

**112.—NOTES ON AN INVESTIGATION OF THE GREAT FISHING BANKS OF THE WESTERN ATLANTIC.\*****By J. W. COLLINS.**

[Abstract.]

This report covers a trip of twenty-nine days, made in pursuance of instructions from the Commissioner to accompany the Albatross, as fishery expert, to the great fishing banks off the coast of North America.

On June 19, soundings were taken over the region of the two positions assigned to Hope Bank on the charts (about latitude  $41^{\circ} 25'$  north, longitude  $63^{\circ} 15'$  west), proving that there is no such bank, or even an upheaval of the ocean bed in this vicinity, as a depth of about 2,000 fathoms was uniformly found, under favorable conditions for sounding and determining the ship's exact position. This disproves the existence of what for several years has been a source of speculation to many New England fishermen, and has occasionally caused a loss of time to those that searched for it.†

The next objective point was the position of certain reported "dangers to navigation," laid down on the charts as "rocks awash," at varying distances to the southward of the southern extremity of the Grand Bank of Newfoundland. The whole of the 21st, and the following night and morning, were spent in searching for these "rocks," and the researches proved that no such "dangers" existed, as depths of about 3,000 fathoms were found where these "rocks" were marked on the charts.‡ The results of such searches are of considerable practical value to fishermen.

Early on the morning of June 23, we began dredging with the beam-trawl in 523 fathoms, about 15 miles to the southward of the southern extremity of the Grand Bank, and dredgings were made at regular intervals between that position and the bank, while later in the day many dredgings were made on the bank itself. Perhaps the most important catch of the day, from the standpoint of a fisherman, was the haul made on the bank in 51 fathoms (latitude  $43^{\circ} 08'$  north, longitude  $50^{\circ} 40'$

\* These notes relate to researches made during a cruise of the U. S. Fish Commission steamer Albatross, from June 17 to July 16, 1885, with the object of investigating the fauna and fishing grounds of the chain of great ocean banks between Cape Cod and Newfoundland. An account of this cruise, with tables of dredgings and trawlings, and of fishing stations, is given in Capt. Z. L. Tanner's Report on Work of the Albatross, in the Fish Commission Report for 1885, p. 27 *et seq.*

† See Fish Commission Bulletin for 1885, p. 466.

‡ This is what is referred to in Captain Tanner's Report (p. 28) as Watson's Rock.

west). Here thirty-six specimens of the craig or pole flounder (*Glyptocephalus cynoglossus*) were taken in the beam-trawl, which was on the bottom only a few minutes. These fish were of large size and weighed 106 pounds in the aggregate. The trawl also brought up a very large quantity of ophiurans. Off the southern edge of the Grand Bank, in depths varying from 100 to 300 fathoms, the trawl brought up large quantities of grenadiers (*Macrurus*), blue hake (*Haloporphyrus viola*), soft corals, and a smaller amount of other material.

Several dredgings were made during the early part of the 24th in the shallow water on the eastern edge of the Grand Bank. At dredging station 2437\* the trawl brought up considerable quantities of bryozoa, which fishermen call "sea-moss"; where this occurs the ground is known as "mossy bottom." Many flat sea-urchins, commonly called "sand-dollars," were also taken, but there were no fish, excepting one small flounder. At station 2438, near by, most of the material taken consisted of sand-dollars. A rather small amount was brought up in the trawl, among which were broken shells, one skate (*Raia radiata*), one small fish, and a few shells. At station 2439 the trawl brought up a large mass of holothurians, commonly called "sea-pumpkins," a few ascidians (*Boltenia*), known to the fishermen as "sea-lemons," and many small sponges and shells. Among the latter there were many live mussels, some of which were covered with sponges and barnacles. A small amount of bryozoa, sand-dollars, and a few spider-crabs were taken, also one small codfish. The bulk of the material obtained at station 2440 consisted of dead shells, and, so far as could be judged, the bottom where the dredging was made would be what is termed "barren ground." A few small flounders and three haddock were also taken at this station.

The material brought up in the trawl during the forenoon of the 25th did not indicate for the most part a very good feeding ground for cod. At station 2441 very little material was obtained, consisting of a very few shells and some spiny sea-urchins (*Strongylocentrotus dröbachiensis*), sea-lemons (*Boltenia*), a few shrimp, two small skates (*Raia radiata*), and one young sculpin (*Cottus*). At station 2442 the trawl brought up only about one-half bushel of material in all. This was mostly flat sea-urchins. There were also one sea-lemon (*Boltenia bolteni*), one sea-peach (*Halocynthia pyriformis*), several sea-pumpkins (*Pentacta frondosa*), sea-strawberries or soft coral (*Acyonium* ?), and a few starfish, spiny crabs, and hermit-crabs. There were also some barnacles and several species of shells, chiefly *Saxicava mactrasipho*. Besides these there were a few shrimp.†

\* For latitude and longitude and other details concerning these stations, see Tanner's Report before cited, p. 66 *et seq.*

† I am indebted to Mr. Sanderson Smith for the identification of the shells, while Mr. J. E. Benedict, resident naturalist on the ship, rendered much aid in identifying many of the species of fish and invertebrates.

At station 2443 we got two or three barrels of sea-urchins, one skate (*Raia radiata*), one sand-dab (*Limanda ferruginea*), a considerable quantity of shells (chiefly varieties of sea-whelks or *Buccinum*), and some hermit-crabs. At station 2444 the trawl brought up about two barrels of sand-dollars, three very small fish of undetermined species, one bank-clam (*Glycimeris*), and a few hermit and spiny crabs. At station 2445 many sea-lemons (*Boltenia*) and other varieties of ascidians were taken, also numbers of spiny sea-urchins, small spiny crabs, hermit-crabs, and a few living and as many dead scallops (*Pecten islandicus*). Comparatively few sand-dollars were obtained, a few worm-eaten stones of varying size, and a quantity of pebbles. There were several small fish of undetermined species and a few shrimp. In this neighborhood but little material was obtained, however, which would be suitable as food for cod, and the inference is that the fish in that vicinity were attracted there principally in pursuit of smaller species (as lantern or capelin) which they were feeding upon.

As we proceeded farther north and reached from 46° 20' to 46° 28' north latitude, the character of the fauna, as well as of the bottom, changed very materially, and there were not only indications of a greater abundance of food suitable for the cod, but we also had evidence that the fish were far more numerous than they were in the region near station 2443.

At station 2446 the trawl brought up many sea-lemons (*Boltenia bolteni*) and other varieties of ascidians, while flat sea-urchins were few in number. There were also numbers of shrimp, sea-peaches, spiny crabs, hermit-crabs, scallops, also *Trophon clathratus*, *Saxicava*, *Buccinum*, a considerable quantity of pebbles, and a few worm-eaten stones. A few miles northerly from this position fishing schooners were seen at anchor ahead of the ship and on both sides, and one or two vessels were under way shifting their position. Near these, considerable material was taken which indicated an abundance of animal life on the bottom suitable as food for cod.

At station 2447, which was about 3 miles west-southwest by compass from where "Ryder's Rock" is laid down on the charts, the trawl brought up a rather small amount of material, of which about one-half was sand-dollars, and of the remainder sea-lemons were most numerous.

At station 2448 (latitude 46° 28', longitude 49° 39' 30") we sounded and made a haul with the beam-trawl. This is the position where "Ryder's Rock" is laid down on the charts, and the investigations made here determined the fact that no such rock exists, since in this place a depth of 40 fathoms was obtained on a bottom of sand and gravel. Here, the following were obtained: One flounder (*L. ferruginea*), one skate (*Raia radiata*), about 1½ bushels of sand-dollars, and a few crabs, scallops, &c.

After making this haul the ship steamed up near the schooner Keewatin, of Lockport, Nova Scotia, and I went on board to obtain infor-

mation concerning the fishery on the bank. This vessel was getting reasonably good fishing—a dory-load of cod on about 800 hooks of trawl. The captain told me that on his first “baiting”\* he had mackerel for bait, which he procured at the Strait of Canso. While using this bait, he caught 225 tubs of codfish in six days, the position of his fishing being latitude 44° 55' north, longitude 51° 10' west. He thought that the average catch of the vessels from the United States and the British Provinces would be about 250 tubs (equal to about 400 quintals) on their last baiting. As this would represent about two weeks' work on the bank, it may be considered very good fishing, and the indications pointed to a good season's catch by the Grand Bank fleet, since, of course, each vessel usually has several baitings on a trip.

At station 2449 the trawl brought up about three-quarters of a bushel of various kinds of invertebrates, among which were sea-lemons and spiny sea-urchins. Besides these there were a few scallops (*Pecten islandicus*), shrimp, barnacles, and fish of the *Cottus* genus, also one sponge, some hydroids, hermit-crabs, small stones, &c. At station 2450 sea-lemons and sea-urchins were numerous; shrimp were more abundant than elsewhere in any dredging made during the day; while there were considerable numbers of small fish, two or three starfish, a few hermit-crabs and shells, the latter being chiefly *P. islandicus* and *Buccinum*.

On the morning of the 26th we began dredging at daylight, about 30 miles northwest from the position where we ceased work on the previous evening, this position being in the deep water (about 80 fathoms) northward of the Virgin Rocks, on soft, slimy mud. Dredgings were made at intervals of 6 to 10 miles in the direction of Saint John's, Newfoundland, but the localities where these hauls were made were not on any fishing ground. At five stations (2451 to 2455) a few shrimp, crabs, flounders, starfish, dead shells, one sand-dollar, one small octopus, and some specimens of the basket starfish (*Astrophyton*) were taken.

On the morning of July 2 the ship left Saint John's and headed for Green Bank, and dredging operations were soon begun, the rake or scoop dredge being used. The bottom was generally rocky, and only a small amount of material was obtained, the greater part of it being wave-washed stones. A few shells, sea-urchins, and hermit-crabs were taken.

A little before 6 o'clock on the morning of July 3, soundings were obtained in 59 fathoms (latitude 45° 47', longitude 54° 13' 30") on Green Bank, and fishing lines, baited with fresh capelin, were put out. The ship lay to for 15 or 20 minutes, but no fish were caught nor were there any indications of the presence of cod in the vicinity. After the lines were hauled in, a small dredge was put out and towed for a short time. It came up nearly filled with sand-dollars, with which were also numbers of hermit-crabs, two small flounders, a few sea-urchins,

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\* The word “baiting” is used in two senses: (1) the amount of bait taken by a vessel at one time; (2) the length of time a vessel is on the banks with a supply of bait. The second is the sense in which it is used here.

and some dead shells. Previous to this a haul had been made with the Blake dredge some 6 or 7 miles in a northeasterly direction, just off the edge of Green Bank, but no fishing lines were put out. The haul at this last position (station 2460) consisted of a few crabs, shrimp, starfish, small stones, sea-urchins, and dead shells.

At station 2462 (latitude  $45^{\circ} 45' 30''$ , longitude  $54^{\circ} 20' 30''$ ) eight hand-lines were put out, but not a single fish was caught. Failing to take any fish in a reasonable length of time, a dredging was made, with practically the same result as that obtained at the previous station. The most remarkable catch made by the dredge was pieces of 2 fresh lantern (*Ammodytes americanus*) which had been in some manner intercepted by the dredge.

About 5 or 6 miles farther to the westward, at station 2463 (latitude  $45^{\circ} 44'$ , longitude  $54^{\circ} 27'$ ), the hand-lines were again baited and put out in a depth of 45 fathoms, the result being precisely the same as at the two previous stations. A haul was made at this position with the ship's dredge. Its contents indicated that considerable material existed on the bottom which might serve as food for the *Gadidae*; and it is somewhat remarkable that cod were not found in this region. Among other things the dredge brought up many hermit and spiny crabs, sea-urchins, starfish, and sea-anemones.

At station 2464 (latitude  $45^{\circ} 40'$ , longitude  $54^{\circ} 41'$ ) another trial for fish was made with hand-lines, in 41 fathoms, but none were taken. The dredge was put out, but caught on a rocky bottom and was so badly torn that very little material, save a few crabs and dead shells, was taken in it. At the two succeeding stations hauls were made with the ship's dredge, but no fishing-lines were put out.

At station 2465 there were obtained several ophiurans, sand-dollars in abundance, a few hermit and spider crabs, and some stones.

At station 2466 (latitude  $45^{\circ} 29'$ , longitude  $55^{\circ} 24'$ ), in a depth of 67 fathoms, a considerable quantity of material was obtained in the dredge which indicated good feeding bottom for fish. Among these were a few small fish, hermit and spiny crabs, many brittle-stars or ophiurans, spiny sea-urchins, sponges, sea-anemones, starfish, soft coral, bryozoa, hydroids, and large numbers of live mollusks, chiefly the Iceland scallop. This position was in what is termed the "gully" between Green Bank and Saint Peter's Bank.

At station 2467, in 38 fathoms, on the southeastern side of Saint Peter's Bank (latitude  $45^{\circ} 23'$  north, longitude  $55^{\circ} 41'$  west), the dredge contained several holothurians, sand-dollars, spider and hermit crabs, spiny sea-urchins, and shells. Eight hand-lines were put out at this position and 13 codfish were caught in about 20 minutes. These fish were of rather small size, about three-quarters of them not being large enough to cull as "large fish" in the American markets. These were mostly males, with their spermaries undeveloped. The ovaries of the female fish were also very small. I opened their stomachs and took 13 whole,

undigested bank-clams (*Glycimeris*) from them, besides a number of clams which were more or less digested, and several crabs and small fish.

At station 2468 (latitude  $45^{\circ} 11' 30''$ , longitude  $55^{\circ} 51' 30''$ ), a haul was made with the ship's dredge, in 42 fathoms, near the southwestern edge of the bank, and many dead shells of the bank-clam and other varieties were obtained, also soft corals, sand-dollars, sponges, starfish, ophiurans, holothurians, and some stones.

The forenoon of July 4 was spent in making dredgings across the deep plateau which extends from Saint Peter's Bank nearly across to Banquereau, and which has a depth varying from 200 to 225 fathoms. It is probable that this plateau may, in the future, prove to be a valuable fishing ground for halibut, and already on some parts of it, within 15 or 20 miles of the edge of Saint Peter's Bank, good fares of halibut have been obtained.

We found many varieties of marine life, and there was evidence of an abundance of food for halibut, though the bottom was generally muddy and unsuitable for the above-named species. An exception to this was at station 2471 (latitude  $44^{\circ} 34'$ , longitude  $56^{\circ} 41' 45''$ ), in 218 fathoms. In this position the beam-trawl was torn on rocky bottom, and what material was obtained indicated a ground suitable for halibut. Among other things, a few shrimp and other forms of crustacea were taken, besides seven species of shells, octopus, grenadiers, some sponges, many small brittle-stars, some small crinoids, bob-tailed squid, coral, and several stones. In the two previous hauls during the morning, Norway haddock and pole flounders were taken, besides Baird's grenadiers, several Chester's hake, and various forms of corals, sea-pens (chiefly *Pennatula borealis*), sea-anemones, 1 octopus, some shells (mostly *Eucinum undatum*, *Astarte*, and *Yoldia thraciformis*), some specimens of the Finmark sea-feather (*Balticina finmarchica*), and quantities of skate's eggs (some with living embryos). Also, there were taken cup-corals (*Flabellum*), many fragile sea-urchins (*Schizaster fragilis*), several species of starfish (the most noticeable being *Hippasteria phrygiana*), sponges, bob-tailed squid (*Rossia megaptera*), 2 *Lycodes*, and 1 *Scopelus*.

At station 2472, and the four succeeding stations, tangles and grapnels were put over in depths ranging from 133 to 222 fathoms; but very little material was obtained. Among other things were a few starfish and sea-urchins, some small samples of deep-water coral (*Primnoa reseda*), and one large specimen of *Macrurus bairdii*.

During the evening Mr. Nye rigged the electric light over the ship's side, and this attracted many marine animals which we thought were young squid. There were probably as many as 50 or 75 of them darting about the light, but all efforts to catch any failed, since they would not bite at a jig, and were too quick to be taken in a dip-net.

As it was deemed advisable to make an investigation about the eastern part of Banquereau, the ship lay by the entire night, drifting. The

current during the night evidently ran in a southwesterly direction, as is usually the case here, and it was found on the morning of the 5th that the ship had drifted considerably from her position on the previous evening. During the day it was impossible to obtain observations, owing to the dense fog, and the only thing that could be done to determine the ship's position was to "feel our way" with the lead around the southeast prong of the bank. This was slow and unsatisfactory work, for this part of Banquereau is not correctly laid down on the charts.

Several dredgings were made on the 5th, but the bottom in this region is so rough that the only apparatus which could be used was the ship's dredge or the tangles, and it was even thought unsafe to leave the dredge on the bottom longer than 5 to 10 minutes. The catch was exceedingly meager, generally consisting chiefly of coarse gravel, pebbles, or sand, with very little life of any kind. The dredgings up to about 1.30 p. m. were made in depths varying from 116 to 265 fathoms. In the afternoon the ship steamed on to the shallower part of the bank, and dredgings were made in depths varying from 33 to 39 fathoms. Practically the same result was obtained in these depths as in the deeper water off the edge of the bank, the contents of the dredge being rather uninteresting.

At station 2489 (latitude  $44^{\circ} 43'$ , longitude  $57^{\circ} 22' 45''$ ), in 33 fathoms of water, we made the last dredging for the day, and among other things brought up in the dredge were a few small bank-clams (*Glycimeris*) and a large flounder. Hand-lines were put out baited with fresh capelin, and fishing was carried on for an hour or more, during which time 33 cod and 5 or 6 flounders were taken. The cod were mostly of small size, and their stomachs contained several young bank-clams, and in one a specimen of lant was found.

Soundings were made on Misaine Bank early on the 6th, in 68 fathoms, at station 2491. The dredge was put out, but it brought up little else besides stones. Three hand-lines were also tried, and in about 10 minutes' fishing we caught 3 cod and 1 flounder.

At station 2492 (latitude  $45^{\circ} 22'$ , longitude  $58^{\circ} 43' 45''$ ), in 42 fathoms, we found fish abundant, 10 or 12 cod of small size being taken in a few minutes, of which 2 "pairs" were pulled up. The dredge was put out and brought up a few shells and starfish, while crabs and sea-urchins were abundant. Another haul was made with the dredge at station 2493 (latitude  $45^{\circ} 19'$ , longitude  $58^{\circ} 51' 15''$ ), in 45 fathoms. Considerable material was obtained here, consisting mostly of stones, shells, starfish, spiny crabs, sea-urchins, and sponges. Many barnacles were found here on the stones, shells, &c. Eight hand-lines were put out, and 2 codfish were taken in 10 minutes' fishing.

At station 2494 (latitude  $45^{\circ} 14' 30''$ , longitude  $59^{\circ} 06' 45''$ ), in 50 fathoms of water, 5 cod were taken on the lines. The tangles were put out at this station and brought up many spiny sea-urchins, and and also 1 or 2 basket starfish (*Astrophyton*).

At station 2495 (latitude  $45^{\circ} 10'$ , longitude  $59^{\circ} 23' 45''$ ), in 44 fathoms, the fishing-lines were put out for a few minutes and 1 cod and 1 sand-dab were caught. A haul was made with the tangles, and spiny sea-urchins were found abundant, and some crabs and 1 *Astrophyton* were also taken on them.

At station 2496 (latitude  $45^{\circ} 07' 30''$ , longitude  $59^{\circ} 27' 45''$ ), in 44 fathoms, 5 cod were caught on the hand-lines in a few minutes' fishing, being essentially the same in quality and size as those commonly caught on Banquereau. Here the tangles brought up an abundance of sea-urchins, as before, several small crabs, starfish, two sea-lemons, several dead shells of the bank-clam, and bryozoa. This was the last haul made on Misaine Bank.

This bank, which is of considerable extent, has never been considered of any importance as a fishing ground, and so far as we are aware is not resorted to by American vessels. It was, therefore, deemed highly important to make an investigation of it, so that its value to the fishermen might be determined. The trials for fish that were made, demonstrated the fact that they probably occur all over Misaine Bank in as great abundance as on Banquereau, and are practically the same kind of cod as to size, the majority of them being too small to class as large fish in American markets. In view of the abundance of fish on this bank, it would seem probable that the fishermen have never investigated it, and probably are not aware of its value as a fishing ground.

In the latter part of the day, after the researches on Misaine Bank had been completed, the ship headed for the western part of Banquereau, and occasional dredgings were made in the deep water between the banks, in depths varying from 57 to 130 fathoms. The bottom between these banks is, apparently, composed of mud mixed with stones, pebbles, and occasionally gravel. The beam-trawl was used in these localities, and in some of the hauls a considerable quantity of material was taken, comprising spiny sea-urchins, 4 *Lycodes*, 1 pole flounder, 1 sand-dab, large quantities and many varieties of shells, many shrimp, starfish, brittle-stars, &c.

The ship left Banquereau about 3 a. m. on the 7th, and steamed across to the Middle Ground, which was reached about 7.30 a. m. Dredgings were then begun and continued at intervals throughout the day. The general result of the hauls on Middle Ground and on the northwest prong of the Western Bank, which we crossed later in the day, indicated for the most part an abundance of life on the bottom, much of it of a character suitable for food for the cod and other ground-feeding species.

At station 2500 the trawl brought up the following: One craig or pole flounder, 2 species of ferruginous flounder, 3 or 4 young skates (*Raia radiata*), many starfish (chiefly *Asterias vulgaris*), large quantities of shells (the most noticeable of which were bank-clams), sea-scallops



(*Pecten islandicus*), *Neptunea decemcostata*, *Maetra ovalis*, and *Buccinum undatum*. There were also great numbers of spiny sea-urchins, a few specimens of sea-corn (*Buccinum* eggs), and sea-strawberries or soft coral.

At station 2501 (latitude 44° 27', longitude 60° 20' 15"), in 26 fathoms of water, several hand-lines were put out, and 3 cod, 1 haddock, and several sand-dabs were taken. The cod were gorged with food. From one that weighed only 10 pounds I took 12 lant (*Ammodytes americanus*), 1 spiny crab, and the fin of another cod. Another fish, which weighed 7 pounds, had 8 lant and a small stone in its stomach. A third cod, of about 5 pounds' weight, had 4 crabs in its stomach but no fish. The ovaries and spermaries of these fish were undeveloped. In the trawl at this station there was an abundance of sand-dollars, common starfish (*Asterias vulgaris*), twelve large sand-dabs or ferruginous flounders, 1 sculpin (*Cottus*), a few skate eggs, many live and dead shells, among which were a few specimens of *Natica heros*. There were also several hermit-crabs. Two torpedoes were exploded at the bottom near this station, but with no decisive result.

At station 2502 the trawl was torn on rough bottom. It nevertheless contained many basket starfish (*Astrophyton*), some sponges, large starfish, a few brittle-stars (ophiurans), some spiny sea-urchins, hermit-crabs, small skates (*Raia*), sculpins (*Cottus*), and various kinds of shells, among which were *Pecten islandicus*, *Buccinum*, and *Neptunea*. A few shrimp were also taken.

The bottom on the northwest prong was found to be rather rocky, and at station 2503 (latitude 44° 22' 30", longitude 61° 00' 15"), in 47 fathoms, the beam-trawl was torn to pieces, so that nothing was caught in it. Medium-sized codfish appeared to be abundant, and in a few minutes' fishing with hand-lines 22 specimens were taken, 5 of which were large fish. One of these cod had ovaries well advanced, but the generative organs of the others were undeveloped. The stomachs of the fish were generally full of various kinds of material. One had a partially digested herring and squid in its stomach, besides several crabs more or less decomposed. It is evident that crustacea, particularly spiny crabs, are most generally eaten by the cod in this region, so far as can be judged from the contents of their stomachs. But some fish had worms, others brittle-stars, shells, &c., mixed in their stomachs with crabs or fish, while others had apparently nothing but fish. In one we found 5 worms and 4 crabs, while another had 4 spiny crabs, 1 hermit-crab, and 3 brittle-stars in its stomach.

At station 2504 the dredge came up filled with mud but containing very little animal life, only a few worms and small shells; while at station 2505 the trawl contained several small skates, 3 craig flounders, many large sea-anemones of 2 species, fragile sea-urchins (*Schizaster fragilis*), starfish, worms, and small shells.

On July 8, dredging operations were resumed at a little after 4 a. m., and four dredgings were made during the day, while the vessel was heading for Halifax.

At station 2506 the catch was principally fish, as follows: Seventeen Norway haddock (*Sebastes marinus*), 5 pole flounders, 1 small skate, 1 goose-fish (*Lophius piscatorius*). There were also many sponges of several varieties, 3 species of sea-anemones, large numbers of "lamp-shells" (*Terebratulina*), 3 or 4 species of starfish, many large shrimp, and a very few sea-urchins.

At station 2507 the dredge was filled with stones, many of them as large as the mouth of the bag would admit. The amount of animal life taken was small, comprising 3 species of holothurians, 2 or 3 specimens of starfish, and a few worms.

In the afternoon the Albatross reached Halifax, where she remained until July 11, during which time I busied myself in obtaining details concerning various types of boats and vessels employed in the Nova Scotia fisheries.

Four hauls were made during July 11, 2 with the ship's dredge and 2 with the large beam-trawl. All of these dredgings were made on soft bottom, between Halifax and La Have Bank, in depths varying from 68 to 134 fathoms. The first attempt to dredge, however (at station 2510), resulted in the loss of the dredge and 79 fathoms of wire dredge-rope. At station 2511 the dredge was nearly filled with mud and stones, among which was very little animal life. A few shells, holothurians, and starfish were taken. At station 2512 the dredge was filled with soft sticky mud, in which were 2 sea-pens (*Pennatula aculeata*), 1 holothurian, and a few ascidians.

The most interesting haul, so far as fish are concerned, was made with the large beam-trawl at station 2513 (latitude 43° 34', longitude 63° 56' 30"), in 134 fathoms, on a bottom of gray ooze. Among other things the trawl contained 10 Norway haddock, 4 common hake (*Phycis chuss*), many large shrimp, and 2 young pole flounders. Since the latter species will probably some time become of value commercially, their occurrence here is of interest, for it shows a wide distribution of this fish in depth as well as in area. The haul comprised also several specimens of Baird's grenadiers (*Macrurus bairdii*), many brittle-stars, 3 or 4 species of sea-anemones, starfish (*Archaster*), sea-pens (*Pennatula*), some large specimens of *Dentalium*, and quantities of large *Terebratulina*.

At station 2514 the following material was taken: One Baird's grenadier, 3 species of sea-anemones, large numbers of fragile sea-urchins (*Schizaster fragilis*), large shrimp, and various species of starfish and sponges; also some stones.

At 11 p. m. the ship stopped on La Have Bank. Mr. Nye put an electric light over the side and soon there were numbers of bill-fish darting about it, and squid were seen also. Several of the bill-fish were

caught, but it was found impracticable to capture any of the squid, as they would not bite a jig and could not be taken by other means.

Work was begun early in the morning of July 12, and a line of dredgings and trials for cod, with hand-lines, was run across La Have Bank, beginning on its eastern side and extending to the southeast part of Brown's Bank. These operations were carried on in depths ranging from 47 to 104 fathoms. In all the dredgings except the last, which was made in 104 fathoms, the ship's dredge was used, it not being possible to use the beam-trawl, owing to the rocky character of the bottom. The difficulties of dredging on such bottom are very great, as was evident by the loss of a dredge on the second attempt for the day (at station 2516), while in most instances the dredge came up more or less nearly filled with stones, pebbles, and coarse gravel, and the amount of animal life was generally very small.

At station 2517 (latitude  $43^{\circ} 10'$ , longitude  $64^{\circ} 18'$ ), in 55 fathoms, bottom of yellow sand and black specks, 4 hand-lines were put out, baited with capelin, and 12 cod were caught, these averaging about two-thirds large fish (*i. e.*, over 30 inches in length). The bait we used was very soft and would scarcely stay on the hooks until they reached the bottom. Fish were fairly abundant, and with fresh squid bait could probably have been caught in large numbers. Nearly all the cod taken at this station had squid (*Ommastrephes illecebrosus*) in their stomachs, in a more or less digested condition, and they had also been feeding on bank-clams (*Glycimeris*). The animal life brought up by the dredge at this station comprised 2 species of sea-urchins (the sand-dollar and spiny sea-urchins), 2 species of starfish, 2 spider-crabs, 1 sea-anemone, several sea-spiders (*Pycnogonum*), and various kinds of dead shells.

At station 2518 the dredge was filled with stones of various sizes up to 6 or 8 inches in diameter. To these were attached some small sponges. In the dredge were also a few ascidians, a starfish, and some shells.

A little after meridian a 10-pound torpedo was exploded on the bottom at hydrographic station 821, in 47 fathoms, rocky bottom (latitude  $43^{\circ} 01'$  north, longitude  $64^{\circ} 45' 30''$  west), but no results were obtained. After the explosion of the torpedo 3 hand-lines were put out for from 20 to 30 minutes, and 4 cod and 1 haddock were caught.

At station 2520 the dredge was filled with coarse gravel and stones, among which the most noticeable forms of life were some shells (*Dentalium* and *Leda*), large numbers of worm-tubes of sand and gravel, containing live worms (*Nothria*). There were 2 young sculpins and a few shrimps, sponges, ascidians, and barnacles. At station 2521 the dredge was partially filled with clean coarse gravel, with a few small stones. It contained almost no living animals, a single starfish and a few dead shells being the only objects of interest.

The last dredging for the day was made with the small beam-trawl on the southeast slope of Brown's Bank, in 104 fathoms, sandy and grav-

elly bottom, at station 2522 (latitude  $42^{\circ} 20'$ , longitude  $65^{\circ} 07' 30''$ ). The trawl was dragged over the bottom only a few minutes, because of the supposed rough nature of the ground. But, nevertheless, the net was cut through and probably much of the material taken in the apparatus escaped before the trawl was hove up. Of the material saved, shrimp of two or more species were abundant. There were also young Norway haddock or rose-fish (*Sebastes marinus*), a few sculpins, and several other varieties of small fish, some of them apparently immature. Among the invertebrates the most noticeable were several species of starfish, some large deep-sea barnacles, sea-anemones, sea-spiders, and some young spiny sea-urchins. The fauna of this region is of special interest, since in this locality and its immediate vicinity, in somewhat deeper water, the halibut fishery has been pursued with considerable success, while a few miles northwest, in from 55 to 65 fathoms, many good fares of cod have been obtained.

On the 13th, researches were carried on in deep water, in the so-called "gully" between Brown's Bank and the northeast extremity of George's Bank. This locality has become somewhat celebrated as a deep-water halibut ground upon which gorgonian corals of extraordinary size and in considerable abundance have been found by the fishermen, these corals being often hauled up on the lines with which they become entangled. Attempts were made by means of the dories and with grapnels to secure some of this coral, but without much success, two specimens of the great tree-coral (*Primnoa reseda*) being obtained.

During the forenoon several hauls were made with the ship's dredge, in depths varying from 72 to 121 fathoms, but only a small amount of marine life was obtained. The rough character of the ground precluded the possibility of using the beam-trawl, otherwise it is probable that a larger quantity and a much greater variety might have been secured.

At station 2523 the dredge was filled with stones, coarse gravel, and pebbles. Among these were a few holothurians of two species, lamp-shells (*Terebratulina*), sea-anemones, worm-tubes, sponges, shrimp, small starfish, brittle-stars, sea-urchins, and 2 or 3 small sprays or branches of gorgonian coral. At station 2524 the dredge contained stones and pebbles, with a very small amount of life, as follows: A few sponges, shrimp, lamp-shells, small starfish, holothurians, and ascidians.

At station 2525 the dredge was filled with coarse gravel and stones, while sponges and shells were more numerous than in the preceding haul. Ascidians were plentiful, but there was very little crustacean life. At station 2526 the dredge was filled with coarse gravel and stones, while containing very few living animals, as follows: Small sea-anemones, small holothurians, various kinds of small shells, a few brittle-stars, and 2 or 3 shrimp.

At station 2528 (latitude  $41^{\circ} 47'$  north, longitude  $65^{\circ} 37' 30''$  west) a haul was made with a large beam-trawl in 677 fathoms on a bottom of brown mud, where a large amount of material was taken, which so

closely resembled the fauna so often brought up on the halibut lines from the deep-water fishing areas, that it seems desirable that mention should be made of it, although, strictly speaking, this haul was made beyond the limits frequented by fishing vessels. Among the material brought up were many blue hake (*Haloporphyrus viola*), grenadiers (*Macrurus*), 3 pole flounders (*Glyptocephalus cynoglossus*), a number of other species of fish not identified, a large amount of the little bush-coral (*Acanella normani*), specimens of gold-banded coral (*Keratoisis ornata*), 2 or 3 species of sea-anemones, soft sea-urchins, and several species of shells.

It is worthy of note that swordfish and finback whales were seen in unusual abundance on July 13. During the first part of the day as many as 20 swordfish were seen in from 6 to 8 hours; frequently 2 or 3 were in sight at the same time. As many as 20 whales were seen at one time during the morning, and a still greater number were seen in the afternoon. At station 2528 they were very numerous, apparently feeding on small crustacea, probably from 40 to 50 whales being in sight at one time. They were all finbacks, so far as I could tell. Their movements were sluggish, as they "played" back and forth in the tide rips, with their mouths open, the upper jaw just at the surface, scooping in "feed." They were joined by a school of porpoises (probably *Delphinus delphis*), which drove in among the whales, their movements indicating that they were feeding, but of this we could not be sure.

The electric light was put over the ship's side soon after dark and Mr. Nye succeeded in catching several specimens of young squid and some small fish of the genus *Scopelus*.

The researches on the fishing banks terminated on the 13th, and the ship arrived at Wood's Holl on July 16, thus ending the cruise.

GLOUCESTER, MASS., November 27, 1886.

### 113.—A CURIOUS KNIFE FOUND IN THE FLESH OF A CODFISH.

By J. W. COLLINS.

While discharging a fare of codfish from the schooner Vinnie M. Getchell, at Gloucester, Mass., on September 15, 1886, Capt. John Q. Getchell,\* master of the vessel, found imbedded in the thick flesh of a

\* It may be of interest in this connection to say that Captain Getchell is well known in Gloucester as a veteran fisherman, he having been in command of vessels engaged in the George's fishery for the past twenty years; during which time, he tells me, he has eaten only three Thanksgiving and four Christmas dinners on the land. He is a native of Maine, about fifty years old. When the news of Sumter's fall reached the North, he enlisted and served three years in the Third Maine under Colonel (afterwards General) O. O. Howard. He then exchanged his gun and a soldier's bivouac for nets, lines, and the deck of a fishing-vessel. His integrity and truthfulness are unquestioned.