mouth of the Rappahannock River, and make similar inquiries about the fisheries on the

west side of the bay, between the Rappahannock and Fortress Monroe. You will, of course, time your movements so as to reach Hampton Roads on Friday, in order that we may meet you there.

If you find it impracticable to fully carry out your inquiry of the fisheries along the Chesapeake, or if you arrive too late to enter upon the inquiry before Friday, you will, of course, be governed accordingly, bearing in mind that you should be at Fortress Monroe when we arrive there on Saturday morning.

I shall plan to take with me any apparatus which it is necessary to send you from here.

Very respectfully,

J. W. COLLINS,
Assistant, U. S. Fish Commission.

Capt. D. E. COLLINS,
U. S. Fish Commission Schooner Grampus,
Fortress Monroe, Va.

2. REPORT UPON INQUIRY.

The foregoing orders to make a reconnaissance of the pound-net fisheries of Chesapeake Bay were carried out as fully as circumstances would permit, and, in accordance with instructions, we returned to Hampton Roads on the evening of Friday, April 13. The results of the inquiry are summarized in the following report:

U. S. COMMISSION OF FISH AND FISHERIES,
Schooner Grampus, Hampton Roads, Va., April 17, 1888.

SIR: I have to report that we arrived in Hampton Roads on the morning of April 10, and soon after anchoring I sent ashore to get the vessel's mail and telegraph my arrival. I waited nearly two hours, thinking it possible that I would receive a reply to my telegram, but none came. During the latter part of the day the wind blew a gale from the southeast and made a landing at Old Point Comfort impracticable. The following morning, the wind and weather being suitable for carrying out the instructions sent me to make inquiries concerning the trap fisheries along the Chesapeake Bay, as far as Tangier Island and the mouth of the Rappahannock River, I was anxious to get under way, feeling that the time was short for doing the work assigned. I sent a boat on shore, however, at 8 a. m., and found that the telegraph office would not be opened until some time later. It was, therefore, impracticable for me to notify you by wire of my departure, and deeming it unnecessary and undesirable to wait any longer I got under way and started up the bay.*

The wind was fresh from the westward, and it would have been im-

* Our inability to receive or send telegrams, as indicated, prevented me from receiving orders that were sent from Washington, and which would have materially influenced the movements of the vessel.

practicable to have made investigations on the east side of the bay on the date of our sailing from Hampton Roads. We therefore worked our way along the west shore of the bay, and on the night of the 11th anchored in Mobjack Bay, where we lay until the morning of the 12th. We then ran across to Tangier Island and made as complete an investigation as was practicable. On the morning of the 13th we left Tangier Island and ran across to Mosquito Point, Rappahannock River, and from thence down to Hampton Roads, where we arrived about 7 p. m.

I desired to carry out the instructions to the extent of pursuing the investigation along the eastern side of the bay as far as Cherrystone, but I found it impracticable to do that and return to Hampton Roads at the time designated in my instructions. However, if I understand the instructions correctly, I believe that the information I have obtained relating to the trap fisheries along the Chesapeake Bay is what is required.*

The following is a brief statement of the facts obtained from interviews with men carrying on the trap fisheries:

Between Old Point Comfort and Back River Light there are nearly 100 fish-traps, employing about 400 men. Many of these traps are taken up about the first of June, and the men who fish them are engaged in fishing during the rest of the season by the menhaden "factory" situated upon Back River, which employs 160 men.

The first shad taken this season were caught on the 15th of March. Thus far this season shad have been more abundant than for several years previous. As a rule, the greatest quantity of shad are taken from the 1st to the 15th of April. Herring are caught somewhat earlier in the season. But little effort is made to catch them, since they are not of much value in the markets.

From the middle of May to the middle of August considerable quantities of blue-fish, mackerel, trout, mullet, and black-fish are taken; also sturgeon are caught occasionally.

On April 10, 1,100 shad were taken from one trap, which is the largest number ever caught at one time by the owner of the trap. I learned, however, that fishing had not been good on the east side of the bay, from Cape Charles to ten miles above it, owing to the prevalence of easterly winds during the spring.

The traps between Old Point Comfort and Back River Light are said to cost on an average $400, and a trap will last three years. The fishermen state that $1,000 are realized from each of the traps in this section of the bay.

Messrs. Brooks, Hutchins & Co., who are owners of fish traps in Mobjack Bay, say that they are catching shad, jacks (hickory shad), alewives, and menhaden. Their first shipment of fish was made on March 30, and was composed chiefly of shad and herring. They state that

* The terms "trap fisheries" and "traps," as used in this report, refer to pound-net fisheries and pound-nets.—J. W. Collins.

more fish have been taken this season than for the past three years. Shad fishing ends in May.

Capt. Joseph Louis, of Mobjack Bay, said that there are one hundred traps from New Point Beach to East River, and at this time shad, hickory shad, herring, and menhaden are being caught in them. On the 9th of April a single specimen of the common mackerel was taken in one of the traps. About March 20 fishing was interrupted by a heavy storm. Nevertheless, the fishermen along this shore have done better, according to Captain Louis, than they have for the past eight years. He thinks there are some three hundred men employed in tending the traps above mentioned, but according to Brooks, Hutchins & Co., there ought to be a larger number, since they estimate four men to a trap, and say these traps cost as much as those farther down the bay.

Captain Louis thinks there are about three hundred traps scattered along the shore from New Point Comfort to the Rappahannock River. The fishery for shad ends about the 1st of June, in that locality, and Spanish mackerel are usually taken about five days later. The fish caught in that region are shipped in sloops to Yorktown and Old Point Comfort, where they are transhipped to the large markets along the Atlantic Coast.

Mr. William Harord, who owns three traps in Mobjack Bay, and who has had twelve years' experience in trap fishing, makes the statement that fish, and particularly shad, are more plentiful this year than ever before. In the spring of 1887 the first shad were taken on April 9, but this year they were caught on March 2. He has taken as many as 800 shad at one haul this season. He states that there are nearly 175 traps between York Spit and New Point Comfort, each of these employing about three men, the men being paid $20 per month. The average cost of fish traps in this region is believed to be not more than than $200. He told me of one man, Mr. Thomas, who owns a trap, having taken 1,150 shad at a single haul on April 11. Mr. Harord says that his traps pay about $500 per year each. He stated very emphatically that, in his opinion, the work of the U. S. Fish Commission is exceedingly beneficial to the fisheries of Chesapeake Bay region, and this appears to be the general opinion of the people engaged in the fisheries in all that region which we visited.

I learned that the first shad taken in 1887, at Tangier Island, were caught on March 27. There are ten traps on Tangier Island, and they are now all taking shad and herring in great numbers, and a few menhaden were also caught. These traps are taken up on the 1st of June, and are put down again in the middle of August. From the 15th of August to the end of the season sea trout and blue-fish are the principal species taken. The traps in this region cost about $400 apiece, and the average sales of fish amount to $800.

In the vicinity of Mosquito Point, Rappahannock River, there are 100 traps, according to Mr. J. H. Smith, and they employ about 300

men. He says that at the present time shad, bass, and alewives (or river herring), are being taken. He estimates the average cost of the traps at this point to be $200 and each will stock $600. The fishery at this point has not been so successful as elsewhere during the present season, and it is said that the more important species of fish were quite scarce farther up the river.

Very respectfully,

D. E. COLLINS,
Commanding pro tem.

Capt. J. W. COLLINS,
Assistant, U. S. Fish Commission, Washington, D. C.

C.—NARRATIVE OF CRUISE FROM APRIL 17 TO APRIL 26.

Immediately after we arrived at Hampton Roads, a boat was sent on shore. She soon returned with Capt. J. W. Collins, who brought the vessel's mail. Among the latter was the following telegraphic order, which, owing to circumstances already recited, I failed to get at the proper time:

[Telegram.]

APRIL 10, 1888.

Capt. D. E. COLLINS,
Schooner Grampus, Hampton Roads, Va.

You will wait at Fortress Monroe. The Commissioner and I expect to leave here to-morrow evening and will be on board the *Grampus* Thursday morning. Acknowledge receipt of dispatch.

J. W. COLLINS.

Expecting that the above order would be received, the Commissioner visited Old Point Comfort, but, of course, did not find us there. Unfortunately, it was necessary for him to return to Washington without delay, and, therefore, he had left on the steamer before we arrived on Friday.

I learned that Dr. Bean would not be able to join the vessel at this time; but it was believed his health would be sufficiently restored in a few days for him to come on board. Captain Collins directed me to proceed with the investigation and to report at Hampton Roads in about ten days, at which time it was expected that Dr. Bean would be sufficiently recovered to accompany the vessel. Captain Collins left on Saturday, the 14th of April, and as soon thereafter as practicable, we got under way and proceeded to sea.

Before we reached Cape Henry the wind suddenly hauled to the northeast, increasing to a fresh breeze, but gradually diminished to a moderate breeze from east-northeast after we passed the Cape. Outside of Cape Henry an east-southeast course was steered, the vessel being close hauled on the port tack. At 11 a. m. the small surface net was put out and towed for forty-five minutes without collecting anything.

We kept on this course throughout the afternoon, with a lookout at the mast-head to watch for schooling fish. Three whales were sighted about 4 o'clock, but nothing else of interest was seen. At 3 p. m., in lat. 36° 45′ N., long. 75° 27′ W., the small towing-net was put out for thirty minutes; nothing was taken in it. Several gannets were noticed during the afternoon, generally on the wing.

In lat. 36° 36′ N., long. 75° 13′ W., the towing-net was again used and we secured a small quantity of marine life, which was preserved in alcohol. During the night the wind continued moderate, varying from east to southeast. The vessel was kept on a southerly course.

In the early part of the following day a southeasterly wind prevailed, hauling to southwest towards noon; weather clear and warm. Sea-geese (*Phalaropus*) and gannets were noticed early in the day, the latter seeming to increase in abundance as we sailed south. We saw indications of the presence of some species of fish in the form of "greasy slicks," although a most careful observation failed to detect any at the surface.

Between 7 and 8 o'clock a. m. a small amount of crustacea was collected in the towing-net, our approximate position being lat. 36° 13′ N., long. 74° 51′ W. At 8 o'clock the vessel was hove-to near this position and a trial for surface and bottom fish was made; the temperature of the water at the bottom was also obtained. The result of this trial was very unsatisfactory, since only one dog-fish was caught. We got under way again at 9.15 a. m. and continued on a southeasterly course. The temperature of the water at the bottom was taken at noon. At 2.30 p. m., in lat. 35° 56′ N., long. 75° 02′ W., hove-to and threw toll-bait for mackerel and put out hand-lines for bottom fish. Two dog-fish, caught on the hand-lines, were the only fish taken. While lying-to gannets were seen diving in the water for fish. Bottom temperature was observed at this position, the depth of water being 17 fathoms.

Got under way again at 3.30 p. m., and stood to the southeast. Towards evening the weather changed, assuming a threatening aspect, which, added to a short, sharp sea that began to make from the southward, prevented us from setting the gill-nets that had been prepared for the purpose. At 6.30 p. m. the large and small towing-nets were put out and towed for thirty minutes, the trial resulting in the capture of five small fish in the large net and a quantity of crustacea in the small net, our position at the time of this trial being lat. 35° 46′ N., long. 74° 55′ W. The vessel was hove-to at dark, heading to the southeast.

The 19th of April began with a moderate south-southwest wind and threatening weather, an increasing sharp sea coming from the south, and in that direction dark nimbus clouds were seen above the horizon, indicating a storm in that quarter. At 3 a. m., the weather assuming a milder appearance, one mackerel and one herring gill-net were set at right angles to the vessel, being sunk 2½ fathoms below the surface. The net warp was made fast to the mainmast of the vessel, which was

hove-to on the starboard tack. The nets were hauled at 5 a. m., but contained no fish. This trial did not fully determine the presence or absence of fish, since it is possible that, under more favorable conditions of weather and a longer trial, different results might have been obtained.

After getting the nets on board, the vessel was headed to the northeast and the small surface-net was towed between 7 and 8 o'clock a. m.; a limited amount of small crustacea was collected. At 7 o'clock the wind suddenly changed to the northwest, and a little later to the northeast, accompanied by a dense fog which lasted about two hours.

At 8 a. m. bottom temperature at a depth of 175 fathoms was taken, and at 10 o'clock the towing-net was put out, which collected a small amount of minute crustacea. During the forenoon small flocks of sea-geese were seen. In lat. 36° 34′ N., long. 74° 31′ W., the large and small towing-nets were used and some copepods and one small butterfish were collected. During the day the barometer gradually lowered, indicating the approach of stormy weather. The vessel was therefore hove-to during the night, it being deemed unadvisable to attempt to set gill-nets.

On the morning of the 20th there was an easterly wind, with cloudy sky and rain at intervals. At 5 a. m. threw toll-bait to raise mackerel. Hand-lines baited with salt-pork and menhaden were also put out for bottom fish. This trial, which was continued for forty minutes, resulted in the capture of one dog-fish, our position being lat. 36° 39′ N., long. 74° 51′ 31″ W.

Between 6 and 7 o'clock a. m. a school of porpoises passed us, going in a northwesterly direction, but before we could get a harpoon in readiness they were beyond reach. Two large flocks of sea-geese were seen during the morning.

The small towing-net was put out at 8 o'clock and towed for an hour and a half, but failed to capture anything. After completing this trial we got under way and stood to the northeast for 23 miles, when we tacked to the westward. A few sea-geese and occasionally a gannet were noticed on the last course. A lookout was stationed at the masthead and, notwithstanding that a vigilant watch was maintained, we failed to detect the presence of any surface fish. We continued on the westward course for 12 miles, when we tacked again, heading to the northeast. In lat. 37° 03′ N., long. 74° 49′ W., the small towing-net was used and a limited amount of crustacea was taken in it. On account of the fresh wind and sharp sea it was found impracticable to set the gill-nets, in which I am inclined to think we are more apt to secure evidence of the presence of mackerel or other migratory fish than by using any other form of apparatus.

The morning of the 21st opened with clear and cool weather, a fresh north-northwest breeze and short rough sea, in consequence of which the vessel was kept hove-to the greater part of the forenoon. The wind decreased about 11 o'clock and we got under way, standing to the west-

southwest. At noon tacked to the northward. At 4.30 p. m., in lat. 37° 03′ 45″ N., long. 74° 48′ W., hove-to and threw toll-bait for fifty minutes without succeeding in "raising" any fish. We continued on our course, and a little later put out the large and small towing-nets for about forty minutes. One young fish and some crustacea were taken; our position was lat. 37° 07′ N., long. 74° 48′ W.

Soon after completing the last trial the vessel was hove-to and one mackerel and one herring gill-net were set.

At 5 a. m., on the 22d, we hauled the gill-nets. One small mackerel was caught in the herring-net. The specimen was preserved in alcohol. Got under way at 5.30 a. m. and steered a northerly course. About 6 o'clock put out the little towing-net for one hour and a half, taking in it a small lot of crustacea. At 9 a. m., in about lat. 37° 02′ N., long. 74° 44′ W., a large number of sea-geese were seen scattered in flocks over the surface for a considerable distance; gannets were also abundant, and, in most instances, were sitting on the water. The presence of these birds was apparently no positive indication of the presence of mackerel on this occasion, since a very careful lookout at the mast-head failed to discover any schooling fish. The wind hauled gradually to the eastward, and at 8 o'clock we tacked heading north by west to north-northwest on the starboard tack. The small towing-net was used at 9.40 a. m.; a few sea-fleas and a species of small shrimp were taken in it. At noon threw toll-bait for mackerel, also put out lines for bottom fish and took bottom temperature. No fish were secured in this trial. The position of the vessel at the time of the trial was lat. 37° 22′ N., long. 74° 47′ 30″ W. Later in the afternoon the wind changed to east-southeast and southeast, blowing a moderate breeze, the sky cloudy with indications of rain. At 4.30 p. m. toll-bait was thrown to "raise" mackerel, but with no success. On account of the threatening weather no attempt was made to set gill-nets in the evening.

April 23 began with a moderate southeast wind, a little later hauling to the northeast; sky threatening and stormy. At 6.30 a. m. threw toll-bait, took bottom temperatures, and fished with hand-lines for bottom fish; obtained nothing. The small surface towing-net was used for thirty minutes after finishing the trial, our position being lat. 37° 40′ N., long., 74° 30′ W.

At 9.30 a. m. the wind suddenly backed to northwest, gradually hauling to north by west and increasing in force until about noon, when it blew a gale, with a sharp, rough sea. Hove-to and suspended operations on account of the bad weather. A moderate north to northeast wind prevailed in the early part of the next morning, ending in a calm towards the afternoon. Got under way at 7 o'clock, steering a westerly course. Sounded in 34 fathoms of water at 10 o'clock, and took bottom temperatures. Half an hour later we hove-to and threw toll-bait to attract mackerel; lines were also used for bottom fish. A trial of 50 min-

utes resulted in the capture of a small dogfish on the cod-lines. The position of this trial was lat. 37° 39′ N., long. 74° 38′ W.

Leaving the position of the last trial, we worked to the northeast, the wind varying from a moderate breeze to a light air from that quarter. At 6.45 p. m., took bottom temperatures in 31 fathoms, and at 7 o'clock prepared to set gill-nets. The mackerel net was set at the surface and the herring net 3½ fathoms deeper. The vessel was hove-to on the starboard tack and the net warp made fast to the mainmast.

In the early part of the next day the wind increased to a fresh breeze from the north, and later veered to the north-northeast. Hauled the nets at 4 a. m., taking one branch herring in the mackerel net. At 5 o'clock got under way and kept off on a southwesterly course; changed course later more to the westward, with a view to making a harbor at Hampton Roads to get a supply of water, of which we were in need.

Passed Cape Henry at 3.30 p. m., but owing to a head tide and an adverse wind we did not anchor at Hampton Roads until 6.50 p. m. Immediately after anchoring I went on shore to get the mail and telegraph our arrival.

D.—SUGGESTIONS FOR COLLECTING AND PRESERVING SPECIMENS.

Additional instructions for making observations and caring for specimens, which were prepared by the Assistant in charge of Scientific Inquiry, were received. It may not be out of place to say here that it has been customary on the vessel to carry out such routine as was ordered, since it has always been recognized that the value of the observations, as well as the importance of the collections as study material, depends on the accuracy and completeness of notes on surrounding conditions. The following is a copy of the orders and letter transmitting them:

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., April 27, 1888.

DEAR SIR: I send you, herewith, some suggestions for collecting and preserving specimens, and for making observations, which have been prepared by the Assistant in charge of Scientific Inquiry, and which have been forwarded to me by the Commissioner. As I understand it, you have been carrying on your observations in a manner similar to that required by these suggestions, which you will attach to the instructions for the cruise that I forwarded to you a few days ago, and with which you will comply so far as practicable.

Very truly yours,

J. W. COLLINS,
Assistant, U. S. Fish Commission.

Capt. D. E. COLLINS,
U. S. Fish Commission Schooner Grampus, Fortress Monroe, Va.

SUGGESTIONS FOR COLLECTING AND PRESERVING SPECIMENS AND FOR OBSERVATIONS.

Note air temperatures and the state of the weather at regular periods. This is probably your custom at all times.

Take temperatures at the surface regularly, and read the thermometer with great care. Be certain that it has been immersed a sufficient length of time to take the true temperature. Indicate by latitude and longitude, or by a mark on the chart, the exact position where each temperature observation was made. Take the temperature of the air at the same time that you take the temperature of the water.

Preserve all the materials obtained in each towing in a bottle by itself, and label these bottles carefully. Each label should have written on it the date, the time of day, the latitude and longitude, and the length of time the towing net has been out, or the distance it has gone through the water. Make as many towings as possible.

Each time that a lot of mackerel is taken, cut out and preserve the stomachs of several of the fish in a bottle, first cutting the stomachs open so that the alcohol will enter freely. Put labels on these bottles stating the latitude and longitude where the fish were taken, the date, and time of day.

Note the occurrence of every school of mackerel, and of all stray individuals, and their abundance. Note any observations you can make in regard to their movements; in what direction they are going; do they leave the surface and sink for any reason; what is the cause of this?

Note whether the fish contain spawn. Preserve specimens of the fish from time to time in alcohol, first make a very large cut in the ventral side so that the alcohol may freely enter the visceral cavity. Label all such specimens.

Where you find schools of mackerel is there always an abundance of the small surface feed? Make towings at such times.

Do you ever find the schools of mackerel chased by other fish, and by what kinds?

Make notes on the other fishes which you observe.

The following morning received telegraphic orders to wait at Hampton Roads until further instructions arrived, which would be sent by mail. We remained in the harbor from the 26th to the 30th of April, during which time all the necessary stores were taken on board, including a lot of jars, in which to preserve specimens, that were received from Washington.

E.—ORDERS FOR CONTINUING THE CRUISE.

The following instructions in regard to continuing the investigation were received on the morning of April 30:

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., April 28, 1888.

SIR: The Commissioner directs that you will proceed to sea, as soon after receiving these orders as practicable, and continue your observations and researches for five or six days, when you will again report at Fortress Monroe or Delaware Breakwater, as may be convenient. Dr. T. H. Bean will then be ready to join you, and it is possible that another specialist may go with you.

The Commissioner is desirous of having you pursue your investigations nearly in the latitude of the Chesapeake Capes, and is anxious to have a series of temperatures taken from comparatively near the coast to nearly to the Gulf Stream, and, so far as practicable, he desires to have bottom temperatures taken as well as those of the surface water and air. I would suggest that you run a line of temperature observations, at distances of about 5 or 10 miles, from near the coast to a depth of, say, 200 fathoms. I believe it will be as well to work out and in nearly on the parallel of Cape Henry or Cape Charles until you return to port again, and, in addition to your temperature observations, you will, of course, continue your other trials and researches as heretofore.

Yours very truly,

J. W. COLLINS,
Assistant, U. S. Fish Commission.

Capt. D. E. COLLINS,
U. S. Fish Commission Schooner Grampus,
Fortress Monroe, Va.

F.—NARRATIVE OF CRUISE FROM APRIL 30 TO MAY 5.

In compliance with the above orders, we got under way at 11 a. m. on the 30th and proceeded to sea. When abreast of Cape Henry our course was laid to the eastward. A series of observations of bottom, surface, and air temperatures was begun at this point and continued at intervals until we reached the eastward of coast soundings.

On the morning of the 1st of May the wind was variable from the west-southwest to south by east. At 3 a. m., sounded in 30 fathoms of water and took bottom temperature. Sounded again at 7 o'clock, and put out small surface towing-net for thirty minutes, collecting a limited amount of material; our position was lat. 33° 43′ 30″ N., long. 74° 47′ W. After completing this towing a northeast one half east course was steered for 20 miles. At 10 o'clock (lat. 36° 56′ 30″ N., long. 74° 21′ W.), threw toll-bait for mackerel, and also took bottom temperature in 270 fathoms of water. Leaving this position we steered west-northwest, at

times regulating our speed in order to make trials with the surface towing-net, in which we collected a small amount of marine life.

In taking bottom temperature at lat. 36° 58′ N., long. 74° 27′ W., 330 fathoms of line were put out without reaching the bottom. However, the observation was recorded at that depth. Noted bottom temperature again at 2.30 p. m., in 220 fathoms of water in lat. 36° 59′ N., long. 74° 32′ W. After making the last observation the small surface towing-net was used for thirty minutes, in which we took a limited amount of crustacea. Sounded again in 34 fathoms and took bottom temperatures. At different times used the small surface net, though we did not find an abundance of mackerel food. At 6 o'clock put out both large and small towing-nets, but on account of the light wind the vessel did not move fast enough to make collections. Later in the evening the sky assumed a threatening appearance, accompanied by sharp lightning, and all sails, with the exception of the foresail, were taken in.

The next day (May 2) began with a variable wind from north by east to north-northeast, with clouded sky and choppy sea. At 6.30 a. m., jib and fore-staysail were set, and the vessel was headed northwest by north on the starboard tack. The small surface net was towed between 6 and 7 o'clock and collected some small shrimp and sea-fleas. The towing occupied about thirty minutes and was made in lat. 36° 53′ N., long. 74° 40′ W. On account of the choppy sea it was found impracticable to use the towing-nets satisfactorily; though several attempts were made, the sea caused the net to leap out of the water. A few sea-birds were seen during the forenoon.

The wind moderated a little after noon, and at 2.43 p. m. we tacked ship to the eastward, and a little later put out the small surface net for thirty minutes (lat. 37° 01′ N., long. 75° 00′ W.). Took bottom temperatures at 4.45 p. m., in 23 fathoms of water. At 6.25 p. m., put out large and small towing-nets and towed them for thirty minutes, collecting a lot of crustacea, principally sea-fleas. About 7 o'clock set one mackerel and one herring gill-net, both nets being sunk to a depth of 2½ fathoms; our position was near that of the last towing.

Hauled the nets at 4 a. m., on the 3d, but found no fish in them. At 5 a. m., got under way, heading towards the north-northwest. Noted the temperature at the bottom before making sail. This course was sailed until we reached the meridian of 74° 57′ W. longitude, when we tacked to the eastward. We ran to the eastward until reaching lat. 36° 59′ N., long. 74° 43′ W., where we took bottom temperatures in a depth of 45 fathoms. After making temperature observations the vessel was headed north-northwest. When in lat. 37° 07′ N., long. 74° 51′ W., large numbers of gannets and sea-geese were noticed, the former sitting quietly on the water, and the latter occasionally rising in large flocks, but again settling on the water.

This gathering of birds, by far the largest yet seen by us (knowing their characteristic habit of following migratory fishes), put us on the

alert to discover the local attraction which induced them to congregate in such numbers at this point. Greasy slicks marked the water, and all external signs of mackerel seemed to be present. However, the most searching scrutiny of the sea surface failed to reveal the presence of any fish. The vessel was hove-to in this locality and toll-bait thrown to attract mackerel, but without success. Cod hand-lines were also used, but bottom fish seemed to be as scarce as others, and in consequence nothing was taken. While throwing toll-bait, a species of small fish (apparently that which is known to the fishermen as "brit"), was noticed to school among the bait. Efforts to capture some of these fish proved fruitless.

After completing this trial we got under way and headed to the northeast. At 6.10 p. m., put out the large and small towing-nets for forty-five minutes and collected an abundance of sea-fleas in the small net, and two small fish in the large one. Hove-to at dark and set one herring and one mackerel gill-net. The mackerel net was placed at the surface and the herring net about 2½ fathoms deeper (lat. 37° 09′ N., long. 74° 47′ W.).

The nets were hauled at 4.30 a. m. on the 4th; one butterfish was taken in the mackerel-net. At 7.30 got under way and kept off, steering north by east for 15 miles. Hove-to and threw toll-bait for thirty minutes; cod hand-lines were also put out for bottom fish, but nothing was taken. At 9.45 a. m. changed course to the southward, and at 10 o'clock the small surface net was towed for thirty minutes, collecting only a few sea-fleas. Later the course was changed to west by south. At 1.45 p. m. tacked ship to the southeast, and at 2 o'clock put out small towing-net, towing it for thirty minutes. A small quantity of sea-fleas and other minute marine life was taken in it. (Position, lat. 37° 07′ N., long. 74° 07′ W.) No attempt was made to set gill-nets in the evening on account of the unfavorable weather.

A moderate southerly wind prevailed during the early part of the 5th, which decreased in force about daylight. Got under way at 5 a. m., steering north-northwest, and at 7 o'clock hove-to to make observations, taking bottom temperatures, throwing toll-bait, and trying with hand-lines for bottom fish. Two dog-fish were the only fish taken. (Position, lat. 36° 59′ N., long. 75° 02′ W.) An examination of the stomachs of the dog-fish showed their prey to be squid and some kind of fish which it was impossible to identify on account of disintegration attending digestion. After completing the trial for fish, the small towing-net was used and took an abundance of sea-fleas. Kept off on a north-northwest course for eight miles, when we changed to W. ½ S., for Cape Henry. At 9.15 a. m. the small surface net was towed for thirty minutes; a quantity of sea-fleas was taken. (Position, lat. 37° 04′ N., long. 75° 16′ W.) The surface net was again put out at 10.30 a. m., collecting a very small amount of sea-fleas, which seemed to indicate that the western edge of the distribution of this species had been nearly reached.

(Position, lat. 37° 02′ N., long. 75° 33′ W.) At noon made Cape Henry, bearing west, and at 6.32 p. m. anchored in Hampton Roads.

Immediately upon anchoring I went on shore to telegraph our arrival and to get the vessel's mail. Received telegraphic orders on the 7th to await instructions by mail.

G.—INVESTIGATION OF MENHADEN IN CHESAPEAKE BAY.

3. ORDERS.

On the morning of the 9th we sailed from Hampton Roads under the following orders, to make an investigation of the spawning habits and other characteristics of the menhaden:

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., May 7, 1888.

SIR: I do not think it desirable for you to go outside of the Capes again before you are joined by Dr. Bean. He expects to reach Old Point fully prepared for the cruise by Friday morning. In the interval I wish you, by cruising in the bay and by boarding vessels engaged in the menhaden fishery, to get information in regard to the spawning menhaden, and if possible to procure either the gravid fish or the eggs of the same. With this object in view it is desirable that you should make use of your tow-nets, and the eggs on board of the schooner should be developed to the point when the species may be identified. In the absence of all knowledge of the characteristics of the menhaden, it is of course desirable that no means of investigation should be neglected. My impression, however, is that the egg is heavy and possibly adhesive, and if this be the spawning season the chance of finding eggs of the menhaden will be greater among the material brought up by dredging than that collected from the surface by tow-nets. Without prescribing any specific plan of procedure, I wish you to use your best judgment to get any information in regard to the menhaden.

All young forms of fish taken in tow-nets in the Chesapeake should be preserved most carefully, since the probability is that among the collections made the embryo forms of the same will be present. Please make your arrangements so as to be certainly at Old Point Friday morning on the arrival of the Washington boat.

* * * * * * *

Very truly yours,

M. MCDONALD,
Commissioner.

Capt. D. E. COLLINS,
Commanding Schooner Grampus, Old Point Comfort, Va.

The inquiry ordered by the Commissioner was made with as much promptness as practicable; the results obtained are embodied in the

following report, which was written immediately after our return to Hampton Roads:

4. REPORT UPON INQUIRY.

U. S. COMMISSION OF FISH AND FISHERIES,
Schooner Grampus, Hampton Roads, Va., May 10, 1888.

SIR: In regard to the desired information of the menhaden, and more especially the determination of the period of reproduction of this species, I would say that we left here on the morning of the 9th instant, and proceeded to investigate the waters of the Chesapeake included between Old Point Comfort and York Spit on the west side, and from near the middle ground, off Cape Charles, to Lynn Haven Bay.

This is considered a favorable locality for the occurrence of menhaden at this period, as well as later in the season. The methods used were in accordance with your suggestions, viz: boat dredge, large and small tow-nets. A careful and persistent trial with these forms of apparatus failed to collect either fish eggs or the young fish, the only collections being a species of shrimp secured in the dredge.

Trap fishermen were interviewed at Back River Point, and specimens of menhaden were obtained for examination. About forty of these fish were opened and their ovaries examined, but in every instance they were found in the earlier stages of formation. Specimens have been preserved intact for future reference, as well as the viscera of those examined.

The most important information was obtained from Captain Squires, of the Menhaden steamer *Ida Augusta*, of Onancock, Va. In interviewing him to-day off York Spit Light he said he has been engaged in the menhaden fishery in the Chesapeake for the past seventeen years, and in all of his experience has never found spawning menhaden excepting between the 1st and 20th of October. On two occasions during this period he has seen both the spawn and milt running out of them freely while bailing them out of the seine. He has also attempted to impregnate the eggs on one of these occasions, and says positively that they will not float.

Captain Squires further stated that he has seen this spring, and on former occasions in April and May, the young menhaden about 1 inch in length. The present condition of the fish examined by us, together with the appearance of the young fish alluded to, seem to be corroborative of his testimony, and apparently attaches considerable importance to it.

The sailing schooners which fish for the "factory" on Back River have not commenced operations yet. I am informed that they will begin about July 1st. There did not appear to be any large bodies of menhaden in the localities visited by us. Four steamers, including that commanded by Captain Squires, were fishing off York Spit to-day. I did not have an opportunity to board either of the others while on the

ground, as they were in motion most of the time. One or two small catches were made by them to-day.

I remain, very respectfully,

D. E. COLLINS,
Commanding pro. tem.

Hon. MARSHALL MCDONALD,
U. S. Commissioner of Fish and Fisheries, Washington, D. C.

H.—NARRATIVE OF CRUISE FROM MAY 10 TO MAY 25.

We returned to Hampton Roads late on the afternoon of the 10th, and were joined by Dr. T. H. Bean the following morning. The weather was very unfavorable, and consequently we did not leave harbor until the 12th, when we got under way at 7.10 a. m., and at 9.40 Cape Henry bore south about 3 miles distant. Took bottom temperature at 1 p. m. in 12 fathoms of water, our position being lat. 37° 00′ N., long. 75° 32′ W. After taking the bottom temperature the small surface net was towed for twenty-five minutes, and a small quantity of crustacea was taken. Took bottom temperature again at 4 o'clock, and also towed surface net. (Position, lat. 37° 02′ N., long. 75° 01′ W.) In lat. 37° 03′ N., long. 74° 47′ W. at 6 p. m. took bottom temperature and put out small towing-net for an hour, collecting a lot of little jelly-fishes and some crustacea. Hove-to at dark, but did not set gill-nets, since the weather continued unfavorable.

There was a light baffling wind from the north-northwest and a rough sea heaving from the southward in the early morning of the 13th. Got under way at 5 o'clock and headed to the northeast. Made trial with surface net for an hour, in which we secured a few green fish-eggs. (Position, lat. 36° 59′ N., long. 74° 41′ W.) Used the same form of apparatus from 9.30 until 11 o'clock, collecting more fish eggs.

At 11.45 a. m. tacked ship to the north, the wind having worked around to northeast accompanied by foggy weather. At 4.30 p. m., in lat. 37° 15′ N., long. 74° 48′ W., towed the small surface net for thirty minutes and collected an abundance of sea-fleas in it. Put out both the large and small surface nets at 6.30 p. m. and towed them for fifty minutes, collecting a lot of small crustacea in the small net and nothing in the larger one. Took bottom temperatures at 7.25 p. m. in 26 fathoms of water. The vessel lay-to "jogging" under lower sails during the night.

Put out the small surface net for an hour at 5 a. m. on the 14th, taking in it a quantity of crustacea and small floating shells. (Position, lat. 37° 16′ N., long. 74° 50′ W.) Near this locality, between 5.30 and 7 o'clock, we saw what we believed to be three schools of fish, though it is impossible to say positively what species they were. Hove-to and threw toll-bait and used cod hand-lines baited with salt menhaden. Caught only two skates on the hand-lines, from which a number of parasites were taken. After completing this trial the vessel was kept-off

on a northeast ½ north course. In the position approximating that given for the last trial we put out the small towing-net and collected a quantity of crustacea in it. Saw a few gulls and two or three gannets, also greasy slicks, indicative of some species of fish near the surface. Our course was changed to north-northeast at 12.30 p. m., the wind blowing a moderate breeze from south-southwest to south. About 5 o'clock a large school of porpoises came alongside. We succeeded in harpooning one of them, but did not secure it, since the harpoon-line parted. Our position at this time was lat. 37° 48′ N., long. 74° 38′ W.

Not long after the school of porpoises passed us, and while supper was being served, the vessel ran into a school of fish which, in the opinion of the second officer, who was in charge of the deck at the time, were mackerel, judging from their characteristic rush when disturbed. (Position, lat. 37° 44′ N., long. 74° 38′ W.) The large and small towing-nets were put out and towed for an hour at 6.05 p. m. A number of small jelly-fishes were taken in the small net and one young hake in the larger one. The position of this trial was lat. 37° 49′ N., long. 74° 36′ W.

It was my intention to set gill-nets during the night, but the condition of the water was favorable for noting any schools of fish that might be in the vicinity. In view of this fact and the importance of utilizing the night as well as day to cruise over as large an area as possible in order to observe the movements of surface-swimming fishes, I concluded to keep the vessel under way. Towards midnight a few dog-fish were seen from the mast-head, but no other fish were noticed. During the night our course was to the northeast, with the wind from east-southeast, and occasional showers of rain. The wind fell about midnight and a calm prevailed.

In the early morning of the 15th there was a calm, followed by a light variable wind, which, later in the forenoon, settled to a strong breeze from north-northwest. In lat. 38° 18′ N., long. 74° 14′ W., used the surface towing-net and collected a small quantity of sea-fleas. At 9 o'clock noticed a small flock of sea-geese in lat. 38° 18′ N., long. 74° 14′ W. Observations taken at noon showed our position to be 38° 18′ north latitude and 74° 14′ west longitude.

Tacked ship to the westward at 4 o'clock, and at 6.30 p. m. used the large and small towing-nets for an hour, collecting a lot of minute crustacea in the small net and one small hake in the larger net. (Position, lat. 38° 37′ N., long. 74° 10′ W.) The wind decreased considerably in force at 7 o'clock, and at 9 p. m. the vessel was hove-to and mackerel and herring gill-nets were set.

Hauled the nets at 4.30 a. m. on the 16th and caught 4 silver hake (*Merlucius*) about 13 inches long. As soon as the nets were on board got under way and stood to the west-northwest. Towed the large and small surface nets for a short time at 6.30 a. m., taking in them some small crustacea and two young hake. (Position, lat. 38° 37′ N., long. 74° 18′ W.)

Sighted pilot boat number 3, of Philadelphia, at 7.25 and changed course to intercept her, which we did at 8.20 a. m. Her captain reported not having seen any mackerel this season. After speaking with the pilot boat, the vessel was kept off to the northeast for 40 miles, with a lookout at the mast-head. Hove-to at 1 p. m. in lat. 39° 15′ N., long. 73° 48′ W., and threw toll-bait for thirty minutes, also tried for bottom fish with hand-lines, but got nothing. After completing the trial we got under way and towed the small surface net, collecting a limited amount of crustacea. The vessel was then headed on an east by north course, in which direction we sailed 19 miles, when we again put out the small surface net, in which nothing was taken. (Position, lat. 39° 20′ N., long. 73° 25′ W.)

At 4.30 p. m. the vessel was headed to the northeast, and about 5.40 p. m. we spoke with the British schooner *Atwood*, of Annapolis, Nova Scotia. Her captain reported seeing a large body of schooling fish the previous night, which he thought were mackerel, about 30 miles east-northeast of this position. With a view of finding these mackerel if possible, the *Grampus* was headed northeast by east one-half east, and we ran in that direction for 32 miles. At 11.15 p. m. tacked ship and lay-to. Put out the small surface towing-net for 30 minutes, in which were collected an abundance of the same species of crustacea as was found off Body Island. It is worthy of remark that this form of crustacean was not found in abundance in any other regions traversed to this time. (Position, lat. 36° 31′ N., long. 72° 50′ W.)

In the early morning of the 17th there was a strong breeze from north-northwest, with a sharp sea. At 2 o'clock tacked ship and lay-by on the port tack. The small towing-net was used at 9.15, but the weather was unfavorable for such work and the trial was very unsatisfactory. A trial with toll-bait was made at 1.25 p. m.; nothing was taken. Position, lat. 39° 35′ N., long. 72° 48′ W.

The vessel was kept off on a northeast course until 4.30 p. m., when the small towing-net was put out and took a large collection of crustacea, our position at this time being lat. 39° 42′ N., long. 72° 37′ W. Completing this trial we headed to the northeast and sailed in that direction for 11½ miles, when both the large and small towing-nets were put out, in which were collected an abundance of crustacea and 12 young hake. (Position, lat. 39° 52′ N., long. 72° 30′ W.) Hove-to at 11 p. m., and set large mackerel net.

The mackerel net was hauled at 4.45 a. m. on the 18th, taking nothing. Got under way at 5 o'clock and ran to the eastward for 11 miles. The small surface net was put out at 8 o'clock and collected a quantity of crustacea and one young pollock. At the same time took bottom temperatures in 45 fathoms of water. The position of this trial was lat. 30° 56′ N., long. 72° 12′ W.

The course was changed to northwest by north at 8.35 a m. When in lat. 40° 08′ N., long. 72° 30′ the small towing-net was put out and col-

lected an abundance of sea-fleas and one young hake. Used the small surface net again at 4.45 p. m. in lat. 40° 20′ N., long. 72° 47′ W., and took a small amount of crustacea. After completing the towing, sounded in 27 fathoms and took bottom temperature. (Position, lat. 40° 21′ N., long. 72° 47′ 30″ W.) About this time changed course to the eastward. Towards evening the wind increased, coming from south-southeast, with threatening weather and rain. At 7.45 p. m., hauled the jibs to windward and "jogged" on the starboard tack, and at 8.30 p. m., drew away jibs and "jogged" with mainsheet eased off. Tacked ship at 10 o'clock, heading to the southward, on port tack.

There was a stiff to moderate east-southeast breeze with foggy weather in the early part of the morning of the 19th. At 6 o'clock towed the small surface net for forty-five minutes and secured a few sea-fleas. (Position, lat. 40° 13′ N., long. 72° 19′ W.) The fog prevailed the greater part of the forenoon, with a moderate north by west wind; vessel on the port tack headed to northeast by north. During the afternoon the wind hauled from north-northwest to north-northeast; weather partially clear at intervals. At 4.30 p. m. a large school of porpoises came alongside, from which we harpooned and obtained one specimen. Used the small towing-net at this position, taking considerable crustacea. (Position, lat. 40° 38′ N., long. 71° 49′ W.) Also took bottom temperatures in the above position. Threw toll-bait for thirty minutes at 5.45 p. m., but did not "raise" any fish; also put out hand-lines for bottom fish with no better success. The easterly course was continued during the night.

On the morning of the 20th of May there was a moderate breeze from north-northwest, and clouded sky. At 6 o'clock Block Island bore abeam and a course was shaped for a point between Brenton's Reef and Sakonnet River, in which locality large numbers of floating fish eggs occurred last year. At 8.10 a. m., between the above mentioned places and about 4 miles off shore, the small surface net was towed for twenty minutes, in which were collected a large quantity of crustacea and some fish eggs. Frequent towings were made until 11 o'clock which resulted in the procurement of considerable quantities of fish eggs. Unfortunately, when jibing the main-boom the tackle overturned the dish containing the fish eggs, which occasioned the loss of the entire lot. However, the loss by this accident was repaired, since we made additional collections soon after. Some of the eggs thus obtained were put into the apparatus for developing eggs, and others were put into pans and the ova were kept alive by frequently changing the water on them. After making these collections we filled away for Wood's Holl, where we arrived at 4.35 p. m., and soon thereafter transferred the eggs to the hatchery.

The vessel laid at the Wood's Holl Station from the evening of the 20th until the morning of the 28th, the crew being employed in knitting together the several sections of the purse-seine and getting it ready for use, overhauling the seine-boat, etc.

On May 23d the Commissioner directed that the ship's writer, Mr. A. B. Alexander, be detached from the vessel and ordered to Gloucester, Mass., to await orders, and on the 25th Mr. Alexander left the vessel. Mr. George A. Miller, who was appointed to the position vacated by Mr. Alexander, reported for duty on the 1st of June.

I.—CHANGE OF COMMANDING OFFICER AND IN PERSONNEL.

On the 25th of May the Commissioner ordered me to assume full command of the vessel, in place of Capt. J. W. Collins, who had been assigned more important duties, and promoted Mr. E. E. Hahn to the position of first mate.

J.—CRUISE FOR LIVE MACKEREL.

The purse-seine and seine-boat, having been made ready and transferred to the vessel, we got under way at 9.12 a. m. on the 28th for the purpose of cruising at sea to secure, if possible, a school of spawning mackerel for the Wood's Holl Station, with a view to obtaining the eggs of that species for hatching mackerel fry. At 11.20 a. m., Gay Head bore abeam and our course was laid south by west one-half south. I had intended to cruise to the southward, in the vicinity of Cox's Ledge, judging that locality to be a good one for mackerel, but the threatening appearance of the weather and the increasing southeast wind induced me to run in the direction of Newport. During the early afternoon heavy rain showers prevailed, with an increasing southeast wind, attended by other indications of a stormy night. With such unfavorable conditions in view, I concluded it was best to run into Newport Harbor for the night, and at 4.57 p. m., we anchored between Fort Adams and Lime Rock Light.

The wind continued from the southeast in the early part of the 29th, though moderate in force, with a thick fog. The purse-seine was put into the seine-boat in the morning and the purse-line rove so that the apparatus would be ready for immediate use. The fog lifted about 1 o'clock and soon after we got under way. At 2 p. m., Brenton's Reef Light Ship bore abeam and the vessel was headed south on the starboard tack. The small surface net was put out at 6.20 p. m., in lat. 41° 02′ N., long. 71° 08′ W., and towed for forty minutes; a small collection of crustacea and young hake were obtained. At 7.40 p. m., hove-to for the night.

There was a south-southwest to southwest wind on the morning of the 30th, with squally weather until about 7.30 a. m. The small surface net was towed at 6.30 a. m., and in it was taken an abundance of the crustacean known to the fishermen as "red cayenne," or "seed," together with two young fish. Got under way and stood to the south-southwest at 6.33 a. m. The small towing-net was put out at 11.10 o'clock and secured one small fish. (Position, lat. 40° 45′ N., long. 71° 08′ W.) A

little later tacked ship to the east-northeast. The presence of surface fish-food and other indications of mackerel that were noticed this morning induced me to run back to look for fish in that direction, and also to continue the research farther to the southeast. At 1.53 p. m., put out the small surface net for fifteen minutes and collected six young fish and a few fish eggs.

Between 2 and 3.15 p. m. five towings were made with the small surface net, extending from lat. 40° 46′ N., long. 71° 00′ W., to lat. 40° 47′ N., long. 71° 55′ W. Near the last position an abundance of the red crustacean and small fish were taken in the net. Hove-to and threw "toll-bait" for mackerel, and also used hand-lines baited with alewives for bottom fish. This trial resulted in securing 2 squirrel hake, 6 common hake, and 1 female spiny-backed dog-fish, with young.

The vessel was kept hove-to until 9.25 p. m., when we got under way and stood to the east by north. Between 10 and 11 o'clock, from lat. 40° 47′ N., long. 70° 52′ W., to lat. 40° 50′ N., long. 70° 46′ W., we passed about twenty schools of fish, their presence being visible by the phosphorescence of the water. Most of these schools were small in size and deep down in water, several of them being startled by the vessel running through them. From their movements when disturbed we judged they were mackerel. I was anxious to set the purse-seine for some of these fish to determine the species, as well as to obtain some eggs for the hatchery, but the nature of the weather, a dense fog having set in, convinced me that an attempt at night seining could not have been successfully accomplished, with the small complement of men which we carried, without too much risk, since only one man could be left on board to work the vessel. At 11 o'clock the vessel was hove-to for the night on the starboard tack.

In the early morning of the 31st there was a moderate south-southwest to south breeze, with foggy weather. At 6.30 a. m., in lat. 40° 47′ N., long. 70° 39′ W., put out hand-lines, baited with alewives, for bottom fish, and succeeded in catching 6 codfish, 2 common hake, and 1 haddock. The stomachs of the cod were opened and the contents examined. In them we found scallops, shrimp, and squid. Got under way on a northeast by east one-half east course at 8.24 a. m., and towed the small surface net on two occasions, which took an abundance of crustacea in each trial. (Position, lat. 40° 45′ 30″ N., long. 70° 36′ W., and lat. 40° 45′ N., long. 70° 35′ 30″ W., D. R.).

Between lat. 40° 46′ N., long. 70° 33′ W., and lat. 40° 45′ 30″ N., long. 70° 29′ W., from 10.45 to 11.30 a. m., three towings with the small surface net were made. Young hake, fish eggs, and "red seed" were collected. From the scant amount of the latter I judged we had reached the eastern limit of its distribution. Tacked ship at 11.30 and steered southwest, the object of this course being to locate the limits of the "red cayenne." Towings were made between 12.20 and 1.40 p. m. from lat. 40° 45′ N., long. 70° 29′ W., and lat. 40° 44′ N., long. 70° 32′ W. The

red crustacean was found very abundant in the last position. Two towings to the northeast of the last position failed to collect specimens of this form, but secured young hake and fish eggs.

During the day three hagdons and one jaeger were shot, though the birds were by no means numerous. At 5.35 p. m. a porpoise was harpooned by the second officer, and we succeeded in taking it on board. It is probably worthy of remark that this porpoise and its mate were in company with a school of blackfish. (Position, lat. 40° 43′ N., long. 70° 32′ W.) Towings with the small surface net in this position gave an abundance of the red crustacean, together with small round jellyfishes. The vessel was hove-to on the port tack at 7 o'clock.

In the early part of the following day (June 1) the wind was from the south, gradually hauling to the north-northwest, and then backing to the southwest in the afternoon, the weather being rainy and foggy. At 12.10 a. m. changed course to northwest one-half north, in which direction we sailed 21 miles, when the vessel was headed north-northwest for a distance of 2 miles, when our course was changed to north by east.

The small surface net was towed for twenty minutes at 9.05 a. m., in lat. 41° 07′ N., long. 71° 02′ 30″ W. (D. R.), and quantities of floating fish eggs, small crustaceans, and a few young fish were collected. At 10.35 the small towing-net was used; it took an abundance of fish eggs, which were put into the hatching apparatus. About 16 miles south-southwest from Vineyard Sound Light-Ship masses of floating fish eggs were collected, the tide probably bringing them together at this point. The fog cleared about 2 o'clock in the afternoon and the vessel was steered northeast by east. At 4 p. m. Gay Head bore abeam, and at 6.30 we ran into Wood's Holl Harbor and transferred the fish eggs to the hatchery.

K.—ORDERS FOR CONTINUING THE CRUISE.

After our arrival I received the following orders from the Commissioner, expressing his desire to have the work continued:

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., May 30, 1888.

SIR: You will continue cruising for the purpose of taking live mackerel for the Wood's Holl hatchery, and making observations and studies of the movements of mackerel, etc., until further orders. Should you succeed in bringing in a lot of live mackerel, please telegraph the fact. At present it looks as though it may be desirable to continue your cruise until near the close of June, but we shall be governed largely by the results obtained.

Very respectfully,

M. MCDONALD,
Commissioner.

Capt. D. E. COLLINS,
Schooner Grampus, Wood's Holl, Mass.

L.—NARRATIVE OF CRUISE FROM JUNE 4 TO 30.

The vessel laid at Wood's Holl until June 4, the intervening period being occupied in routine work. The porpoise was shipped in ice by express to the U. S. National Museum, Washington, D. C., on the 2d.

We got under way at 1.20 p. m. on the 4th, and were towed to the entrance of the harbor by the steam-launch belonging to the station. Beat down the sound with a very light wind, and at 4 p. m. anchored in Tarpaulin Cove. The small surface net took a quantity of crustacea which resembled larval crabs. Terns were numerous and evidently had found some kind of food in the water. A school of fish was noticed inside the buoy off the point of the harbor, but it was, of course, impossible to secure it. The surface net was put out at 6.30 p. m., and took some small crustaceans.

Got under way at 5 a. m. on the 5th, with a light westerly breeze and strong head tide, and beat out of the Sound. At 8.10 put out the surface towing-net and took a great quantity of small copepods. It may be interesting to state that the copepods were noticed at the surface of the water in long streaks.

Spoke with the fishing schooner *James Dyer* about 7 miles southwest of No-Man's Land. Her captain reported not having seen any schooling mackerel, but that a few schools had been taken in this vicinity on the 3d. I learned later that the captain was mistaken in regard to the species, since it was reported to me that several schools of alewives were caught, but no mackerel.

After speaking with the *Dyer* the *Grampus* was headed southeast by south one-half south, in which direction we sailed 32 miles. The surface net was towed at this point and took a small quantity of crustacea, some fish eggs, 2 young hake, 2 specimens of another species of fish, and two jelly-fishes. (Position, lat. 40° 47′ N., long. 70° 29′ W.) In this position a small school of fish was noticed and an attempt was made to capture them, but before the seine was in position they had sunk deep below the surface. After this attempt we continued on our southeast course under shortened sail. At 8 p. m. some porpoises were seen.

The vessel was hove-to from midnight until 5 a. m. on the next day. At 5 o'clock the small surface net was put out and collected an abundance of crustacea in fifteen minutes. (Position, lat. 40° 27′ N., long. 70° 01′ W.) Got under way at 5.15 a. m., steering east-southeast, in which direction we sailed 10 miles. The small towing-net was put out in lat. 40° 26′ N., long. 69° 49′ W., but collected nothing. Tacked ship at 7.25 a. m. and stood to the west-northwest for 3 miles and then to the north for 10 miles. The small surface net was towed for 25 minutes at 10 o'clock, but took nothing. (Lat. 40° 36′ N., long. 69° 55′ W.)

We spoke with the schooner *Nellie M. Rowe*, of Gloucester, soon after making the last trial, and, in an interview with her captain, learned

that they had been searching for mackerel for the past week, but, so far, had not succeeded in getting any. On the 4th instant they took a school of menhaden about east by north 20 to 25 miles from Barnegat. Finishing our interview with the captain of the *Rowe*, we steered a course to the south-southeast, in which direction we sailed a distance of 13 miles. At 1.45 p. m. the small surface-net was put out, in which we took nothing. (Position, lat. 40° 27′ N., long. 69° 47′ W.) We then tacked and stood to the west by north, and ran a distance of 13½ miles. At 3.53 p. m. used the small surface-net in lat. 40° 29′ N., long. 70° 04′ W., and obtained an abundance of the red crustaccan. Our next course was west, in which direction we sailed a distance of 4 miles, when we tacked to south-southeast. At 6.20 p. m., in lat. 40° 22′ N., long. 70° 04′ W., put out the small surface towing-net for twenty minutes, and took the largest quantity of the red crustaceau yet obtained. The wind increased to a very fresh breeze with a sharp sea, which was unfavorable for noting the presence of schooling fish at any distance from the vessel, unless they should "show up" very plainly at the surface. At dark the vessel was hove-to on the port-tack.

In the early part of the next day (June 7) there was a stiff breeze from south-southwest, with cloudy weather. At 4.40 a. m. sounded in 48 fathoms of water and took bottom temperature; put out the small surface-net, in which were collected a lot of sea-fleas and other crustacea. (Position, lat. 40° 13′ N., long. 69° 58′ W.) At 6.40 a. m. kept off to the northwest by north, on which course black hagdons were seen at intervals. The small towing-net was put out at 3 o'clock and collected some fish eggs and two young fish. (Position, lat. 40° 57′ N., long. 71° 03′ W.) At 3.20 p. m. sounded in 26 fathoms of water and took bottom temperature. At 3.30 changed course to north-northeast one-half east, and in a few minutes steered to the northeast.

We spoke with the fishing schooner *Elisha Baker*, fishing for cod-fish on Cox's Ledge. Her captain reported not having seen any schooling fish, but that several mackerel vessels had recently been in this vicinity. He gave us the head of a large mackerel which he had taken from his trawl-line, and he supposed that sharks had eaten the body.

After speaking with the *Baker* we changed our course and steered north-northwest one-half west. The small surface net was towed between 6 and 7.30 o'clock, and in it was obtained a large quantity of fish eggs, copepods, and other small crustacea, our position being about 8 or 10 miles southeast from Block Island. About dark the captain of the schooner *Stowell Sherman*, of Provincetown, boarded us to learn news about mackerel. We furnished him with what information we had, and in return learned that he had been cruising for mackerel since June 2, covering a region between Shinnecock and South Shoal Light-ship, but in the whole of the cruise had not seen any schooling fish. He also said that several weirs at Truro had caught mackerel just previous to his departure from port. We hove-to for the night at 7 o'clock.

There was a stiff to fresh breeze from northeast by east in the early morning of the 8th, with a sharp sea, the weather being misty and rainy. The vessel was "jogging" from 12.30 a. m. until daybreak, when the sheets were trimmed and we stood inshore towards Newport. Anchored in Newport Harbor at 9 o'clock, where we found four or five fishing vessels. Other mackerel schooners arrived during the day until late in the afternoon, when there were twenty-seven sail of fishing vessels in the harbor. Some of the captains visited us for the purpose of learning what news we had of mackerel, and they were informed of the results of our investigation. Their reports acquainted me with the recent catches of mackerel by the vessels of the fleet.

The captain of the *Robert Pettis* reported that the schooner *Active* took 1,500 large mackerel on June 4 about 5 miles southwest of Block Island. Also, that four barrels of salt mackerel were taken by the schooner *Colonel French*, and one barrel by a Portland schooner in the same locality. Mackerel were seen off Cox's Ledge on the 3d, and some of the later arrivals in the harbor reported that mackerel were seen in the vicinity of Montauk Point.

On account of a calm we lay at anchor in Newport Harbor until 8.30 o'clock on the 9th, when we got under way, in company with other fishing vessels, with a light southerly breeze. At 10.15 Brenton's Reef Light-ship bore abeam, the fishing vessels working towards Block Island.

It may not be out of place to mention here that when we left Newport Harbor most of the fishing vessels were outside of the harbor, where they took advantage of the breeze as soon as it came along, which gave them a start of 4 or 5 miles of us, and when we were off Brenton's Reef Light-ship they still had a lead of 4 or 5 miles dead to windward of us. We gained quite rapidly on the fleet and at 4 p. m. our vessel was to the windward of them all, with the exception of the schooner *I. J. Merritt, jr.*, of Gloucester, and another schooner hailing from Wellfleet.

At 4.30 o'clock, when about 5 miles south by east from Block Island, we hove-to and spoke with the fishing schooner *Elizabeth Smith*, of Portland, Me., her captain desiring information in reference to mackerel, which was furnished him. The captain reported having sailed 30 miles to the southward of this position, but had seen no schooling fish. The purse-seine was transferred to the seine-boat, and at 6.40 p. m. we kept off on a southeast course, with four or five vessels of the mackerel fleet in company. We hove-to for the night at 7.45 p. m.

The fishing schooner *Gertrude Summers*, of Provincetown, made inquiries of us concerning mackerel in the early morning of the 10th. From her captain I learned that he had been along the south side of Long Island, where he saw schooling menhaden, but no mackerel.

Got under way, steering east-northeast, at 9.55 a. m., with cloudy and foggy weather; changed course to north at 10.15 a. m., and steered to the westward at 10,50. The schooner *C. A. Sanford*, of Dennis, spoke

with us at 11.10. She had cruised as far as 40 miles south-southwest of Fire Island. Saw menhaden, but no mackerel.

When about 5 miles south by east from Block Island, at 1.50 p. m., put out hand-lines for bottom fish, and in an hour caught five cod-fish and eighteen cunners. The fog cleared at 4.45 p. m., when we laid a course for Block Island and came to anchor on the northeast side of the island at 5.35 o'clock, where also were twenty-three sail of mackerel schooners. At the time of anchoring the wind was fresh from south-southwest, with threatening weather.

We laid at anchor off Block Island during the 11th, the fresh south-southwest wind continuing, accompanied by foggy weather until 6 a. m., and low barometer. I visited the schooner *Jennie Seaverns*, of Gloucester, in the afternoon. From her captain I learned that on the previous day he cruised 60 miles southeast of Block Island, during which he saw several schools of herring. He said that the schooner *David F. Low*, of Gloucester, caught 60 barrels of small mackerel on the 4th, about 35 miles from Fire Island. These fish were marketed in New York, but they brought a low price, on account of their small size. The captain of the *Low* reported that small mackerel were numerous in that locality at the time. I also learned that two or three small schools of large mackerel had been seen near Shinnecock recently.

At 4 o'clock on the morning of the 12th got under way on the port tack, steering to the southward, in company with the whole mackerel fleet. When about 3 miles southeast from Block Island Light changed course to south-southwest. We ran into numerous schools of fish about 5 miles southeast of Block Island, which had the appearance of menhaden. At 6 a. m. left the vessel, in the seine-boat, to set the purse-seine around a school of fish, but on finding them to be menhaden did not shoot it. It was noticed that none of the fleet succeeded in getting any fish, although several of them set their seines. Menhaden steamers were seen inshore, to the westward of Montauk Point. At 10.55 a. m. there were numerous schools of menhaden in sight, all of which seemed to be moving to the eastward. Made another trial with the purse-seine, but did not succeed in getting fish. After this trial we stood off-shore on a south-southeast course, the wind having veered round to the southwest. We sailed in this direction for 20 miles and occasionally passed schools of menhaden. At 5.40 p. m. we saw several schools of fish which appeared to be mackerel, and captured a school containing about six barrels, in the purse-seine, about 6 o'clock. Upon examination, the largest were found to be only 8 inches in length and were not spawning fish. We saved about a barrel of them and liberated the rest. These fish were captured in lat. 40° 36′ N. long. 72° 00′ W. It was noticed that the vessels of the fleet, which were to the southward and westward of us, were apparently among the fish, though it is impossible to say whether they took any. Near the position where the small mackerel were caught the small surface net was used and in it

we collected a very limited amount of crustacea. In the position of the first set of the seine this morning a species of crustacea was very abundant. The vessel was hove-to at dark, with jibs to windward.

There was a moderate breeze from the southwest with clear weather on the morning of the 13th. Got under way at 5.40 a. m. and stood to the westward until 8 o'clock, at which time we tacked ship and ran to the southward. At 10.45 tacked ship and "jogged," while bottom temperatures were taken. Spoke with the schooner *Carl Schurz*, the captain reporting that he had been cruising off Fire Island, but saw nothing but small mackerel and menhaden. The surface net was put out at 11.35 and secured a small amount of crustacea. The schooner *F. A. Lambert*, of Cohasset, was spoken at 12.30 p. m.; the captain reported having taken some small mackerel on the previous day, but had seen none since. A large school of porpoises passed us at this time.

We continued on the southerly course until 3.20 p. m., when a school of mackerel was seen and we succeeded in capturing it. The school contained about 14 barrels of "tinkers" about the same size as those taken yesterday, and we turned them loose. (Position, lat. 40° 25′ N., long. 72° 28′ W., D. R.). After making this trial the vessel was steered on a northeast course. It was noticed that the schooner *George A. Leland* made a haul of fish, and soon after we got under way and spoke with her, learning that the fish were all small. During the afternoon numerous schools of these small fish were passed; as the fish were well up at the surface it was an easy matter to determine their size and species. At 8.30 p. m. changed course to northeast by east, and at 9 o'clock Shinnecock Light bore abeam, at which time the vessel was headed to the east-northeast.

The morning of the 14th opened with a moderate southerly wind and clear weather. At 5 o'clock Montauk Point bore northwest about 6 miles distant. There were five fishing vessels near us steering to the eastward, and the rest of the fleet in sight to the southeast, about 8 or 9 miles. Changed course and steered towards this last lot of vessels, and soon after it was noticed that three of them had taken fish. We ran up to the *Mertie and Delmar*, of Chatham, and boarded her. The captain reported having taken 50 barrels of small mackerel the afternoon before, and at the time we went on board the crew were engaged in dressing them. No large mackerel had been seen by him. The position of the catch of the *Delmar* was about 12 miles south-southeast from Block Island. At 9.30 o'clock a. m. we kept off and ran to the northeast by east. Put out the small surface net at 11.20, when about 4 miles northwest one-half north from Cox's Ledge; towed it for twenty-five minutes and collected a small amount of fish eggs.

After completing this towing the *Grampus* was kept-off on a northeast course. The towing-net was again put out at 12.45 p. m. and took a small amount of fish eggs in five minutes. At 1.40 o'clock the same apparatus was towed for 10 minutes; two young fish and some fish eggs

were collected. At 2.30 p. m. Gay Head bore abeam, and a little later we spoke with the schooner *Lizzie Maud*, of Portland, off Manemsha Bight. Her captain reported getting 800 large mackerel in this locality the day before. We hove-to off Manemsha Bight to look for mackerel, and saw one school containing probably a barrel, which, however, sunk out of sight before we had an opportunity to attempt a capture. Later in the afternoon the wind increased to a fresh breeze, accompanied by rain squalls, and the vessel was headed for Wood's Holl, where we arrived about dark.

Dr. T. H. Bean left the vessel on the 15th and proceeded to Gloucester, in compliance with instructions from the Commissioner. The Commissioner visited the vessel during the afternoon and made arrangements to have the crew assist in preparing a shipment of live lobsters for the West Coast. After completing this work, the purse-seine was prepared for storing, and, together with other apparatus taken on board at the beginning of the cruise, was transferred to the store-house at this station, in accordance with verbal instructions from the Commissioner. Completing the storing of the apparatus, the vessel sailed for Gloucester, Mass., on the 18th, where we arrived the next day. From the 19th of June until the end of the fiscal year the vessel laid at Gloucester painting and refitting for her summer's work.

On account of failing health I was granted leave of absence from the 24th of June until the vessel was fitted for sea, the repairs being under the direct supervision of the first officer, Mr. E. E. Hahn.

The following tabulated statements present in a concise form the results of the work performed on the cruise:

M.—TABULATED STATEMENTS.

TABLE 1.—*Showing towings with small surface-net.*

Date.	Hour.		Position.		Time occupied.	Distance towed.	Results
	A. M.	P. M.	Lat. N.	Long. W.			
1888.			° ′ ″	° ′ ″		*Miles.*	
Apr. 17	11	.....	36 50	75 45	45 minutes..	2	Nothing.
17	.....	3	36 45	75 27	30 minutes..	1½	Do.
17	.....	7	36 36	75 13	....do	1½	Miscellaneous forms of crustaceans.
18	7	.....	36 13	74 51	1 hour	3	Do.
18	.....	6.30	35 46	74 55	½ hour	1½	Do.
19	7	.....	35 48	74 43	.....	.....	Do.
19	10	.....	.....	.....	.....	.....	Do.
19	.....	4	36 34	74 34	.....	.....	Do.
20	8	.....	.....	.....	1½ hours	3½	Nothing.
20	.....	6	37 03	74 49	.....	.....	Miscellaneous forms of crustaceans.
21	.....	4.30	37 07	74 48	40 minutes..	.....	Do.
22	6	.....	.....	.....	1½ hours	2	Do.
22	9.40	.....	.....	.....	30 minutes..	.....	Do.
22	.....	6	37 35	74 39 30	....do	1	Do.
23	6.30	.....	37 40	74 30	....do	1	Do.
May 1	7	.....	36 43 30	74 47 30	....do	1	Do.
1	11	.....	36 58	74 26	....do	1	Do.
1	.....	2.30	36 59	74 32	....do	1	Do.
1	.....	4	37 00	74 40	....do	1	Do.
1	.....	6	36 59 45	74 46	....do	1	Nothing.

TABLE 1.—*Showing towings with small surface-net*—Continued.

Date.	Hour. A. M.	Hour. P. M.	Position. Lat. N.	Position. Long. W.	Time occupied.	Distance towed.	Results.
1888.			° ′ ″	° ′ ″		*Miles.*	
May 2	6.30	.....	36 53	74 40	30 minutes..	1	Miscellaneous forms of crustaceans.
2	.....	2.43	37 01 30	75 00	....do	1	Do.
2	.....	6.25	37 06	74 47	20 minutes..	¾	Do.
3	6	.....	36 58	74 51	1 hour	2	Do.
3	11	.....	36 59	74 50	30 minutes..	1	Do.
3	.....	6.10	37 09	74 47	45 minutes..	1½	Do.
4	10	.....	37 24	74 49	30 minutes..	1	Do.
4	.....	2	37 07	74 07	....do	1	Do.
5	6.20	.....	36 59	75 02	40 minutes..	1	Do.
5	9.15	.....	37 04	75 16	30 minutes..	1	Do.
5	10.30	.....	37 02	75 33	....do	1	Do.
12	.....	1	37 00	75 32	20 minutes..	1	Do.
12	.....	4	37 02	75 01	30 minutes..	1	Do.
12	.....	6	37 03	74 47	60 minutes..	2	Miscellaneous forms of crustaceans and jelly-fishes.
13	6	.....	36 59	74 41	....do	2	Green fish eggs.
13	9.30	.....	37 00	74 40	1½ hours	3	Do.
13	.....	4.30	37 15	74 48	30 minutes..	1	Miscellaneous forms of crustaceans.
13	.....	6.30	37 22	74 53	50 minutes..	1½	Do.
14	5	.....	37 16	74 50	60 minutes..	1½	Miscellaneous forms of crustaceans and mollusca.
14	7	.....	37 18	74 48 30	....do	1½	Miscellaneous forms of crustaceans.
14	.....	6	37 49	74 36	....do	1½	Do.
15	6	.....	38 18	74 14	30 minutes..	1	Do.
15	.....	6.30	38 37	74 10	60 minutes..	2	Do.
16	6.20	.....	38 37	74 18	30 minutes..	1	Do.
16	.....	1	39 15	73 48	....do	1	Do.
16	.....	4.05	39 20	73 25	....do	1	Nothing.
16	.....	11.15	39 31 30	72 50	....do	1	Crustaceans.
17	9.15	.....	39 31	72 50	....do	1	Nothing, weather bad.
17	.....	4.30	39 42	72 37	25 minutes..	1	Miscellaneous forms of crustaceans.
17	.....	6.45	39 52	72 30	50 minutes..	1½	Crustaceans and 1 small pollock.
18	8	.....	39 56	72 12	30 minutes..	1	Crustaceans and 1 small hake.
18	.....	1.30	40 08	72 30	60 minutes..	2	Crustaceans.
18	.....	4.45	40 20	72 47	30 minutes..	1	Do.
18	.....	7	40 23	72 26	....do	1	Do.
19	6	.....	40 13	72 19	45 minutes..	1½	Do.
19	.....	5.45	40 38	71 49	30 minutes..	1	Do.
29	.....	6.20	41 02	71 08	40 minutes..	1½	Crustaceans and 2 young hake.
30	6.30	.....	40 51	70 51	20 minutes..	¾	"Red Cayenne" and 2 young hake.
30	11.10	.....	40 45	71 08	13 minutes..	¼	1 small fish.
30	.....	1.53	40 46	71 00	15 minutes..	¼	Fish eggs and young fish.
30	.....	2	40 47	71 55	75 minutes..	4	Crustaceans.
31	8.24	.....	40 45 30	70 36	23 minutes..	½	Do.
31	10.05	.....	40 45	70 35 30	.....	.....	Do.
31	10.45	.....	40 46	70 33	45 minutes..	2	Crustaceans, hake, and fish eggs.
31	.....	12.20	40 45	70 29	80 minutes..	.....	Crustaceans.
31	.....	5.35	40 43	70 32	.....	.....	"Red Cayenne" and jelly-fishes.
June 1	9.05	.....	41 07	71 02 30	20 minutes..	¼	Crustaceans, fish eggs, and young fish.
1	10.35	.....	.....	.....	....do	¼	Fish eggs.
4	.....	4	Tarpaulin Cove ...		.....	.....	Crustaceans.
4	.....	6	....do	.....	.....	.....	Do.
5	8.10	.....	....do	.....	.....	.....	Do.
5	.....	5.25	40 47	70 29	20 minutes..	.....	Crustaceans, 2 small hake, and fish eggs.
6	5	.....	40 27	70 01	15 minutes..	¼	Crustaceans.
6	7	.....	40 26	69 49	10 minutes..	¼	Nothing.
6	10	.....	40 36	69 55	25 minutes..	½	Do.
6	.....	1.45	40 27	69 47	20 minutes..	¼	Do.
6	.....	3.53	40 29	70 04	....do	⅛	"Red Cayenne" very abundant.
6	.....	6.20	40 22	70 04	....do	⅛	Do.
7	4.40	.....	40 13	69 58	10 minutes..	¼	Crustaceans.
7	.....	3	40 57	71 03	....do	¼	Fish eggs and 2 young fish.
7	.....	7	Off Block Island ..		90 minutes..	.....	Fish eggs in abundance.
12	.....	6	40 36	72 00	.....	.....	Crustaceans.
13	11.35	.....	40 29	72 00	.....	⅛	Do.
14	11.20	.....	Off Cox's Ledge ...		30 minutes..	.....	Fish eggs.
14	.....	12.45	....do	.....	5 minutes..	.....	Do.
14	.....	1.40	Off Gay Head.....		10 minutes..	.....	Fish eggs and young fish.

TABLE 2.—*Showing towings with large surface-net.*

Date.	Hour.		Position.		Time occupied.	Distance towed.	Results.
	A. M.	P. M.	Lat. N.	Long. W.			
1888.			° ′ ″	° ′ ″		*Miles.*	
Apr. 18	.....	6.30	35 46	74 55	30 minutes..	1½	5 young fish.
19	.....	.....	36 34	74 34	.....	.....	1 butterfish.
21	.....	5	37 07	74 48	40 minutes..	1½	1 small fish.
22	.....	6	37 35	74 39 30	30 minutes..	1	Nothing.
23	6.30	.....	37 40 30	74 30 00	... do	1	Do.
May 1	.....	6	36 59 45	74 46	....do	1	Do.
2	.....	6.25	37 06	74 46	20 minutes..	1	Do.
3	.....	6.10	37 09	74 47	45 minutes..	2	1 butterfish and 1 small hake.
13	.....	6.30	37 22	74 53	50 minutes..	2	Nothing.
14	.....	6	37 49	74 36	60 minutes..	2	1 small hake.
15	.....	6.30	38 37	74 10	60 minutes..	2	1 small hake.
16	6.20	.....	38 37	74 18	30 minutes..	1	2 small hake.
17	.....	6.45	39 52	72 30	50 minutes..	1½	12 small hake.

TABLE 3.—*Showing trials for fish with "toll-bait," hand-lines, etc.*

Date.	Hour.		Position.		Apparatus.	Bait.	Time occupied.	Results.
	A. M.	P. M.	Lat. N.	Long. W.				
1888.			° ′ ″	° ′ ″				
April 18	8	.....	36 13	74 51	Toll-bait....	Toll	30 minutes..	Nothing.
18	8	.....	36 13	74 51	Hand-lines..	Salt fish ..	....do	1 dog-fish.
18	.....	2.30	36 56	75 02	Toll-bait....	Toll	....do	Nothing.
18	.....	2.30	36 56	75 02	Hand-lines..	Salt fish ..	....do	2 dog-fish.
19	3	.....	35 48	74 43	Gill-nets....	Nets.....	2 hours	Nothing.
20	5	.....	36 39	74 51	Toll-bait....	Toll	40 minutes..	Do.
20	5	.....	36 39	74 51	Hand-lines..	Salt fish ..	....do	1 dog-fish.
21	.....	4.30	37 07	74 48	Toll-bait..	Toll	50 minutes..	Nothing.
21	.....	7	37 07	74 48	Gill-nets....	Nets.....	10 hours	1 small mackerel.
22	12 m.	.....	37 22	74 47	Toll-bait....	Toll	1 hour	Nothing.
22	12 m.	.....	37 22	74 47	Hand-lines..	Salt fish ..	....do	Do.
22	.....	4.23	37 32	74 50	Toll-bait....	Toll	....do	Do.
23	6.30	.....	37 40	74 30	....do	... do	30 minutes..	Do.
23	6.30	.....	37 40	74 30	Hand-lines..	Salt fish ..	....do	Do.
24	10.30	.....	37 39	74 38	Toll-bait....	Toll	50 minutes..	Do.
24	10.30	.....	37 39	74 38	Hand-lines..	Salt fish ..	....do	1 dog-fish.
25	1	.....	37 31 45	74 39	Gill-nets....	Nets.....	3 hours	1 Branch herring
May 1	10	.....	36 56 30	74 21	Toll-bait....	Toll	30 minutes..	Nothing.
2	.....	6.45	37 06	74 47	Gill-nets....	Nets.....	9 hours	Do.
3	.....	3.25	37 07	74 51	Toll-bait....	Toll	2 hours	Schools of "Brit."
3	.....	3.25	37 07	74 51	Hand-lines..	Salt fish ..	2 hours	Nothing.
3	.....	7	37 09	74 47	Gill-nets....	Nets.....	9½ hours	1 butterfish.
4	9.15	.....	37 24	74 49	Toll-bait....	Toll	30 minutes..	Nothing.
4	9.15	.....	37 24	74 49	Hand-lines..	Salt fish ..	....do	Do.
5	6.20	.....	36 59	75 02	Toll-bait....	Toll	40 minutes..	Do.
5	6.20	.....	36 59	75 02	Hand-lines..	Salt fish ..	....do	2 dog-fish.
14	8.25	.....	37 18	74 48 30	Toll-bait....	Toll	60 minutes..	Nothing.
14	8.25	.....	37 18	74 48 30	Hand-lines..	Salt fish ..	... do	2 skates.
15	.....	9	38 36 30	74 12	Gill-nets....	Nets.....	7½ hours	4 silver hake.
16	.....	1	39 15	73 48	Toll-bait ...	Tolling ...	30 minutes..	Nothing.
16	.....	1	39 15	73 48	Hand-lines..	Salt fish ..	....do	Do.
17	.....	1	39 35	72 48	Toll-bait ...	Toll	50 minutes..	Do.
17	.....	11	39 52	72 33	Gill-nets....	Nets.....	5.45 hours ..	Do.
18	.....	.....	40 38	71 49	Toll-bait....	Toll	30 minutes..	Do.
18	.....	.....	40 38	71 49	Hand-lines..	Salt fish ..	....do	Do.
30	.....	3.35	40 47	71 55	Toll-bait....	Toll	....do	Do.
30	.....	3.35	40 47	71 55	Hand-lines..	Salt fish ..	....do	6 common hake, 2 squirrel hake.
31	6.30	.....	40 47	70 39	....do	Alewives .	1 hour	6 cod, 2 common hake, 1 haddock.
June 10	.....	1.50	5 M. E. off Block Id		....do	.....	.....	5 cod, 18 cunners.
12	6	.....	3 M. S. E. Block Id.		Purse-seine .	Seine	....do	Liberated fish.
12	8.40	.....	4 M. off Montauk Pt		....do	....do	....do	Missed.
12	.....	6	40 36	72 00	....do	....do	45 minutes..	6 barrels tinker mackerel.
13	.....	3.20	40 25	72 28	... do	....do	40 minutes..	14 barrels tinker mackerel.

TABLE 4.—*Showing positions of occurrence of pelagic fishes, etc., spring of* 1888.

Date.	Hours.		Position.		Species.	Quantity.	Remarks.
	A. M.	P. M.	Lat. N.	Long. W.			
			° ′ ″	° ′			
Apr. 9	.....	8	37 27	74 48	Unknown.....	3 pods.....	Seen from mast-head.
17	.....	4	36 45	75 27	Whales.....	3.....	Do.
20	6	.....	36 39	74 51	Porpoises.....	School.....	Going N. W.
May 3	.....	3.25	37 07	74 51	"Brit".....	School	Attracted by "toll-bait."
14	7	.....	37 16	74 50	Unknown.....	3 schools....	At distance from vessel.
14	.....	5	37 44 30	74 38	Porpoises.....	School.....	Harpooned one specimen.
14	.....	5.40	37 44 30	74 38	Mackerel	....do	Encountered by vessel.
15	.....	11	39 36	72 45	....do	....do	Reported by schooner *Atwood.*
19	.....	4.30	40 38	71 49	Porpoises.....	....do	Captured one specimen.
20	8	.....	Off Brenton's Reef.		Fish eggs.....	250,000.....	Between reef and Sakonnet River.
30	.....	10	40 47	70 52	Schooling fish.	20 schools...	Between lat. 40° 47′ N. long. 70° 52′ and lat. 40° 50′, long. 70° 46′.
31	.....	5.35	40 43	70 32	Porpoises.....	School	With school of blackfish.
June 4	.....	5	Tarpaulin Cove...		Mackerel	....do	Inside harbor.
4	.....	.....	25 miles east of Barnegat.		Menhaden	....do	Captured by *Nellie M. Rowe.*
4	.....	.....	Off Block Island...		Mackerel	1,500 large..	Captured by schooner *Active.*
4	.....	.....	....do		....do	4 barrels....	Captured by schooner *Col. French.*
4	.....	.....	35 miles off Fire Island.		....do	60 barrels...	Captured by schooner *David J. Low.*
5	.....	.....	Tarpaulin Cove...		Alewives. ...	School	Reported by schooner *James Dyer.*
5	.....	5.25	40 47	70 29	Mackerel	...do	Tried for, but "missed."
5	.....	8	40 47	70 29	Porpoises.....	Several.....	Seen from vessel.
6	.....	.....	Cox's Ledge		Mackerel	Head of....	On trawl-line.
12	6	.....	3 m. SE. Block Id		Menhaden	Schools	Seen from vessel.
12	8.40	.....	4 m. off Montauk .		....do	....do	Do.
12	.....	12.30	.....		Porpoises.....	....do	Passing to eastward.
13	.....	3.20	40 25	72 28	Mackerel	....do	Seen from vessel.
13	.....	.....	Manemsha Bight...		....do	800 large....	Taken by schooner *Lizzie Maud.*
14	.....	.....	12 m. SSE. Block Id.		....do	50 barrels...	Taken by schooner *Mertie and Delmar.*
14	.....	.....	Manemsha Bight...		....do	School	Seen from vessel.

TABLE 5.—*Showing temperatures of air, surface and bottom water, etc., from April* 17 *to June* 13, 1888.

Date.	Hour.		Position.		Depth (fathoms).	Character of bottom.	Temperatures.		
	A. M.	P. M.	Lat. N.	Long. W.			Air.	Surface.	Bottom.
			° ′ ″	° ′ ″			°	°	°
Apr. 17	8	.....	36 58 00	76 02 00	.....	Mud	45	51	.....
17	12 m	.....	36 50 00	75 45 00	.....	....do.....	44	45	.....
17	.....	4	36 44 00	75 24 00	.....	....do.....	42	45	.....
18	12 m	.....	36 20 00	75 01 00	.....	....do.....	43	45	.....
18	4	.....	36 14 00	74 53 45	.....	....do.....	46	46	.....
18	8	.....	36 13 00	74 50 00	47	....do.....	49	46	46
18	12 m	.....	36 04 00	74 54 00	.....	.....	54	47	.....
18	.....	2.35	35 55 00	75 02 00	17	Mud.....	52	48	47.5
18	.....	6	35 46 00	74 55 00	28	....do.....	54	48.5	48
19	8.15	.....	35 57 00	74 28 00	175	....do.....	53	49	46
19	.....	4	36 30 00	74 41 00	22	....do.....	50	46.5	46
19	.....	6.45	36 34 00	74 34 00	22	.....	50	46.5	46
20	8	.....	36 39 00	74 51 30	32	Mud	50	45	45
20	12 m	.....	36 42 00	74 48 00	43	....do.....	45	45	45
21	8	.....	37 04 00	74 44 15	30	....do.....	44	45	45.5
21	12 m	.....	37 03 45	74 48 30	30	...do.....	48	45	43.5
22	10	.....	37 16 00	74 47 00	.....	.....	46	45	.....
22	12 m	.....	37 22 00	74 47 30	24½	Mud	48	45	43
22	.....	4.33	37 32 00	74 50 00	21	.....	50	45	43
23	7	.....	37 40 30	74 30 00	38	Mud.....	45	45	43
24	10	.....	37 29 00	74 35 30	34	....do.....	46	47.5	43.5
24	.....	6.15	37 31 45	74 39 00	31	....do.....	46	46	43
25	.....	3.30	Cape Henry.....		.....	.....	46	52	.....

TABLE 5.—*Showing temperature of air, surface and bottom water, etc.*—Continued.

Date.	Hour. A. M.	Hour. P. M.	Position. Lat. N.	Position. Long. W.	Depth (fathoms).	Character of bottom.	Temperatures. Air.	Surface.	Bottom.
			° ′ ″	° ′ ″			°	°	°
Apr. 25	.....	7	Hampton Roads		.....	.....	43	52	.....
26	6	.....	....do.....		.....	.....	44	52	.....
26	12 m	.....	....do.....		.....	.....	52	54	.....
26	.....	4	....do.....		.....	.....	52	54	.....
27	6	.....	....do.....		.....	.....	48	53	.....
27	12 m	.....	....do.....		.....	.....	60	53	.....
27	.....	4	....do.....		.....	.....	60	54	.....
28	6	.....	....do.....		.....	.....	52	54	.....
28	12 m	.....	....do.....		.....	.....	55	54	.....
28	.....	4	....do.....		.....	.....	55	56	.....
29	6	.....	....do.....		.....	.....	55	56	.....
29	12 m	.....	....do.....		.....	.....	60	56	.....
29	.....	4	....do.....		.....	.....	65	56	.....
30	7	.....	....do.....		.....	.....	63	57	.....
30	.....	2	37 02 00	76 02 00	10	Mud.....	72	62.5	49
30	.....	3	36 58 00	75 53 00	7	....do.....	66	54	49
30	.....	4	36 57 45	75 42 00	8	....do.....	60	51.5	48
30	.....	5	36 57 00	75 29 30	11½	....do.....	56	50	45
30	.....	6	36 56 30	75 18 00	16	....do.....	55	48	44.5
30	.....	7	36 56 00	75 07 30	23	....do.....	55	48	45
30	.....	9	36 52 45	75 01 30	22	....do.....	54	47.5	44.3
30	.....	12 m	36 49 30	74 56 30	23	....do.....	52	47.5	44.2
May 1	3	.....	36 46 30	74 54 00	30	....do.....	53	48	44
1	7	.....	36 43 30	74 47 30	49	....do.....	54	47.5	44.7
1	10	.....	36 58 00	74 21 00	270	No bottom.....	55	60	42
1	.....	12.30	36 58 00	74 27 00	320	....do.....	55	46	41
1	.....	2.25	36 59 30	74 32 00	220	.....	50	49	43.2
1	.....	4	37 00 00	74 40 00	35	Muddy.....	50	49	45
2	1	.....	36 55 00	74 49 00	30	....do.....	50	48	47
2	11	.....	36 59 30	74 51 00	19	....do.....	48	48	.....
2	.....	3	37 05 00	74 57 00	23	....do.....	49	48.5	47.3
2	.....	4.45	37 05 00	74 57 00	23	....do.....	49	48.5	47.3
2	.....	11	37 03 45	74 48 30	30	....do.....	46	48	45
3	5	.....	36 58 00	75 04 00	27	....do.....	46	48	44
3	12 m	.....	36 59 00	74 43 30	45	....do.....	49	48	45
3	.....	3.25	37 07 00	74 51 00	30	....do.....	50	48	47
3	.....	7	37 09 00	74 47 00	32	....do.....	47	47	43
4	9.15	.....	37 24 00	74 49 00	25	....do.....	52	48	48.2
4	.....	12.45	37 10 00	74 58 00	19½	....do.....	50	47	46
4	.....	11	36 54 00	74 48 00	31	....do.....	51	48	43.8
5	3	.....	36 52 30	74 54 00	22	....do.....	53	48	45.5
5	5	.....	36 52 18	74 57 00	21	....do.....	58	48	47
5	7.20	.....	36 59 00	75 02 00	21	....do.....	52	48	48
5	10.50	.....	37 01 30	75 37 30	13	....do.....	55	48.5	48.5
5	.....	3.30	Cape Henry		.....	.....	63	59	.....
5	.....	8	Hampton Roads		.....	.....	60	60	.....
6	8	.....	....do.....		.....	.....	60	59	.....
6	12 m	.....	....do.....		.....	.....	65	62	.....
6	.....	4	....do.....		.....	.....	65	62	.....
7	8	.....	....do.....		.....	.....	60	60	.....
7	12 m	.....	....do.....		.....	.....	65	65	.....
7	.....	4	....do.....		.....	.....	65	62	.....
8	8	.....	....do.....		.....	.....	65	63	.....
8	12 m	.....	....do.....		.....	.....	70	63	.....
8	.....	4	....do.....		.....	.....	70	62	.....
9	8	.....	....do.....		.....	.....	65	62	.....
9	12 m	.....	Chesapeake Bay		.....	.....	70	62	.....
9	.....	4	....do.....		.....	.....	68	62	.....
10	8	.....	....do.....		.....	.....	68	62	.....
10	12 m	.....	....do.....		.....	.....	65	62	.....
10	.....	4	....do.....		.....	.....	65	64	.....
11	8	.....	Hampton Roads		.....	.....	68	64	.....
11	12 m	.....	....do.....		.....	.....	69	64	.....
11	.....	4	....do.....		.....	.....	69	65	.....
12	.....	1	37 00 00	75 32 00	12½	Hard sand.....	65	59	49
12	.....	4	37 02 00	74 01 30	20	....do.....	63	56	53
12	.....	6	37 03 30	74 47 00	35	....do.....	60	56.5	44.5
12	.....	12 m	36 59 00	74 43 00	55	....do.....	61	55	48.5
13	7.25	.....	36 59 00	74 40 00	56	....do.....	56	56	48
13	.....	6.30	37 22 30	74 55 00	26	....do.....	54	55	43
13	.....	9	.....	.....	22	....do.....	55	55	N. S.
13	.....	12 m	.....	.....	23	....do.....	55	56	N. S.
14	4	.....	37 14 00	74 50 30	25	....do.....	55	56	48
14	.....	12 m	38 00 30	74 26 00	25	....do.....	54	54	45
15	6.30	.....	38 18 00	74 14 00	27	....do.....	50	53.5	44
15	.....	4.22	38 37 37	74 10 00	21	....do.....	52	53	43
15	.....	12 m	38 36 30	74 12 00	22	....do.....	50	52	45
15	.....	4	38 36 30	74 10 00	25	....do.....	52	53	46
16	4	.....							

TABLE 5.—*Showing temperature of air, surface and bottom water, etc.*—Continued.

Date.	Hour.		Position.		Depth (fathoms).	Character of bottom.	Temperatures.		
	A. M.	P. M.	Lat. N.	Long. W.			Air.	Surface.	Bottom.
			° ′ ″	° ′ ″			°	°	°
May 16	.....	1	39 15 00	73 48 00	21	Hard sand.....	50	52.5	45.8
16	.....	11.15	39 31 30	72 50 00	38	....do.....	50	50	41
17	6.15	.....	39 27 30	72 50 30	38	....do.....	45	48	41
17	.....	12.45	39 35 00	72 48 00	36	....do.....	49	49.5	44
17	.....	11	39 52 00	72 33 00	35	....do.....	48	48	40
18	4	.....	39 55 00	72 28 00	34	Muddy.....	49	48.5	40
18	8.35	.....	39 56 00	72 14 00	45	....do.....	50	47.5	40.5
18	.....	5	40 21 00	72 47 30	27	....do.....	50	49	42
19	7	.....	40 13 00	72 19 00	35	....do.....	50	48	39
19	.....	4.30	40 38 00	71 49 00	36	....do.....	48	47.5	41
20	8	.....	.....	.....	.....	.....	50	48.5	.....
20	12 m	.....	.....	.....	.....	.....	55	49.5	.....
20	.....	4	.....	.....	.....	.....	55	51	.....
21	8	.....	Wood's Holl, Mass		.....	.....	47	50	.....
21	12 m	.....	....do		.....	.....	55	54	.....
21	.....	4	....do		.....	.....	55	55	.....
22	8	.....	....do		.....	.....	55	51	.....
22	12 m	.....	....do		.....	.....	58	54	.....
22	.....	4	....do		.....	.....	56	55	.....
23	8	.....	....do		.....	.....	55	52	.....
23	12 m	.....	....do		.....	.....	64	53	.....
24	8	.....	....do		.....	.....	60	52.5	.....
24	12 m	.....	....do		.....	.....	60	52.5	.....
24	.....	4	....do		.....	.....	59	52.5	.....
25	8	.....	....do		.....	.....	55	53	.....
25	12 m	.....	....do		.....	.....	60	53	.....
25	.....	4	....do		.....	.....	58	53	.....
26	8	.....	....do		.....	.....	54	53	.....
26	12 m	.....	....do		.....	.....	56	53	.....
26	.....	4	....do		.....	.....	54	53	.....
27	8	.....	....do		.....	.....	56	52.5	.....
27	12 m	.....	....do		.....	.....	63	53	.....
27	.....	4	....do		.....	.....	60	53	.....
28	8	.....	....do		.....	.....	55	52.5	.....
28	12 m	.....	Off Gay Head		.....	.....	50	54	.....
28	.....	4	Off Brenton's Reef		.....	.....	50	50	.....
29	8	.....	Newport, R. I., Harbor.		.....	.....	55	51	.....
29	12 m	.....	....do		.....	.....	65	53	.....
29	.....	4	.....	.....	.....	.....	55	48.5	.....
30	.....	3.25	40 47 30	70 55 00	31	Hard.....	57	49	40
30	.....	10	40 50 00	70 46 00	32	....do.....	51	48	41
31	6.30	.....	40 47 00	70 39 00	32	....do.....	51	48	N.S.
31	10	.....	40 45 30	70 36 00	32	....do.....	53	48	40.5
June 1	10	.....	41 09 00	71 03 00	20	....do.....	54	49	N.S.
1	10.30	.....	41 11 30	71 01 00	19	....do.....	54	49	N.S.
2	8	.....	Wood's Holl, Mass.		.....	.....	58	56	.....
2	12 m	.....	....do		.....	.....	68	57	.....
2	.....	4	....do		.....	.....	70	57	.....
3	8	.....	....do		.....	.....	59	56	.....
3	12 m	.....	....do		.....	.....	65	57.5	.....
3	.....	4	....do		.....	.....	64	60.5	.....
4	8	.....	....do		.....	.....	65	59.5	.....
4	12 m	.....	....do		.....	.....	67	61.5	.....
4	.....	4	Tarpaulin Cove		.....	.....	64	57	.....
5	.....	7	40 35 15	70 22 00	25	Hard.....	59	55	41.7
6	8.15	.....	40 28 30	69 49 30	38	Soft.....	56	52	41.5
6	10.35	.....	40 42 00	69 53 00	29	....do.....	57	50	42
6	6.30	.....	40 22 00	70 04 00	45	....do.....	57	53	44
7	4.40	.....	40 13 00	69 58 00	48	Hard.....	57	53	45
7	.....	1.05	40 37 30	70 53 00	28	Soft.....	60	54	.....
7	.....	3.25	40 57 00	71 03 00	26	....do.....	64	53	.....
8	8	.....	Off Newport Harbor.		.....	.....	58	58	.....
8	12 m	.....	....do		.....	.....	65	58	.....
8	.....	4	....do		.....	.....	69	57	.....
9	8	.....	....do		.....	.....	63	58	.....
9	12 m	.....	Off Brenton's Reef		.....	.....	68	58	.....
9	.....	4	Off Block Island		.....	.....	58	55.5	.....
10	9.40	.....	40 45 00	71 32 00	34	.....	57	58	40.1
11	8	.....	Block Id. Harbor		.....	.....	62	55.5	.....
11	12 m	.....	....do		.....	.....	64	56	.....
11	.....	4	....do		.....	.....	66	58	.....
13	11	.....	40 29 00	72 19 00	31	Hard.....	68	58.5	41.5