I.—REPORT ON THE WORK OF THE UNITED STATES FISH COMMISSION STEAMER ALBATROSS FOR THE YEAR ENDING DECEMBER 31, 1884.

By Lieut.-Commander Z. L. Tanner, U. S. N., Commanding.

The Albatross was on Skinner & Son's Marine Railway, Baltimore, Md., at the close of my last report ending December 31, 1883, for the purpose of cleaning and painting her bottom.

The weather on January 1, 1884, was unfavorable for our work, being rainy and misty, followed on the 2d by severe cold, which not only interfered with putting on the paint, but delayed its drying on the frosty surface of the iron. We succeeded, however, in getting on two coats, the first of red lead, followed by one of white zinc; and lowered her from the railway into the water on the evening of the 5th, although the last coat of paint was not thoroughly dry. The ice was forming rapidly in the bay and harbor, and we feared it would cause us serious delay if we remained longer on the dock. As it was, we found it between two and three inches thick when we left the harbor the following morning, and were obliged to force our way through it, scraping the fresh paint from the vessel's sides and bottom several feet below the water-line.

Arriving at Hampton Roads at 12.20 a. m. on the 7th, we anchored till daylight, then steamed up to the navy-yard, Norfolk, Va., and moored to the coal wharf at 8.40 a. m. We went to Norfolk to escape the ice, to fill up with coal, and to meet the naturalists, who joined us at that port. The coal was on board on the evening of the 9th, and the vessel ready for sea.

Our destination was the West Indies, where, under the direction of the Bureau of Navigation, Navy Department, we were to be employed in surveying, deep-sea sounding, &c. The Hydrographer and the Chief of the Bureau of Navigation considered it desirable to have the Caribbean Sea sounded, its currents and temperatures observed, besides other investigations in that region which could be made only by a steamer completely fitted for the work. The Navy had no available vessel at the time, and knowing that the Albatross was eminently qualified to perform the rather difficult task, the Chief of the Bureau requested her services for the winter.

The following correspondence will explain the arrangements finally made with the Bureau of Navigation, and also the instructions under which we were about to sail:

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, D. C., November 27, 1883.

SIR: Referring to our conversation of a few days ago, I have the honor to ask whether it will be practicable to obtain the use of the U. S. F. C. steamer Albatross this winter, for the purpose of making surveys and examinations in the Caribbean Sea under the direction of this Bureau.

Very respectfully,

J. G. WALKER,
Chief of Bureau.

Prof. SPENCER F. BAIRD,
Secretary Smithsonian Institution, Washington, D. C.

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., December 1, 1883.

SIR: In reply to your letter of November 27, I beg to say that it will give me much pleasure to authorize the use of the steamer Albatross for the performance of the service desired by the Navy Department—namely, of prosecuting soundings and surveys in the Caribbean Sea.

The steamer is now being placed in a thorough state of efficiency and equipment at the expense of the U. S. Fish Commission, and in the event of her entering on your work it is to be understood that all expenses of maintenance and repairs are to be borne by the Navy Department during her term of service; and that the vessel is to be returned to the Commission at the navy-yard in Washington or in New York by the 1st of May next, with clean bottom and in an equally perfect condition, and ready for service.

Captain Tanner will be duly instructed to carry out any plan of operations you may designate as being desired by the Department.

I have the honor to be, very respectfully, your obedient servant,

S. F. BAIRD,
Commissioner.

Commodore J. G. WALKER,
Chief of Bureau of Navigation, Navy Department.

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, D. C., December 14, 1883.

SIR: I have the honor to acknowledge with thanks the receipt of your letter of the 1st. instant, authorizing the use of the Fish Commission steamer Albatross in the prosecution of surveys in the Caribbean Sea, under the direction of the Bureau of Navigation, provided that all the expenses of maintenance and repairs are to be borne by the Navy Department during the term of her service, and the vessel to be returned to the Fish Commission at Washington or New York by May 1st next, with clean bottom and in a condition as good as that in which she was received.

In reply I have the honor to state that all expenses of maintenance and repair of the vessel during the term she is under the direction of the Bureau of Navigation will be borne by the Bureau, and the vessel will be returned to the Fish Commission, either at New York or Wash-

ington, by the 1st of May next, with clean bottom and in as good condition as she shall be when received, accidents and the wear and tear of time and legitimate service excepted.

Very respectfully,

J. G. WALKER,
Chief of Bureau.

Prof. S. F. BAIRD,
Commissioner.

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, December 21, 1883.

SIR: In reply to your letter of the 15th instant, requesting a formal statement of the character of the service desired from Lieutenant-Commander Tanner in the Albatross, I beg leave to inclose the instructions which have been prepared in this Bureau for his guidance during the time that he shall be employed in obtaining the information desired by the Navy Department.

As it is understood that Lieutenant-Commander Tanner is to do certain work for the U. S. Fish Commission during his cruise in the Caribbean Sea, it is expected that in case he should be delayed by that work, the support of the steamer during such delay will be borne by the Fish Commission.

Very respectfully,

J. G. WALKER,
Chief of Bureau.

Prof. SPENCER F. BAIRD,
Commissioner, U. S. Fish Commission, Washington, D. C.

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, December 20, 1883.

SIR: You will be guided by the following instructions during the time that you are employed in making the examinations desired by this Bureau.

Run a line of traverses from the island of St. Thomas, along the south side of the island of Porto Rico, from the vicinity of the shore to the 100-fathom curve. As the south part of the coast of this island is very imperfectly known, the traverses should extend to Aguila Point.

Run a line of deep-sea soundings from the west end of Santa Cruz to a point south of the east end of Porto Rico, in order to ascertain if these islands are connected, as the temperatures found by the United States Coast and Geodetic Survey steamer Blake in 1879, would seem to indicate.

From Aguila Point run a line of deep-sea soundings across the Caribbean Sea to the island of Blanquilla. The soundings are to be taken at such distances as the contour of the bottom may suggest, but not to be more than twenty-five miles apart.

From the island of Blanquilla run traverses from the 100-fathom curve to the shore, as far as Curaçao, making an examination of the localities on which the sea is reported to "break."

At Curaçao you can probably obtain coal.

From Curaçao run a line of deep-sea soundings to the island of Beata, and run traverses to the 100-fathom curve along the south side of the island of Santo Domingo, sounding carefully over the reported dangers south of Aux Cayes.

From Santiago de Cuba to Kingston, Jamaica, stop off Morant Point and develop the reported shoal off the point, marked 8 fathoms.

From Kingston run a line to Santa Marta, New Granada, taking in the doubtful shoal on the way.

Make an examination of the mouth of the Magdalena River, for which special instructions are sent you.

From Savanilla run traverses along the coast to Aspinwall.

From thence proceed to Cape San Antonio, west end of Cuba; take deep-sea soundings off Cape San Antonio, in order to determine definitely that the reported dangers do not exist, and determine the exact longitude of the light-house on Cape San Antonio, if possible.

Deep-sea soundings will be valuable whenever they are not already on the charts furnished you.

It is of great importance that the depths, temperatures, and currents of the main Caribbean should be investigated, and the suggestions for the lines of deep-sea soundings are for that purpose.

The necessary expenditures for coal and other supplies required while engaged in the duty strictly under this Bureau will be charged to the appropriation, "Special Ocean Surveys," Navigation, 1883–'84. As this appropriation is limited in amount, it is expected that you will use great care in economizing coal and other supplies.

It is understood that this Bureau is not to be charged with the expenses of the ship while you are engaged in work not under its cognizance.

Very respectfully,

J. G. WALKER,
Chief of Bureau.

Lieut.-Commander Z. L. TANNER, U. S. N.,
Commanding U. S. Fish Commission Steamer Albatross.

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, December 26, 1883.

SIR: During the time you are engaged in surveying work in the Caribbean Sea, it is expected that you will make an examination of the entrance to the Magdalena River and of its channels as far as Barranquilla, United States of Colombia.

The inclosed copies of letters from the Secretary of State and the United States consul at Barranquilla show the necessity of the work.

Very respectfully,

J. G. WALKER,
Chief of Bureau.

Lieut.-Commander Z. L. TANNER, U. S. N.,
Commanding U. S. Fish Commission Steamer Albatross,
Washington, D. C.

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., December 27, 1883.

SIR: I have forwarded to you the communications from the Navy Department, embodying the information which it desires to obtain, and on account of which it has been determined to send the Albatross to sea for a winter's cruise.

You will use your best endeavors to solve as many of the problems presented by the Department as practicable, within the limit of time allotted to your cruise.

You are instructed to return to Washington as early in May as possible, so as to be able to make a cruise in northern waters by the beginning of June. This, of course, is subject to such contingencies as may develop themselves hereafter.

In returning by way of Cape San Antonio it will be well to make a run into the Gulf of Mexico and spend a short time in making soundings and dredgings therein, for the purpose of obtaining a general idea of the natural history and the fisheries of the Gulf, preliminary to a more lengthened visit to be made hereafter.

In connection with the work of soundings you will take occasional hauls of the dredge and trawl, and preserve carefully such numbers of specimens as the naturalists may recommend.

In addition to the purely physical work asked for by the Navy Department, or constituting a part of the general plan of research of the steamer, you are instructed to do what is in your power towards obtaining a knowledge of the natural history of the shores and waters visited; giving such facilities to those connected with this department as may be in accordance with the best interests of the expedition.

It is considered particularly important to secure a fair representation of the shore fauna of the Caribbean Sea and its surroundings, as there is much to be learned in regard to areal distribution of the various species of animals and plants.

Where practicable, a small boat-dredge should be used from the launch, as likely to furnish many shallow-water species of interest to science.

An important branch of research consists in the investigation of the parasites of the larger fish, such as sharks, swordfish, &c. These should, as far as possible, be secured and carefully overhauled for this object. The jaws and teeth of the larger sharks should also be preserved after having been properly identified.

In the department of marine birds, there is a large field for research, there being many species of gulls, petrels, herons, cormorants, gannets, &c., of which but little is known.

Reptiles, freshwater fishes, and the various species of mammals should also be secured.

Attention is invited to the study of the cetaceans; and, if practicable, drawings and photographs should be taken and the crania properly preserved.

Whenever an opportunity presents itself of obtaining aboriginal relics, in the way of articles of stone, pottery, &c., care should be taken to secure them. Illustrations of the handiwork of the modern tribes of the coast, especially such as relate to their methods of hunting and fishing, should also be gathered.

Fossil remains of any kind, minerals, specimens of rock, &c., are very desirable.

I would advise that whenever a convenient opportunity occurs, the dried specimens, such as skins of birds and mammals, jaws of fish, &c., be transmitted to Washington, so as to relieve the store-rooms of the steamer. Such objects should be addressed to the "Smithsonian Institution, Washington, D. C.," and, as far as possible, sent by way of New York, in which case they should be marked "Care of Collector of Customs," who should be advised of the same.

A formal statement of the fact and mode of shipment should always accompany each sending.

Very respectfully,

SPENCER F. BAIRD,
Commissioner.

Captain TANNER,
U. S. Steamer Albatross, Baltimore, Md.

The following officers were attached to the ship and made the cruise in the West Indies:

Z. L. Tanner, lieutenant-commander, U. S. N., commanding.

Seaton Schroeder, lieutenant, U. S. N., executive officer and navigator.

S. H. May, lieutenant, U. S. N.

A. C. Baker, lieutenant, U. S. N.

C. J. Boush, ensign, U. S. N.

R. H. Miner, ensign (junior grade), U. S. N.

L. M. Garrett, ensign (junior grade), U. S. N.

A. A. Ackerman, ensign (junior grade), U. S. N.

C. G. Herndon, passed assistant surgeon, U. S. N.

C. D. Mansfield, paymaster, U. S. N.

George W. Baird, passed assistant engineer, U. S. N., in charge of machinery.

Petty officers.—S. M. McAvoy, John Hawkins, John Bergesen, Walter Blundell, machinists; Charles Wright, master-at-arms; George B. Till, equipment yeoman; N. B. Miller, apothecary; George A. Miller, paymaster's yeoman; Frank L. Stailey, engineer's yeoman.

The crew numbered 59 men.

Mr. James E. Benedict was attached to the vessel as resident naturalist, with the following-named gentlemen as assistants:

Willard Nye, jr.

Ensign R. H. Miner, U. S. N., in charge of department of fishes.

Ensign L. M. Garrett, U. S. N.

Ensign A. A. Ackerman, U. S. N., in charge of department of geology and mineralogy.

We left the navy-yard, Norfolk, Va., at 7 a. m., January 10, and proceeded to sea. The weather was clear and pleasant, with light westerly breeze in the morning, backing to SSW., and increasing to a strong wind during the latter part of the day.

Having passed Cape Henry, we laid a course for a reported danger marked "Orion," on the eastern verge of the Gulf Stream, off Hatteras. We entered the stream in latitude 35° 48′ 48″ N., longitude 74° 09′ 00″ W., the temperature of the water rising from 54° to 67°, finally reaching 71° F.

The following morning we had strong winds to moderate gale from SSW., with heavy confused swell, the sea becoming more regular later in the day. We were on the position of the shoal above-mentioned about noon, but did not consider it advisable to sound under the circumstances. A lookout was kept at the mast-head for anything that might indicate shoal water; but there was nothing seen, although the weather was clear and the sea heavy enough to mark a shoal anywhere within the line of vision.

Having passed the above position, a course was laid for another danger marked "Ashton," in latitude 33° 50′ 20″ N., longitude 71° 42′ 00″ W., and at 10.25 p. m. on the 11th we sounded in 2,953 fathoms,

the bottom being a light chocolate ooze, rich in foraminifera. The sounding was finished and we started ahead about midnight for still another danger marked "Perseveranza." It was our intention to sound at meridian on the 12th, but a southerly gale was blowing and the sea was so high that it was not considered advisable.

We had heavy rains during the day, and between 10 and 11 p. m. came a heavy shower with very large drops, a sure indication under the circumstances, both in the Atlantic and Pacific, of a shift of wind to the westward. The barometer ceases to fall and frequently begins to rise during such a shower, preceding the change of wind from a few minutes to an hour or more. At 11.10 p. m. the wind veered to WNW. with clearing weather, and later to NE. with a long heavy swell. The ship had been in the trough of the sea most of the time since leaving Hatteras, and, the wind backing to the southward, fore-and-aft sail only could be carried. The behavior of the vessel under the adverse circumstances was admirable, the heaviest lurch being 34° to port and 22° to starboard.

At 9.50 a. m. on the 13th we sounded in latitude 31° 15′ 22″ N., longitude 67° 39′ 10″ W., the position assigned to the "Perseveranza" shoal. We found 2,787 fathoms, and brought up light chocolate-colored ooze containing but few foraminifera. It is needless to say that shoal water was not the origin of this reported danger. There was a heavy swell, the spray frequently flying over the stern while we were sounding, but the vessel was held in position without difficulty and without unusual strain on the engines except occasionally when the propellers were thrown out of water. The lashings of the rudder chains were, however, soon carried away by the force of the sea.

We took the trade-winds during the night in latitude 29° 00′ 00″ N., from SE. to ESE., light to gentle breeze; the long, rolling swell from the NE. still continued. At 8.41 a. m. on the 14th we sounded in 2,957 fathoms, latitude 28° 17′ 07″ N., longitude 66° 17′ 37″ W.

At 11.48 a. m. on the 15th we sounded in 3,006 fathoms, yellow clay, latitude 24° 35′ 14″ N., longitude 65° 13′ 07″ W., on the position assigned to the danger marked "Mourand, 1773." There were already two soundings near the same spot, H. O. No. 21, one 3,560 fathoms and the other 2,850, but the danger still remaining on the chart led us to suppose that some doubt existed as to the accuracy of these soundings, and to settle the matter we concluded to take another, which proved conclusively that shoal water does not exist in that locality.

The trades continued light from SE., and the NE. swell having left us we had practically a smooth sea. Two soundings were taken on the morning of the 17th; the first in 3,468 fathoms, latitude 19° 15′ 00″ N., longitude 65° 07′ 00″ W., and the other in 1,902 fathoms, latitude 18° 59′ 00″ N., longitude 65° 07′ 00″ W. They were taken to define more fully the slope north of St. Thomas and to fill blanks in a line of soundings already plotted on H. O. No. 40. Having completed

the last sounding, we laid a course for St. Thomas, arriving at meridian. An officer was sent to call on the United States consul, V. V. Smith, esq., who returned to the ship with him. At 3 p. m., accompanied by the consul, I made an official visit to the governor, Oberst Arendrup, and during the call obtained permission for the scientists to shoot birds, &c., on the island. The governor expressed a desire to render us every assistance in his power.

Showers of rain were of frequent occurrence, this being the rainy season, which, it is said, lasts from about November until April. The rains and partially cloudy weather temper the atmosphere, and, was it not for the constant moisture, the climate at this season would be perfect.

Preparations were made for coaling, and on the 18th we took on board 92 tons of double-screened Cardiff coal, for which we paid $7.75 per ton stowed in the bunkers.

The scientists were thus far successful and anticipate excellent results from their labors here.

Mechanics commenced work in the boilers on the morning of the 19th and finished on the 23d. On the evening of the 22d, accompanied by five officers, I dined with the governor of St. Thomas, and on the following day he paid an official visit to the ship, carefully inspecting all her appointments, including the scientific apparatus. We received many courtesies from the government and people, and were greatly indebted to the United States consul for advice and assistance, not only in the ordinary business of the ship, but in making scientific collections. He even acted as pilot and guide to a lagoon in a remote part of the island, where many interesting specimens were procured.

We left St. Thomas at 7 a. m., January 24, and at 8.43 a. m. sounded in 516 fathoms 12′ SSW. of the light-house. The following lines were then run and soundings taken every 5′: SSW. (mag.) 50′; N. by W. ½ W. (mag.) 45′, and SW. ½ W. (mag.) 25′, developing a connecting ridge between Santa Cruz and Porto Rico having from 578 to 933 fathoms of water on it, 2,000 fathoms or more being found on either side. Serial temperatures were taken both east and west of the ridge.

Fresh winds were encountered after we left the islands, with frequent squalls of wind and rain and the short chopping sea peculiar to the Caribbean. At 10.10 p. m. on the 25th we started on a course SE. ¼ E. (mag.), sounding every 25′. The deepest water—2,690 fathoms—was found the first cast in latitude 17° 15′ 30″ N., longitude 65° 26′ 30″ W., the depth decreasing gradually to Aves Island, which we reached at 11.30 a. m. on the 27th. It was our intention to locate the island and give the naturalist an opportunity to examine it, but on approaching within a mile of the lee beach we found the surf much too heavy to admit of landing with safety.

The island is small and low, not over 10 feet in height, with a few low bushes, and near the center two rough board houses and a tall flagstaff

on which were hoisted the Venezuelan colors. Several men were seen about the buildings, but there were no boats visible, and they did not seem to expect us to attempt a landing. These men are left here during the winter to collect guano, which is shipped in the summer months when the trades are light and the sea smooth. Several huge piles of the fertilizer were seen near the beach ready for shipment.

The anchorage is on a white sand and coral spit running off from the SW. end of the island, and can be seen at a distance of two miles from a ship's deck, showing white water. The bottom can be seen distinctly in 15 fathoms 1½ miles from land. We found 355 fathoms 1′ west of the island, and after passing the anchorage laid a course S. by E. ½ E. (mag.), sounding every 5′. At 2.45 p. m. we put the trawl over in 683 fathoms, latitude 15° 24′ 40″ N., longitude 63° 31′ 30″ W. At 5 p. m. the trawl was landed on deck, after a very successful haul, containing numerous specimens of rare corals, fish, sponges, &c. The boat-dredge usually attached to the tail of the trawl came up full of the ooze of the sea-bottom, which proved to be particularly rich in foraminifera, principally globigerina.

After the trawl was up we resumed our course, sounding at intervals of 25′, getting from 684 to 871 fathoms, until at 9.16 a. m. on the 28th, after putting the trawl over in 690 fathoms, latitude 13° 32′ 40″ N., longitude 62° 54′ 00″ W., we hove it up and found it had not reached the bottom. A cast of the lead showed that we had deepened the water 125 fathoms.

Our soundings developed comparatively shoal water south of Aves Island, but did not determine whether we were traversing the crest of a ridge or a plateau. The sudden increase in depth on our easterly course demonstrated that we were near the eastern slope, and to determine its angle we ran 20′ SE. ¾ E. (mag.), sounding every 10′, the depth increasing from 815 fathoms at the point of departure to 1,028 fathoms at 10′ and to 1,686 at 20′. Soundings on the chart in 1,700 fathoms to the eastward of our position showed that we had reached the normal depth between the islands, so we changed the course to SW. ½ W. (mag.), sounding every 10′, intersecting our line from Aves Island 25′ to the southward of the point at which we left it, but the elevation had terminated. The soundings continued with remarkable regularity from 1,634 to 1,642 fathoms for nearly 40′, when we changed the course to SE. by S. (mag.), sounding every 25′ until the south end of Granada bore E. 35′ distant. Here the water began to shoal, and soundings were taken every 5′ up the slope, then every 10′ to the vicinity of Boca Grande, the entrance to the Gulf of Paria.

At 1.07 p. m., January 29, latitude 11° 48′ 30″ N., longitude 62° 17′ 30″ W., we sounded in 1,140 fathoms, and put the trawl over, veering to 1,800 fathoms on the dredge-rope. It dragged lightly for half an hour and then suddenly fouled, either by coming in contact with some obstruction or burying in the mud. The bridles came up with a por-

tion of the tail lashings, which were the last to part; but the trawl was lost.

At 6.30 a. m., January 30, we put the dredge over in 73 fathoms, latitude 11° 07′ 00″ N., longitude 62° 14′ 30″ W., and landed it on deck at 7.20, the frame being bent and the netting torn by coming in contact with coral patches. There were, however, several interesting specimens brought up.

We entered the Boca Grande at 2 p. m. and took two casts of the lead at points where negative soundings were shown on the chart, and at 5 p. m. anchored off Port of Spain. An officer was sent to the United States consul, J. Fowler, esq., immediately after our arrival, and, although quite late, he visited the ship the same evening, returning with the officer who called on him.

We hauled fires during the night to stop several leaks in the boilers.

During the rainy season, from about April to November, the trades are from east or south of east in Port of Spain, and from NE. during the dry season, which continues from November to April. The present season is exceptional, as the trades are still east and the rains continue.

At 11 a. m. on January 31 I called with the United States consul on the governor, Sir Sanford Freeling, and during the visit obtained a permit for Messrs. Benedict and Nye to use firearms in making scientific collections. The naturalists were at work in various directions, and on board ship we were busily employed rewinding the wire on one of the working reels and reeling a supply on the spare reels.

We made inquiries on shore about the caverns inhabited by the guacharo birds (*Steatornis caripensis*) in the vicinity of Mono Island. Several people had visited them in the summer time, but thought it would be impracticable to enter them at this season, as they were exposed to the full force of the sea, which was always more or less rough in winter. They all referred us to Mr. William Morrison, postmaster of Mono, as the person best able to give information or assistance. As it was desirable to procure specimens of this rare bird for the Smithsonian Institution, we left the ship at 7.30 the following morning in the steam-cutter, with the dinghy and skiff in tow, for Mono Island, about eleven miles from the anchorage. Messrs. Garrett and Ackerman were dropped off Gaspar Grande, in the skiff, to land and examine that island, Messrs. Benedict and Nye forming the party with me in the cutter.

We were fortunate in finding Mr. Morrison at home, and willing not only to give information, but to act as guide and assist us in every possible way. He first piloted us to a cave on the west side of Mono Island, inhabited by fishing-bats, where six of them were shot and placed in alcohol. We continued our course around the island to the Mono passage, procured the services of a native with his canoe, and then went to a cavern on Trinidad Island, about the center of the passage above-mentioned. This was inhabited by large numbers of the cave birds of which we were in search. Several attempts were made

to enter; in fact, two or three birds were shot, but it was impossible to recover them, as a heavy surf broke through the entire length of the cavern. As they could not be reached inside the cave, Messrs. Benedict and Nye remained to watch the entrance and attempt to shoot some as they came out at night, Mr. Morrison offering to furnish them with a boat and lodging. They succeeded in shooting a single specimen, which they brought on board the following morning. Mr. Nye was confident that, with their experience of the past night, they could do better if they had another chance.

We were employed during the day swinging ship under steam to obtain compass errors, and towards night we dropped Messrs. Benedict and Nye, with a party in charge of Lieutenant May, U. S. N., near the cave for a final attack on the birds. The ship, after finishing compass observations, anchored in Dehert Bay, Mono Island, for the night. The party returned from the cavern about 8 p. m. with one more bird, which was shot by Mr. Nye as it flew out. Others were killed, but could not be found in the darkness and the dense thicket.

There is a larger cave on the north side of Huevos, an island near by, inhabited by these birds, but the approach is impracticable during the winter months.

At 5.45 a. m., February 3, we got under way, steamed out of Dehert Bay into the Gulf of Paria and took three hauls of the trawl; the first two were successful, but during the third the trawl fouled on a coral patch and was lost, together with 300 fathoms of rope.

After entering the Caribbean we laid a course NW. (mag.), sounding every 10′ for 45′, then NW. by W. ¾ W. 125′, sounding every 25′. This course was taken in order to ascertain whether spurs run off to the northward from Los Testigos or Blanquilla. Having completed the line, we hauled up to NE. ½ N. (mag.), sounding every 25′, to determine the western slope of the ridge before mentioned, extending to the southward from Aves Island.

Our course was nearly head to wind and sea, which reduced the speed and increased our coal expenditure considerably, but we thought it advisable to ascertain the extent of the elevation referred to. We reached the summit in 652 fathoms, then kept away to NW. ½ W. (mag.), sounding as before, until we reached 2,000 fathoms, then every 50′ to latitude 16° 36′ 20″ N., longitude 66° 41′ 00″ W. in 2,501 fathoms. We then ran W. ¼ S. (mag.) 76′, and at 1.45 a. m., February 7, sounded in 2,458 fathoms, latitude 16° 35′ 20″ N., longitude 68° 00′ 30″ W. After the last sounding the course was changed to SSE. ½ E. (mag.), and soundings taken every 50′. A set of serial temperatures and water specimens were taken during the afternoon in latitude 15° 02′ 00″ N., longitude 67° 13′ 20″ W. Our soundings showed a gradual increase in depth as we went to the southward, and there is a probability that the greatest depth will be found in the southern portion of the Sea.

At 4.15 p. m., February 8, latitude 12° 54′ 40″ N., longitude 66° 11′

00″ W., we sounded in the position assigned to breakers reported in 1870 by H. D. M. S. Ancona, and found bottom at 2,768 fathoms. At 12.51 a. m. the following day we sounded in latitude 12° 10′ 30″ N., longitude 66° 11′ 00″ W., in the position assigned to a "vigia," reported in 1803, and found bottom at 2,707 fathoms. An intermediate sounding between the two reported dangers gave 2,814 fathoms. The positions of the above soundings were determined by astronomical observations during clear weather. A lookout was kept at the mast-head in daytime and an extra lookout at night, which, by the way, was bright moonlight, but there was no sign of shoal water discovered, and, whatever may be the origin of the breakers reported, they cannot be attributed to that cause. A possible solution may be found in the fact that strong currents prevail in this locality, and tide rips or even overfalls might be found under certain conditions.

The bottom has been generally yellow ooze, very rich in foraminifera, but the deep soundings of the 8th developed a yellow or brown clay almost wholly devoid of organic matter. After completing the soundings above-mentioned we started ahead, S. by W. (mag.), to pass between Orchilla and Los Roques. A sounding was taken at 3.30 a. m. and another at 6.20 a. m., latitude 11°·49′ 00″ N., longitude 66° 16′ 50″ W., the west end of Orchilla Island bearing east 6′. The above is an astronomical position, and shows both Orchilla and Los Roques to be placed about 4′ too far west on H. O. chart No. 40.

From the last position we ran S. by W. ¾ W. (mag.), sounding every 15′, until reaching the mainland about 10′ to the eastward of La Guayra, then NW. by W. ¼ W. (mag.) for Curaçao, sounding as before. The water shoaled gradually from 774 fathoms 6′ west of Orchilla, to 135 fathoms within 5′ of the mainland, increasing to 1,040 fathoms 56′ NW. (mag.) from La Guayra, and shoaling again as we approached Curaçao. The latter port and islands to the eastward are also about 4′ too far west on H. O. chart No. 40. The soundings were continued to a point 600 yards south of the entrance, where 74 fathoms was found. While in the act of sounding we were boarded by the harbor-master, who acted as pilot, and at 3.05 p. m., February 10, we anchored in the Schottegat, in 10½ fathoms, near the U. S. S. Vandalia. Boarding officers visited the ship from the Vandalia and the Alkmaar, a Dutch station-ship, with offers of assistance and tendering the usual civilities of the port.

The trade-winds were brisk to fresh in the vicinity of St. Thomas, with heavy swell, both wind and sea moderating as we went to the southward. Moderate to gentle winds were experienced after leaving Aves Island. Rain squalls were of frequent occurrence from St. Thomas to Trinidad and for two days after our arrival in that port. After that, for a while we had but few light showers.

The currents of the Caribbean north of latitude 13° N. we found thus far to trend to the southward of west about 1′ per hour, somewhat stronger near St. Thomas and Porto Rico, and weaker towards the

center of the Sea. To the southward of latitude 13° N. they trend to the northward of west, and between Trinidad and Blanquilla northwest from 1½′ to 3′ per hour. Between La Guayra and Curaçao it was about W. by S. to W. ½′ per hour.

There were neither birds nor fish observed between St. Thomas and Aves Island, but from the latter point to Trinidad small flying-fish and flocks of sea-birds were seen daily. Flying-fish were also seen in the central part of the Sea, but no birds till we approached the islands, where we frequently observed them in great numbers in search of food. Two dolphins and two sharks represent the larger marine life seen thus far in the Caribbean.

During the 11th I paid official visits to his excellency N. Van den Brandhof, governor of Curaçao, Capt. Rush R. Wallace, U. S. S. Vandalia, and Capt. A. Baron Collot d'Escury, commanding the Dutch sloop of war Alkmaar. Captain Wallace visited the ship during the afternoon.

The naturalists were out collecting both on shore and in the lagoons. During my call on the governor I obtained permission for them to use firearms and shoot specimens for scientific purposes.

Preparations were made for coaling, and at 6.20 a. m. the following day we got under way and went alongside the brig Florence, of Sunderland, and commenced work at 8 a. m., taking 84 tons on board during the day. Coal is handled here in small wooden tubs, holding an average of 40 pounds, making it slow work. We finished at 11.30 a. m. on the 13th, having taken on board $119\frac{1576}{2240}$ tons of double-screened Cardiff coal, for which we paid $10 per ton, American gold, delivered in the bunkers. We returned to the anchorage between noon and 1 p. m., hauled fires, and blew down the port boiler for repairs.

Capt. A. Baron Collot d'Escury made an official visit to the ship. The American steamer Caracas left with mails for the United States, and the record of soundings to date and other reports were forwarded by her.

At 10 o'clock on the morning of the 14th the governor of Curaçao and party visited the ship and made a thorough inspection of the vessel and her apparatus. Dr. Herndon, Mr. Benedict, and I lunched with the governor on the 17th. The repairs on the boiler and engine were completed on the above date and preparations made for sea.

The temperature ranged from 71° to 82° during our stay, and at our anchorage, where the trade-winds had a clear sweep, the weather was very comfortable. We usually had several passing showers during the day, which tended also to temper the atmosphere. We were entirely free from mosquitoes and flies, which is quite unusual in the tropics. The naturalists were successful, both ashore and afloat.

We left Curaçao at 7.20 a. m. on February 18, and ran a line of soundings in a southerly direction to the mainland, the greatest depth being 738 fathoms. The government and people of Curaçao will watch

with peculiar interest the results of this line of soundings, as it will go far towards solving the problem of a much-needed supply of fresh water. The relation this island bears to the mainland has been heretofore unknown, the general impression being that it was an isolated volcanic peak, having no connection with the watershed of the contiguous coast of Venezuela. In this case water would not be found by sinking artesian wells. On the other hand, if connected with the mainland by a plateau or neck of land having a moderate depth of water over it, wells might be sunk with a fair probability of success. An effort was made recently by the colonial government to ascertain the depth of the channel, but without success. The vessel sent on that duty, being supplied only with the ordinary deep sea lead and line, failed to reach bottom. When the governor learned that we intended running this line of soundings he requested me to furnish him with a list of the depths found, which I have done, forwarding it from Kingston, Jamaica.

During the afternoon we made a haul of the dredge in 122 fathoms, and of the trawl in 208 fathoms, in the channel above-mentioned, with but moderate success. A few specimens were, however, secured from both hauls. The small amount of life on the bottom of the Caribbean compared with that off the New England coast has been a constant surprise to us during the cruise. We extended the line of soundings across the channel to a point five miles from the coast; then stood to the northward and westward, sounding at short intervals, until at 11.30 p. m. we made the light on the east end of Oruba, recently erected by the phosphate company that is working the rich deposits on that island. The greatest depth found on this line was 455 fathoms.

At 1 a. m. the following day a course was laid NNW. (mag.) for Alta Vela, a small island on the south coast of Santo Domingo. Soundings were taken at intervals of 10′, 20′, and 25′; and at 9.10 a. m. we sounded in latitude 13° 17′ 45″ N., longitude 70° 01′ 00″, W., with a depth of 1,701 fathoms, the bottom being composed of foraminiferous ooze and coarse coral sand. The wind and sea being moderate, and indications favorable, we put the small beam-trawl over, veering to 2,800 fathoms on the dredge rope. It was landed on deck again at 2.25 p. m. with a few sponges, shrimp, small fish, &c., indicating anything but rich ground. Soundings were continued at varying intervals, the wind and sea gradually increasing until the morning of the 21st, when we passed a few miles to the westward of Alta Vela and laid a course NW. ¼ W. (mag.) for Cape Jacmel, sounding at intervals of about 16′.

The deepest water found between Curaçao and Santo Domingo was 2,694 fathoms, in latitude 13° 40′ 20″ N., longitude 70° 10′ 45″ W. The bottom was brown ooze without a trace of foraminifera. The average depth was about 2,300 fathoms until within a short distance of the land, when it shoaled rapidly to 302 fathoms four miles SW. ¼ W. of Alta Vela; the next sounding, 16′ distant NW. by W. ¼ W., revealing 2,434 fath-

oms, the greatest depth between Curaçao and this place, with the single exception before mentioned.

The line was extended to Jacmel, showing bold water to the cape; then 60′ south crossing a ridge which extends westward from Alta Vela. We then ran a line NW. ½ N. (mag.) 40′, crossing the line of the ridge above-mentioned, but found it had terminated or changed its direction, as we carried a uniform depth of about 2,400 fathoms.

We then steamed 18′ WSW. (mag.) and sounded in 2,490 fathoms, brown ooze, latitude 17° 39′ 30″ N., longitude 73° 22′ 15″ W., "Leighton Rock awash," H. O. chart No. 36, being located in latitude 17° 37′ 00″ N., longitude 73° 21′ 00″ W. After another run of 15′ NW. by W. ½ W. (mag.) we sounded in 2,369 fathoms, brown ooze, latitude 17° 48′ 00″ N., longitude 73° 34′ 15″ W., "Loos Shoal" being placed in latitude 17° 45′ 00″ N., longitude 73° 30′ 00″ W., H. O. chart No. 36. These shoals were searched for in 1872 by H. M. S. Philomel and Plover, and, being unable to find them, they were expunged from the Admiralty charts, but as they were still shown on H. O. charts, we considered it advisable to settle the matter beyond all dispute by ascertaining the actual depth in the localities assigned them.

The soundings south and west of Jacmel were taken during the prevalence of strong winds and heavy confused seas. An easterly current of ¾ to 1 knot per hour was encountered in this locality and added not a little to the exceedingly uncomfortable swell. It occurred to me more than once that under certain conditions heavy tide rips or overfalls might be encountered, giving color to reported dangers.

Another sounding was taken 9′ south of Point Abaçou in 1,039 fathoms, and then a line run 30′ W. ¼ S. (mag.), sounding every 10′; then NW. ½ W. 13′, and SSW. (mag.) 53′, sounding at intervals of 15′, for the purpose of eliminating a large number of negative soundings appearing on the chart, also to examine two shoals referred to in H. O. publication No. 63, vol. 1, p. 226, as follows:

"More recent soundings of 16 fathoms have been reported in latitude 17° 45′ 00″ N., longitude 74° 39′ 00″ W., and also in latitude 17° 13′ 00″ N., longitude 74° 58′ 00″ W."

We found 803 fathoms within 3 miles of the former position and 1,120 fathoms on the position assigned to the latter, demonstrating conclusively that shoal water does not exist in the positions named. It is highly probable, however, that much less water may be found west and north of this locality. The wind and sea moderated as we left the coast, and we finally lost the easterly current.

From our last position we ran 15′ NNW. (mag.) and sounded in 968 fathoms, and then changed the course to N. by E. (mag.) for 70′, sounding at intervals of 15′ except in one case, when a sounding of the Blake intervened. A reference to this line will show the bottom to be very uneven in this locality, and a depth of 262 fathoms in latitude 18° 18′ 30″ N., longitude 74° 53′ 30″ W., about 10′ SE. by E. from Navassa,

is something of a surprise. The water deepens to 1,040 fathoms 15′ to the northward and eastward of the island, and to 1,347 fathoms 8′ NW. of Cape Dame Marie. From this point we ran E. by N. 60′, sounding at intervals of 20′, the second cast giving us 1,974 fathoms and the third 342 fathoms about 10′ to the westward of Gonaive Island. From this point we steamed N. by E. ¼ E. (mag.) 20′, where we found 800 fathoms, and 20′ W. by S. (mag.), 502 fathoms, which was of course a surprise. From this point we ran a line WNW. (mag.) 76′, sounding at intervals of 20′. The maximum depth found in the windward passage was 1,923 fathoms.

At 12.40 p. m., February 25, we sounded in 1,639 fathoms, green sand, latitude 19° 45′ 00″ N., longitude 75° 04′ 00″ W., took serial temperatures, and at 2.50 p. m. put the trawl over, veering to 2,400 fathoms, landing it on deck again at 6.35 p. m., having made a successful haul. There were a variety of sponges, some very large shrimp, one fish, numerous shells, small crabs, holothurians, and an interesting octopus, the arms all of the same length and connected by a membrane. The color was cherry-red on its head, becoming gradually darker towards the extremities.

After the trawl was on deck we started ahead, sounding at various intervals along the southern coast of Cuba during the night. The wind was light, with smooth sea. Heavy clouds hung over the island and frequent bright flashes of lightning were seen.

The light of Santiago de Cuba was sighted at 12.40 a. m., and the vessel was hove to soon after till daylight, when we steamed in and anchored in the harbor at 8 a. m., February 26. A boat was sent for the United States consul, John C. Landreau, who visited the ship. Boarding-officers were received from the Spanish iron-clad ram Sanchez Barcaiztagui, from the captain of the port, and health officer.

At noon, accompanied by the United States consul, I made an official call on the governor and the captain of the port, and at 1.30 p. m. I called on the commander of the Spanish ram, who returned the visit at 3 p. m. A mail was received from the consulate, provisions taken on board, and at 9.30 a. m. the following day we got under way, stood out of the harbor, and made ten hauls of the tangles in search of *Pentacrinus*. Several hauls were made before we succeeded in getting a specimen. Finally, however, after working until late in the evening, we procured four fine ones in perfect condition. We left the ground reluctantly, for we wished to procure a large supply, but the small amount of coal in the bunkers admonished us to be moving towards Kingston without further delay.

We ran a line SSE. ¾ E. (mag.) 93′ in the direction of Navassa, sounding at intervals of 10′ to 20′. The maximum depth, 2,275 fathoms, was found 44′ from Santiago de Cuba light-house. The soundings gradually decreased to 870 fathoms about 6′ from Navassa, from which point we ran a line W. ½ S. (mag.) 30′ sounding at intervals of 15′, the first cast giving 1,015 fathoms, and the second 620 fathoms, 7′ E. ½ N. from

Formigas Banks. A line was then run SSW. ¼ W. (mag.) 50′, sounding at intervals of about 12′. The greatest depth, 1,153 fathoms, was found midway between the banks and Morant Point, the last cast on the line giving 450 fathoms 10′ ESE. ¼ E. (mag.), from the light, which was in full view.

Having located the ship accurately with reference to the above-mentioned light, we started ahead at 4 a. m. running a line ESE. ¾ E. (mag.), sounding at short intervals, toward a shoal marked as follows on H. O. chart No. 35, "(8) shoal," and concerning which the following references are made in H. O. publication No. 63, pp. 226 and 227:

"Several reports have been received of banks in the windward channel. H. M. brig Renard in 1805 sounded in 18 fathoms for five miles on an easterly course on a bank considered to be 16 miles in length in latitude 17° 44′ 00″ N. and NE. 27′ from Morant Cays.

"Mr. John S. Holt, master of the brig Georgia, reports in 1867 that on his passage from Kingston, Jamaica, toward Navassa Island he sounded in 14 fathoms of water, and from the color of the bottom he judged that some places on the bank had as little as 8 or 10 fathoms of water. The position of the shoal he gives as latitude 17°46′ 00″ N., longitude 75°45′ 00″ W., Point Morant bearing by compass W. by N. 28 miles. There is doubtless a shoal in this vicinity, and the attention of navigators is called to the desirability of obtaining and publishing its exact position and extent."

Although the above positions differ somewhat from each other and from that found by us, they evidently refer to the same bank. We found 21 fathoms on the northern end of the shoal ESE. ½ E. (mag.) about 32′ from Morant Point light-house, in latitude 17° 44′ 00″ N., longitude 75° 50′ 00″ W. It is about 9′ in length NNE. ½ E. and SSW. ½ W., and from 3′ to 4′ in width. The least water found was 17½ fathoms.

After finding the shoal as mentioned above, we anchored a boat with a flag at her mast-head, and ran lines of soundings off and on until dark, when, owing to our nearly empty bunkers, we were obliged to start for port intending to complete the examination on our way to Savanilla. Leaving the southern edge of the bank, we ran a line W. by N. (mag.) 58′, sounding at intervals. The depth of water found the first cast (¾′ SE. of an 18-fathom sounding on the edge of the bank) was 360 fathoms, increasing to 838 fathoms 3½′ to the westward, the greatest depth on the line, 875 fathoms, being reached 4′ farther to the westward, from 400 to 700 fathoms being found throughout the remainder of the line. Port Royal light bore NNW. ½ W. (mag.) 7′ distant at the last sounding on the above line, which gave 484 fathoms. Another and the last cast before entering port gave 400 fathoms 2′ NW. by N. (mag.) from the position above-mentioned and quite near the bank. A course was then laid for the entrance, and we reached quarantine without difficulty. We were detained there about half an hour before satisfactory arrangements could be made in the absence of a bill of health, which we had omitted to procure at the last port. Our own certificate was

finally accepted and we went on to Kingston, where we anchored at 1.22 p. m. A boat was sent for the United States consul, George E. Hoskinson, who came on board. A visit was also received from an officer representing the commandant of the naval station at Port Royal, with offers of assistance. A large mail was received from the consulate. Immediate inquiries were made for coal, and at 9 a. m., March 3, we went alongside the English steamer Grip Fast lying at the coal wharf and coaled ship across her decks. At 1 p. m. I left the ship, and, accompanied by the United States consul, made an official visit to the governor, Sir Henry Norman, and at 2 p. m. lunched at King's House with the governor and his family. At 4 p. m. I called on the commandant of the naval station at Port Royal, the call being returned the following day by Lieutenant Swan, R. N., representing the commandant in his absence. We finished coaling at 3.15 p. m. and left the wharf, anchoring in the harbor. The fires were then hauled and repairs commenced on the boilers; other repairs were already under way, and having expended our sounding-shot, a fresh supply was ordered. At 1.50 p. m. March 5 the governor and aid-de-camp visited the ship and made a thorough inspection of the vessel and her apparatus.

The trades, which had been light since our arrival, increased to their full force on the 6th, and continued during our stay. The breeze would spring up between 8 and 9 a. m., attain its greatest force about 2 p. m. and the least about 7 or 8 p. m. A heavy swell came up with the wind, which made communication in the harbor with small boats rather a difficult matter. Our steam-cutter and gig, however, made us practically independent of wind and sea.

We usually had one or more showers during the day, and in Santiago de Cuba we had heavy rain. The showers continued in Kingston until the strong trades set in, when they ceased, and we had several dry days in succession, an unusual occurrence since our arrival in the Caribbean.

The naturalists were busily engaged collecting during our stay in port and found it excellent ground, the best in many respects that we had found in the West Indies.

Repairs on the boilers were finished March 10; engineers and paymaster's stores on board, and the sounding-shot, the last articles to complete our outfit, were received on the morning of the 11th, and at 11.40 a. m. we got under way and proceeded to sea. Arriving near the edge of the bank, we put the tangles over, but unfortunately they fouled on the bottom and were lost. We then ran a line of soundings S. ¼ E. 15′ at varying intervals, crossing the center of California Bank in 26 fathoms. At 6.40 p. m. we sounded in 966 fathoms, sand, latitude 17° 36′ 10″ N., longitude 76° 46′ 05″ W., and put the trawl over, landing it on the bottom at 8.20 and on deck at 10 p. m., after a successful haul. One rather remarkable specimen was a large earthenware jar, with its surfaces pretty well covered with worm-tubes. We steamed

about 5′ to the northward and eastward during the haul, and, starting from that point, ran a line directly to Morant Cays, ESE. ½ E. (mag.) 42′, sounding at short intervals. At 11.45 a. m., March 12, we anchored in 4 fathoms under the lee of Northeast Cay, and sent the whale-boat with the naturalists, in charge of Lieutenant May, with instructions to land if it could be done without risk, otherwise to return to the ship.

The trades were blowing fresh and a heavy swell set around the ends of the cay, causing a break on the beach that made landing impracticable without danger of staving the boat on the coral lumps. The temptation to land on this (to the naturalists) virgin soil was very great, but Lieutenant May, having in mind the safety of the boat, very wisely returned. Getting under way we ran a line of soundings in various directions from the cays to the shoal which we had examined on the 29th of February, and, although the sea was too rough to permit a more extended reconnaissance, we developed the fact that the bank referred to is an extension of Morant Cays.

At 8.35 p. m. we turned our head to the southward and ran a line S. by E. about 140′ to a group of negative soundings, in the midst of which we cast the trawl in 2,295 fathoms, latitude 15° 18′ 30″ N., longitude 75° 22′ 30′ W., then continued the line about SSE. ½ E. (mag.) in the direction of Santa Marta.

At 9.41 a. m., March 15, we sounded in 2,057 fathoms, on the position assigned a doubtful shoal, H. O. chart No. 36, in latitude 12° 11′ 30″ N., longitude 74° 27′ 30″ W., and, it is needless to say, failed to discover any indications of shoal water.

We then ran a line S. ½ E. (mag.) 60′, passing about 12′ to the westward of Santa Marta light-house, sounding at frequent intervals as we approached the coast, then stood off NW. ¾ W. (mag.) 35′, sounding at intervals of 15′, then S. ¼ W. for the mouth of the Magdalena River and Savanilla, anchoring off the latter place at 8.28 a. m., March 16.

We had strong winds to moderate gales after leaving Morant Cays, from E. to ENE. in the northern Caribbean, and NE. as we approached the Colombian coast. The heavy winds were accompanied by rough seas, making the work of sounding an exceedingly critical operation. The sounding-wire parted several times during the night of the 11th and morning of the 12th in a most unaccountable manner, losing either lead or sounding-rod and a thermometer with more or less wire each time. We were inclined to blame the splices at first, but soon found that we must look further for the cause. In the meantime we changed reels, leaving the solution of the mystery until the following day, when, after reeling the wire off, the drum was found to be collapsed. The metal was neither broken nor cracked, but the center simply settled down on the bolts, the sides retaining their form. There would have been little or no harm arising from this had not the edges of the drum drawn away from the sides, leaving sufficient space for a turn or two of wire, which became so firmly fixed, when reeling in, that it would

part before clearing itself while sounding. I think this condition was not caused by any sudden strain, but that it has been gradual, from the fact that we have been troubled with slack turns from time to time when taking very deep soundings.

The instructions of the Bureau of Navigation contemplated the examination of the bar at the mouth of the Magdalena River, but we found it impracticable to accomplish anything with ship's boats at this season of the year, when the trades are at their height. The worst sea we have encountered during the cruise was a few miles to the northward of this bar.

I went to Barranquilla on the morning of the 17th, called on the United States consul, Thomas M. Dawson, esq., and with his assistance had interviews with ship-masters, steamship agents, &c., with reference to the conditions and character of the bar.

From the information obtained and from personal observation, my opinion is that a survey with ship's boats is impracticable during the winter months; May and June being the most favorable. Examinations may, however, be made at any time with a sea-going tug of moderate draught. A survey of the bar would be of no commercial benefit after the expiration of a few weeks. Vessels drawing eight feet of water or less may enter at any time with comparative safety, simply keeping clear of the breakers; with from 8 to 12 feet draught it would be prudent to examine the bar before entering, and for greater draught an examination is imperatively necessary before attempting to cross.

In 1875 the bar cut away, giving about 30 feet, and steamers began to cross and ascend the river, continuing to do so until 1880, when, owing to the risks of grounding on the bar or detention in the river, they discontinued the practice, and now all anchor at Savanilla, or Salgar, as it is locally called.

Merchandise descending the river must be transhipped from the river steamers to the railway at Barranquilla and transported about 12 miles to Salgar, where it is transferred to lighters, which are towed about 3 miles to the shipping at Savanilla anchorage. There are no facilities for the rapid handling of freight, and with but five lighters to transport the cargoes of seven steamship lines calling regularly at the port, it is no matter of surprise to see vessels detained a week or more, losing valuable time and frequently missing connections.

The Government of the Republic and the people of Barranquilla realize the necessity of providing a more practicable outlet for their great river, and with this end in view surveys have been made for a deep-water terminus of the Bolivar Railway. At a new harbor recently surveyed, called Puerto Belillo, a pier is projected where steamers can lay alongside and discharge into cars or receive freight from them direct. There is 30 feet of water at the end of the pier and 26 feet 200 feet inside. The length of the extension is about 5¾ miles on level ground, with no serious engineering difficulties, and the harbor is easy of ap-

proach, perfectly protected from the prevailing winds, and of ample size for the present or future commerce of the port. This, it seems to me, is the most practicable and economical method of solving (what is to Barranquilla in particular) a vital problem, the total estimated expense for extension and pier being only about $1,000,000.

The trades were blowing fresh during our stay, getting up a considerable swell between the anchorage and railway terminus, thus making communication with ordinary ship's boats very tedious. Here again we had reason to appreciate our admirable little steam-cutter, which enabled us to come and go at pleasure.

On the 19th instant, accompanied by the United States consul and vice-consul, I made official visits to the President of the State (who was in Barranquilla at the time), the governor, and military commandant.

We left Savanilla at 8.15 a. m. on the 22d, and ran a line of soundings W. ¾ N. (mag.) 52′ to the position in which the U. S. S. Powhatan reported shoal water, latitude 11° 11′ 00″ N., longitude 75° 50′ 30″ W., where we found 1,175 fathoms, the water having deepened regularly since leaving port. From this point we ran a line S. ½ E. (mag.) 40′, and being then 16′ W. by N. (mag.) from Cartagena light-house, in 825 fathoms, we stood off shore WSW. (mag.) 43′, then SSE. (mag.) 51′ to a point 7′ NW. ½ N. of Fuerte Island, where we found 38 fathoms. Soundings were taken at intervals of 10′ to 15′ since leaving Savanilla, and in running the traverses off and on shore, the change in the depth was gradual, making it extremely improbable that shoals exist outside of the shore reefs.

At 3.30 p. m. we started on a line W. ¼ N. (mag.), sounding at intervals of 5′ to 20′ while crossing the bay at the south of which lies the Gulf of Darien. At 4 p. m. we cast the trawl in 42 fathoms, green mud, latitude 9° 30′ 15″ N., longitude 76° 20′ 30″ W.; and at 4.55 another haul was made in 155 fathoms, green mud, latitude 9° 30′ 45″ N., longitude 76° 25′ 30″ W., both hauls furnishing us a small number of good specimens.

Strong trades and a heavy sea followed us till we passed Cartagena, when the wind died out and the sea moderated, causing a marked change in the motions of the vessel, which was duly appreciated by all on board.

The line was continued sounding at various intervals to Aspinwall, where we arrived at 2.55 p. m. March 26. A boat was sent for the United States consul, but the dispatching of a steamer which was to sail during the afternoon prevented his coming on board. He sent off word, however, that several deaths had occurred recently from what had been called malignant malarial fever, but which, in his opinion, was yellow fever. Pending further investigations orders were given that there should be no communication with the shore, except when it was absolutely necessary in carrying on the ship's duties.

Dr. Herndon made inquiries the following day and satisfied himself that the cases referred to were yellow fever; and although he was unable to learn of the existence of any cases at that time, he advised every possible precaution. We followed this advice as strictly as possible, no one leaving the ship except on duty.

On the morning of the 27th we went alongside of a vessel just arrived from Liverpool with coal for the Pacific Mail Steamship Company, and took on board 60 tons, returning to our anchorage in the evening. The strict quarantine observed prevented the naturalists from making collections at this port, which I expected would be the most fruitful, owing to the facility with which they could reach the interior by the railroad. Ensign A. A. Ackerman was detached by telegraphic orders from the Navy Department, and subsequently assigned to duty in the Greely Relief Expedition. His departure restricted the scope of our investigations, as he had charge of the departments of botany, geology, and mineralogy. Necessary repairs on the boilers detained us several days after we were in other respects ready for sea. The quarantine having been maintained until we departed, there was little opportunity for collecting specimens. Such as could be taken from the ship were, in fact, the only ones secured.

We left Aspinwall at 9.30 a. m., April 2. Steaming out about 5 miles from the anchorage, we put the dredge over in 25 fathoms, with slight success, the bottom being apparently smooth and hard, where we expected mud. Thinking the trawl might do better, we put it over, about 5 miles to the northward, in 34 fathoms on smooth bottom, but soon dragged on to foul ground, where it caught frequently, and, after heaving it up, we found the net a wreck, but the bag still held a large variety of corals, sponges, fish, crabs, ophiurans, &c., three or four fine specimens of free crinoids being considered special prizes by Mr. Benedict. The tangles, with a boat-dredge attached, were put over in 130 fathoms about 2 or 3 miles from the latter position, but came up perfectly clean, indicating a smooth, hard bottom, or a mud so thin that it all washed through the dredge-net.

After the tangles were up, a line of soundings was started NNW. ½ W. (mag.) for Old Providence Island, about 240 miles distant. Casts were made at intervals of 10 to 25 miles. Starting with 707 fathoms, 17 miles from Aspinwall, the water shoaled to 611 fathoms at 27 miles, reaching the maximum, 1,900 fathoms, 77 miles from port, then shoaled gradually to 339 fathoms close to the reef off the SW. end of Old Providence. We made the island at 8.30 a. m. on the 4th, and anchored in Catalina Harbor at 3.50 p. m.

We called here for the double purpose of procuring supplies and giving the naturalists an opportunity of examining the fauna of this isolated island. I wished also to give the officers and crew an opportunity to stretch their legs on shore after their long confinement on board, very few of them having been out of the ship since leaving Kingston.

This was in old times the favorite resort of buccaneers, and the ruins of their fortifications, even some of their ancient cannon, are still to be seen. A glance at the beautiful little harbor of Catalina and its surroundings reveals the wisdom of its selection as a rendezvous by the lawless freebooters. The island is entirely surrounded by dangerous reefs, and the entrance to the harbor is narrow, somewhat tortuous, and was commanded by their batteries on shore. Ample supplies of wood, water, fresh meats, fruit, and vegetables were procured from the inhabitants, with whom they made it a point to be on friendly terms. Its location near to but outside the great routes of commerce made it particularly valuable for their purpose.

The island belongs to the United States of Colombia, and has a population of about 800, the Indian blood predominating, but there is a large African element. The English language is universally spoken, and the Protestant religion is the only one professed by the people. Schools are maintained, and it is the exception when a native is unable to read and write.

There is no physician on the island, and the lack of proper medical attendance causes great suffering among the inhabitants. Dr. Herndon had a room fitted up on shore, and gave his whole time to the sick who came or were brought to him, the ship furnishing such medicines as could be spared. As soon as we anchored, an officer was sent on shore to call on the magistrate and inform him of our mission. He received the officer very cordially and offered every assistance in his power. The naturalists began work at once and succeeded in making a very creditable collection. Quite a large variety of fish were procured for specimens, and an ample supply for officers and crew was caught with the seine. Fresh beef, poultry, sweet potatoes, yams, and fruit were plentiful at fair prices. Tortoise-shell and cocoanuts are articles of export. The climate during the dry season, from November to May, is tempered by the trades, which blow constantly, and is probably unexcelled by that of any island in the West Indies.

We left the harbor at 6 a. m. on the 9th instant, and, after clearing the reef, laid a course of NNE. $\frac{3}{4}$ E. for a doubtful bank 109′ distant, in latitude 14° 53′ 00″ N., longitude 80° 20′ 00″ W., sounding at intervals of about 11 miles. We put the tangles over, with a boat-dredge attached, in 382 fathoms, latitude 13° 34′ 45″ N., longitude 81° 21′ 10″ W. The tangles came up quite clean, but the boat-dredge was filled with a compact mass of white ooze, very rich in foraminifera. The water increased gradually in depth to 1,151 fathoms on the reported bank where it was supposed to break at times. The sounding was made at 4.30 a. m. on the 10th instant, and the spot carefully located by astronomical observations before leaving it. The soundings were quite regular, but, to make a sure thing of it, we sounded 5 miles to the southward of the position in 1,069 fathoms, and again 6 miles to the northward in 971 fathoms, after which we changed the course to NW. by N. (mag.),

sounding at varying intervals, the water shoaling gradually to 511 fathoms 15 miles from the eastern edge of a bank lying between Thunder Knoll and Rosalind Bank. We crossed the bank before mentioned in from 19 to 24 fathoms, coral, and laid a course NW. ½ W. (mag.), for a vigia, marked on H. O. chart No. 394 in latitude 18° 30′ 00″ N., longitude 83° 16′ 00″ W., sounding at intervals as usual.

The trawl was lowered at 1.22 p. m. in 653 fathoms, yellow ooze, latitude 15° 28′ 30″ N., longitude 80° 36′ 00″ W. Serial temperatures and water specimens were taken to 500 fathoms. A few deep-sea fish and small crustaceans were all that were brought up, the bottom being almost destitute of marine life.

Several boobies (*Sula*) were flying around the ship, and finally one of them alighted on the forecastle, when it was caught by one of the men, who, after amusing himself and shipmates awhile, tossed it overboard, expecting it would take itself off as quickly as possible; but, to our surprise, it returned immediately, alighting on the rail where nearly every man of the crew had congregated to watch its performance. It did not seem to be distressed in any way, and went deliberately to work rearranging its plumage, which had been somewhat ruffled by handling, calmly surveying the noisy crowd of men gathered around it. They tried to feed it, offering everything that could be found, but nothing seemed to suit its taste. It would not submit quietly to being handled, but made no attempt to fly away, and, although tossed overboard six times during the afternoon, it returned as often, invariably alighting in the same place among the men, where it finally took up its quarters for the night, remaining till 6 o'clock the following morning, when it left without ceremony and was not seen again. I relate this incident, as it is the first instance of the kind in my experience at sea.

The line of soundings was continued during the 11th, the depth increasing gradually to 920 fathoms 75 miles from Thunder Knoll, then dropped off to 3,169 fathoms at 105 miles. This was the greatest depth found in the Caribbean, and the sounding was made under adverse circumstances. On the first trial, the stray-line parted after something over 200 fathoms had run out, the sounding-rod, water-bottle, and shot being lost. It is difficult to explain this accident unless we lay it to a shark or some other fish, as the strain on it at the time did not equal one-tenth of its tensile strength. On the second attempt, all the wire was run off the reel without reaching bottom and the shot had to be reeled in; more wire was added, and finally the sounding was taken. The bottom was a light yellow ooze, with only a trace of foraminifera, resembling in this feature the bottom at our greatest depth near the breakers reported by H. D. M. S. Ancon.

The currents, which had been light since leaving Old Providence, became strong and irregular. At 5.25 on the morning of the 12th we sounded in 2,829 fathoms on the position assigned to the vigia above-mentioned, which is 66 miles from the deep sounding of the previous

day. While making this distance and taking two intermediate soundings we were so beset by strong and erratic currents that it was only by locating each position astronomically that we could keep near the desired locality.

If these currents were encountered by other navigators who were steering a course without taking hourly observations, a very brief period would be required to take them sufficiently out of their reckoning to account not only for the vigia mentioned, but the soundings of H. B. M. S. Phœbe and Rosario to the eastward of Misterioso Bank, which was itself doubtless reported in a multitude of positions before it was finally located on the charts of to-day.

Having sounded on the position of the vigia, we stood for Misterioso Bank, which we crossed in from 12 to 14 fathoms, coral. We found 708 fathoms about three miles east of the bank, and 891 fathoms 2½ miles to the westward. From this point, a course NNW. ¼ W. (mag.) was laid for Cape San Antonio, 189 miles distant, soundings being taken until we passed the light on the evening of the 13th, when a course was laid for Key West, Fla., where we arrived at 7.15 a. m. on the 15th instant. It was our intention to search for shoals reported off Cape San Antonio, but our coal running short, we were obliged to make the best of our way to port.

We finished coaling on the evening of April 17, and were detained in port till the 27th repairing boilers.

There were no boiler-makers to be found in the place, but with the facilities of the Government machine-shop, which the commandant of the station, Lieut.-Commander George F. F. Wilde, U. S. N., placed at our disposal, we were able to do the work with our own men.

We reeled on a thousand fathoms of new dredge-rope while in port, all the reel would hold, in fact, and made several tangle-bars and a large supply of swabs preparatory to a search for *Pentacrinus* on our return to the Cuban coast. The ground is said to be very foul where they are found; so we went prepared to lose any amount of gear and still be in working order.

We left Key West at 4.40 p. m., April 27, arriving in Havana at 6.20 the following morning, and moored to one of the government buoys. The health officer came alongside and gave us pratique, and officers from the captain of the port and the Spanish flagship Jorge Juan called to offer the usual courtesies. An officer was sent to call on the acting consul-general, Clarence C. Ford, to inform him of our arrival and request him to make an appointment to call on the captain-general.

During the morning I called on the admiral, Florencio Montajo, and the commander of the flagship; the latter officer returning the call later in the day, and the fleet-captain returning the call on the part of the admiral the following morning. At 11 a. m. the same day I made an

official call on the captain-general, accompanied by the acting consul-general and Lieut. A. C. Baker, of this ship.

During the interview I took occasion to inform the captain-general that we wished to make some deep-sea explorations in the immediate vicinity of the harbor, and, after completing this work, to examine the region about Cape San Antonio in order to determine the existence or non-existence of Sancho Pardo Shoal, which had been reported from time to time since 1606. I mentioned also that it was desirable to observe the longitude of Cape San Antonio.

The captain general very kindly informed me that we could do anything we wished on the coast of Cuba, and we subsequently learned that he sent orders to Cape San Antonio that we should be permitted to land and take observations for longitude.

At 12.45 p. m. there were three heavy explosions in the city, following in rapid succession. Dense volumes of smoke obscured the view, and the concussion was very heavy even on board ship. The first explosion was a magazine in the arsenal, and the others, which were a gasometer and another magazine, were caused by concussion or falling fragments. There was serious loss of life, and great damage was done to buildings in that section of the city. A panic followed, which in the narrow crowded streets resulted in much personal injury.

At 5.30 a. m. on the 30th we left our moorings and stood out of the harbor. At 6.05 we sounded in 387 fathoms, 2 miles NW. of Morro Castle, and put the tangles over for *Pentacrinus*. We had poor success during the forenoon, but later in the day were more fortunate. Twelve hauls were made over very rough coral bottom, the tangles fouling nearly every haul, but we succeeded in clearing them till the last cast in the evening, when we were obliged to break the rope, losing 110 fathoms, besides the tangles and weights. We were well satisfied with the day's work, notwithstanding the loss, and at 5.20 ran into port, taking up our former berth.

The morning of May 1 opened with light easterly winds, clear weather, and smooth sea. At 5.48 a. m. we left our moorings and steamed out of the harbor. Our experience of the previous day enabled us to select good working ground at once, and after 6 hauls, which were finished at 11.30 a. m., we started for Cape San Antonio, having procured a fine lot of *Pentacrinus*, as well as a good general assortment of specimens. Although the bottom was exceedingly rough and the tangles fouled at every haul, we were fortunate enough to lose no more gear. The immunity from loss was due in a great measure to the promptness with which the engine signals were obeyed.

At 3.40 p. m. we sounded in 625 fathoms, latitude 23° 06′ 00″ N., longitude 83° 05′ 45″ W., on the position assigned, in H. O. chart, No. 576, to the shoal reported by the Hattie Weston in 1880. There is no doubt as to this vessel having been on a reef, but it was the shore reef and not an isolated or outlying danger. I have no knowledge of the

methods adopted by the Hattie Weston for locating the shoal on which she struck, or whether her position was entirely by dead-reckoning. Assuming the latter to be the case, her probable position was on the reef to the westward of Bahia Honda.

It is a well-known fact that strong southwesterly currents are encountered between Havana and Cape San Antonio. I have myself experienced from half a knot to two knots per hour, and on one occasion it was setting so much on shore that I found it necessary to head off one point and a quarter at an average speed of about 12 knots under steam. Had we laid a course parallel with the reef, even with a good offing, we would have found ourselves in shoal water in a few hours, when by our reckoning we should have been at a safe distance off shore.

There is a note on H. O. chart No. 516 with reference to Colorado Reefs, which reads as follows: "These reefs are reported to extend further out." The prevailing current setting inshore has doubtless given rise to the note quoted above.

We made Cape San Antonio at 8 a. m. the following morning and commenced the work of sounding. The plan adopted was to run lines on and off shore, keeping the light-house on a certain bearing, and sounding at intervals varying from half a mile to two miles. The distance from the light-house was measured by a micrometer telescope whenever the elevation of the landmark would permit, and by a taffrail log when too far off shore to use the telescope. The run by log was checked by the first micrometer distance when approaching land. The bearing of the light-house was changed about one point for each line of soundings, varying somewhat when necessary to pass over the various positions assigned to Sancho Pardo Shoal, for which we were searching. The micrometer telescope was not available at night, but the run was checked at each end of the line offshore by the range of visibility of the light and inshore by the reef. The correct bearing of the light was maintained usually with little difficulty, although at times, particularly near the shore, the currents were so strong that without careful watching the vessel would change her bearing very rapidly.

The above-mentioned plan was adopted from necessity, as, owing to the peculiar form of the land near the cape and the fact that it is laid down incorrectly on the charts, cross-bearings were out of the question except at a very few of the stations.

Having run the first line inshore S. by E. (mag.), we stood off NNW. (mag.), and at 10.48 a. m. struck 15½ fathoms on Antonio Knoll, latitude 22° 00′ 42″ N., longitude 85° 02′ 00″ W., the latitude being obtained by meridian altitude of the sun with two observers and the longitude by bearing from the light-house. A boat was anchored in the above position and the shoal developed by the ship, 14½ fathoms being the least water found. The center of the knoll lies NNW. ½ W. (mag.) 9 miles from the light-house, and is about 2½ miles in length SW. ½ S. and NE. ½ N. by 1 mile in width. A depth of 10 fathoms has been reported on the knoll,

and although we failed to find it, I have no doubt that the reports are correct. The formation is coral and the whole surface very uneven, as shown by our soundings.

At 2.50 p. m. we hoisted the boat and continued the lines off and on shore until we pretty well covered the ground to the westward of the light. With the exception of Antonio Knoll, we found the water to deepen gradually as we left the reef until the thousand-fathom line was reached, from 15 to 20 miles off shore. There were 1,149 fathoms on the position originally assigned Sancho Pardo Shoal in 1606, and not less than 500 fathoms in any of the half-dozen localities in which it has been subsequently reported. I have no doubt that vessels found themselves unexpectedly in shoal water when by their reckoning they were in the several positions assigned to the shoal; but no navigator familiar with the strong currents in the region off the cape, after having examined our soundings, will find it difficult to connect them with Antonio Knoll, or even the Colorado Reefs. The remarkable distinctness with which the numberless coral growths can be seen on Antonio Knoll, through the clear blue waters of the Gulf, contributed, doubtless, in no small degree toward the erroneous impression that they were in much shoaler water than really existed in that locality.

The weather could not have been more favorable for our work, which was carried on day and night until the evening of the 4th, when we anchored near the Leña Cays. The longitude of Cape San Antonio lighthouse was obtained the next day by Lieutenant Schroeder, several sets of equal altitude of the sun being taken, and the meridian distance carried to Key West.

The height of the tower above the ground is 23.1 meters; height of base of tower above mean sea-level, 18 meters; height of light above mean sea-level, 39 meters; revolving light; period of brilliancy, 6 seconds; partial eclipse, 24 seconds; power of light, 1,440 carcel burners; longitude (Lieutenant Schroeder), 84° 57′ 38″ W., and is 100 yards from the beach.

The navigator returned at 5 p. m., and at 7 we got under way and ran a line of soundings NNW. (mag.) 20 miles from the light, where, according to the light-house keeper, the shoal had been reported. The depths increased gradually from Antonio Knoll to nearly 1,000 fathoms at the distance above-mentioned, which, taken in connection with depths on contiguous lines, makes the existence of a shoal in that position wholly impossible. We finished the soundings and started for Albatross Shoal at 1 a. m., and at 8.43 cast the lead a short distance outside of the reef in 388 fathoms, latitude 22° 41′ 20″ N., longitude 84° 15′ 00″ W. (mag.), then run 4 miles N. ½ W. (mag.) and sounded in 817 fathoms, then 4 miles further on the same course and sounded in 950 fathoms on the position assigned to the shoal on H. O. chart No. 516, latitude 22° 49′ 20″ N., longitude 84° 15′ 00″ W. We then run 4 miles E. ½ N. (mag.) and sounded in 801 fathoms, after which a course was laid for

Key West. The above positions were accurately obtained by cross-bearings of well-known points on shore, and the results of the three soundings show conclusively that no shoal exists in that locality.

We arrived at Key West at 5 a. m. on the morning of the 7th and anchored near the quarantine station. We were visited by the health officer between 8 and 9 a. m., and at 11 a. m. went alongside the coal wharf. The fires were hauled and boilers blown down preparatory to making temporary repairs, and at 1.30 p. m. we commenced coaling, and finished about 9 a. m. on the 8th, having taken on board $61\frac{1847}{2240}$ tons of anthracite coal.

At 2 p. m. on the 10th we got under way and stood out to sea, bound for Washington, D. C.

At 7.52 a. m. on the 12th we sounded in 470 fathoms, latitude 30° 46′ 00″ N., longitude 75° 35′ 00″ W., on the position of Huntley Shoal, H. O. chart No. 21, reported in 1833.

We then stood for another shoal, marked on H. O. chart No. 21. At 6 a. m. on the 14th we sounded in 2,537 fathoms, latitude 34° 14′ 00″ N., longitude 72° 35′ 30″ W., and at 5.12 p. m. sounded in 2,462 fathoms, latitude 34° 48′ 45″ N., longitude 72° 25′ 00″ W., on the position assigned to Orion Shoal.

This sounding completed the work planned for us; and we then made the best of our way to Washington, where we arrived at 4.10 p. m. on the 16th instant; hauled fires on the 17th, and commenced the work of refitting, preparatory to the summer's cruise.

The deck-house, forecastle, and poop-decks were caulked; otherwise there was but little to do to the vessel proper, except the usual cleaning, painting, &c. There were some slight repairs on the Sigsbee sounding-machine, and a supply of tangles and trawl-frames were made at the navy-yard. The Tanner sounding-machine was repaired at small expense. The galley required repairs to the extent of $5. It has given general satisfaction since the last improvements were made, and I have reported the fact to the Chief of the Bureau of Equipment and Recruiting, according to an agreement made when it was ordered.

The principal expense in time and money was on the boilers. The engines, pumps, and various special machinery required only the ordinary overhauling, being, as a rule, in excellent condition. The repairs on the boilers were completed on the evening of July 11, and at 4 p. m. the following day we left the yard and steamed down the Potomac, anchoring near Quantico for the night. We were under way again at daylight and anchored at Hampton Roads at 7.30 p. m. the same evening, going to the navy-yard, Norfolk, Va., early on the morning of the 14th, and into the dry-dock at 11 a. m., orders having been sent from the Navy Department to have the dock ready for us at that time. The water was pumped out of the dock during the afternoon, and on the following day most of the scraping was done and the first coat of paint was put on one side. The other side was finished the following day,

and on the 17th the second coat was put on. The vessel was hauled out of the dock and to the coal wharf at 2 p. m. on Friday, when we commenced coaling, finishing at 2 p. m. the following day, having taken on board 131 tons. We left the yard at 6 p. m. the same day and proceeded to sea. After passing the Capes we steamed off shore, keeping a lookout for surface fish, particularly menhaden and mackerel. In watching the migrations of these fish, our cruising ground last year was between the inner edge of the Gulf Stream and the coast, from the Capes of the Chesapeake to Cape Hatteras. To the northward of the Chesapeake our operations were confined mostly to the immediate vicinity of the coast, except, of course, our cruises to the Banks and the Gulf of Maine. Taking up the offshore search to the eastward of the Capes, we continued it between the northern edge of the Gulf Stream and the 100-fathom line as far as the meridian of Block Island. The only surface fish seen were two small schools of menhaden near the Capes of the Chesapeake, a school of porpoises, and two dolphins, which were in pursuit of small fish.

On the morning of the 20th, in latitude 37° 47′ 00″ N., longitude 74° 15′ 00″ W., near the 100-fathom line, we passed numerous dead octopods floating on the surface. This unusual sight attracted immediate notice and no little surprise among those who knew their habits, as it was not suspected at first that they were dead. We lowered a boat and picked up three or four specimens, which we were unable to identify, but in general appearance they resembled *Alloposus mollis* (Verrill) of unusually large size. These dead cephalopods were seen frequently on the 100-fathom line and outside of it from the position given above to the meridian of Montauk Point, a distance of 180 miles. They were less numerous, however, as we went to the northward and eastward. Several dead squid were seen also, and two specimens were picked up with a scoop net. The occurrence recalls the great destruction of tilefish in the same locality during the winter of 1882. Three hauls were taken with the trawl during the day between latitude 37° 50′ 00″ and 38° 01′ 15″ N., longitude 73° 53′ 30″ and 73° 44′ 00″ W., in from 155 to 568 fathoms, and, although we found the bottom unusually barren, many valuable specimens were procured. Among them were large quantities of quill-like worm tubes, some beautiful specimens of flabellum, free crinoids, shrimp, a few large crabs, large flat sea-urchins, shells, foraminifera, and the usual quantity of deep-sea fish (*Macruridæ* and *Gadidæ*). A set of serial temperatures and water specimens were taken. We steamed about thirty miles to the eastward during the night, and at 4 a. m. on the 21st sounded in 1,600 fathoms, took a set of serial temperatures and water specimens, and at 6.25 a. m. put the trawl over in latitude 37° 57′ 00″ N., longitude 72° 34′ 00″ W., and landed it on deck, after a successful haul, at 10.50 a. m.

We then steamed to the eastward thirty miles, and at 2.59 p. m. sounded in 1,594 fathoms, globigerina ooze, latitude 38° 15′ 00″ N.,

longitude 72° 03′ 00″ W.; and at 3 p. m. put over the beam-trawl, veering to 2,300 fathoms of rope. It was on the bottom at 5 p. m., dragged until 6.20, and was landed on deck at 7.52 p. m. Among the specimens taken were a large number of holothurians, new to us last year; large numbers and great variety of starfish, sea-anemones, hermit-crabs, flounders, and other deep-sea fish. The trawl came up after dark the last haul, and the specimens were collected from the table-sieve by aid of the arc light. The vessel was put under very low speed for an hour for surface towing.

On the morning of the 22d we sounded our way into the remarkable hole referred to during our last year's cruise, and at 7.52 a. m. we cast the lead in 452 fathoms, green mud, latitude 39° 33′ 00″ N., longitude 72° 18′ 30″ W., took a set of serial temperatures and water specimens, and at 9 a. m. put over the small beam-trawl. Four hauls were made during the day between the position given above and latitude 39° 29′ 00″ N., longitude 72° 05′ 15″ W., in from 87 to 452 fathoms. In addition to our catch of the previous day, we took quite a number of pole-flounders and a large proportion of deep-sea fish. At 6.50 p. m., having finished dredging for the day, we hove to and drifted until 4 a. m. the following morning, when we sounded in 510 fathoms, black mud, latitude 39° 30′ 10″ N., longitude 71° 50′ 00″ W., and at 4.35 put over the beam-trawl. Four hauls were made during the day between the above position and latitude 39° 25′ 30″ N., longitude 71° 44′ 00″ W., in from 510 to 861 fathoms, with very satisfactory results. Among the many valuable specimens taken was a large cephalopod, genus *Eledone;* about 50 large red crabs, *Geryon quinquedens* (Smith), which we found last year; many shrimps; a small cephalopod, genus unknown; and an unusually large number of fish, mostly *Macrurus*, other varieties being, however, well represented. A set of serial temperatures and water specimens were taken after the last haul. The water specimen from 500 fathoms requires special mention from the unprecedented amount of gas it contained. When placed in the specific-gravity cup the escape of gas was perceptible to the eye and the rapid rising of bubbles made it impracticable to obtain the specific gravity for the moment. The operator, noticing the peculiarity, turned the water into a specimen bottle and sealed it as soon as possible, and even then after the loss of a large quantity of gas, it had very much the appearance of soda-water. This was so remarkable that we immediately sent down three water-bottles and thermometers, the specimens showing a large quantity of gas, but nothing like the former one. The ship had drifted about ¼ of a mile between the taking of the first and second specimens. The temperatures were uniform at 40° F.

It will be recollected that we experienced great difficulty in taking serial temperatures during the winter cruise in the Caribbean Sea from the mercury shaking down and filling the tubes of the Negretti & Zambra deep-sea thermometer. We used what is known as the Tan-

ner case and Sigsbee clamp, by which the thermometer was secured rigidly to the sounding-wire or temperature-rope, thereby transmitting all vibrations to the instrument, causing the mercury to shake down, as before mentioned. With a view of overcoming this difficulty we suspended the thermometer in its metal case by a rubber-lined thimble and delicate spiral spring at each end, allowing it a free vertical movement, intended to absorb all vibrations or jars resulting from surging of the temperature-rope or other causes incident to service under the various conditions of wind and sea. We have taken a large number of temperatures this trip, without a single failure, from causes above mentioned, and congratulate ourselves on our success in overcoming what has been to us a serious obstacle to the rapid and successful observation of serial temperatures.

At 6.35 p. m. we started for Montauk Point, under steam and sail, the weather clear and pleasant, with a brisk SW. breeze, but during the evening a heavy bank rose from the northward, and at 10 p. m. the wind came out from that direction, making it necessary to take in sail. The sky was overcast with drizzling rain during the latter part of the night, and after daylight a thick fog set in, which continued until we passed Montauk Point, about 6 a. m., when it cleared up and we proceeded to Napeague Bay, anchoring at 7.45 a. m. An officer was sent to the Excelsior Oil Factory to collect information regarding the menhaden fishing during the present season. He was cordially received by the superintendent, who made the following statement: "This factory employs two working gangs, running the works night and day. Two steamers are employed, and double the number of fish have been taken this season that were caught last year. All the factories in Promised Land are doing equally well. Last year 1,143,000 fish were taken by the two steamers up to July 24, and the present season one boat has taken 2,500,000; the other one, being temporarily disabled, has not made so good a record. The fish were taken from Fire Island to the eastward, also in Long Island Sound, where an ample supply has been found, making it unnecessary to go to the New Jersey coast as we have usually been obliged to do. They are very large and fat, those from Long Island Sound averaging from 7 to 8 gallons of oil per thousand, and those from the south coast of Long Island from 4 to 5 gallons per thousand. We have as much oil now as we made all last season. All the factories of any account in Long Island Sound are in operation this year; namely, seven in Promised Land, two in Sag Harbor, and two in Shelter Island. Edible fish are frequently taken in small numbers with menhaden, and sharks are very troublesome, particularly this season, large numbers of them getting in the seine at times. Mackerel were seen in schools off Shinnecock early in June."

The boat having returned to the ship we got under way at 10.30 a. m., and steamed to Block Island, anchoring at 2.25 p. m. An officer was sent ashore and called on Mr. Nicholas Ball, who stated that the mack-

erel fishing was much better than usual on the Block Island ground. The first fish were taken on the 10th of June. Cod and striped bass are scarce, but swordfish are very plentiful. Bluefish are also taken in large numbers. Fishermen are making from seven to eight dollars a day.

We left Block Island at 3.30 p. m. and anchored at Newport at 5.48 p. m. Several fishing schooners were cruising near Point Judith and between there and Newport, but none of them had boats out. We saw no fish on the trip.

It was our intention to leave port at daylight the following morning, but were detained until 11.40 a. m. by thick rainy weather. It cleared at that time, however, and we got under way and proceeded to sea. We passed seven fishing steamers between Brenton's Reef light-ship and Point Judith; several of them had boats out, and menhaden seemed to be plentiful. We saw at least a dozen schools.

No fish were seen outside of the latter point, except two small schools of tinker mackerel between Block Island and Cox's Ledge. At 2.45 p. m. we cast the lead in 21 fathoms, coarse sand, on this ledge, and put over a couple of cod lines to try for fish. A cod was taken as soon as the line reached bottom, and the order was then given to put the lines out. About twenty were used by the officers and crew, very few of whom were expert fishermen. Nevertheless, fish began to come in quite rapidly, and after two hours' work we had taken 85 cod, the largest weighing 25½ pounds, 13 hake, 3 pollock, 1 deep-sea perch, and 4 sculpin. They were placed in a large dredging-tub as soon as caught and a stream of water from the steam hose turned into it, keeping them alive. After we stopped fishing, Mr. Benedict carefully examined the catch for parasites, finding quite a large number. We caught 35 cod on this ground the 23d of October, 1883, and made a careful search for parasites, but failed to find even a single specimen, which would seem to indicate that the season of the year had some influence on the presence of these pests. Before leaving the fishing-ground we put a small beam-trawl over, intending to tow it rapidly through the water near the bottom, in order to test the practicability of taking fish in that manner. Unfortunately for the success of our experiment, we veered too much rope for the speed we were making, and the trawl took the bottom, caught on some obstruction, and parted the dredge-rope. There were several small schooners in the vicinity during the afternoon fishing for swordfish. We saw one large fish and sent a boat after it, but it disappeared before they reached the spot where it was seen.

At 5.15 p. m. we stood inshore and anchored in Tarpaulin Cove for the night. We were under way again at 4.45 a. m. on the morning of the 26th, arriving in Wood's Holl at 5.58 a. m.

The machinery, including the motive power, dredging and sounding engines, electric apparatus, &c., worked satisfactorily. The boilers, however, still gave us trouble.

The weather was squally and rainy until the 29th. The repairs to the boilers were completed on the 28th, and steam raised preparatory to going to sea. It was our intention to make a trip to the tilefish ground, but failing to procure bait we were detained in port over night, and the following day being thick and rainy we remained at our moorings until 9 a. m. July 31, when we left for Newport to procure menhaden for bait, and arrived there at 1.20 p. m.

On our arrival a telegram was received from the Chief Signal Officer, informing us that bad weather might be expected; and, as our principal work would be in boats, we decided to remain in port until the storm was over.

We left Newport August 1, having procured a supply of fresh menhaden, and stood to the southward. At 3.40 p. m. we hove to on Cox's Ledge and fished about two and a half hours with hand-lines, meeting with indifferent success. Large numbers of hake and dogfish were caught, but only a few cod. After the lines were in we put over the circular towing-net, having a ring ten feet in diameter and twenty feet length of net, to try rapid towing near the bottom for fish. We steamed at the rate of about five knots per hour for half an hour and hauled it in. There were no fish in the net, but a few starfish and shells showed that it had reached bottom occasionally. At 7.37 p. m. we stood to the southward to reach our fishing-ground at daylight of the following morning. The trawl-line, containing 1,000 hooks, was baited during the night. A school of menhaden was seen outside of Brenton's Reef light-ship, and a swordfish on Cox's Ledge. With these exceptions no surface fish were seen during the day.

Light SW. winds, hazy weather, and smooth sea were experienced on the 2d. At 5.24 a. m. we set the trawl-line in 101 fathoms, green mud and fine sand, latitude 40° 03′ 00″ N., longitude 70° 38′ 00″ W. The boat returned at 9.45 a. m. with 103 hake, 2 whiting, 1 large skate, and 49 dogfish, but no tilefish. The line was set again at 1.25 p. m. in 136 fathoms, green mud and sand, latitude 40° 00′ 15″ N., longitude 70° 55′ 30″ W., the boat returning at 5.40 p. m. with 68 hake, 4 whiting, and 5 large skates. No tilefish were taken. We made three hauls of the trawl during the day on the slope near the fishing-boat, where we found many of the forms discovered by the Fish Hawk in 1880. All fish taken were examined, and numerous parasites found. Some of the whiting had partially-developed roes, and in the numerous dogfish were found recently-impregnated eggs and half-grown embryos. Life on the surface was very meager, a few petrels and one swordfish being all that was seen.

Light SE. to SW. winds prevailed on the 3d with cloudy weather and an occasional shower during the first part. The sea was smooth and everything favorable for our work. At 5.30 a. m. we set the trawl-line in 113 fathoms, green mud and fine sand, latitude 40° 01′ 30″ N., longitude 71° 12′ 30″ W., the catch being 98 hake, 15 whiting, 3 skates, and

1 dogfish. At 2.07 p. m. we set the line again in 237 fathoms, green mud and fine sand, latitude 39° 54′ 30″ N., longitude 71° 08′ 00″ W., the catch being 5 large skates and 1 whiting. We hardly expected to take many fish at the depth in which we set the line, but having tried shoaler water without success, we considered the experiment worth a trial. We were somewhat surprised at the absence of hake on the line, as we were not out of their depth, for we took large numbers of them in the immediate vicinity with the trawl-net. Two hauls of the trawl were made during the day, and a set of serial temperatures and water specimens taken in the evening.

During the early part of the 4th we had light SW. winds, cloudy weather, and occasional showers. It cleared, however, before noon and ended with a brisk breeze from SSW., and clear, pleasant weather. At 4.30 a. m. we sounded and put the trawl over in 600 fathoms, green mud, latitude 39° 49′ 30″ N., longitude 70° 26′ 00″ W. It loaded up so heavily that much time was expended in heaving it to the surface, and then we did not succeed in landing it on board until the bridle-stops parted and relieved the trawl of most of its load. It was a good haul, notwithstanding the loss, several valuable specimens being found in the net. It was lowered again at 10.53 a. m. in 1,180 fathoms, latitude 39° 40′ 00″ N., longitude 70° 20′ 15″ W., but failed to reach the bottom, although more than the usual allowance of rope was given it. Several specimens were taken, however, from intermediate depths, and the contents of the wing-nets possessed more than usual interest, owing to the rapid towing.

The next haul, in 961 fathoms, green mud, latitude 39° 45′ 30″ N., longitude 70° 17′ 00″ W., was an unfortunate one, as the trawl buried in the soft mud so deeply that we were unable to clear it, even after hours of careful manipulation, and were obliged to break the rope. Fortunately it parted near the end, the loss being confined to the trawl itself and the wing-nets. A set of serial temperatures and water specimens were taken during the evening to a depth of 700 fathoms. We were surrounded by the usual number of petrels during the day, and several dolphins were seen about the ship. With the above exceptions no life was seen on the surface. It was our intention to set the trawl-line again, but the sea was rather rough for boat-work, so we decided to pass the time in dredging, which we could carry on in comparative comfort, even with a moderately heavy sea.

At 5.30 a. m. the following morning we lowered the trawl in 1,060 fathoms, latitude 39° 46′ 30″ N., longitude 70° 14′ 45″ W., and made a successful haul. We sent it down again in 1,122 fathoms, latitude 39° 44′ 30″ N., longitude 70° 10′ 30″ W., at 11.20 a. m., and brought up a heavy load of stones with a fair proportion of specimens. At 3.15 p. m. we sounded in 1,140 fathoms, latitude 39° 43′ 45″ N., longitude 70° 07′ 00″ W., and put over the trawl. After landing it on deck at 6.55 p. m., we found the tail folded snugly over the beam, closing the net entirely.

This was the first accident of the kind for nearly two years. There were a few specimens taken in the folds of the net, and the wing-nets brought up their usual collection of minute forms. At 7.13 p. m. we put the trawl over again in 1,058 fathoms, latitude 39° 44′ 00″ N., longitude 70° 03′ 00″ W., and at 11 p. m. landed it on deck after a successful haul. As soon as it was up we steamed to the southward, and at 4.45 a. m. sounded in 1,230 fathoms, latitude 39° 35′ 00″ N., longitude 69° 44′ 00″ W., and put the trawl over, landing it on deck again at 9 a. m. after a successful haul. The southerly swell was still rolling in, but had become more regular, and as the wind had moderated to a gentle breeze, we concluded to set the trawl-line again, and stood to the northward for that purpose.

At 11.30 a. m. we sounded and set the trawl-line in 84 fathoms, sand, gravel, and broken shells, latitude 39° 56′ 30″ N., longitude 69° 43′ 00″ W., the catch being 15 hake and 8 dogfish. Having failed to discern any sign of the presence of tilefish after examining the whole region where they have been taken heretofore, it would, I think, be safe to assume that they have abandoned that locality. Four hauls of the trawl were made while the fishing party was away, in the immediate vicinity of the above position, the material procured being the well-known forms we have dredged from this region in former years. Our bait and alcohol being expended we started for port at 6 p. m. The weather was clear and pleasant, with SW. airs, but at 10 p. m. we ran suddenly into a dense fog-bank, seen ahead for an hour or more, and from that time to our arrival in Wood's Holl, at 1 p. m. on the 7th, we were groping our way through it.

We were employed during the 8th in cleaning ship, overhauling apparatus, &c., and on the 9th hauled fires to clean and repair boilers. A schooner with coal for us arrived early on the morning of the 14th, and we took on board $101\frac{1}{2}\frac{2}{4}\frac{1}{6}$ tons during the day.

Preparations for a dredging trip were completed on the 16th, and at 4 p. m. on the 18th we left port and steamed to the southward for about latitude 39° 40′ 00″ N., longitude 71° 35′ 00″ W., where we proposed to commence work at daylight the following morning. The wind was light to moderate from SW., with a smooth sea. At 9 p. m. a thick fog set in, which continued through the night. The usual outlook was kept for surface fish; none were seen, however, except a school of porpoises early in the evening.

At 6.10 a. m. on the 19th we sounded in 538 fathoms, latitude 39° 39′ 45″ N., longitude 71° 35′ 15″ W., and put the trawl over. Four successful hauls were made during the day in the same locality, the depth of water varying from 500 to 700 fathoms. The hauls were particularly rich in the large red crabs (*Geryon quinquedens*) peculiar to this locality, between fifty and sixty being taken. Several being prepared they were eaten by the officers, who were unanimous in the opinion that they were very sweet and palatable. Several species of cephalopods were taken,

besides fish, sea-urchins, starfish of various kinds, and many fine specimens of flabellum. Dead octopods (*Alloposus mollis*) were passed frequently during the day. Gulls were seen flying about the ship, an unusual occurrence with us in this locality, and large numbers of petrels were hovering around us. At 4.18 a. m., August 20, we sounded in 1,073 fathoms, and put the trawl over, latitude 39° 35′ 00″ N., longitude 71° 18′ 45″ W. Three hauls were made during the day, the first two very successful, and the last, although containing a fair number of specimens, was remarkable principally for the enormous load of mud brought up in the net, which must have buried as soon as it struck bottom. It required hours of labor and most careful handling to get it on board. A set of serial temperatures and water specimens were then taken to a depth of 800 fathoms, after which we steamed ahead slowly for an hour, to allow of surface towing. Later in the evening we hove to, and with the assistance of the submarine electric light took a large number of squid and several small surface fish. The hauls during the day were particularly rich in deep-sea fish, holothurians, benthodytes, anthozoa, ophiurans, sea-urchins, &c. A large number of *Geryon* were taken also.

The 21st commenced with moderate SW. winds, smooth sea, and squally, rainy weather, continuing until about 8 a. m., when it cleared. At 5.20 a. m. we sounded in 1,178 fathoms, latitude 39° 33′ 00″ N., longitude 71° 16′ 15″ W., and put the trawl over. Four hauls were made during the day, three of them successful, but the last was very light. The character of the specimens was much the same as those taken on the 20th, with the addition of a brachiopod shell, which is exceedingly rare in this locality.

The weather continued good during the 22d, when five hauls of the trawl were made in the vicinity of latitude 40° 00′ 00″ N., longitude 70° 30′ 00″ W., in from 384 to 963 fathoms. The bottom was composed of a soft and exceedingly tenacious mud, which would not wash through the meshes of the net. The first three hauls were composed principally of this material, the specimens being very few compared with the numbers usually found in the same depths a few miles to the eastward. The last two hauls were better, a number of valuable specimens being taken.

The wind gradually increased during the 23d until at dark we had a brisk breeze and moderate swell, with falling barometer and unsettled weather. The trawl was lowered at 5.37 a. m. in 924 fathoms, latitude 39° 47′ 20″ N., longitude 69° 34″ 15′ W., and brought up an enormous load of mud with a few good specimens. The dredge-rope stranded at a splice while heaving in, 1,380 fathoms from the end, and, in order to repair it with as little delay as possible, the deep-sea dredge was lowered and rope veered until the bad place was reached, when a strand was put in. The dredge, which had been dragging slowly on the bottom, brought up a number of specimens. Four hauls were made during the day, with fair success, and a set of serial temperatures and water specimens was taken in the evening.

The fish taken during the trip represent forty-three species, fifteen of which we were unable to identify. Among those occurring in the largest numbers may be mentioned the *Macrurus Bairdii*, pole-flounders, *Synaphobranchus pinnatus*, *Histiobranchus*, and *Haloporphyrus*. A chowder was made from the last-named fish one day, which was eaten by all the officers and naturalists, the universal opinion being that it was a good chowder, *almost* as good as it would have been *without the fish*. Nearly the same species were taken at each haul, varying somewhat in numbers.

At 10.05 p. m. we started for port. The weather was squally, with occasional showers and lightning from NW. At 3.40 a. m. on the 24th we ran into a thick fog, which lasted till 9.30 a. m., at which time we were near No Man's Land. We arrived in Wood's Holl at meridian and made fast to our moorings.

The specimens taken during the trip were landed the following day, the starboard boiler was blown down for cleaning and repairs, the dredge-rope spliced where it stranded during the trip, and preparations were made for coaling. The weather was squally and rainy during the day.

At meridian August 26th, we left Wood's Holl for Newport, R. I., under the following orders:

U. S. COMMISSION OF FISH AND FISHERIES,
Wood's Holl, Mass., August 26, 1884.

SIR: A telegram just received from the Secretary of the Navy inquires whether he can borrow the steamer Albatross for a week. If the vessel is in a suitable condition to move, or can be readily made so, you will proceed to Newport and report to the Secretary for such duty as he may wish to assign you for the period in question. While in Newport, should you find it expedient to take on board coal for the vessel before returning to Wood's Holl, you will do so. You will also report your arrival at Newport by telegraph, and keep me duly informed of the general movements of the vessel.

Very respectfully,

S. F. BAIRD,
Commissioner.

Capt. Z. L. TANNER,
Commanding Steamer Albatross, Wood's Holl, Mass.

Reported at Newport 5 p. m., August 26, 1884.

WM. E. CHANDLER,
Secretary of the Navy.

The weather was thick and foggy in the Sound, but became more favorable as we approached Newport, where we anchored at 4.50 p. m., and at 5 p. m. I reported for duty to the Secretary at the torpedo station, as indicated by his indorsement on the orders above quoted. He visited the ship at once, accompanied by Capt. Thomas O. Selfridge, U. S. N., commandant of the station, inspected the vessel, her quarters,

&c., made an appointment for the following morning, and at 6 p. m. left the ship, returning to the torpedo station.

The Despatch, flying the flag of the President of the United States, was lying in the inner harbor, and the following vessels of the North Atlantic fleet were at anchor outside of Goat Island: The Tennessee, flying the flag of Acting Rear-Admiral Luce; Swatara, Vandalia, and Alliance. The monitors Passaic and Nantucket, and the torpedo-boat Alarm were at moorings near Coaster's Harbor Island.

At 9.20 a. m. on the 27th the fleet got under way and steamed up Narragansett Bay, anchoring off Conanicut Park to await the arrival of the President and the Secretary of the Navy. At 11.50 the Despatch, flying the flag of the President, steamed up the bay, followed by the Albatross at 11.55, flying the flag of the Secretary of the Navy at the main. We soon joined the fleet and took a favorable position to witness torpedo practice by the several vessels, after which we returned to Newport, anchoring in the inner harbor near the Despatch.

The services of the vessel were not required on the 28th, the day being spent by the President, Secretary of the Navy, officers of the fleet, and invited guests at the torpedo station, witnessing various experiments and inspecting the buildings and workshops. The President was saluted with twenty-one torpedoes when he landed on the island.

At 9.15 a. m., on the 29th, the fleet got under way and proceeded to sea. The Albatross, with the Secretary of the Navy and a distinguished party on board, followed at 10.55 a. m. The iron-clads that had gone out during the morning were met off Beavertail, standing in.

We joined the fleet to the eastward of Point Judith about noon, and witnessed target practice, tactical exercise, and, finally, sail and light-spar drill. The Despatch, flying the President's flag, joined the fleet in time to see the later evolutions and sail exercise. We returned to Newport in company with the fleet, and anchored at 3.45 p. m.

The weather was overcast on the morning of the 30th with light westerly winds. Heavy rain set in about 4 p. m. and continued during the evening. At 9.15 a. m. the fleet got under way and steamed up the bay, anchoring off Coddington Point, where the Despatch, flying the President's flag, and the Albatross, bearing the flag of the Secretary of the Navy, joined them at 12.10 p. m. A landing party was sent on shore from the fleet about 1 p. m. and had a sham battle, was reviewed by the President, and returned on board about 3 p. m., when the fleet returned to its former position outside of Goat Island. At 4.15 p. m. the Despatch and Albatross got under way and steamed around the fleet in company. The yards were manned and a salute of twenty-one guns fired in honor of the President, after which both vessels steamed to the inner harbor and anchored at 4.56 p. m.

The weather was overcast and rainy during the morning of the 31st, clearing at noon. At 2.30 p. m. we got under way for Wood's Holl, having the Secretary of the Navy on board. Soon after 4 p. m. we ran

into a fog, making it necessary to feel our way very carefully. The Vineyard Sound light-ship was sighted at 5 p. m., and taking our departure from it we ran to the vicinity of Tarpaulin Cove and hove to until 7 p. m., when, the fog lifting a little, we saw the light and stood in, anchoring at 7.27 p. m. for the night. The wind veered to NW. soon after, and the weather became clear and pleasant.

At 4.43 a. m. the following morning, September 1, we got under way, arriving in Wood's Holl at 5.20 a. m. The Secretary visited the wreck of the Tallapoosa during the day, and on his return was met by Com. J. G. Walker, Chief of the Bureau of Navigation, and Chief Constructor T. D. Wilson, who came here by direction of the Secretary to confer with him on matters pertaining to their respective Bureaus. The party remained on board during the night, leaving by train on the morning of the 2d, when the Secretary's flag was hauled down and the work of the Commission resumed.

The wire on the working reel was overhauled and splices renewed where they showed signs of wear. Fires were hauled and repairs commenced on the starboard boiler. We coaled ship on the 3d, taking on board $79\frac{2}{2}\frac{0}{4}\frac{1}{0}\frac{3}{0}$ tons. Repairs on the boilers were completed on the evening of the 4th, and at 4.20 p. m. on the 5th we cast off from our moorings and started for an offshore dredging trip. Passing No Man's Land at 7 p. m. we laid a course S. § W. per compass, intending to reach a depth of about 1,500 fathoms by 9 a. m. the following morning. The night was exceedingly pleasant, with moderate SW. wind, a smooth sea, and the full moon shining brightly in a cloudless sky.

At 9 a. m. on the following morning we sounded in 1,525 fathoms, latitude 39° 05′ 30″ N., longitude 70° 44′ 30″ W., and at 9.57 put the trawl over with wing-nets and mud-bag attached. It was landed on the bottom at 11.34 a. m., with 2,200 fathoms on the dredge-rope, dragged until 12.39 p. m., and landed on deck at 2.13 p. m. after an unusually rich haul. At 2.20 p. m. we sounded again in 1,537 fathoms, latitude 39° 03′ 15″ N., longitude 70° 50′ 45″ W., and at 3.03 p. m. put the trawl over with wing-nets and mud-bag attached, as usual, veering to 2,300 fathoms on the dredge-rope. It was landed on deck at 7.51 after a successful haul, and at 7.53 we started ahead full speed on a southerly course to deepen the water.

Although this report is intended merely to chronicle the movements of the ship and the mechanical operations performed in procuring specimens, leaving the purely scientific data in the hands of the naturalists, it may not be out of place simply to mention some of the principal objects of interest. In our hauls to-day a large quantity of foraminifera was procured, not only in the mud-bag secured to the tail of the trawl-net, but in the trawl itself; particularly in the first haul. Immense numbers of small ophiurans were taken in both hauls, the lower portion of the trawl-net being literally covered with them; several specimens of small brachiopods exceedingly rare in this region

were taken in the first haul, besides three species of starfish, small ascidians, several species of anthozoa, one very large shrimp and numerous smaller ones, a variety of shells, and several benthodytes, the largest we have ever taken. A remarkable feature of the last haul was the bringing up of several bricks with a quantity of mortar. Conjecture was rife as to the origin of our peculiar catch, the classical mind suggesting that we had been raking over the chimneys of famed Atlantis; whereupon the practical man destroyed all romance by the matter-of-fact statement that it was in all probability the discarded try-works of some homeward-bound whaler.

At 4.40 a. m. on the 7th we sounded in 2,516 fathoms, latitude 37° 48′ 30″ N., longitude 69° 43′ 30″ W., and at 6.42 put the trawl over with usual attachments of wing-nets and mud-bag, veering to 3,800 fathoms on the dredge-rope. While the trawl was down a boat was lowered and a large dead octopus secured from the surface. The trawl was landed on deck at 1.20 p. m., but had no bottom specimens; there were, however, several shrimp, one squid, and nine *Cyclothone lusca* in the trawl, besides many small crustaceans in the wing-nets. The current of the Gulf Stream was running between 3 and 4 knots per hour, which, even with every precaution, prevented our landing and retaining the trawl on the bottom. While heaving in, the dredge-rope stranded 1,996 fathoms from the end, and we were obliged to run that amount overboard with a sinker attached, and repair the damage by putting in a new strand. This occupied us until 6 p. m., when we took a set of serial temperatures and water specimens to 1,000 fathoms. A comparison of this series with others taken on opposite sides of the Gulf Stream will show conclusively the depths to which its waters penetrate the ocean bed. The taking of serial temperatures in a 4-knot current is by no means a simple operation, and wholly impracticable with our ordinary methods. It is our custom to use the dredge-rope with a hundred-pound sinker attached for taking serial temperatures and water specimens, but the vibration of the rope was so great in the present instance that it played havoc with the thermometer readings, and obliged us to resort to the sounding-wire. Even then we could use only two thermometers at a time, which made it a slow and tedious operation.

Marine life was more plentiful during the day than usual. A school of finback whales was seen during the forenoon, and occasionally a sea-bird. A school of blackfish passed us about dusk, and a small gray bat, which had been hovering about the ship for a day or two, was captured and kept alive. After dark the submarine electric light was brought into requisition, and by its aid a shark 7 feet 3 inches in length was captured, and five young about 6 inches in length were taken from it. A sucker-fish (*Echeneis remora*) was also captured. It clung tenaciously to the shark until landed on deck, when it was forcibly removed. The larger fish was carefully examined for parasites, without, however, meeting with success.

At 7 a. m. the following morning we sounded in 2,574 fathoms, latitude 36° 16′ 30″ N., longitude 68° 21′ 00″ W., and at 8.31 put over the trawl, with the usual attachments, veering to 3,800 fathoms on the dredge-rope, landing it on the bottom at 11.05 a. m. It dragged until 1 p. m., when we began heaving in, and at 1.24 the rope parted at 3,400 fathoms, under a strain of 5,000 pounds. It broke inboard, and, fortunately, the loose end caught under the guard of the block at the boom end, holding the rope under a tension of over two tons until we could secure it. It was spliced, and the trawl hove up and landed on deck at 7.40 p. m., after a successful haul, although the amount of material was no larger than usual in the same depth. The mud-bag came up full of ooze, rich in foraminifera, and in the trawl were two dozen *Ophioglypha convexa*, several shrimp, shells, one large galacantha-like form, several fragments, and one whole octopus, besides one specimen of *Sternoptyx diaphana*. A variety of minute crustaceans was as usual found in the wing-nets. A set of serial temperatures and water specimens to 1,000 fathoms was taken after the trawl was up. A few sea-birds and a solitary shark were the only evidence of marine life seen during the day. At 9.35 p. m. we started ahead WSW. ¼ W. per compass to change the ground.

At 5.07 a. m. on the 9th we commenced to sound, but the stray-line parted when 600 fathoms had run out, obliging us to reel in the wire and begin again. The sinker and sounding-rod were lost. At 6.07 we got bottom in 2,513 fathoms, latitude 36° 05′ 30″ N., longitude 69° 51′ 45″ W., and at 7 a. m. put the small trawl over, with wing-nets and mud-bag attached, landing it on the bottom at 9.23 with 3,300 fathoms of rope out. The splice in the rope at 3,400 fathoms was renewed while the trawl was dragging. We commenced heaving in at 12.30 p. m., landing the trawl on deck at 3.06 p. m., with an enormous load of clay and a fair collection of specimens. The mud-bag came up full of blue and gray clay with a mixture of ooze, containing a small amount of foraminifera. In the trawl wings we found a few crustaceans, and in the trawl itself was the load of clay above-mentioned, several *Ophioglypha convexa*, a number of large cephalopods in good condition, nearly a bucketful of small stones, several shells, a small piece of wood, and two unknown fish. After the trawl was landed on deck, serial temperatures and water specimens were taken to a depth of 1,000 fathoms, and at 5 p. m. we started ahead WNW. per compass to change our station. After running all night we sounded at 5 a. m. the following morning in 2,045 fathoms, latitude 37° 00′ 00″ N., longitude 71° 54′ 00″ W., and at 6.20 put the small beam-trawl over with wing-nets and mud-bag attached. It landed on the bottom at 8.20 with 3,000 fathoms of rope out, and at 9.58 we began heaving in, landing it on deck at 12.15 p. m. The rope stranded at 2,500 fathoms while heaving in, causing a delay of half an hour repairing it. At 12.20 p. m. we sounded in 2,109 fathoms, latitude 36° 55′ 23″ N., longitude 71° 55′ 00″ W., and at 1.15 put the small trawl over, with attachments as before, landing it on the bottom at 3.25 with 3,200 fathoms of rope

out. After dragging an hour the trawl buried in the mud and clay of the bottom and was lost, together with the wing-nets and mud-bag.

In the first haul several valuable specimens were taken. Among them were three very large red shrimp and many smaller ones, a variety of anthozoa, ophiurans, *Ophioglypha convexa*, several species of starfish, including a rare *Archaster*, shells, &c. A few crustaceans were found in the wing-nets, and the mud-bag was filled with rich foraminiferous ooze. Several varieties of fish were taken, among them a large number of *Macrurus asper*, a few *Cyclothone lusca*, and a single specimen of *Sternoptyx diaphana*. A set of serial temperatures and water specimens were taken to 1,000 fathoms, and at 9 p. m. we started ahead W. ½ N. per compass for the night. The hauls described above were taken about the center of the Gulf Stream, with a current of 2 knots or more per hour; a condition which would be rather favorable than otherwise in shoal water, but in depths exceeding 2,000 fathoms it complicates matters more than one would believe, unless one had experienced the perplexities of keeping the trawl on the bottom without kinking the rope or burying it so deeply as to lose the outfit.

We left the Stream between 4 and 5 o'clock the following morning, the water changing from 83° to 78° Fahr.; and at 5 a. m. sounded in 1,582 fathoms, latitude 37° 25′ 00″ N., longitude 73° 06′ 00″ W. The trawl was lowered at 5.37, the dredge-rope veered to 1,984 fathoms, and the vessel allowed to drift while a splice was made 2,000 fathoms from the end, where the rope stranded. The trawl was landed on deck at 11.25 a. m., with an enormous load of mud and a variety of valuable specimens. A sounding was then taken in 1,600 fathoms, latitude 37° 22′ 53″ N., longitude 73° 06′ 30″ W., and a set of serial temperatures and water specimens obtained to 1,000 fathoms. We then steamed to the northward and westward until 4.12 p. m., when we sounded in 1,423 fathoms, latitude 37° 38′ 40″ N., longitude 73° 16′ 30″ W., and at 4.54 put the trawl over, landing it on the bottom at 6.10 p. m., with 2,100 fathoms on the dredge-rope. It dragged until 7.05 and was landed on deck at 8.35, proving an excellent haul. At 9.30 p. m. we started ahead NNE. per compass to change our station.

Among the many valuable specimens taken during the day may be mentioned a variety of anthozoa, large quantities of foraminifera, several specimens of benthodytes, large quantities of *Archaster grandis*, and other varieties of starfish, shells, worm-tubes, some very small holothurians, and a heavy load of a substance which resembled cinders from a furnace, both in color and form, but there the resemblance ceased. It was light and quite soft, crumbling under pressure of the hand, and cutting readily with a knife. It came up in fragments from the size of a silver dollar to a foot in diameter, and from ½ inch to 1½ inches in thickness. There were many burrows, or worm holes, running through the mass, some of them three-eighths of an inch or more in diameter. From appearances I should judge that this peculiar sub-

stance formed a crust underlying a thin covering of ooze through which it frequently cropped out, as many of the fragments were covered with anthozoa, shells, and worm-tubes. The mud-bag, which is simply a boat-dredge with a tight canvas bag attached to the end of the trawl-net, was filled with soft foraminiferous ooze, but there was none of the substance referred to above, indicating that it had simply skimmed along the surface without penetrating the dense medium below. There were not many fish taken; a few *Macrurus asper*, *Haloporphyrus viola*, and *Licodes* being the most important.

At 4.37 a. m. on the 12th we sounded in 1,168 fathoms, latitude 38° 27′ 00″ N., longitude 73° 02′ 00″ W., and at 5.17 put the trawl over, veering to 1,800 fathoms on the dredge-rope. It was landed on deck again at 8.33 a. m. Three more hauls were made during the day, all of them fairly successful. Enormous loads of mud were brought up, rendering the work of hoisting rather tedious, but it served the purpose of protecting delicate specimens, the result being that our catch was as a rule in excellent condition. The result of the day's work may be summarized as follows: ooze, mud, and clay from the trawl-net, mud-bag, and on one occasion even the wing-nets gave us many minute shells, foraminifera, and worms. Several specimens of *Octopus Bairdii* were taken in good condition. *Benthodytes* were plentiful, and *Geryon quinquedens* were found in large numbers in some of the hauls. Shrimp, worms, shells, starfish, and ophiurans were more or less abundant. Two species of *Archaster* were taken. As we were operating in comparatively shallow water the number and variety of fish was notably increased. *Haloporphyrus viola* were found in considerable numbers, and a few specimens of *Macrurus asper*, *Halosaurus macrochir*, *Chauliodus Sloani*, and *Macrurus Bairdii* were taken. *Phycis Chesteri*, whiting, small skates, and pole-flounders were more plentiful, while single specimens only were found of *Halieutæa senticosa*, *Alepocephalus*, the snipe, and long-nosed eels, &c. Three unknown species were taken. Serial temperatures and water specimens were taken in the evening, after which we steamed to the northward and eastward to change our working ground.

The weather, which had been exceptionally pleasant during the trip, became squally and unsettled in the morning, with brisk winds from NE., moderating, however, toward evening. We were visited during the day by several small land-birds, a fish-hawk, a couple of small bats; schools of porpoises and blackfish were seen also. Attempts were made to capture a porpoise, but they kept out of reach of our harpoons.

At 4.30 a. m. on the 13th we commenced work in 810 fathoms, latitude 39° 09′ 00″ N., longitude 72° 13′ 15″ W., making five hauls during the day. All of them were successful except the last, when the net came up empty, the lashing having parted. Large numbers of *Geryon quinquedens*, large soft sea-urchins, shells, shrimps, *Flabellum Goodeii*, and starfish were taken; also a large quantity of foraminifera and

crustacea. The collection of fish was quite extensive and interesting, although well-known, a single specimen only remaining unrecognized. The list of species taken the previous day, with the addition of a dogfish, *Synaphobranchus*, *Chimæra*, *Stomias ferox*, *Cottunculus torvus*, a pug-nosed eel, and a black dogfish would represent our catch during the day. In addition to the above, we caught a dolphin (*Coryphæna*) with a hook and line, and a shark (*Aprionodon punctatus*) seven feet seven inches in length. A single specimen of sucker (*Echeneis remora*) was taken from the shark's side and preserved in alcohol. The larger fish was examined for parasites, several being found. Serial temperatures and water specimens to 700 fathoms were taken after we finished dredging, and at 7.52 p. m. we started for port.

The wind increased gradually during the day, until at dark it was blowing a moderate gale from NE. with a heavy swell. This continued during the night, moderating the following morning as we approached land. We reached Wood's Holl at 4.20 p. m. on the 14th without incident worthy of notice, and made fast to our moorings.

We were employed during the 15th in landing specimens and overhauling apparatus. Fires were hauled and preparations made for cleaning and repairing the boilers. Hon. Theodore Lyman, M. C., and Sir Lyon Playfair, M. P., visited and inspected the ship and her scientific apparatus during the day.

We coaled ship on the 18th and 19th, taking on board 99¾ tons. The boilers were ready for service on the evening of the 20th, and fires were started on the 22d, with the intention of going to sea, but unfavorable weather being reported by the Chief Signal Officer, we remained in port until 8.05 a. m. on the 25th. We then left for Newport to procure bait, with which we proposed to try for fish in the various localities where our dredging and trawling operations would carry us. Our work was to be confined to depths between 30 and 125 fathoms, for the purpose of ascertaining at what point the Gulf Stream waters cease to exert a perceptible influence on the fauna at the sea-bottom.

Mr. Richard Rathbun, Sanderson Smith, Peter Parker, jr., and Willard Nye, jr., accompanied us as naturalists, in addition to Mr. James E. Benedict, the resident naturalist.

We arrived at Newport at 1 p. m., procured three barrels of fresh menhaden for bait, and at 2.30 p. m. left the harbor and stood to the southward. Reaching Cox's Ledge at 5.30 we hove to and tried for codfish, but failed to take a single specimen, although we kept lines over for three hours. A dogfish was taken from the bottom and a rare species of shark from the surface, the latter having been attracted to the ship's side by the submarine electric light, which was being used to catch squid. Two schools of small mackerel were seen while we were hove to on the ledge. At 8.30 p. m. we started ahead slowly, and surface towing was carried on till 9.30, when we laid a course SSE. for the night. Fresh breezes from SSW. prevailed during the morning

with clear sky, the wind moderating about noon, and at 9 p. m. it veered to NE., with overcast, rainy weather.

At 5.25 a. m. on the 26th we put the trawl over in 32 fathoms, latitude 40° 38′ 00″ N., longitude 70° 29′ 45″ W. Eight hauls were made during the day in a southerly direction, ending in 122 fathoms, latitude 39° 56′ 45″ N., longitude 70° 20′ 30″ W. The hauls were all successful; large numbers of pectens were taken, particularly at station 2241, when over 500 were found in the net, besides shells of various species. Worms, among which were *Lœtmatonice armata* and *Hyalinœcia artifex*, were plentiful, as well as *Archaster americanus* and *Ophioglypha Sarsii* among the echinoderms. Shrimp, crabs of various species, and mollusks were found in every haul. The fish were represented by seventeen species, *Phycis chuss* being the most plentiful. One hundred and seventy squid were taken during the evening with jigs, the submarine light being used to attract them alongside. A large mackerel-shark was caught with hook and line. Strong winds prevailed during the day, with a heavy swell, making boat service impracticable; even the dredging operations were carried on with some inconvenience at times.

Work was resumed at 5 o'clock the following morning, the trawl being lowered in 78 fathoms, latitude 40° 03′ 00″ N., longitude 69° 57′ 00″ W. Eight hauls were made during the day in a northerly direction between the above position and latitude 40° 46′ 30″ N., longitude 69° 50′ 15″ W., in 18 fathoms. From dark until 8.20 p. m. hand-lines were used and a large number of dogfish taken. Earlier in the evening we hove to in 25 fathoms and tried for codfish, but met with no success. Two porpoises were taken with the harpoon and iced, and a fish-hawk was shot and the skin preserved. The catch during the first part of the day was much the same as yesterday, but the bottom changed later and we brought up great numbers of sand-dollars, filling the table-sieve at a single haul. Fifteen species of fish were taken, *Glyptocephalus cynoglossus* being plentiful and of large size; the first full-sized specimens we have taken south and west of Monomoy Point. The weather was more moderate during the day and toward evening the sea became quite smooth, but the barometer was falling steadily and the weather indications were decidedly unfavorable.

At 5.32 a. m. on the 28th we put the trawl over in 30 fathoms, latitude 40° 38′ 30″ N., longitude 69° 29′ 00″ W., and ran a line to the southward, making six hauls between the above position and latitude 39° 54′ 45″ N., longitude 69° 29′ 45″ W., in 250 fathoms. At 4.25 p. m. we started for port, our supply of alcohol being exhausted. During the morning large numbers of sand-dollars and shells were taken, and several very large and perfect specimens of *Asterias vulgaris* were preserved in alcohol. The last haul brought up the table-sieve full of worm-tubes, most of them having sea-anemones attached, besides a few brachiopods.

There were fifteen species of fish taken, corresponding generally with

the list of previous days; *Macrurus Bairdii*, *Macrurus carminatus*, and *Scopelus*, which were taken in the last haul in 250 fathoms, may, however, be added. The weather was unsettled during the evening, and after midnight we had several heavy rain-squalls; the wind moderated, however, as we approached the land.

At 6.30 a. m. on the 29th we arrived in Wood's Holl and made fast to our moorings. The specimens were landed during the day. Slight repairs were made to the machinery and boilers, and on October 7 we received $48\frac{133}{224}\frac{3}{0}$ tons of coal on board. All preparations having been made to leave the station for the season, we started for New York at 9.10 a. m., October 8. We stood first for Cox's Ledge and spent several hours trying for fish, with indifferent success. Arriving in New York at 10.30 a. m. the following day, we anchored off Twenty-fourth street, North River. Official visits were received from the U. S. S. Minnesota and the French flagship Flore. The yacht Coquette was capsized near this vessel during a squall. Her crew was rescued and the yacht towed ashore by our steam-cutter.

I returned the official visits from the U. S. S. Minnesota and the French flagship Flore on the 10th, and on the following day the executive officer of the Flore with his aide visited the ship and made an extended and careful examination of vessel and apparatus. Capt. T. H. Parfait was in command of the Talisman during her scientific explorations in 1883. Later in the day, Hon. William E. Chandler, Secretary of the Navy, and Senator Rollins visited the ship. On the 13th, a large party of officers from the Flore came on board and made a thorough examination of the scientific apparatus.

Our stores were all on board and everything ready for sea on the morning of the 16th, but cautionary signals being reported on the coast of North Carolina, we remained at anchor until 10.50 a. m. on the 17th, when we got under way and proceeded to sea.

The wind being favorable, we stood to the southward under steam and sail during the night, and, at 1.30 p. m. the following day, put the trawl over in 430 fathoms, latitude 37° 08′ 00″ N., longitude 74° 33′ 00″ W. Three hauls were made during the afternoon, with good results. At 5.05 p. m. we started again for Hatteras, intending to reach our working ground at daylight the following morning. At 6.15 a. m. on the 19th we put the small beam-trawl over in 111 fathoms, latitude 35° 07′ 00″ N., longitude 75° 08′ 30″ W. It was a very light haul, but the next one in 68 fathoms, within a mile of the former position, was exceedingly rich. Several rare and beautiful starfish, sea-urchins, coral, &c., were found in the remnants of the net, which had been torn by dragging over a bed of coral. The tangles were then used with good results outside of 50 fathoms; and finally a line of dredgings, in which the trawl, with mud-bag attached, was used, was run inshore to 11 fathoms, latitude 35° 21′ 30″ N., longitude 75° 25′ 00″ W. Twenty hauls were made

during the day, nearly all of them bringing up a variety of specimens. Large numbers of crabs, sponges, worms, corals, and fish were taken. Many of the latter we were unable to identify. A large number of minute shells were brought up in the mud-bag. We stood off shore a few miles after the last haul and lay to for the night, keeping within range of the light. At daylight the following morning we ran into 7 fathoms, latitude 35° 22′ 30″ N., longitude 75° 26′ 00″ W., and commenced work, running a line of fourteen hauls offshore, the last one being 671 fathoms, latitude 35° 41′ 30″ N., longitude 74° 48′ 30″ W. Crabs were found very abundant, and worms, sea-anemones, hermit-crabs, &c., were taken in large numbers. A single specimen of a full-grown lobster (*Homarus americanus*) was taken in 49 fathoms. It would be difficult to tell which was the most surprised, the lobster or ourselves, as it is the first time on record of a lobster having been found in these regions. Fish were taken in considerable numbers, and many minute shells were found in the mud-bag.

At 6 a. m. on the 21st we put the tangles over in 57 fathoms, latitude 35° 11′ 30″ N., longitude 75° 05′ 00″ W., in search of the coral bed over which we had dragged the trawl on the previous day, and although we were unable to find the spot, we succeeded in obtaining a number of interesting specimens. Ten hauls with tangles and trawl were made during the day, with fair success; although much time was consumed in an attempt to make a haul with the trawl in the current of the Gulf Stream, which was running nearly four knots an hour.

From 1.10 to 2.35 p. m. we were experimenting with Read's photometer for determining the penetration of light in sea-water. A series of three photographs were taken at 5 fathoms, and another at 25 fathoms; the exposures being 5, 10, and 15 minutes for each depth. The apparatus performed its work satisfactorily at the depths indicated, but it will require some alterations to make it practicable in great depths, where it must necessarily be used.

At 7.56 p. m we started for Washington, D. C., anchoring near Upper Cedar Point at 5.30 p. m. on the 22d, and arriving at the navy-yard at 10.30 a. m on the 23d.

The specimens taken during the trip and other articles consigned to the Smithsonian Institution were landed, and the work of overhauling and refitting commenced. The holds and store-rooms were broken out, cleaned, and restowed; the bilges were cleaned, chains overhauled, the ship painted inside and out, rigging overhauled, &c.

The dredge-rope was examined and an additional quantity reeled on the drum. New trawls and dredges were procured, and a new accumulator of greater length and larger buffers, was substituted for the old one.

Ensign L. M. Garrett reported for duty November 1, and Ensign Franklin Swift on the 1st of December. The weather became very cold

toward the latter part of the month, ice forming around the ship on the 20th thick enough to bear the weight of a man. The vessel was not quite ready for sea, but fearing an ice blockade, we left on the 24th for Norfolk, Va., where we could complete our outfit and sail at any time without fear of detention.

The Eastern Branch was covered with about 3 inches of ice through which we were obliged to break our way until reaching the Potomac, where the channel was kept open by the frequent passage of vessels. Arriving off Quantico about dark we anchored for the night, and getting under way at daylight the following morning, reached Hampton Roads at 9.15 p. m. and anchored near the fort.

A thick snow storm set in during the night, and when we got under way the following morning we could not see more than two or three ship-lengths. We felt our way through it, however, reaching the navy-yard at Norfolk, Va., about 9.30 a. m.

The bunkers were filled with coal, and on the evening of December 31st the Albatross was ready for sea, waiting only the arrival of the naturalists who were to join us for a cruise in the Gulf of Mexico.

The following officers were attached to the ship at this date:
Z. L. Tanner, lieutenant-commander, U. S. N., commanding.
Seaton Schroeder, lieutenant, U. S. N., executive officer and navigator.
A. C. Baker, lieutenant, U. S. N.
C. J. Boush, lieutenant (junior grade), U. S. N.
R. H. Miner, ensign, U. S. N.
L. M. Garrett, ensign, U. S. N.
Franklin Swift, ensign, U. S. N.
J. M. Flint, surgeon, U. S. N.
C. D. Mansfield, paymaster, U. S. N.
George W. Baird, passed assistant engineer, U. S. N., in charge of machinery.

Petty officers.—S. M. McAvoy, John Hawkins, John Bergesen, Walter Blundell, machinists; Charles Wright, master-at-arms; Samuel LeRoy Pritchard, equipment yeoman; N. B. Miller, apothecary; George A. Miller, paymaster's yeoman; Frank L. Stailey, engineer's yeoman.

The crew numbered 59 men.

Mr. James E. Benedict was still attached to the ship as naturalist.

Attention is called to the following appended reports, giving much valuable information in regard to the work of the various departments: Navigation Report; Engineer's Report; Medical Department, Sanitary Report, and Records of Specific Gravities; Naturalist's Report, with lists of birds, fishes, &c., taken; Dredging and Trawling Record; and Table of Serial Temperatures.

NAVIGATION REPORT OF LIEUT. SEATON SCHROEDER, U. S. N., NAVIGATOR.

During the year 1884 the geographical limits of the cruising of the Albatross were the parallels of 8° 30′ and 43° north latitude, and the meridians of 61° 30′ and 85° 30′ west longitude. The number of days at sea and the distances run, together with the object of each trip, are given in the following table:

Date.	Object.	Distance.
		Miles.
January 6 to 7	Baltimore to Norfolk	163
January 10 to 17	Sounding trip	1,417.5
January 24 to 30	Sounding and dredging trip	660.2
February 2	Swinging ship	20
February 3 to 11	Sounding and dredging trip	1,209.4
February 18 to 26	....do	1,100.8
February 27 to March 1	....do	333.8
March 12 to 16	....do	605.1
March 22 to 26	....do	429.4
April 2 to 5	....do	253
April 9 to 15	....do	813.1
April 29	Key West to Havana, Cuba	100
April 30 to May 7	Sounding and dredging trip	603.8
May 11 to 17	Sounding trip	1,270.5
July 13 to 14	Washington to Norfolk	174
July 20 to 26	Investigating migrations of menhaden and mackerel	651.7
July 31 to August 8	Dredging trip	486.4
August 19 to 25	....do	429.2
August 27	Wood's Holl to Newport	42
August 28 to 31	Flagship of Honorable Secretary of the Navy	47
September 1	Newport to Wood's Holl	42
September 6 to 15	Dredging trip	943
September 25 to 29	....do	424.1
October 8 to 9	Wood's Holl to New York	189
October 17 to 23	Dredging trip	797
December 25 to 26	Washington to Norfolk	174
Total (134 days)		13,388

The number of soundings taken during the year was 701, almost all of which were located with sufficient accuracy to be of hydrographic value; of these, 191 were also dredging stations.

During the winter and spring the vessel was employed in hydrographic work for the Navy Department; searching for reported dangers in the West Indies and between there and the Chesapeake; running lines of soundings across the Caribbean Sea and among some of the islands; taking serial temperatures and noting surface currents; making an examination of a part of Savanilla Bay, United States of Colombia, and establishing the longitude of Cape San Antonio light-house, Cuba.

Following is a list of reported dangers over or near which the depths were found in the positions given:

List of reported dangers.

Name.	Latitude N.			Longitude W.			Depth.
	°	′	″	°	′	″	*Fathoms.*
Orion Shoal	84	48	45	72	25	00	2,462
Ashton Shoal	83	50	20	71	42	00	2,953
Perseveranza Shoal	81	15	42	67	39	10	2,787
Mourand Shoal	24	35	14	65	13	07	3,006
Leighton Rock	17	39	30	73	22	15	2,490
Loos Shoal	17	48	00	73	34	15	2,369
Breakers	12	54	40	66	11	10	2,768
Vigia	12	10	30	66	11	00	2,707
Georgia Shoal	Many soundings.						(Least) 17
Tribune Shoal	12	11	30	74	27	30	2,057
Powhatan Shoal	11	11	00	75	50	30	1,195
Doubtful	14	53	40	80	20	00	1,151
Sancho Pardo Shoal	Off Cape San Antonio.						Many.
Albatross Shoal	22	49	20	84	15	00	950
Vigia	23	00	00	83	03	45	625
Huntley Shoal	30	46	00	78	35	00	470

The soundings were such as to prove the non-existence of all except the Georgia Bank off the east end of Jamaica, which had been recently searched for by several vessels. It was originally discovered by Capt. John S. Holt, of the American brig Georgia, in 1867, who reported 14 fathoms in about latitude 17° 46′ N., longitude 75° 45′ W. An extensive and careful search was made for this, resulting in the discovery of a bank with a least depth of 17 fathoms a little to the southward of the reported position, in latitude 17° 36′ to 17° 44′ N., longitude 75° 40′ to 75° 45′ W. The Navy Department has given it the name of Albatross Bank. This must not be confounded with the Albatross Shoal off the northwestern shore of Cuba, which was reported by the German gunboat of that name, and not subsequently found.

One hundred soundings were taken off Cape San Antonio, extending to just beyond the range of the light, with deep water everywhere (up to 1,200 fathoms), and Sancho Pardo Shoal has, in consequence, been expunged from the charts of the Hydrographic Office, Navy Department.

Six lines of soundings were run across the Caribbean Sea, four between the Leeward Islands and the Main, and diagonal lines on and off the coast of the United States of Colombia. The eastern part of the Caribbean Sea is the deepest, the greatest depth being 2,844 fathoms, in latitude 13° 25′ N., longitude 66° 25′ W. Off the Honduras coast, however, still deeper water was found, there being 3,169 fathoms at 60 miles southwest of the Grand Cayman.

An interesting discovery was that of a submarine ridge connecting the islands of Santa Cruz and Puerto Rico, the least depth on which was 578 fathoms and the greatest 900, while on either side was found over 2,000 fathoms.

Aves Islet, 100 miles westward of Guadaloupe, was found to be the summit of a mountain, precipitous on its western slope and extending in a south-southeast direction over 150 miles to the 1,000-fathom curve.

The longitude of Cape San Antonio light-house (west end of Cuba) was found to be 84° 57′ 38″ W., depending on that of the Soldiers' Monument, Key West, Fla., being 81° 48′ 25″ W. The time was carried to and back by five chronometers, and the observations were of equal altitudes of the sun by sextant and artificial horizon.

The following table gives the position and depth of each sounding while the ship was working for the Navy Department, together with remarks on currents, &c. The numbers above 2,000 indicate dredging stations:

Table of sounding and dredging stations occupied during the winter and spring.

Date.	Number.	Depth.	Bottom.	Latitude N.	Longitude W.	Remarks.
		Fathoms.		° ′ ″	° ′ ″	
Jan. 11	Hyd. 36	2,953	lt. choc. Oz	33 50 20	71 42 00	Near Ashton Shoal.
13	Hyd. 37	2,787	lt. choc. Oz. Glob	31 15 42	67 39 10	Near Perseverunza Shoal.
14	Hyd. 38	2,957	lt. choc. Oz Glob	28 17 07	66 17 37	
15	Hyd. 39	3,006	stf choc. C	24 35 14	65 13 07	Near Mourud Shoal.
17	Hyd. 40	3,468	Glob. Oz	19 15 00	65 07 00	
17	Hyd. 41	1,902		18 59 00	65 07 00	Parted wire at 10 fathoms. Light westerly current.
24	Hyd. 42	516	Co. R	18 09 00	64 58 50	Saint Thomas light NNE. ¼ E. (mag.). Sail rock NW. ¼ N. (mag.). Slight SW. set.
24	Hyd. 43	1,146	Co. S. For	18 04 30	65 01 10	Sail rock N. by W. ½ W. (mag.).
24	Hyd. 44	1,975		18 00 00	65 04 00	Wire parted.
24	Hyd. 45	2,501	Co. S. For	17 55 30	65 06 00	Slight SW. set.
24	Hyd. 46	2,423	fne. Co. S. For	17 51 00	65 08 05	Fresh NE. breeze.
25	Hyd. 47	1,462	crs. Co. S. brk. Sh. For	17 46 30	65 10 25	About 1 knot WSW. current.
25	Hyd. 48	978	Co. Oz. For	17 42 00	65 12 40	Do.
25	Hyd. 49	928	Oz. For	17 37 30	65 15 00	Do.
25	Hyd. 50	940	Co. S. For	17 33 00	65 17 20	Moderated to fresh ENE. breeze.
25	Hyd. 51	1,265	Co. Oz. fne. Pter. Sh. For	17 28 30	65 19 40	
25	Hyd. 52	1,895	Co. S. For	17 24 00	65 22 00	Westerly current, about 1 knot.
25	Hyd. 53	1,350	Oz. For	17 29 10	65 23 30	Do.
25	Hyd. 54	990	Co. S. For	17 34 20	65 25 00	Do.
25	Hyd. 55	933	Pter. Co S. For	17 39 30	65 26 30	Do.
25	Hyd. 56	1,243	Pter. Co. Oz. For	17 44 15	65 27 50	
25	Hyd. 57	2,188	Oz. For	17 49 06	65 29 00	Fresh ENE. to NE. breeze.
25	Hyd. 58	1,345	Oz. For	17 45 20	65 35 35	WSW. current, about ½ knot.
25	Hyd. 59	789	Oz. For	17 42 10	65 39 40	Do.
25	Hyd. 60	578	Co. S. For	17 39 00	65 44 00	Do.
25	Hyd. 61	1,303	fne. Co. S. For	17 35 50	65 48 10	Fresh ENE. breeze.
25	Hyd. 62	2,017	Pter. Co. S. For	17 32 40	65 52 20	
26	Hyd. 63	2,690	Co S. Sh	17 15 30	65 36 20	WSW. current, about 1½ knots, with fresh ENE. breeze
26	Hyd. 64	2,543	fne. Co. S. Sh	16 52 00	65 19 20	Do.
26	Hyd. 65	2,312	fne. Co. S. Sh. For	16 42 02	65 02 20	WSW. current, about 1 knot.
26	Hyd. 66	2,192	Co. S. For	16 28 00	64 42 30	Breeze moderating.
26	Hyd. 67	2,069	Co. S. For. Sh	16 13 45	64 22 30	Very slight W. set, the wind being light from E.
27	Hyd. 68	1,920	yl. Oz. For	16 04 15	64 07 00	Do
27	Hyd. 69	1,060	Co S. For	15 54 46	63 52 00	No appreciable current.
27	Hyd. 70	1,091	Co S. For	15 48 00	63 45 20	
27	Hyd. 71	950	brk. Co. Sh	15 44 10	63 42 10	
27	Hyd. 72	808	fne. Co. S. Sh	15 41 00	63 42 00	House on Aves Islet E. (mag.) 4½ m.
27	Hyd. 73	335	Co brk. Sh	15 40 18	63 38 30	House on Aves Islet NE. by E. (mag.) 1.3 m.
27	Hyd. 74	15	Co	15 38 32	63 37 36	No appreciable current.
27	Hyd. 75	172	fne. Co. S	15 33 55	63 35 38	
27	Hyd. 76	367	fne. Co. S.	15 29 18	63 35 40	
27	2117	683	yl. M. fne. S	15 24 40	63 31 40	

Table of sounding and dredging stations occupied during the winter and spring—Continued.

Date.	Number.	Depth.	Bottom.	Latitude N.	Longitude W.	Remarks.
		Fathoms.		° ′ ″	° ′ ″	
Jan. 27	Hyd. 77	776	Co. S. For	15 08 20	63 26 00	Light W. set.
27	Hyd. 78	871	fne. Co. S. Sh	14 44 25	63 18 00	Do.
27	Hyd. 79	821	Co. S. Sh. For	14 20 30	63 10 00	
28	Hyd. 80	684	gy. M. For	13 56 35	63 02 00	
28	2118	690	gy. M. bk. S	13 32 40	62 54 00	
28	Hyd. 81	815	M. For	13 34 35	62 51 20	
28	Hyd. 82	1,051	For. M. bk. Sp	13 29 00	62 42 40	
28	Hyd. 83	1,606	For. M. bk. Sp	13 23 00	62 34 15	
28	Hyd. 84	1,690	For. M. bk. Sp	13 15 00	62 39 00	
28	Hyd. 85	1,614	For. M. bk. Sp	13 07 10	62 43 40	No current at all; wind very light.
28	Hyd. 86	1,635	bu. M. For. bk. Sp	12 58 40	62 48 00	
29	Hyd. 87	1,642	M. bk. Sp. For	12 50 40	62 53 00	
29	Hyd. 88	1,630	M. bk. Sp. For	12 29 00	62 38 30	Very slight set to about SSE.; wind light from ENE.
29	Hyd. 89	1,552	bu. M. For	12 07 30	62 24 00	
29	Hyd. 90	1,437	bu. M	12 03 00	62 22 20	
29	Hyd. 91	1,121	gy. bu. M	11 58 00	62 20 50	
29	Hyd. 92	1,247	gy. M	11 53 10	62 19 10	
29	2119	1,140	gy. M	11 48 30	62 17 30	Light W. set; ENE. breeze.
29	Hyd. 93	828	hrd	11 42 40	62 17 00	Do.
29	Hyd. 94	441	gy. M. fne. S	11 34 20	62 15 40	WNW. current, about 1 to 1½ knots.
29	Hyd. 95	280	bk. M	11 27 00	62 13 00	
29	Hyd. 96	70½	crs. G. brk. Sh	11 19 40	62 10 00	WNW. current, about 2 knots, with moderate to fresh ENE. breeze.
30	Hyd. 97	63	dk. M. crs. S	11 12 20	62 07 10	Do.
30	Hyd. 98	83	bu. M	11 05 00	62 04 30	2 to 2½ knot WNW. current.
30	2120	73	bu. M	11 07 00	62 14 30	
30	Hyd. 99	159	M. S	10 44 45	61 48 18	S. end Chacachacare Island SSE. ¾ E. (mag.). Cariaquita Point SW. ¼ W. (mag.).
30	Hyd. 100	141	bu. M	10 43 45	61 48 50	E. end Goose Island SSW. (mag.). E. end Islette WNW. (mag.).
Feb. 3	2121	31	dk. slat. M	10 37 40	61 42 40	S. side Goose Island W. (mag.). W. end Mono Island N. ¼ E. (mag.).
3	2122	34	dk. slat. M	10 37 00	61 44 22	S. side Goose Island W. ¼ N. (mag.). W. end Mono Island NNE. ¾ E. (mag.).
3	2123	117	bu. M	10 42 02	61 48 48	E. end Islette NW (mag.). E. end Goose Island SSW. ¾ W. (mag.)
3	Hyd. 101	61	sft. bu. M	10 54 00	61 58 40	2-knot NW. current; moderate breeze from NNE.
3	Hyd. 102	57	sft. bu. M.	11 02 30	62 06 00	Do.
3	Hyd. 103	46	brk. Sh	11 19 00	62 22 00	Current about WNW., 1½ knots.
3	Hyd. 104	176	bu. M	11 34 20	62 38 15	
3	Hyd. 105	387	bu. M	11 45 30	63 01 00	
3	Hyd. 106	949	rky	11 59 00	63 27 40	WNW. current, 1 to 1¼ knots; moderate NE. breeze.
4	Hyd. 107	1,256	gy. M. fne. S	12 09 00	63 57 20	Do.
4	Hyd. 108	2,020		12 17 30	64 14 30	Wire parted.
4	Hyd. 109	2,371	gy. Oz	12 22 50	64 38 10	1½-knot W. current.
4	Hyd. 110	1,828	br. gy. M	12 41 00	64 23 00	
4	Hyd. 111	1,714	gy. M	12 59 20	64 08 00	Light W. set; moderate NE. breeze.
4	Hyd. 112	1,463	br. Oz. For	13 15 30	63 52 10	½ to ¾ knot SW. current.
5	Hyd. 113	680	gy. Oz. For	13 32 00	63 36 30	Do.

5	Hyd. 114	632	br. Oz. bk. Sp	13	48	30	63	29	00	Do.
5	Hyd. 115	852	yl. M. fne. S	14	07	10	63	37	55	Do.
5	Hyd. 116	1,615	gy. M. For	14	21	44	63	58	45	Moderate NE. breeze; current to SW., about 1 knot.
5	Hyd. 117	1,810	gy. M. For	14	35	10	64	21	10	Do.
5	Hyd. 118	2,115	For. Oz	14	51	00	64	42	00	Do.
6	Hyd. 119	2,461	lt. gy. M. For	15	26	00	65	19	20	
6	Hyd. 120	2,492	gy. M. For	16	01	00	65	56	20	Current to WSW., about ½ knot.
6	Hyd. 121	2,501	choc. Glob. Oz	16	36	20	66	41	00	Breeze falling light, ENE.
7	Hyd. 122	2,458	choc. Oz. For	16	35	20	68	00	30	Light easterly airs. No perceptible current in sounding.
7	Hyd. 123	2,616	choc. Oz. For	15	49	00	67	36	40	Slight set to SSW.; moderate ENE. breeze.
7	Hyd. 124	2,747	choc. Oz. For	15	02	00	67	13	30	Slight set to SW.; light ENE. breeze.
8	Hyd. 125	2,804	choc. M. Co	14	20	30	66	54	00	Slight set to WSW.; light ENE. breeze.
8	Hyd. 126	2,814	br. M. Co	13	40	00	66	35	00	½ to 1 knot WNW. current; ENE. breeze.
8	Hyd. 127	2,844	br. M. Co	13	25	04	66	25	00	1-knot WNW. current; light ENE. airs.
8	Hyd. 128	2,768	dk. choc. Oz	12	54	40	66	11	10	1½ to 2 knot WNW. current; light ENE. airs.
8	Hyd. 129	2,820	dk. clayey Oz	12	35	20	66	14	00	2-knot WNW. current; light ENE. airs.
9	Hyd. 130	2,707	dk. clayey Oz	12	10	30	66	11	00	2 to 2½ knot NW. current; light ENE. airs.
9	Hyd. 131	1,806	choc. Oz. For	12	04	00	66	16	40	2 to 2½ knot NW. current; light ENE. airs. El Roque light on horizon from a height of 25 feet. Bearing WNW. ½ W. (mag.).
9	Hyd. 132	774	gy. S. brk. Sh	11	49	00	66	16	50	Astronomical position; Orchilla Island distant 6 miles; principal peak E. ¼ N. (mag.). No current.
9	Hyd. 133	533	gy. M. For	11	33	20	66	19	00	½ to ¾ knot W. current; ENE. breeze.
9	Hyd. 134	656		11	18	50	66	24	20	½ to ¾ knot W. current; ENE. breeze. Stray line parted (35-pound lead).
9	Hyd. 135	239	gn. M. S	11	05	00	66	33	00	¾-knot W. by S. current; breeze ENE.
9	Hyd. 136	150	bu. M. fne. S	10	51	00	66	35	00	Do.
9	Hyd. 137	135	gn. M. fne. S	10	42	30	66	48	20	Line of bearing of sun, and bearing and distance of Punta Anaro.
9	Hyd. 138	164	gy. S. brk. Sh	10	51	30	67	01	40	About ¾ to 1 knot current to WSW.
9	Hyd. 139	605	gy. M	11	01	00	67	14	15	Do.
9	Hyd. 140	947	gy. M	11	09	40	67	27	00	Do.
10	Hyd. 141	1,040	lt. choc. M	11	19	50	67	40	00	Do.
10	Hyd. 142	1,021	gy. M	11	28	10	67	53	00	Do.
10	Hyd. 143	1,030	lt. gy. C	11	37	30	68	06	30	½ to ¾ knot westerly current.
10	Hyd. 144	980	gy. M	11	46	40	68	19	50	½-knot westerly current.
10	Hyd. 145	630	wh. S. R	11	52	00	68	35	40	Do.
10	Hyd. 146	641	yl. M. fne. S	11	55	20	68	46	00	½-knot W. by N. current; positions checked by bearing and distance of Little Curaçao light plotted in latitude 11° 58', longitude 68° 39'.
10	Hyd. 147	507	gy. M	11	59	00	68	49	00	½-knot W. by N. current; moderate NE. breeze.
10	Hyd. 148	74	crs. S	12	05	52	68	55	00	½-knot W. by N. current; Fort Rif light north (mag.) 1,800 feet.
18	Hyd. 149	410	yl. M. S	12	01	20	68	55	30	½ to ¾ knot W. current; fresh ENE. breeze.
18	Hyd. 150	703	yl. M. S	11	56	00	68	56	00	¾ to 1 knot W. current; fresh ENE. breeze.
18	Hyd. 151	738	yl. M. S	11	50	45	68	56	30	1-knot W. current; fresh ENE. breeze.
18	Hyd. 152	321	lt. gn. M. Grit	11	40	25	68	57	30	1-knot W. by S. current; moderate ENE. breeze.
18	Hyd. 153	138	gn. M	11	35	10	68	58	00	1-knot W. by S. current; light breeze.
18	Hyd. 154	45	lt. br. M	11	30	00	68	58	30	Astronomical position; Zamuro Point SE. (mag.); 1-knot W. by S. current; light ENE. breeze.
18	2124	122	gn. M. fne. Sh	11	34	30	69	02	10	1-knot W. by S. current; light ENE. breeze.
18	2125	208	yl. M. S. bk. Sp	11	43	00	69	09	30	
18	Hyd. 155	458	bu. M. fne. S	11	51	00	69	18	00	1 to 1½ knot W. by S. current; wind in squalls from ENE.
18	Hyd. 156	455	lt. gn. M. Grit	11	58	30	69	26	20	Do.
18	Hyd. 157	305	gn. M. crs. S	12	06	00	69	34	40	Do.
18	Hyd. 158	299	gn. M. Grit	12	13	30	69	43	00	Do.
19	Hyd. 159	420	gy. M	12	23	30	69	48	00	Light on east end Orubo Island W. ¼ S. (mag.) 8 miles; about ½-knot westerly set.

Table of sounding and dredging stations occupied during the winter and spring—Continued.

Date.	Number.	Depth.	Bottom.	Latitude N.	Longitude W.	Remarks.
		Fathoms.		° ′ ″	° ′ ″	
Feb. 19	Hyd. 160	634	gy. M.	12 32 50	69 50 00	Light SW. set; light ENE. breeze.
19	Hyd. 161	787	yl. M. crs. S. For	12 54 30	69 55 00	Light W. set; light ENE. breeze.
19	2126	1,701	yl. M. crs. S. For	13 17 45	70 01 00	1 knot NW. set; fresh ENE. breeze in squalls.
19	Hyd. 162	2,694	dk. br. M	13 40 20	70 10 45	½ to ¾ knot WSW. set; moderate ENE. breeze in squalls.
19	Hyd. 163	2,360	lt. br. M. S	14 24 00	70 28 20	1 to 1½ knots SW. set; moderate ENE. breeze in squalls.
20	Hyd. 164	2,338	lt. br. M. crs. S. For	15 09 20	70 46 50	1 to 1½ knots SW. set; moderate to fresh ENE. breeze.
20	Hyd. 165	2,209	lt. br. M. For	15 55 00	71 03 00	½ to 1 knot SW. set; moderate to fresh ENE. breeze.
20	Hyd. 166	2,028	lt. br. M. For	16 42 00	71 18 00	1½ knots SW. by W. set; moderate to fresh ENE. breeze.
21	Hyd. 167	522	lt. br. M. For	17 17 30	71 35 00	1½ knots SW. by W. set; moderate to fresh ENE. breeze.
21	Hyd. 168	302	wh. Co. S. brk. Sh	17 26 00	71 44 45	Alta Vela NE. ¼ E. (mag.) 4 miles.
21	Hyd. 169	2,410	wh. S. brk. Sh	17 36 30	72 00 00	1½-knot SSW. current.
21	Hyd. 170	2,434		17 48 00	72 12 20	1-knot SSE. current. Old splice drew when half in; 35-pound lead.
21	Hyd. 171	1,929	gy. M. bk. S. brk. Co. Sh	18 01 30	72 23 00	1-knot SSE. current.
21	Hyd. 172	1,538	brk. Co. S	18 07 00	72 29 00	½ to 1 knot ESE. current.
21	Hyd. 173	253	bu. M	18 10 30	72 32 30	Jacmel NW. ¾ N. (mag.); Jacmel Point W. by S. (mag.); slight easterly set.
21	Hyd. 174	1,903	gy. M. bk. S. brk. Co. Sh	18 01 00	72 34 00	½-knot ESE. current.
21	Hyd. 175	1,594	lt. br. M. For	17 44 00	72 35 00	1 to 1½ knot SE. current.
22	Hyd. 176	1,946	yl. M. S. For	17 28 00	72 36 30	1½-knot SE. by E. current; fresh ESE. wind.
22	Hyd. 177	2,391	br. M. For	17 12 45	72 38 00	Do.
22	Hyd. 178	2,393	br. Oz. For	17 24 45	72 47 00	1½-knot ESE. current; fresh E. wind.
22	Hyd. 179	2,423	br. M. For	17 36 30	72 58 00	1-knot E. current; fresh E. wind.
22	Hyd. 180	2,391	br. Oz. For	17 45 30	73 04 00	1½-knot ENE. current.
22	Hyd. 181	2,490	br. Oz. For	17 39 30	73 22 15	1-knot NE. current.
22	Hyd. 182	2,369	br. Oz. For	17 48 00	73 34 15	1½-knot NE. current; moderate E. breeze.
22	Hyd. 183	1,039	gy. M. fne. S. For	17 54 00	73 46 15	No perceptible current; light E. breeze.
23	Hyd. 184	1,970	gy. M. S. For	17 53 30	73 59 30	About 1 knot ENE. set.
23	Hyd. 185	1,672	gy. M. fne. S. For	17 53 15	74 11 00	About 1½ knots ENE. set.
23	Hyd. 186	1,206	gy. M. fne. S. For	17 53 00	74 22 30	About 2 knots ENE. set.
23	Hyd. 187	894	S. M. Sh. For	18 01 00	74 31 45	About 1½ knots ENE. set.
23	Hyd. 188	894	yl. M. Sh. For	17 51 40	74 36 30	About 1 knot SE. set.
23	Hyd. 189	803	br. M. For	17 42 30	74 40 00	About ½ knot ESE. set.
23	Hyd. 190	955	yl. M. S. bk. Sp	17 33 30	74 45 00	About ½ knot N. and E. set.
23	Hyd. 191	1,146	gy. M. S. For	17 23 15	74 51 30	Slight set N. and E.
23	Hyd. 192	1,122	gy. M. S. For	17 13 15	74 57 45	
23	Hyd. 193	963	yl. M. fne. S	17 26 30	75 06 45	½ to ¾ knot N. set.
24	Hyd. 194	1,510	yl. M	18 02 00	74 57 30	Slight N. set.
24	Hyd. 195	282	hrd	18 18 30	74 53 30	Do.
24	Hyd. 196	1,040	gy. S	18 34 00	74 50 00	Do.
24	Hyd. 197	1,347	yl. M	18 45 00	74 32 40	Very slight ENE. set; calm.
24	Hyd. 198	1,537	yl. M	18 50 00	74 12 00	No current; light NW. breeze.
24	Hyd. 199	1,974	dk. M	18 56 00	73 51 00	Do.
24	Hyd. 200	342	hrd	18 59 40	73 30 00	No current.
24	Hyd. 201	900	yl. M. Sh. For	19 19 40	73 27 00	Do.

25	Hyd. 202	502	yl. M. S. Sh. For	19	16	30	73	47	30	Do.
25	Hyd. 203	700	yl. M	19	24	30	74	05	15	Do.
25	Hyd. 204	1,906	yl. M. brk. Sh. For	19	32	30	74	23	00	Do.
25	Hyd. 205	1,923	gy. M. fne. S. For	19	40	00	74	42	00	Do.
25	2127	1,639	gn. M	19	45	00	75	04	00	E. point Guantanamo Port NW. ½ W. (mag.). ½ knot about, WSW. set.
25	Hyd. 206	1,745	gy. M. S	19	43	21	75	15	30	E. point Guantanamo Port N. by W. (mag.). Barracas Point WNW. ½ W. (mag.). Latitude by * Rigel. No current.
25	Hyd. 207	1,380	gy. M. S. Sh	19	44	45	75	24	15	½ to ¾ knot E. set.
25	Hyd. 208	1,380	dk. bk. S. Sh	19	46	10	75	33	00	Do.
26	Hyd. 209	1,425	br. M. S. Sh	19	47	30	75	41	30	Do.
26	Hyd. 210	1,175	br. M. S. Sh	19	49	00	75	50	30	Santiago light N. by W. ½ W. (mag.) 8¼ m. No current.
27	2128	400	bu. M. fne. S	19	55	46	75	49	23	Light W. set.
27	2129	274	bu. M. fne. S	19	56	04	75	48	55	Do.
27	2130	175	gy. M. S. brk. Sh	19	56	25	75	49	49	Do.
27	2131	202	brk. Co. S	19	56	44	75	50	49	
27	Hyd. 211	211	gy. M. fne. S. brk. Co	19	56	33	75	50	40	By bearing and mic. distance of Santiago de Cuba light, plotted in latitude 19° 57′ 26″, longitude 75° 52′ 13″. Light E. set.
27	2132	478	yl. M. brk. Sh	19	55	38	75	49	16	
27	2133	290	wh. S. brk. Sh	19	55	55	75	48	03	Do.
27	2134	254		19	56	06	75	47	32	Light E. set. Stray-line cut on rocks.
27	2135	262	brk. Co	19	55	58	75	47	07	Light E. set.
27	Hyd. 212	2,265	gy. M	19	40	00	75	39	00	No current.
28	Hyd. 213	2,275	br. M	19	23	00	75	30	00	Do.
28	Hyd. 214	1,768	yl. M. brk. Sh. For	19	06	00	75	21	30	Do.
28	Hyd. 215	1,486	yl. M. brk. Sh. For	18	54	30	75	16	30	Do.
28	Hyd. 216	870	wh. S. brk. Co. Sh	18	32	30	75	06	00	Do.
28	Hyd. 217	1,015	lt. M. Sh. For	18	34	00	75	21	00	N. set.
28	Hyd. 218	620	yl. M	18	32	40	75	36	00	About 1-knot NE. current.
28	Hyd. 219	646	brk. Sh	18	22	20	75	41	20	About 1½-knot NE. current.
28	Hyd. 220	1,153	brk. Sh. bk. S	18	12	00	75	46	40	Do.
28	Hyd. 221	960	gy. M	18	01	30	75	52	00	Do.
29	Hyd. 222	450	gy. M. S	17	51	00	76	00	30	Bearing and dist. Morant light. NE. set.
29	Hyd. 223	762	yl. M	17	49	00	75	54	40	
29	Hyd. 224	708	yl. M. S	17	47	40	75	50	00	Slight northerly set.
29	Hyd. 225	830	yl. M	17	46	50	75	47	20	Do.
29	Hyd. 226	828	yl. M	17	46	15	75	45	30	Do.
29	Hyd. 227	443	Co. S	17	45	20	75	42	45	Do.
29	Hyd. 228	335	wh. S. brk. Sh	17	44	40	75	40	50	Do.
29	Hyd. 229	22	Co	17	43	55	75	39	00	Do.
29	Hyd. 230	86	Co. brk. Sh	17	43	37	75	38	00	Do.
29	Hyd. 231	98	Co	17	43	20	75	37	10	Do.
29	Hyd. 232	193	Co	17	44	20	75	37	40	
29	Hyd. 233	448	Co. brk. Sh	17	45	20	75	38	15	
29	Hyd. 234	540	Co	17	46	30	75	38	50	
29	Hyd. 235	387	wh. Co. S. brk. Sh	17	45	25	75	39	05	
29	Hyd. 236	23	Co	17	44	05	75	39	00	Anchored boat and established position.
29	Hyd. 237	22	Co	17	44	05	75	39	05	Bearing and distance of boat. No current.
29	Hyd. 238	21	wh. Co	17	43	35	75	38	55	Do.
29	Hyd. 239	20	Co	17	43	05	75	38	50	Do.
29	Hyd. 240	32	Co	17	42	35	75	38	45	Do.
29	Hyd. 241	200	Co. brk. Sh	17	42	10	75	38	40	Do.
29	Hyd. 242	376	Co. brk. Sh	17	42	15	75	37	40	Do.

Table of sounding and dredging stations occupied during the winter and spring—Continued.

Date.	Number.	Depth.	Bottom.	Latitude N.	Longitude W.	Remarks.
		Fathoms.		° ′ ″	° ′ ″	
Feb. 29	Hyd. 243	329	Co. brk. Sh	17 42 20	75 36 40	Bearing and distance of boat; no current.
29	Hyd. 244	196	Co. brk. Sh	17 42 45	75 37 15	Do.
29	Hyd. 245	166	Co. brk. Sh	17 43 15	75 37 50	Do.
29	2136	52	cra. brk. Sh	17 43 40	75 38 25	Do.
29	2137	47	brk. Sh. Co	17 44 50	75 39 20	Do.
29	Hyd. 246	22	brk. Sh. Co	17 44 00	75 39 40	Bearing and distance of boat; northerly current.
29	Hyd. 247	21	brk. Sh. Co	17 43 55	75 40 20	Do.
29	Hyd. 248	81	brk. Sh. Co	17 43 50	75 41 00	Do.
29	Hyd. 249	141	brk. Sh. Co	17 43 45	75 41 40	Do.
29	Hyd. 250	21	Co	17 42 50	75 41 35	Do.
29	Hyd. 251	23	Co	17 42 35	75 42 05	Do.
29	Hyd. 252	24	Co. Sh	17 42 20	75 42 35	Do.
29	Hyd. 253	261		17 42 05	75 43 05	Bearing and distance of boat; northerly current; wire parted.
29	Hyd. 254	90	Co	17 41 25	75 43 05	Bearing and distance of boat; northerly current.
29	Hyd. 255	20	Co	17 40 30	75 43 00	Do.
29	Hyd. 256	19	Co	17 41 15	75 42 10	Do.
29	Hyd. 257	21	Co	17 41 55	75 41 25	Do.
29	Hyd. 258	20	Co	17 42 15	75 41 00	Do.
29	Hyd. 259	21	Co	17 42 40	75 40 40	Do.
29	2138	23	Co	17 44 05	75 39 00	Position of Hyd. 236.
29	Hyd. 260	21	Co	17 42 50	75 39 20	
29	Hyd. 261	20	Co	17 41 35	75 39 40	
29	Hyd. 262	17½	Co	17 40 20	75 40 00	
29	Hyd. 263	18½	Co	17 39 45	75 40 10	
29	Hyd. 264	20	Co	17 39 10	75 40 20	Current to S. and E.
29	Hyd. 265	20	Co	17 38 00	75 40 40	Do.
29	Hyd. 266	51	Co	17 36 50	75 41 00	Do.
29	Hyd. 267	19	Co	17 36 50	75 41 50	Do.
29	Hyd. 268	18	Co	17 36 55	75 42 40	Do.
29	Hyd. 269	20	Co	17 37 00	75 43 30	Do.
29	Hyd. 270	19	Co	17 37 00	75 44 20	Do.
29	Hyd. 271	524		17 37 05	75 45 15	Current to S. and E.; wire parted.
29	Hyd. 272	18	Co	17 36 30	75 44 45	E. current.
29	Hyd. 273	360	Co	17 36 00	75 44 15	Do.
29	Hyd. 274	250	Co	17 36 00	75 45 10	Do.
29	Hyd. 275	320	Co	17 36 05	75 46 10	Do.
29	Hyd. 276	806	Co	17 36 30	75 48 00	Do.
29	Hyd. 277	675	yl. M. Sh. For	17 37 35	75 52 10	Do.
Mar. 1	Hyd. 278	863	yl. M. S. Sh	17 38 20	75 56 25	Do.
1	Hyd. 279	597	yl. M. S. Sh	17 39 10	76 00 35	Do.
1	Hyd. 280	760	yl. M. S. Sh	17 40 10	76 04 50	Bearing and distance of Morant light.
1	Hyd. 281	414	yl. M. S. Sh	17 41 20	76 09 40	E. current.
1	Hyd. 282	490	brd	17 42 30	76 14 30	Do.

1	Hyd. 283	612	Co	17	43	40	76	19	15	Do.
1	Hyd. 284	581	br. M	17	41	50	76	24	00	Cross-bearings of objects on shore; E. current.
1	Hyd. 285	590	yl. M	17	46	00	76	28	40	Do.
1	Hyd. 286	542	bu. M	17	47	00	76	33	10	Do.
1	Hyd. 287	777	gy. M. bk. S	17	48	10	76	37	50	Cross-bearings of objects on shore; no current.
1	Hyd. 288	484	gy. M	17	49	30	76	43	35	Cross-bearings of objects on shore; NW. current.
1	Hyd. 289	400	gy. M	17	51	20	76	44	30	Do.
11	Hyd. 290	440	bk. M	17	53	05	76	43	00	Cross-bearings on shore; no current.
11	Hyd. 291	18	Co	17	52	20	76	46	05	Do.
11	2139	215	bk. M	17	52	00	76	45	30	Do.
11	Hyd. 292	355	br. M. fne. S	17	48	45	76	46	05	Do.
11	Hyd. 293	26	Co	17	46	10	76	46	05	Do.
11	Hyd. 294	790	br. M. crs. S	17	41	10	76	46	05	
11	2140	966	S	17	36	10	76	46	05	
11	Hyd. 295	890		17	38	40	76	41	10	Wire parted.
12	Hyd. 296	980	bk. M. S	17	37	10	76	36	40	Slight set to W. by N.
12	Hyd. 297	1,043	gy. S	17	35	40	76	32	10	Do.
12	Hyd. 298	1,084	bu. M	17	34	10	76	27	40	Do.
12	Hyd. 299	933	Co	17	32	40	76	23	10	Do.
12	Hyd. 300	822	yl. M. Sh. For	17	29	40	76	14	10	Do.
12	Hyd. 301	808	yl. M. S	17	28	00	76	09	10	
12	Hyd. 302	790	hrd	17	26	45	76	04	10	
12	Hyd. 303	620	hrd	17	25	40	76	01	10	
12	2141	5	Co	17	25	00	75	59	55	Cross bearings on cays.
12	Hyd. 304	794	yl. M	17	31	10	75	58	00	
12	Hyd. 305	723	hrd	17	32	30	75	53	00	
12	Hyd. 306	218	Co	17	32	45	75	49	55	
12	Hyd. 307	490	hrd	17	32	50	75	48	20	
12	Hyd. 308	527		17	34	35	75	46	50	Wire parted.
12	Hyd. 309	505	gy. S	17	34	35	75	44	45	
12	Hyd. 310	500		17	34	35	75	43	40	Wire parted; reel was found to have crushed in.
12	Hyd. 311	515	S	17	34	35	75	39	35	About 1 knot WNW. set.
12	Hyd. 312	645	hrd	17	23	40	75	38	15	Do.
13	Hyd. 313	915	yl. M. S	17	12	00	75	36	30	Do.
13	Hyd. 314	1,012	yl. M. S. For	16	54	20	75	33	50	Do.
13	Hyd. 315	1,250	yl. M. S. For	16	31	00	75	30	10	Do.
13	Hyd. 316	1,230	yl. M. S. For	16	07	45	75	26	30	Do.
13	Hyd. 317	1,662	yl. M. S. For	15	43	00	75	24	30	Do.
13	Hyd. 318	2,295		15	18	30	75	22	30	About 1 knot WNW. set; wire parted.
14	Hyd. 319	2,315	yl. M. S. For	14	42	30	75	18	30	Do.
14	Hyd. 320	2,250	dk. br. M. For	14	06	30	75	14	30	About 1 knot W. set.
14	Hyd. 321	2,175	dk. br. M. S. For	13	30	00	74	57	00	About 1 knot WSW. set.
14	Hyd. 322	2,185	bk. M. For	12	53	30	74	38	00	Do.
15	Hyd. 323	2,095	bk. M. S	12	17	00	74	19	00	Do.
15	Hyd. 324	2,057	bk. S	12	11	30	74	27	30	1 to 1½ knots W. set.
15	Hyd. 325	1,250	bk. M	11	46	00	74	27	30	Do.
15	Hyd. 326	745	bk. M	11	31	00	74	28	00	Do.
15	Hyd. 327	578	bu. M	11	21	00	74	28	00	Do.
15	Hyd. 328	420	bk. M. S	11	11	00	74	28	00	Do.
15	Hyd. 329	440	bk. S. bu. M	11	22	00	74	41	30	Do.
16	Hyd. 330	920	bk. S. bu. M	11	33	30	74	57	00	
16	Hyd. 331	615	bk. S. bu. M	11	18	30	74	58	20	E. set.

Table of sounding and dredging stations occupied during the winter and spring—Continued.

Date.	Number.	Depth.	Bottom.	Latitude N.	Longitude W.	Remarks.
		Fathoms.		° ′ ″	° ′ ″	
Mar. 16	Hyd. 332	457	bk. M	11 13 00	75 05 00	E. set.
22	Hyd. 333	10	bk. M	11 01 00	75 03 00	
22	Hyd. 334	39	bu. C	11 01 15	75 08 40	
22	Hyd. 335	228	bu. M	11 01 45	75 19 40	½ knot W. set.
22	Hyd. 336	625	bu. M	11 05 00	75 32 00	Do.
22	Hyd. 337	845	br. M	11 08 00	75 41 40	½ to 1 knot W. set.
22	Hyd. 338	1,195	br. M. gn. M	11 11 00	75 50 30	Do.
22	Hyd 339	980	br. M. gn. M	10 56 00	75 49 50	
22	Hyd. 340	880	br. M. gn. M	10 42 30	75 49 00	NE. set.
22	Hyd. 341	825	br. M	10 30 30	75 48 30	½ to ¾ knot NE. set.
23	Hyd. 342	1,165	br. M	10 26 15	76 03 00	Do.
23	Hyd. 343	1,270	br. M	10 22 10	76 17 30	Do.
23	Hyd. 344	1,560	br. M	10 18 00	76 32 00	Do.
23	Hyd. 345	750	br. M	10 01 30	76 24 45	Do.
23	Hyd. 346	255	gn. M	9 46 00	76 18 30	Slight ENE. set.
23	Hyd. 347	38	gn. M. S	9 30 00	76 14 45	Do.
23	2142	42	gn. M. S	9 30 15	76 20 30	½ knot E. set.
23	2143	155	gn. M. S	9 30 45	76 25 30	Do.
23	Hyd. 348	466	brd	9 32 00	76 34 45	Do.
23	Hyd. 349	960	br. M. gn. M	9 33 30	76 43 45	Do.
24	Hyd. 350	1,616	choc. Oz. For	9 36 20	77 02 45	¾ knot E. by S. set.
24	Hyd. 351	1,363	br. M. For	9 39 40	77 25 00	Do.
24	Hyd. 352	570	br. M. For	9 43 00	77 47 00	Do.
24	Hyd. 353	550	lt. br. M	9 44 40	77 56 00	Do.
24	Hyd. 354	630	br. M. S	9 47 00	78 09 30	Do.
24	Hyd. 355	1,017	br. M. S	9 48 00	78 24 00	
24	Hyd. 356	962	br. M	9 47 00	78 39 00	½ knot SE. set.
24	Hyd. 357	950	gy. M	9 45 30	78 54 00	Do.
24	Hyd. 358	1,060	sft. gy. M	9 47 00	79 03 00	½ knot E. set.
24	Hyd. 359	970	gn. M. br. M	9 48 30	79 11 45	Do.
25	Hyd. 360	828	gn. M. gy. M. Sh	9 51 15	79 20 30	½ knot ENE. set.
25	Hyd. 361	1,155	br. M. gn. M	9 54 00	79 30 00	SE. set.
25	2144	896	gn. M	9 49 00	79 31 30	Do.
25	Hyd. 362	580	bu. M	9 47 00	79 32 30	Do.
25	Hyd. 363	370	bu. M	9 45 15	79 34 00	Do.
25	Hyd. 364	58	bu. M	9 43 15	79 35 30	Do.
Apr. 2	2145	25	gn. M. brk. Sh	9 27 00	79 54 00	Cross-bearings of objects on shore.
2	2146	34	brk. Sh	9 32 00	79 54 30	Light SW. set.
2	2147	34	brk. Co	9 32 20	79 54 45	Do.
2	2148	130	brd	9 35 00	79 55 30	Do.
2	Hyd. 365	707	stk. C	9 36 30	79 59 22	Do.
2	Hyd. 366	611	br. S	9 47 45	80 02 50	About 1 knot SW. set
2	Hyd. 367	1,153	gy. M	9 57 00	80 06 20	About 1½ knots SW. set.

2	Hyd. 368	1,853	br. M. For	10	14	20	80	13	30	Do.
3	Hyd. 369	1,990	br. M. For	10	35	30	80	22	30	About 1 knot SW. set.
3	Hyd. 370	1,849	br. M	10	46	30	80	32	60	
3	Hyd. 371	1,832	br. M. For	11	20	00	80	41	10	Light E. set.
3	Hyd. 372	1,570	br. M. For	11	43	30	80	51	30	Light NW. set.
4	Hyd. 373	1,736	br. M. For	12	08	00	81	03	15	1 knot NW. set.
4	Hyd. 374	1,002	br. M. For	12	32	00	81	16	00	1½ knots NW. set.
4	2149	992	yl. M	13	01	30	81	25	00	Do.
4	Hyd. 375	727	yl. M	13	12	00	81	27	20	1½ knots NW. set.
4	Hyd. 376	339	Co. S	13	16	65	81	26	40	1½ knots NW. set; cross-bearings on Old Providence Island.
9	Hyd. 377	601	hrd	13	26	10	81	25	10	No current; cross-bearings on Old Providence Island.
9	Hyd. 378	472	fne. Co. S	13	30	30	81	23	30	Do.
9	2150	382	wh. Co. S	13	34	45	81	21	10	Do.
9	Hyd. 379	262	Co. S. For	13	41	20	81	15	30	Light NE. set.
9	Hyd. 380	498	yl. M. Co	13	45	15	81	11	30	Do.
9	Hyd. 381	625	hrd	13	53	15	81	03	45	Do.
9	Hyd. 382	577	Co. & S	14	01	20	80	56	10	Do.
9	Hyd. 383	596	yl. M	14	09	20	80	50	10	No appreciable current.
9	Hyd. 384	661	hrd	14	17	00	80	43	30	Do.
9	Hyd. 385	869	Co	14	25	45	80	37	45	Light NE. set.
10	Hyd. 386	982	yl. M. For	14	34	30	80	32	00	¼ knot NE. current.
10	Hyd. 387	1,066	yl. M. For	14	43	20	80	26	00	Do.
10	Hyd. 388	1,089	yl. M. fne. Co	14	48	30	80	23	00	Do.
10	Hyd. 389	1,151	yl. M. fne. Co	14	53	40	80	20	00	Do.
10	Hyd. 390	971	yl. M. fne. Co	14	58	50	80	17	00	N. set.
10	Hyd. 391	756	yl. Co. Oz. For	15	09	00	80	23	00	1½ knots NW. current.
10	Hyd. 392	690	yl Co. Oz	15	19	00	80	28	45	1 to 1½ knots NW. current.
10	2151	653	yl. Co. Oz	15	28	39	80	36	00	1 knot NW. current.
10	Hyd. 393	511	br. M. For	15	47	30	80	46	00	1 to 1½ knots NW. current.
10	Hyd. 394	19	Co	16	02	00	80	53	20	1 knot NW. current.
10	Hyd. 395	19	Co	16	15	00	81	01	00	No current.
10	Hyd. 396	23	Co	16	28	30	81	06	00	Do.
11	Hyd. 397	136	brk. Co	16	41	30	81	21	40	1 knot NW. by N. current.
11	Hyd. 398	444	gy. M. fne. Co. For	17	03	30	81	42	40	1 knot NW. by W. current.
11	Hyd. 399	920	yl. Oz. For	17	25	00	82	05	40	1½ knots NW. by W. current.
11	Hyd. 400	3,169	yl. Oz. For	17	42	00	82	34	00	2 knots WNW. current.
11	Hyd. 401	2,695	yl. Oz. For	18	01	30	82	54	10	2½ knots W. by N. current.
11	Hyd. 402	2,299	yl. Oz. For	18	18	45	83	01	10	Light E. set.
12	Hyd. 403	3,008	yl. Oz. For	18	24	20	83	15	15	2 knots WSW. current.
12	Hyd. 404	2,829	yl. Oz. For	18	30	00	83	16	30	1½ knots NW. by W. current.
12	Hyd. 405	735	yl. Oz. For. Pier	18	43	00	83	36	45	1 knot NW. current.
12	Hyd. 406	708	yl. Oz. For	18	48	30	83	45	30	¾ knot NW. current.
12	Hyd. 407	12	Co	18	49	00	83	46	45	Do.
12	Hyd. 408	14	Co	18	52	00	83	52	45	No appreciable current.
12	Hyd. 409	891	yl. Oz	18	54	45	83	53	45	NW. set.
12	Hyd. 410	2,014	yl. Oz. For	19	11	00	84	01	15	1½ knots NW. current.
12	Hyd. 411	2,522	yl. Oz. For	19	55	00	84	19	45	N. set.
13	Hyd. 412	2,575	yl. Oz. For	20	33	00	84	36	20	Do.
13	Hyd. 413	2,350	yl. Oz. For	21	15	41	84	48	00	Light NNE. set.
13	Hyd. 414	1,550	yl. Oz. For	21	40	00	84	57	00	¼ to ¾ knot NNW. current.
13	Hyd. 415	950	yl. Oz. For	21	44	40	84	58	45	Bearing of Cape San Antonio Light, and altitude of * Capella.
14	Hyd. 419	1,356	yl. Oz. For	23	48	14	84	06	55	Light NE. set.

Table of sounding and dredging stations occupied during the winter and spring—Continued.

Date.	Number.	Depth.	Bottom.	Latitude N.	Longitude W.	Remarks.
		Fathoms.		° ′ ″	° ′ ″	
Apr. 30	2152	387	Co			2¾ miles NW. of Havana light. (Approximate.)
30	2153	283	Co	23 10 19	82 23 10	Bearing and distance of Morro light. 1 knot westerly set.
30	2154	310	Co	23 10 16	82 22 54	Do.
30	2155	300	Co. S	23 10 21	82 22 44	Do.
30	2156	279	Co	23 10 35	82 21 55	Do.
30	2157	29		23 10 04	82 21 07	Do.
30	2158	86	Co	23 10 25	82 20 36	Do.
30	2159	98	Co	23 10 39	82 20 08	Do.
30	2160	167	Co	23 10 31	82 20 37	Do.
30	2161	146	Co	23 10 36	82 20 28	Do.
30	2162	122	Co	23 10 30	82 20 25	Do.
30	2163	133	Co	23 10 31	82 20 29	Do.
May 1	2164	182	Co	23 10 39	82 20 29	Do.
1	2165	200	Co	23 10 39	82 20 28	Do.
1	2166	196	Co	23 10 36	82 20 30	Do.
1	2167	201	Co	23 10 40	82 20 30	Do.
1	2168	122	Co	23 10 36	82 20 20	Do.
1	2169	78	Co	23 10 28	82 20 27	Do.
1	Hyd. 420	625	Co	23 06 00	83 03 45	Astronomical observation; cross-bearings on shore; 1¼ knots W. set.
2	Hyd. 421	476	yl. Co. M	22 04 15	84 59 35	No apparent current.
2	Hyd. 422	243	Co	22 01 25	85 00 30	
2	Hyd. 423	314	Co	22 00 25	85 00 25	
2	Hyd. 424	355	Co	22 00 00	85 00 15	
2	Hyd. 425	357	Co	21 59 00	84 59 55	
2	Hyd. 426	279	Co	21 58 00	84 59 35	
2	Hyd. 427	370	fne. S	21 59 15	85 00 35	
2	Hyd. 428	15½	Co	22 00 42	85 02 00	Anchored boat and established position.
2	Hyd. 429	19	Co	22 01 10	85 02 20	
2	Hyd. 430	114	Co	22 01 30	85 02 40	
2	Hyd. 431	258	Co	22 01 20	85 03 30	
2	Hyd. 432	250	fne. Co	22 00 20	85 03 25	
2	Hyd. 433	207	Co	22 00 25	85 03 05	
2	Hyd. 434	128	Co	22 00 30	85 02 50	Meridian altitude of sun, two observers, sea horizon. Bearing of light.
2	Hyd. 435	16	Co	22 00 35	85 02 30	
2	Hyd. 436	252	Co. brk. Sh	22 00 10	85 02 15	
2	Hyd. 437	227	Co. brk. Sh	22 00 20	85 01 45	
2	Hyd. 438	15½	Co	22 00 48	85 01 30	
2	Hyd. 439	14½	Co	22 01 16	85 01 15	
2	Hyd. 440	16½	Co	22 01 44	85 01 00	
2	Hyd. 441	24½	Co. brk. Sh	22 02 12	85 01 45	
2	Hyd. 442	251	Co. br. R	22 02 40	85 00 30	
2	Hyd. 443	424	Co	22 02 45	85 01 50	
2	Hyd. 444	270	Co. brk. Sh	22 02 10	85 02 05	

2	Hyd. 445	21	Co	22	01	45	85	02	05	
2	Hyd. 446	16½	Co	22	01	15	85	02	05	
2	Hyd. 447	567	Co	23	04	18	85	02	15	
2	Hyd. 448	701	yl. Oz. For	22	05	50	85	04	30	
2	Hyd. 449	918	yl. Oz. For	22	07	20	85	06	45	
2	Hyd. 450	1,069	yl. Oz. For	22	08	55	85	09	00	
2	Hyd. 451	1,186	For. Pter	22	10	50	85	12	00	
2	Hyd. 452	1,238	For. Pter	22	09	40	85	18	40	Light easterly set.
2	Hyd. 453	1,149	Co	22	06	30	85	15	00	Do.
2	Hyd. 454	871	Co	22	03	50	85	11	55	Do.
2	Hyd. 455	277	Co	West of Antonio Knoll.						Position not satisfactorily established.
2	Hyd. 456	490	Co	West of Antonio Knoll.						Do.
3	Hyd. 457	450	Co	21	57	10	85	04	30	
3	Hyd. 458	576	Co	21	55	45	85	02	50	
3	Hyd. 459	402	Co	About 2½ miles WNW. of San Antonio light						Position not satisfactorily established.
3	Hyd. 460	629	Co	21	53	00	85	02	55	
3	Hyd. 461	618	Co	21	54	25	85	07	55	
3	Hyd. 462	691	Co	21	55	50	85	13	00	
3	Hyd. 463	608	Co	21	56	30	85	15	20	
3	Hyd. 464	859	Co	21	59	55	85	13	45	
3	Hyd. 465	543	Co	21	58	30	85	10	50	
3	Hyd. 466	487	Co. brk. Sh	21	57	00	85	08	00	
3	Hyd. 467	593	Co. brk. Sh	21	55	30	85	05	15	
3	Hyd. 468	523	Co	21	54	05	85	02	40	
3	Hyd. 469	558	Co	21	53	05	85	00	40	
3	Hyd. 470	541	Co. Oz	21	52	35	85	00	45	
3	Hyd. 471	629	Co. Oz	21	52	40	85	01	45	
3	Hyd. 472	692	Co. Oz	21	51	55	85	02	30	Light easterly current.
3	Hyd. 473	583	Co	21	52	10	85	05	30	Do.
3	Hyd. 474	885	Co. Oz	21	52	30	85	09	35	Do.
3	Hyd. 475	775	hrd	21	52	50	85	13	25	Do.
3	Hyd. 476	923	rky	21	49	45	85	13	25	Do.
3	Hyd. 477	887	rky	21	50	10	85	08	45	Do.
3	Hyd. 478	815	rky	21	50	45	85	04	10	Do.
3	Hyd. 479	263	rky	21	51	20	84	59	30	
3	Hyd. 480	342	Co	21	50	10	85	01	35	
3	Hyd. 481	674	Co	21	49	05	85	05	50	
3	Hyd. 482	937	Co. S	21	47	55	85	10	00	
3	Hyd. 483	1,023	Co. S	21	46	25	85	15	20	
3	Hyd. 484	1,062	fne. Co	21	43	20	85	14	00	
3	Hyd. 485	971	Co	21	45	30	85	10	00	
3	Hyd. 486	574	hrd	21	48	00	85	04	45	
3	Hyd. 487	306	hrd	21	50	20	84	59	30	
3	Hyd. 488	329	hrd	21	47	35	84	57	15	
4	Hyd. 489	874	Co. br. M	21	45	50	84	59	15	1½ knots SE. current.
4	Hyd. 490	288	Co	21	48	00	84	57	30	Do.
4	Hyd. 491	232	Co	21	50	10	84	58	45	Light southerly set.
4	Hyd. 492	255	fne. Co	21	50	45	84	59	00	Do.
4	Hyd. 493	415	fne. Co	21	53	05	84	59	30	
4	Hyn. 494	537	Co	21	54	00	85	00	40	
4	Hyd. 495	516	hrd	21	53	00	85	01	50	

Table of sounding and dredging stations occupied during the winter and spring—Continued.

Date.	Number.	Depth.	Bottom.	Latitude N.	Longitude W.	Remarks.
		Fathoms.		° ′ ″	° ′ ″	
May 4	Hyd. 496	274	hrd	21 54 45	84 58 40	
4	Hyd. 497	475	Co	21 55 55	85 00 15	
4	Hyd. 498	474	Co. crs. G	21 57 10	85 01 50	
4	Hyd. 499	461	Co	21 58 25	85 03 40	
4	Hyd. 500	283	hrd	21 59 40	85 05 15	
4	Hyd. 501	703	yl. M	22 01 05	85 07 10	
4	Hyd. 502	732	yl. Oz. For	22 00 35	85 08 25	
4	Hyd. 503	776	hrd	22 00 05	85 09 40	
4	Hyd. 504	715	yl. Oz	21 59 20	85 08 40	
4	Hyd. 505	554	yl. Oz	21 59 10	85 06 55	
4	Hyd. 506	747	yl. Oz	21 59 50	85 07 45	
4	Hyd. 507	423	brk. Sh	21 58 30	85 06 10	
4	Hyd. 508	269	hrd	21 58 45	85 04 50	
4	Hyd. 509	657	yl. Oz	22 03 00	85 04 50	
4	Hyd. 510	526	yl. Oz	22 02 20	85 03 00	
5	Hyd. 511	600	co	22 07 05	85 02 45	
5	Hyd. 512	818	hrd	22 09 15	85 03 30	
5	Hyd. 513	986	yl. M. brk. Co	22 11 40	85 04 15	
5	Hyd. 514	953	yl. M. fne. Co	22 12 15	85 00 45	
6	Hyd. 515	769	yl. Oz. For	22 09 15	85 00 25	
6	Hyd. 516	499	yl. M	22 06 30	85 00 00	
6	Hyd. 517	388	yl. Oz	22 41 20	84 15 00	No current. N. end of Jutias Cay ENE. (mag.).
6	Hyd. 518	817	yl. Oz	22 45 20	84 15 00	Do. E. by S.
6	Hyd. 519	950	fne. Co. S	22 49 20	84 15 00	Do.
6	Hyd. 520	801	yl. Oz. S. For	22 50 10	84 11 00	
12	Hyd. 521	470	G. brk. Sh	30 46 00	78 35 00	No current.
14	Hyd. 522	2,507	br. Oz	34 14 00	72 35 30	Southerly set.
14	Hyd. 523	2,462	br. Oz	34 48 45	72 25 00	Do.

NOTE.—The latitudes of positions on Antonio Knoll are absolute; those of other soundings and the longitudes of all depend upon Cape San Antonio light being in latitude 21° 51′ 30″ N., longitude 84° 57′ 58″ W.

The statements of currents in the above table are based on careful estimates of their direction and strength while holding the sounding wire vertical, verified by their influence on the ship's reckoning between stations.

From these frequent observations it appears: (1) There is a general westerly drift throughout, as indicated on the charts, being strongest in the eastern part. (2) The currents appear to depend mainly on the wind, the direction of which they quickly follow approximately with a velocity proportioned to its force.

One exception to the first general rule was noted in latitude 12° to 12° 30′, longitude 62° 20′ to 62° 50′, where a slight set to the southward and eastward was experienced, the wind being light from ENE. It appears probable that vessels in this locality may be affected by the tidal currents of Grenada, although distant 40 to 60 miles from that island. The rule used by the island seamen for determining the time of the turn of the stream (see Navy Department H. O. Publication No. 63, page 554) is as follows: "From the time of the moon's rising until her superior transit or passing the meridian, the stream sets to the eastward; from the superior transit until she sets, it runs westward." While this vessel was in the area mentioned above, the moon was rising, which, according to the rule quoted, would account for the easterly set; the westerly set was again experienced two or three hours after the moon's meridian passage, increasing from that time on as the ship, moving southward, approached the western branch of the equatorial current flowing in between Grenada and Trinidad.

In connection with the second general statement made above, it should be observed that in the northern part of the Sea the set was generally to the southward of west, nearly following the winds; but south of the parallel of 12° or 12° 30′ the direction is to the northward of west, and usually quite strong—much more marked than farther north. For 100 miles northward of the Bocas de Dragos the current ran 2 to 3 knots an hour to NW., and farther to the NW. and W. (for 200 to 300 miles) it ran between NW. and W., also strong, in spite of the wind being in the NE. At the time of our visit to the Gulf of Paria (1st of February) the rainy season had not yet ended, and it is probable that the water from the Orinoco contributed to the stream in this vicinity. As far westward as longitude 66° 30, latitude 13°, a strong northwest current was experienced on the 8th of February.

Under the lee of Orchilla Island no current was perceptible, although running strong to NW. immediately north of it. In the broad channel between the Leeward Isles and the Main, the drift was to the southward of west until approaching Curaçao Island, when the current was found to be setting to about W. by N. The strength throughout here was ½ to ¾ knot.

Near the southern shores of Santo Domingo and Jamaica there are many eddies that may be somewhat tidal; but through them all is a

general easterly counter-set, of which advantage is frequently taken by the coasters in working to windward.

In the western part of the Caribbean Sea the strength of the westerly set is much less than farther east. Off the coast of the Isthmus of Panama there is not infrequently a counter-current to the eastward, which, although slight, is doubly perplexing from the fact that allowance is generally made for the usual westerly set. This may sometimes be accounted for by a continuance of northerly or northwesterly winds, but has at times been known to exist without that apparent cause.

In the broad channel between Yucatan and Honduras in the west and Cuba and Jamaica in the east the currents are extremely erratic. The amount of northwest drift in twenty-four hours was found generally to tally with what vessels have usually experienced there, being about 30 to 40 miles in a day; but during individual hours or portions of a day there were remarkable fluctuations noted. For instance, the current was WSW. 2½ knots an hour at one time; in two hours afterwards, just a few miles to the northward, it was setting feebly eastward; and again in two hours more, to southwest, and later on to the northwestward. This may be due to tidal influences, but it seems probable that the movement of the water is largely affected by the extraordinary variations in the depth, nearly 3,200 fathoms being found 75 miles eastward of Swan islet (60 feet high), 3,000 fathoms at 40 miles southeast of Misterioso Bank (10 fathoms), and so forth.

Fortunately while in this vicinity circumstances were very favorable for locating accurately each individual sounding, a bright moon lighting the horizon at night so that altitudes of stars could be observed at each station.

During the summer and autumn of 1884 hydrographic work was merely incidental, as continuous dredging and trawling generally interfered with the correct locating of the stations. Still, a number of the soundings taken were considered plotted with sufficient accuracy to be of hydrographic value. This work was off the United States coast between Cape Hatteras and George's Banks.

Nothing of special interest was definitely ascertained. But in the course of the season it became very evident that in the vicinity of the 40th parallel and the 70th and 71st meridians there is an easterly and a westerly movement of the water, alternating at intervals of apparently about half a day. Circumstances prevented a close examination into this matter, but, as the approximate time of the change of the current was noticed on several occasions to be later each day, it is believed that the phenomenon may be attributed to the influence of the moon, and that probably there may be tidal currents, less pronounced, but as regular there as along shore.

Indications were also found of a pocket running in northward from the 600-fathom line on about the meridian of 70° 15′, differing from the contour lines on existing charts. But, owing to cloudy weather and the

impossibility of keeping a good reckoning while trawling, the positions found were not considered sufficiently reliable to warrant making a report to the Hydrographic Office.

Table of sounding and dredging stations occupied during the summer and fall.

Date.	Number.	Depth.	Bottom.	Latitude N.	Longitude W.
		Fathoms.		° ′ ″	° ′ ″
July 20	Hyd. 524	86	G	37 57 20	73 56 10
20	2170	155	gy. S	37 57 00	73 53 30
20	2171	444	gn. M	37 59 30	73 48 40
20	2172	568	gn. M	38 01 15	73 44 00
21	2173	1,600	Glob. Oz	37 57 00	72 34 00
21	2174	1,594	gy. M	38 15 00	72 03 00
22	Hyd. 525	79	gn. M. S	39 29 00	72 22 00
22	Hyd. 526	104	gn. M. S	39 30 00	72 18 00
22	Hyd. 527	197	stf. bu. C	39 32 00	72 18 20
22	2175	452	gn. M	39 33 00	72 18 30
22	Hyd. 528	121	gy. M. S	39 29 30	72 14 40
22	Hyd. 529	94	gn. M	39 28 00	72 16 00
22	Hyd. 530	91	bk. M. fne. S	39 27 40	72 18 30
22	Hyd. 531	73	bk. M. S	39 27 20	72 20 40
22	2176	302	bk. M	39 32 30	72 21 30
22	2177	87	gn. M. S	39 33 40	72 08 45
22	Hyd. 532	143	gy. S. bk. Sp	39 31 50	72 05 00
22	2178	229	gn. M. S	39 29 00	72 05 15
23	2179	510	bk. M	39 30 10	71 50 00
23	2180	523	bk. M	39 29 50	71 49 30
23	2181	693	gy. M. fne. S	39 29 00	71 46 00
23	2182	861	gn. M	39 25 30	71 44 00
23	Hyd. 533	992	gn. M. R	39 23 45	71 43 00
Aug. 2	Hyd. 534	172	gy. M. fne. S	40 00 00	70 38 00
2	Hyd. 535	139	gy. M. fne. S	40 01 30	70 38 00
2	Hyd. 536	101	gn. M. fne. S	40 03 00	70 38 00
2	2183	195	gn. M. S	39 57 45	70 56 30
2	Hyd. 537	108	gn. M. S	39 58 45	70 55 30
2	2184	136	gn. M. S	40 00 15	70 55 30
2	2185	129	gn. M. S	40 00 45	70 54 15
2	2186	353	gn. M	39 52 15	70 55 30
3	Hyd. 538	57	gy. S	40 04 30	71 20 00
3	Hyd. 539	100	gn. M. S. Sp	40 02 00	71 13 45
3	Hyd. 540	113	gn. M. S. bk. Sp	40 01 30	71 12 30
3	Hyd. 541	194	gn. M. S	39 56 30	71 10 00
3	2187	420	gn. M	39 49 30	71 10 00
3	Hyd. 542	192	gn. M. S	39 56 30	71 08 00
3	2188	235	gn. M. S	39 54 30	71 08 00
3	Hyd. 543	265	gn. M. S	39 54 00	71 04 00
3	Hyd. 544	221	gn. M. S	39 55 00	71 07 00
4	2189	600	gn. M	39 49 30	70 26 00
4	2190	1,180	gy. Glob. Oz	39 40 00	70 20 15
4	2191	961	gn. M	39 45 30	70 17 00
4	Hyd. 545	784	gn. M. S	39 47 00	70 16 30
5	Hyd. 546	762	gn. M	39 54 30	70 15 40
5	Hyd. 547	769	gn. M. S	39 50 30	70 15 40
5	2192	1,060	gy. Oz. St.	39 46 30	70 14 45
5	2193	1,122	gn. M hrd	39 44 30	70 10 30
5	2194	1,140	br. Oz	39 43 45	70 07 00
5	2195	1,058	gn. M	39 44 00	70 03 00
6	2196	1,230	gn. M	39 35 00	69 44 00
6	2197	84	crs. S. brk. Sh	39 56 30	69 43 20
6	2198	84	crs. S. brk. Sh	39 56 30	69 43 20
6	2199	78	gy. S	39 57 30	69 41 10
6	2200	148	crs. S. bk. Sp	39 53 30	69 43 20
19	Hyd. 548	111	gn. M. S	39 48 30	71 41 15
19	2201	538	bu. M	39 39 45	71 35 15
19	2202	515	gn. M	39 38 00	71 39 45
19	2203	705	gn. M. S	39 34 15	71 41 15
19	2204	728	br. M	39 30 30	71 44 30
20	2205	1,073	gy. Oz	39 35 00	71 18 45
20	2206	1,043	gn. M	39 35 00	71 24 30
20	2207	1,061	gn. M	39 35 33	71 31 45
20	Hyd. 549	925	gy. Oz	39 34 00	71 34 30
21	2208	1,178	gn. M. S	39 33 00	71 16 15
21	2209	1,080	Glob. Oz	39 34 45	71 21 30
21	2210	991	gy. Glob. Oz	39 37 45	71 18 45
21	2211	1,064	gn. M	39 35 00	71 18 00
22	2212	428	gn. M	39 59 30	70 30 45
22	Hyd. 550	243	gn. M	40 00 00	70 28 30
22	2213	384	gn. M	39 58 30	70 30 00

Table of sounding and dredging stations occupied during the summer and fall—Continued.

Date.	Number.	Depth.	Bottom.	Latitude N.			Longitude W.		
		Fathoms.		°	′	″	°	′	″
Aug. 22	2214	475	gn. M	39	57	00	70	32	00
22	Hyd. 551	356	gn. M	39	53	00	70	31	45
22	2215	578	(Lost lead)	39	49	15	70	31	45
22	2216	956	gn. M	39	47	00	70	30	30
23	2217	924	gy. M	39	47	20	69	34	15
23	2218	948	gy. M	39	46	22	69	29	00
23	2219	948	gy. M	39	46	22	69	29	00
23	2220	1,054	gy. M	39	43	00	69	23	00
23	Hyd. 552	1,094	bu. Oz	39	40	05	69	23	00
Sept. 6	2221	1,525	gy. Oz	39	05	30	70	44	30
6	2222	1,537	gy. Oz	39	03	15	70	50	45
7	2223	2,516	Glob. Oz	37	48	30	69	43	30
7	Hyd. 553	2,704	gy. Oz	37	41	00	69	16	15
8	2224	2,574	Glob. Oz	36	16	30	68	21	00
9	2225	2,512	yl. Oz	36	05	30	69	51	45
10	2226	2,045	Glob. Oz	37	00	00	71	54	00
10	2227	2,109	Glob. Oz	36	55	23	71	55	00
11	2228	1,582	br. M	37	25	00	73	06	00
11	Hyd. 554	1,600	gy. Glob. Oz	37	22	53	73	06	30
11	2229	1,423	Glob. Oz	37	38	40	73	16	30
12	2230	1,168	gy. Oz	38	27	00	73	02	00
12	2231	965	gy. Oz	38	29	00	73	09	00
12	2232	243	gn. M	38	37	30	73	11	00
12	Hyd. 555	190	gn. M. fne. S	38	38	20	73	10	00
12	2233	630	gn. M	38	36	30	73	06	00
12	Hyd. 556	474	gn. M	38	40	00	73	03	00
13	2234	810	gn. M	39	09	00	72	03	15
13	2235	707	gn. M	39	12	00	72	03	30
13	2236	636	gn. M	39	11	00	72	08	30
13	2237	520	gn. M	39	12	17	72	09	30
13	2238	904	gy. M	39	06	00	72	10	00
13	Hyd. 557	851	gn. M	39	08	30	72	12	30
26	2239	32	gn. M	40	38	00	70	29	45
26	Hyd. 558	37	gn. M	40	37	00	70	32	00
26	2240	44	gn. M	40	27	30	70	29	00
26	2241	50	gn. M	40	21	00	70	29	15
26	2242	58	gn. M	40	15	30	70	27	00
26	2243	63	gn. M	40	10	15	70	26	00
26	2244	67	gn. M. S	40	05	15	70	23	00
26	2245	98	gy. S. bk. Sp	40	01	15	70	22	00
26	2246	122	gn. M	39	56	45	70	20	30
27	2247	78	gn. M. S	40	03	00	69	57	00
27	2248	67	gn. M. S. brk. Sh	40	07	00	69	57	00
27	2249	53	gn. M. fne. S	40	11	00	69	52	00
27	2250	47	gn. M. fne. S	40	17	15	69	51	45
27	2251	43	gy. M. fne. S	40	22	27	69	51	30
27	2252	38	gn. M. fne. bk. S	40	28	00	69	51	00
27	2253	32	gy. S. bk. Sp	40	34	20	69	50	45
27	2254	25	S. bk. Sp	40	40	30	69	50	30
27	2255	18	fne. S. bk. Sp	40	46	30	69	50	15
28	2256	30	yl. S	40	38	30	69	29	00
28	2257	33	yl. S. bk. Sp	40	32	30	69	29	00
28	2258	36	yl. S. bk. Sp	40	26	00	69	29	00
28	2259	41	gy. S. bk. Sp	40	19	30	69	29	10
28	2260	46	gy. S	40	13	15	69	29	15
28	2261	58	gy. S. brk. Sh	40	04	00	69	29	30
28	2262	250	gn. M. S	39	54	45	69	29	45
Oct. 18	2263	430	gn. M	37	08	00	74	33	00
18	2264	167	gy. S	37	07	50	74	34	20
18	2265	70	gn. M. G	37	07	40	74	35	40
18	Hyd. 559	54	S. G	37	07	30	74	37	00
19	2266	111	fne. S. brk. Sh	35	07	00	75	08	30
19	2267	68	gy. S	35	08	50	75	07	20
19	2268	68	gy. M	35	10	40	75	06	10
19	2269	48	crs. gy. brk. S	35	12	30	75	05	00
19	2270	32	fne. gy. S. bk. Sp	35	14	15	75	07	00
19	2271	26	crs. gy. S. brk. Sh	35	16	00	75	09	00
19	2272	15	crs. gy. S. brk. Sh	35	20	10	75	14	00
19	2273	17	gy. S. bk. Sp. brk. Sh	35	20	30	75	17	30
19	2274	16	gy. S. bk. Sp. brk. Sh	35	20	35	75	18	05
19	2275	16	gy. S. bk. Sp. brk. Sh	35	20	40	75	18	40
19	2276	16	gy. S. bk. Sp. brk. Sh	35	20	45	75	19	15
19	2277	16	gy. S. bk. Sp. brk. Sh	35	20	50	75	19	50
19	2278	16	gy. S. bk. Sp. brk. Sh	35	20	55	75	20	20
19	2279	16	gy. S. bk. Sp. brk. Sh	35	20	55	75	20	55
19	2280	16	gy. S. bk. Sp. brk. Sh	35	21	00	75	21	30
19	2281	16	gy. S. bk. Sp. brk. Sh	35	21	05	75	22	05
19	2282	14	bk. S	35	21	10	75	22	40
19	2283	14	gy. S	35	21	15	75	23	15
19	2284	13	crs. gy. S	35	21	20	75	23	30

Table of sounding and dredging stations occupied during the summer and fall—Continued.

Date.	Number.	Depth.	Bottom.	Latitude N.			Longitude W.		
		Fathoms.		°	′	″	°	′	″
Oct. 19	2285	13	crs. gy. S. bk. Sp	35	21	25	75	24	25
19	2286	11	crs. gy. S	35	21	30	75	25	00
20	2287	7	crs. S	35	22	30	75	26	00
20	2288	7½	crs. S. bk. Sp	35	22	40	75	25	30
20	2289	7	crs. S. bk. Sp	35	22	50	75	25	00
20	2290	9¾	S. bk. Sp	35	23	00	75	24	30
20	2291	15	gy. S. bk. Sp. brk. Sh	35	25	30	75	20	30
20	2292	17	bk. gy. S. brk. Sh	35	27	20	75	16	30
20	2293	18	crs. S. brk. Sh	35	29	10	75	12	30
20	2294	16	crs. gy. S	35	31	00	75	08	30
20	2295	22	crs. gy. S. bk. Sp	35	32	41	75	04	30
20	2296	27	crs. yl. S	35	35	20	74	58	45
20	2297	49	bk. M. S. brk. Sh	35	38	00	74	53	00
20	2298	80	bk. M. S. brk. Sh	35	39	00	74	52	00
20	2299	296	bk. M	35	40	00	74	51	30
20	2300	671	bk. M	35	41	30	74	48	30
21	2301	59	crs. S. brk. Sh	35	11	30	75	05	00
21	2302	49	S. Co	35	14	00	75	03	00
21	2303	41	fne. bk. gy. S	35	17	00	75	01	00
21	2304	37	fne. bk. gy. S	35	19	00	74	58	00
21	Hyd. 560	43	gy. bk. S	35	23	00	74	54	30
21	2305	58	fne. bk. S	35	23	00	74	51	30
21	Hyd. 561	1,007	gy. M	35	21	30	74	48	30
21	2306	322	gy. M	35	21	30	74	52	00
21	2307	43	gy. bk. S. brk. Sh	35	42	00	74	54	30
21	2308	45	gy. bk. S. brk. Sh	35	43	00	74	53	30
21	2309	56	gy. S. brk. Sh	35	43	30	74	52	00
21	2310	132	bk. M. fne. Sh	35	44	00	74	51	00

In the preceding tables the abbreviations for the bottom are from the following code:

Abbreviation.	Meaning.	Abbreviation.	Meaning.	Abbreviation.	Meaning.
C	Clay.	Sp	Specks.	bk	black.
Co	Coral.	St	Stones.	br	brown.
For	Foraminifera.	brk	broken.	bu	blue.
G	Gravel.	crs	coarse.	choc	chocolate colored.
Glob	Globigerina.	fne	fine.	dk	dark.
M	Mud.	hrd	hard.	gn	green.
Oz	Ooze.	lge	large.	gy	gray.
P	Pebbles.	rky	rocky.	lt	light.
Pter	Pteropods.	sft	soft.	rd	red.
R	Rock.	sml	small.	slat	slate colored.
S	Sand.	stf	stiff.	wh	white.
Sh	Shells.	stk	sticky.	yl	yellow.

In the month of February the ship was swung in the Gulf of Paria, latitude 10° 30′ N., longitude 61° 35′ W. The azimuth of the sun was observed on every alternate point on even beam, swinging first with starboard and afterwards with port helm; and on every fourth point, while listed about 5° to port and 5¼° to 6¼° to starboard, swinging both times with starboard helm. From the mean deviation table, derived from the two swingings on even beam, a steering-card was constructed (see Plate I). In it the inner graduated circle shows the magnetic courses to be made; the lines radiating from it to the outer circle indicate on the latter the corresponding courses to be steered by the standard compass.

The effect on the deviation of listing to either side was similar to that

found in higher latitudes, though of course less marked. When listed to starboard the ship's head is thrown to windward when on courses north of east and west, and to leeward when on courses south of east and west. When listed to port the ship's head is thrown to windward when on any course west of north and south, and to leeward on any course east of north and south. The greatest difference caused by starboard list was on a southwest course, when the deviation was 11° 15′ E. as compared with 8° 30′ E. on even beam. The greatest change caused by port list was on a northwest course, when the deviation was 5° 15′ E. as compared with 2° 30′ E. on even beam.

In the month of July a magnetic survey of the vessel was made while in the dry dock of the navy-yard, Norfolk, Va., and the data sent to the Navy Department.

The general methods of navigation were as described in the report for 1883. The following examples will serve to illustrate the practical working of them:

EXAMPLE I.—On January 15 the problem was to sound over the position of Mourand Shoal, latitude 24° 35′ N., longitude 65° 13′ W. An altitude of the sun taken at 8.20 a. m., and worked out for latitudes 25° and 25° 10′ showed the ship to be somewhere on the line A B (Plate II). Clouds interfered with subsequent time-sights, but it was seen that if 12 miles were made on the same course (S. by E. ¾ E.) the ship would be on a line passing over Mourand Shoal and parallel to the line of position found at 8.20. So, when that distance had been made, it being believed that the ship was to the northeastward of the shoal, the course was changed to run southward along that line, and, as the hour of noon approached, ex-meridian altitudes were observed and computed in quick succession. Finally, a short time before noon, the latitude of 24° 35′ was reached. The ship was immediately stopped and the sounding begun, No. 39. The meridian altitude taken while sounding gave 24° 35′ 14″ as the latitude; and as no current was detected while sounding (3,006 fathoms), the vessel was presumably in the required longitude also.

EXAMPLE II.—During the night of April 11 and 12, while sounding at 8.15 p. m., altitudes of Sirius and Capella were taken and worked out for latitudes 18° and 18° 10′, placing the ship at Station No. 401, the intersection of the two lines of equal altitude. It was found necessary to steam ahead about 2½ knots an hour E. by S. to keep the wire vertical. The course was then shaped for the vigia, making allowance for the westerly current, and a sounding taken about midway. The current was here found to have changed to the eastward, quite feeble, and altitudes of Vega and Polaris showed the ship at No. 402. The difference between the intended and actual positions corroborated fairly the change of current. The course was then shaped for the vigia again, and a sounding taken a few miles southward of it so as to have a definite starting point not far from the desired position. The current was here found to be setting to the WSW. about 2 knots, and altitudes of

Polaris and Altair placed the ship at No. 403. The course was once more shaped for the vigia; a latitude by Polaris, plotted just before reaching it, and an altitude of the sun while reeling in, placed the vessel at No. 404. The current was here found running to the NW. by W. about 1½ knots.

EXAMPLE III.—On August 22, while sounding at Station No. 550, an altitude of the sun was observed; from there 2 miles were made on a SSW. course to No. 2213, where the sun was again observed while sounding; from here about two miles were made trawling towards SW. to No. 2214, and the sun again observed. In all these positions the sights were worked out for latitudes 39° 50′ and 40°, giving the lines shown. At half a mile southward of 2214 a meridian altitude of the sun gave the latitude 39° 56′ 35″. By plotting between all these lines a westerly set was detected, and the positions were fixed as in Plate III. From No. 2214 made about 8 miles in a southerly course to No. 2215, when the sun was again observed; then made about 2½ miles (trawling) to SSE., when another sounding was taken (No. 2216), and the sun again observed. Finally, after trawling about 2 miles to E. by S. from No. 2216, a meridian altitude of α Ophiuchi placed the ship in latitude 39° 46′ 50″. By working out the p. m. sights for latitudes 39° 40′ and 39° 50′ and plotting forward from the noon position, the westerly current was found to have stopped, and the positions were fixed as shown. In this case the depth was not sufficient to admit of any current being detected while sounding, but in the morning the vessel was drifted over the dredge-rope somewhat.

REPORT OF PASSED ASSISTANT ENGINEER G. W. BAIRD, U. S. N.

MAIN ENGINES.

During the year the engines have been in operation 1,652 hours while the ship was on her course in free route, besides the time occupied in sounding and dredging at sea, when the engines were worked to signals. The ship has steamed on her course in all weathers 13,388 miles, an average of 7.93 per hour, during which time the port engine made 6,333,776 and the starboard engine 6,316,140 revolutions, a mean of 63.8 per minute. It has been the custom to aim at economical rather than quick voyages, and the engines have been seldom run wide open, even with the reduced pressure of 50 pounds, which we are now carrying. The maximum speed recorded during the year is 10½ knots, while the highest average for ten hours is 10.44 knots per hour.

BOILERS.

During the year repairs have been made to the boilers whenever fires were permitted to be hauled. The crown sheets, which are of "mild

steel," and which were soft and ductile when new, are now brittle and so hard that they will turn the edges of steel tools unless they are tempered as hard as fire and water can make them. During the winter's voyage these sheets cracked in several places, but have been hard-patched since then. New leaks appear in the boilers, which we patch in turn. The braces are so close together in the boilers that the cost of removing them to repair a leak is sometimes greater than the absolute repairs.

STEAM-CUTTERS.

The two steam-cutters have been eminently satisfactory. Except the fracture of a feed-pump bracket, there have been no mishaps during the year. A new piston spring has been put in, and the air-pump connections have been bushed, there being no provisions to take up the wear. The propeller blades have been bent several times, but were straightened on board. New casings have been put on the boilers, new firebricks put in the furnaces, and new mineral wool put under the casings. We have found it necessary to make an alteration in the stern stuffing-box of the larger boat. The cost for repairs to the two boats during the year has been $110.57.

PUMPS.

The steam pumps continue to give satisfaction. We have put plugs in the "throw ports" of the circulating pump, to throttle the steam and retard the motion of the main steam-valve; it has the effect of making the pump linger a moment at the end of the stroke, which permits the valves to seat without slamming.

STEERING ENGINE.

The steering engine continues to do its work admirably whenever used (which is not often); but from the extensive surface of the joints on the exhaust side, the air-leaks impair our vacuum from 2 to 3 inches, when it is exhausted into the main condenser.

DREDGING ENGINE.

The dredging engine, having a great surplus of power, continues to do its work with ease. We have cut away parts of the cylinder heads to clear the frames, that we may take the heads off without taking down the engine frames.

REELING ENGINE.

The reeling engine continues to work well, requiring but few repairs.

STEAM WINDLASS.

The steam windlass continues to work well requiring but little attention.

SOUNDING ENGINE.

Except making a new piston spring and occasionally keying the journals, this engine has required no repairs. Since we cut the lap off the valve we have been able to get the engine started quicker, and also clear it of water more readily.

WARMING.

The steam radiators, though presenting a much less aggregate surface than is customary to provide for a ship of this size, have proved sufficient for the purpose. The traps which drain off the condensed water have required much attention, and I have put on a "blow-through" arrangement, which appears to improve the circulation.

VENTILATING.

The conduits, registers, and fan appear to be sufficient in every way, but the lack of power in the "Wise motor," which drives the fan, is such that we get a much smaller circulation than was intended. An experiment recorded in my report of September 30 gives the power and efficiency of the motor.

DISTILLER.

The distiller continues to furnish a plentiful supply of excellent water.

LIGHTING.

The Edison-light plant continues to give great satisfaction. During the year we have improvised submarine lamps, which the Naturalists use in catching squid and other marine fauna at night; they appear to attract a great variety of creatures. We have provided two clusters of three 16 candle-power lamps each, having cables 30 feet in length, for use on deck. These lamps were intended to light the trawl-sieves on deck, and have been so successful that the use of the arc-lamps has been discontinued. They require so much less current than the arc-lamp that the dynamo does not feel the additional load as it did from the arc-lamps. The cables are carried on convenient reels, one of which is fixed under the forecastle and one in the pilot-house. During the year two additional lamp-fixtures have been placed in the cabin. The usual breaking of wires and of sockets has continued; the repairs being made by our engine-room force. The lamp has been cut from the deep-sea cable, and the photometer of Paymaster Read has been put in its place; the current to operate the deep-sea photometer is taken from four Le Clanché disk cells. We have purchased a 7-inch belt, which drives the dynamo with less slipping. During the year the dynamo has been in operation 1,482 hours, giving practically the same economy as previously reported. The brightness of the lamps is unimpaired and the steadiness remains uniformly constant. The average number of lamps

in nightly use is about 47. The total cost of the light has been as follows:

13½$\frac{89}{240}$ tons of coal	$97 07
92¼ gallons of oil	55 50
12 attachment plugs	3 90
7 brushes	7 00
5 cut-out blocks (additional)	1 70
39 3-light safety-plugs	2 73
6 6-light safety-plugs	48
1 20-light safety-plug	08
11 40-light safety-plugs	1 80
9 key-sockets	8 28
4 pounds insulation compound	48
5 feet of ⅜-inch rubber tubing	30
2 pounds insulation tape	96
3 deep-sea lamps	3 00
1 pound of No. 12 wire	40
1 pint of solution of gutta-percha	3 75
4 cigar-lighter plugs	2 20
⅛ gross assorted screws	1 12
7 ounces hydrochloric acid	1 31
1 2-point switch	45
2 electroliers	1 50
141 lamps	141 00
Total	335 01

From this it appears that the light in candle-power per hour is costing us $\left(\frac{33501}{1482 \times 47 \times 8} =\right)$ 0.0601 cent per hour; about the cost of gas for an equal light in New York City. It is proper to add that the cost of coal during this year has averaged us $6.99 per ton, and the entire expense in fixtures, wires, &c., are included, the item of labor alone being omitted, for the reason that no extra hands are employed for this purpose, the engine and dynamo being run by an enlisted man, in addition to his other duties in this department.

COAL EXPENDITURES.

During the year the expenditure of coal for the different purposes has been divided, approximately, as follows:

	Tons.
Coal consumed while the main engines were in operation for propulsion of the ship, warming, pumping bilges, washing decks, and steering	864$\frac{143}{240}$
Coal consumed for lighting the ship (by electricity)	13$\frac{89}{240}$
Coal consumed for ventilating	50$\frac{209}{240}$
Coal consumed for distilling water	19$\frac{134}{240}$
Coal consumed for warming the ship, keeping banked fires, hoisting anchors and trawls, and pumping water while the main engines were not running.	73$\frac{166}{240}$
Total coal consumed by the engineer's department	1022$\frac{141}{240}$
Coal for cooking (equipment department)	54$\frac{111}{240}$

REPORT OF THE MEDICAL DEPARTMENT, BY JAMES M. FLINT, SURGEON, U. S. N.

The sanitary arrangements of the ship for ventilation, heating, lighting, &c., were very thoroughly considered by Passed Assistant Surgeon C. G. Herndon, U. S. Navy, in his General Medical Report for 1883. No changes have since been made which render further comment necessary. The system of forced ventilation by down-draft has demonstrated the possibility of supplying an abundance of fresh air to all parts of a ship. The question is reduced to one of expense merely, in the form of coal and labor. It only remains to convince those in authority that oxygen is an element as important to the animal tissues as carbon, hydrogen, and nitrogen; in other words, that a supply of fresh air is as necessary to the health, comfort, and cheerfulness of men, as is a liberal allowance of other food, now so generously provided for; and the question of expense will be quickly solved. The lavish hand that prepares the ration tables will not be less free in dealing out oxygen, when its necessity or even advantage shall be realized. I concur with the opinion of Dr. Herndon that for the best results the fan should be run continuously at a low speed, rather than intermittently at a high rate.

The general health of the ship's company during the year has been excellent. No severe accident or serious illness has occurred. Of the minor ailments few, if any, have been due to removable local conditions. The irritations of mucous membranes, as shown by catarrhs and slight bronchial affections, and the cellular inflammations resulting in abscesses and boils, are properly attributable to sudden changes of temperature, or strong local draughts of cold air, or to excessive humidity, but these conditions are for the most part irremediable, and must be reckoned among the unhealthful influences inseparable from the occupation of the mariner. It is only fair to state that other conditions than purely local ones tend to keep up the good health of the ship. The crew are all in the prime of life, no boys or old men among them; the period of enlistment is for one year only, thus permitting a weeding out of the less vigorous and the inefficient; the climatic conditions are most favorable, the ship cruising in northern waters in summer, and southern in winter; and while liberty is freely granted the men at all ports, yet the disposition to riotous forms of dissipation is much less than the average.

The determination and records of sea-water densities have been assigned to this departments. This work has been principally carried on by Mr. N. B. Miller, apothecary of this ship, and I can testify to the care and faithfulness with which it has been executed. The gravities of a few samples have been determined by actual weight by Dr. J. H. Kidder, and a comparison of results justifies a belief in the general accuracy of the work done on board. The instrument in use is the

cup and stem-float, in the combination known as Hilgard's salinometer. The water as soon as received is poured into bottles fitted with ground-glass stoppers, and is kept in the laboratory with the instrument until it has taken the temperature of the room. The water is carefully poured down the side of the cup to prevent the entanglement of air, which is liable to rise in bubbles, and adhering to the float, to vitiate the result. The float is carefully inserted so as to avoid wetting the stem above the line of flotation, and the graduation is read at the water level, through the little cone which rises around the stem. The rolling motion of the ship being very slight under all ordinary circumstances of weather, and the laboratory being situated near the center of fore and aft movement, it is possible to attain here nearly the accuracy that could be expected from the use of the same instruments on shore.

Appended are the records of specific gravities (marked A).

Particular attention is called to the interesting series of surface-gravities taken on May 15th and 16th, during the passage of the ship from the Gulf Stream up Chesapeake Bay and the Potomac, and again on a similar trip. The gradual and regular diminution of density and the variability under differing conditions are well shown by the figures.

Through the courtesy of the Coast Survey Office an instrument for measuring the specific gravity of sea-water, known as Hilgard's optical densimeter, has been received. The instrument is fully described in Coast Survey Report for 1877, Appendix No. 10. Much time has been spent in the effort to become thoroughly acquainted with the use of the instrument and to determine its advantages, if any, and its accuracy in actual practice. After many trials, extending over a period of several months, I am compelled to say that, in its present form at least, it is less reliable and much more difficult to use than the old stem-float.

The following series of trials (marked B) with distilled water illustrates the unreliability of the instrument in my hands. For each experiment the densimeter was taken from its case, the prismatic bottle filled from a large jar of distilled water, and after the examination the bottle emptied and corked and the instrument returned to its case. All the appliances, were kept together and were of uniform temperature at the time of the experiment. Every precaution was taken to make the conditions always the same and to secure the greatest possible accuracy in the reading. As will be seen, there is an extreme variation in the series of 14.2 micrometer divisions, and as each division represents a change of .00007026 in density, the possible error in determining the gravity of distilled water mounts up to .001. No satisfactory explanation has been reached of the causes of the sudden changes observed in the tables. The probable error in reading the micrometer should not exceed 3 divisions, and the error in reading the thermometer must be less than .5°.

There is also appended a table (marked C), showing the comparative results with this instrument and the salinometer, using specimens of

sea-water obtained on three successive days. Before examining the specimens, the constant of the densimeter for distilled water was determined for that day by taking the average of three trials. The readings are generally a little lower, but not greatly different from those obtained by the salinometer.

A.—*Specific gravities of sea-water.*

Date.	Time of day.	Station.	Latitude N.	Longitude W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Reduced to 60° F.
1884.			° ′ ″	° ′ ″		°	°	°		
Jan. 24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	Surface.	78	77	88	1.0234	1.028104
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	50	78	77	88	1.0340	1.028704
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	100	67	77	87	1.0242	1.028709
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	200	.....	77	87	1.0242	1.028709
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	300	.....	77	87	1.0242	1.028709
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	400	45	77	86	1.0230	1.027916
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	500	.....	77	87	1.0230	1.027509
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	600	.....	77	86	1.0240	1.028316
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	700	40	77	.....	.....	(*)
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	800	.....	77	87	1.0230	1.027509
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	900	40	77	87	1.0230	1.027509
24	7.30 p.m.	Hyd. 47	17 46 30	65 10 25	1,000	....	77	87	1.0240	1.028509
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	Surface.	77	76	89	1.0234	1.028330
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	25	77	76	87	1.0242	1.028709
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	50	69	76	87	1.0242	1.028709
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	100	61.25	76	87	1.0240	1.028509
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	200	50	76	87	1.0236	1.028109
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	300	45	76	88	1.0230	1.027704
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	400	43.5	76	88	1.0228	1.027504
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	500	.....	76	88	1.0232	1.027904
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	600	40.7	76	88	1.0230	1.027704
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	700	40.2	76	89	1.0226	1.027530
28	5.00 p.m.	Hyd. 83	13 23 00	62 34 15	800	40	76	89	1.0226	1.027530
29	1.00 p.m.	Dredge 2119	11 48 30	62 17 30	Surface.	77	75	80	1.0250	1.028160
29	1.00 p.m.	Dredge 2119	11 48 30	62 17 30	25	75.75	75	78	1.0256	1.028418
29	1.00 p.m.	Dredge 2119	11 48 30	62 17 30	50	69.25	75	76	1.0260	1.028432
Feb. 3	9.00 a.m.	Dredge 2122	10 37 00	61 44 22	Surface.	78	77	81	1.0208	1.024239
3	10.00 a.m.	Dredge 2123	10 42 02	61 48 48	...do	76	77	78	1.0208	1.023783
3	11.00 a.m.	Hyd. 101	10 54 00	61 58 40	...do	77	77	78	1.0210	1.023808
3	12.00 m.	Hyd. 102	11 02 30	62 06 00	...do	77	77	80	1.0230	1.026160
3	12.00 m.	Hyd. 102	11 02 30	62 06 00	5	76	77	79	1.0232	1.026183
3	12.00 m.	Hyd. 102	11 02 30	62 06 00	25	70	77	76	1.0252	1.027632
3	2.45 p.m.	Hyd. 103	11 19 00	62 22 00	Surface.	77	77	80	1.0252	1.028360
3	5.00 p.m.	Hyd. 104	11 34 20	62 38 15	...do	78	78	81	1.0252	1.028539
3	7.30 p.m.	Hyd. 105	11 45 30	63 01 00	...do	77	76	81	1.0248	1.028139
4	8.30 a.m.	Hyd. 109	12 22 50	64 38 00	...do	78	78	80	1.0250	1.028160
4	1.00 p.m.	Hyd. 110	12 41 00	64 22 00	...do	78	78	80	1.0250	1.028160
4	5.30 p.m.	Hyd. 111	12 59 20	64 08 00	...do	77	75	80	1.0251	1.028260
5	8.00 a.m.	Hyd. 115	14 07 10	63 37 55	...do	77	75	79	1.0252	1.028183
5	12.00 m.	Hyd. 116	14 21 44	63 58 45	.. do	77	77	80	1.0251	1.028260
5	3.00 p.m.	Hyd. 117	14 35 10	64 21 10	Surface.	78	78	80	1.0252	1.028360
5	7.00 p.m.	Hyd. 118	14 51 00	64 42 00	...do	77	75	79	1.0254	1.028383
6	9.00 a.m.	Hyd. 120	16 01 00	65 56 20	.. do	77	78	79	1.0252	1.028183
6	9.00 a.m.	Hyd. 120	16 01 00	65 56 20	5	77	78	80	1.0250	1.028160
6	9.00 a.m.	Hyd. 120	16 01 00	65 56 20	25	77.5	78	80	1.0248	1.027960
6	4.00 p.m.	Hyd. 121	16 36 20	66 41 00	Surface.	77	80	80	1.0250	1.028160
7	9.00 a.m.	Hyd. 123	15 49 00	67 36 40	.. do	77	74	80	1.0250	1.028160
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	.. do	78	75	86	1.0238	1.028116
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	25	77.75	75	87	1.0234	1.027909
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	50	78	75	86	1.0240	1.028316
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	100	66.6	75	87	1.0242	1.028709
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	200	53	75	87	1.0234	1.027909
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	300	.....	75	87	1.0230	1.027509
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	400	.....	75	88	1.0225	1.027204
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	500	.....	75	87	1.0228	1.027309
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	600	.....	75	88	1.0226	1.027304
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	700	41	75	88	1.0226	1.027304
7	5.00 p.m.	Hyd. 124	15 02 00	67 13 20	800	40	75	88	1.0226	1.027304

* No water in cup.

A.—*Specific gravities of sea-water*—Continued.

Date.	Time of day.	Station.	Latitude N.	Longitude W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Reduced to 60° F.
1881.			° ′ ″	° ′ ″		°	°	°		
Feb. 8	8.00 a.m.	Hyd. 126	13 40 00	66 35 00	Surface.	77	77	80	1.0251	1.028260
8	11.00 a.m.	Hyd. 127	13 25 04	66 25 00	...do	77	78	80	1.0252	1.028360
8	4.30 p.m.	Hyd. 128	12 54 40	66 11 10	...do	78	80	80	1.0250	1.028160
9	8.40 a.m.	Hyd. 133	11 33 20	66 19 00	...do	75	76	78	1.0256	1.028408
9	11.00 a.m.	Hyd. 134	11 18 50	66 24 20	...do	76	78	79	1.0256	1.028583
9	3.00 p.m.	Hyd. 136	10 51 00	66 35 00	...do	77	80	80	1.0254	1.028560
9	6.30 p.m.	Hyd. 138	10 51 30	67 01 40	...do	75	74	77	1.0258	1.028418
10	8.30 a.m.	Hyd. 144	11 46 40	68 19 50	...do	77	76	79	1.0254	1.028383
10	10.30 a.m.	Hyd. 145	11 52 00	68 35 40	...do	77	76	79	1.0254	1.028383
10	12.30 p.m.	Hyd. 146	11 55 20	65 46 00	...do	77	78	79	1.0253	1.028283
10	1 15 p.m.	Hyd. 147	11 50 00	68 40 90	...do	77	79	79	1.0252	1.028183
10	3.00 p.m.	Hyd. 148	12 05 52	68 55 00	...do	77	80	79	1.0252	1.028183
11	12.00 m.	.....	Harbor Curaçao.		...do	75	78	79	1.0256	1 028583
18	8.30 a.m.	Hyd. 149	12 01 20	68 55 30	...do	75	75	77	1.0260	1.028618
18	10.00 a.m.	Hyd. 151	11 50 45	68 56 30	...do	75	75	77	1.0260	1.028618
18	12.00 m.	Hyd. 153	11 35 10	68 58 00	...do	75	77	77	1.0260	1.028618
18	1.00 p.m.	Hyd. 154	11 30 00	68 58 30	...do	75	76	76	1.0261	1.028532
18	2.00 p.m.	Dredge 2124	11 34 30	69 02 10	...do	74	76	76	1.0261	1.028532
18	4 00 p.m.	Dredge 2125	11 43 00	69 09 30	...do	74	76	76	1.0261	1.028532
48	7.00 p.m.	Hyd. 155	11 51 00	69 18 00	...do	74	75	77	1.0260	1.028618
19	9 30 a.m.	Dredge 2126	13 17 45	70 01 00	...do	76	79	79	1.0254	1.028383
19	4.30 p.m.	Hyd. 162	13 40 20	70 10 45	...do	76	79	79	1.0253	1.028283
20	1.30 p.m.	Hyd. 165	15 55 00	71 03 00	...do	77	81	80	1.0250	1.028160
20	8.00 p.m.	Hyd. 166	16 42 00	71 18 30	...do	75	78	79	1.0248	1.027783
21	7.00 a.m.	Hyd. 169	17 36 30	72 00 00	...do	75	79	79	1.0246	1.027583
21	9.30 a.m.	Hyd. 170	17 48 00	72 12 20	...do	77	79	80	1.0246	1.027760
21	1.30 p.m.	Hyd. 171	18 01 30	72 23 00	...do	78	82	81	1.0244	1.027739
21	3.00 p.m.	Hyd. 172	18 07 09	72 29 00	...do	78	79	80	1.0246	1.027760
21	3.00 p.m.	Hyd. 172	18 07 00	72 29 00	25	78	79	81	1.0246	1.027039
21	3.00 p.m.	Hyd. 172	18 07 00	72 29 00	50	77	79	81	1.0268	1.028139
21	4.30 p.m.	Hyd. 173	18 10 30	72 32 30	Surface.	77	79	80	1.0242	1.027360
21	6.30 p.m.	Hyd. 174	18 01 00	72 34 00	...do	77	78	83	1.0244	1.028126
22	7.00 a.m.	Hyd. 178	17 24 45	72 47 00	...do	76	76	79	1.0250	1.027083
22	10.00 a.m.	Hyd. 179	17 36 30	72 56 00	...do	76	78	80	1.0247	1.027860
22	12.30 p.m.	Hyd. 180	17 45 30	73 04 00	...do	78	78	80	1.0246	1.027760
22	4.00 p.m.	Hyd. 181	17 39 30	73 21 15	...do	78	80	80	1.0244	1.027560
22	7 00 p.m.	Hyd. 182	17 48 00	73 24 15	...do	77	78	80	1.0246	1.027760
23	9.00 a.m.	Hyd. 187	18 01 00	74 31 45	...do	77	74	80	1.0250	1.028160
23	11.00 a.m.	Hyd. 188	17 51 40	74 36 30	...do	77	76	80	1.0250	1.028160
23	2.00 p.m.	Hyd. 190	17 33 30	74 45 00	...do	77	80	80	1.0246	1.027760
23	6.00 p.m.	Hyd. 192	17 13 15	74 57 45	...do	77	78	80	1.0246	1.027760
24	10.00 a.m.	Hyd. 197	18 45 00	74 32 40	...do	78	80	81	1.0250	1.028339
24	1.00 p.m.	Hyd. 198	18 30 00	74 12 00	...do	80	84	81	1.0246	1.027939
24	4 00 p.m.	Hyd. 199	18 56 00	73 51 00	...do	79	80	81	1.0246	1.027939
24	7 00 p.m.	Hyd. 200	18 59 40	73 30 00	...do	78	78	81	1.0248	1.028139
25	10.00 a.m.	Hyd. 205	19 40 00	74 42 00	...do	78	78	80	1.0250	1.028160
25	1.00 p.m.	Dredge 2127	19 45 00	75 04 00	...do	78	78	81	1.0250	1.028339
26	12.00 m.	.....	Santiago de Cuba.		...do	82	82	84	1.0240	1.028512
27	12.00 m.	Dredge 2128	19 55 46	75 45 23	...do	79	80	81	1.0250	1.028339
28	9.00 a.m.	Hyd. 215	18 54 30	75 16 30	...do	78	78	80	1.0248	1.027960
28	1.30 p.m.	Hyd. 216	18 32 30	75 06 00	...do	78	78	81	1.0248	1.028139
28	6.00 p.m.	Hyd. 218	18 32 40	75 30 00	...do	78	78	80	1.0250	1 028160
29	8.00 a.m.	Hyd. 226	17 46 15	75 45 30	...do	78	77	81	1.0247	1.028039
29	1.00 p.m.	Hyd. 243	17 42 20	75 36 40	...do	78	79	81	1.0246	1.027939
29	5.30 p.m.	Dredge 2138	17 44 05	75 39 00	...do	77	78	81	1.0246	1.027939
Mar. 1	8.00 a.m.	Hyd. 286	17 47 00	76 33 10	...do	77	78	80	1.0248	1.027960
1	10.30 a.m.	Hyd. 288	17 49 30	76 43 35	...do	78	79	81	1.0244	1.027739
1	11.00 a.m.	Hyd. 289	17 51 20	76 44 30	...do	78	80	81	1.0244	1 027730
6	12.00 m.	.....	Kingston, Jamaica.		...do	78	80	80	1.0246	1.027760
11	6.00 p.m.	Hyd. 294	17 41 10	76 46 05	...do	78	78	79	1.0256	1.028583
12	4.00 p.m.	Hyd. 305	17 32 30	75 33 00	...do	78	79	78	1.0252	1.028008
13	11.30 a.m.	Hyd. 316	16 07 45	75 26 30	...do	76	77	78	1.0250	1.027808
13	3.30 p.m.	Hyd. 317	15 43 00	75 24 30	...do	77	79	79	1.0250	1.027983
14	8.30 a.m.	Hyd. 320	14 06 30	75 14 30	...do	75	77	78	1.0260	1.028808
14	3.00 p.m.	Hyd. 324	13 30 00	74 57 00	...do	76	80	77	1.0264	1.029018
15	8.30 a.m.	Hyd. 324	12 11 30	74 27 30	...do	75	77	77	1.0260	1.028018
15	1.00 p.m.	Hyd. 325	11 46 00	74 27 30	...do	75	77	76	1.0260	1.028432
15	4.30 p.m.	Hyd. 327	11 21 00	74 28 00	...do	75	79	77	1.0260	1.028018
20	11.00 a.m.	.....	Savanilla, U. S. C.		...do	74	79	75	1.0262	1.028465
22	11.00 a.m.	Hyd. 337	11 01 15	75 08 40	...do	75	76	76	1.0256	1.028032
22	1.30 p.m.	Hyd. 336	11 05 00	75 32 00	...do	75	77	77	1.0256	1.028218

A.—*Specific gravities of sea-water*—Continued.

Date.	Time of day.	Station.	Latitude N.	Longitude W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Reduced to 60° F.
1884.			° ′ ″	° ′ ″		°	°	°		
Mar. 22	7.30 p.m.	Hyd. 339	10 56 00	75 49 50	...do	77	77	78	1.0254	1.028208
23	10.00 a.m.	Hyd. 345	10 01 30	76 24 45	...do	79	79	80	1.0250	1.028160
23	1.00 p.m.	Hyd. 346	9 46 00	76 18 30	...do	82	82	82	1.0246	1.028120
23	7.15 p.m.	Hyd. 348	9 32 00	76 34 45	...do	79	78	80	1.0253	1.028460
24	9.00 a.m.	Hyd. 352	9 43 00	77 47 00	...do	76	80	79	1.0256	1.028587
24	1.00 p.m.	Hyd. 354	9 47 00	78 09 30	...do	79	79	80	1.0253	1.028460
24	6.00 p.m.	Hyd. 356	9 47 00	78 39 00	...do	79	78	79	1.0252	1.028183
25	11.00 a.m.	Hyd. 363	9 45 15	79 34 00	...do	80	79	80	1.0250	1.028160
Apr. 2	9.30 a.m.	.....	Harbor of Colon.		...do	79	80	81	1.0250	1.028330
2	12.00 m.	Dredge 2146	9 32 00	79 54 30	...do	79	79	81	1.0252	1.028539
2	7.30 p.m.	Hyd. 367	9 57 00	80 06 20	...do	78	78	81	1.0254	1.028739
3	8.00 a.m.	Hyd. 370	10 46 30	80 32 00	...do	79	80	80	1.0254	1.028560
3	1.00 p.m.	Hyd. 371	10 46 30	80 32 00	...do	79	79	80	1.0254	1.028560
3	1.00 p.m.	Hyd. 371	10 46 30	80 32 00	25	78	79	80	1.0262	1.029360
3	1.00 p.m.	Hyd. 371	10 46 30	80 32 00	100	64	79	74	1.0264	1.028486
3	1.00 p.m.	Hyd. 371	10 46 30	80 32 00	300	46.5	79	76	1.0274	1.029832
3	1.00 p.m.	Hyd. 371	10 46 30	80 32 00	500	40.7	79	74	1.0254	1.027486
3	1.00 p.m.	Hyd. 371	10 46 30	80 32 00	700	39.8	79	74	1.0260	1.028086
3	1.00 p.m.	Hyd. 371	10 46 30	80 32 00	900	39.5	79	73	1.0260	1.027924
4	9.30 a.m.	Dredge 2149	13 01 30	81 25 00	Surface.	78	79	79	1.0256	1.028563
9	8.30 a.m.	Hyd. 378	13 30 30	81 23 30	...do ..	78	82	79	1.0260	1.028983
9	12.00 m.	Hyd. 379	13 41 20	81 15 30	...do	79	82	79	1.0257	1.028083
10	9.00 a.m.	Hyd. 392	15 09 00	80 28 45	...do	78	80	78	1.0256	1.028408
10	1.00 p.m.	Dredge 2151	15 28 39	80 36 00	...do	79	80	80	1.0256	1.028760
10	1.00 p.m.	2151	15 28 39	80 36 00	50	77.5	80	79	1.0256	1.028583
10	1.00 p.m.	2151	15 28 39	80 36 00	200	55.5	80	76	1.0260	1.028432
10	1.00 p.m.	2151	15 28 39	80 36 00	400	43	80	75	1.0252	1.027465
11	4.00 p.m.	Hyd. 400	17 42 00	82 34 00	Surface.	80	80	81	1.0252	1.028539
12	9.30 a.m.	Hyd. 405	18 43 00	83 36 45	...do ..	80	87	80	1.0254	1.028560
12	2.00 p.m.	Hyd. 409	18 54 45	83 53 45	...do	80	85	80	1.0255	1.028660
12	3.20 p.m.	Hyd. 410	19 11 00	84 01 15	...do	78	79	80	1.0256	1.028760
13	11.20 a.m.	Hyd. 413	21 15 45	84 48 00	...do	80	81	80	1.0254	1.028560
13	11.20 a.m.	Hyd. 413	21 15 45	84 48 00	25	78.6	81	80	1.0254	1.028560
13	11.20 a.m.	Hyd. 413	21 15 45	84 48 00	100	73	81	79	1.0260	1.028983
13	11.20 a.m.	Hyd. 413	21 15 45	84 48 00	300	54.8	81	78	1.0254	1.028208
13	11.20 a.m.	Hyd. 413	21 15 45	84 48 00	500	42.3	81	77	1.0250	1.027618
13	11.20 a.m.	Hyd. 413	21 15 45	84 48 00	700	40.3	81	77	1.0250	1.027618
13	11.20 a.m.	Hyd. 413	21 15 45	84 48 00	900	40	81	77	1.0248	1.027418
14	12.00 m.	Hyd. 419	23 48 14	84 00 55	Surface.	80	79	80	1.0254	1.028560
14	.....	Hyd. 419	.....	.....	25	78.6	79	80	1.0254	1.028560
14	.....	Hyd. 419	.....	.....	100	68	79	78	1.0256	1.028408
14	.....	Hyd. 419	.....	.....	300	51.6	79	76	1.0254	1.027832
14	.....	Hyd. 419	.....	.....	500	.....	79	76	1.0252	1.027632
14	.....	Hyd. 419	.....	.....	700	40.4	79	76	1.0250	1.027432
14	.....	Hyd. 419	.....	.....	900	.....	79	75	1.0252	1.027465
25	4.00 p.m.	.....	Key West, Fla.		Surface.	77	80	77	1.0268	1.029418
25	10.00 p.m.	.....	....do		...do	75	70	77	1.0268	1.029418
26	10.00 a.m.	.....	....do		...do	77	79	77	1.0266	1.029218
26	5.00 p.m.	.....	....do		...do	75	74	76	1.0270	1.029432
27	10.00 a.m.	.....	....do		...do	77	78	77	1.0266	1.029218
27	4.30 p.m.	.....	....do		...do	76	76	76	1.0272	1.029632
28	12.00 m.	.....	Havana, Cuba.		...do	79	79	79	1.0256	1.028583
28	6.00 p.m.	.....	....do		...do	75	75	75	1.0260	1.028265
30	9.00 a.m.	Dredge 2155	28 10 21	82 22 44	...do	78	78	78	1.0256	1.028408
May 1	3.30 p.m.	Hyd. 420	Off Havana, Cuba.		...do	79	79	79	1.0255	1.028483
2	8.00 a.m.	Hyd. 421	22 04 15	84 59 35	...do	79	78	79	1.0256	1.028583
2	12.20 p.m.	Hyd. 435	20 00 35	85 02 30	...do	79	81	79	1.0252	1.028183
2	6.00 p.m.	Hyd. 451	22 10 50	85 12 00	...do	79	79	79	1.0254	1.028383
3	8.30 a.m.	Hyd. 470	21 52 35	85 00 45	...do	79	80	79	1.0256	1.028583
3	12.00 m.	Hyd. 475	21 52 50	85 13 25	...do	79	79	80	1.0254	1.028560
3	6.00 p.m.	Hyd. 482	21 47 55	85 10 00	...do	79	80	80	1.0256	1.028760
4	9.30 a.m.	Hyd. 496	21 54 45	84 58 40	...do	79	80	79	1.0254	1.028383
4	1.00 p.m.	Hyd. 504	21 50 20	85 08 40	...do	79	81	80	1.0254	1.028560
12	8.00 a.m.	Hyd. 521	30 46 00	78 35 00	...do	79	79	79	1.0260	1.028983
12	12.00 m.	.....	31 16 16	78 25 00	...do	79	80	79	1.0260	1.028083
12	8.00 p.m.	.....	32 00 00	77 10 00	...do	78	80	79	1.0258	1.028783
13	8.00 a.m.	.....	33 00 00	75 45 00	...do	71	70	75	1.0256	1.027865
13	12.00 m.	.....	33 21 36	75 10 00	...do	75	72	75	1.0260	1.028265
13	8.00 p.m.	.....	34 10 00	77 12 00	...do	72	70	73	1.0264	1.028324
14	7.00 a.m.	.....	34 14 00	72 35 30	...do	67	70	69	1.0270	1.028287
14	12.00 m.	.....	34 33 03	73 24 30	...do	68	73	70	1.0268	1.028250

A.—*Specific gravities of sea-water*—Continued.

Date.	Time of day.	Station.	Latitude N.	Longitude W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Reduced to 60° F.
1884.			° ′ ″	° ′ ″		°	°	°		
May 14	8.00 p.m.	.....	34 55 00	72 43 00	...do	67	70	69	1.0270	1.028287
15	8.00 a.m.	.....	35 37 00	74 24 00	...do	77	63	77	1.0260	1.028618
15	12.00 m.	.....	35 53 18	75 04 00	...do ...	54	57	56	1.0256	1.025120
15	8.00 p.m.	.....	Off Cape Henry, Va.		...do	61	60	63	1.0200	1.020411
15	10.00 p.m.	.....	Willoughby Spit, Va.		...do	61	60	63	1.0150	1.015411
16	12.00 m.	.....	Cherrystone River.		...do	60	61	63	1.0130	1.013411
16	6.00 a.m.	.....	Piney Point, Md.		...do	61	62	63	1.0070	1.007411
16	7.30 a.m.	.....	Blackiston's Island, Md.		...do	61	63	63	1.0050	1.005411
16	9.15 a.m.	.....	Lower Cedar Point, Md.		..do	62	64	64	1.0030	1.003548
16	9.45 a.m.	.....	Mathias Point, Va		...do	62	64	64	1.0010	1.001548
16	10.45 a.m.	.....	Maryland Point, Md.		...do	63	64	64	1.0000	1.000548
July 19	1.30 p.m.	.....	Navy-yard, Norfolk, Va.		Surface.	80	85	82	1.0080	1.011520
19	5.00 p.m.	.....	....do		...do	82	85	84	1.0085	1.012412
20	11.45 a.m.	Dredge 2170	37 57 00	73 53 30	...do	74	75	74	1.0256	1.027686
20	4.00 p.m.	2172	38 01 15	73 44 00	...do	74	76	74	1.0258	1.027886
20	4.00 p.m.	2172	38 01 15	73 44 00	25	58.8	76	70	1.0262	1.027650
20	4.00 p.m	2172	38 01 15	73 44 00	50	55.4	76	65	1.0268	1.027490
20	4.00 p.m.	2172	38 01 15	73 44 00	100	51	76	63	1.0270	1.027411
20	4.00 p.m.	2172	38 01 15	73 44 00	200	45.1	76	62	1.0270	1.027270
20	4.00 p.m.	2172	38 01 15	73 44 00	300	40.7	76	61	1.0272	1.027330
20	4.00 p.m.	2172	38 01 15	73 44 00	400	40	76	61	1.0272	1.027330
21	5.30 a.m.	2173	37 57 00	72 34 00	Surface.	70	69	70	1.0254	1.026850
21	5.30 a.m.	2173	37 57 00	72 34 00	25	53	69	69	1.0262	1.027487
21	5.30 a.m.	2173	37 57 00	72 34 00	50	51.7	69	60	1.0270	1.027000
21	5.30 a.m.	2173	37 57 00	72 34 00	100	51.7	69	59	1.0274	1.027280
21	5.30 a.m.	2173	37 57 00	72 34 00	200	51.7	69	58	1.0273	1.027060
21	5.30 a.m.	2173	37 57 00	72 34 00	300	40	69	57	1.0273	1.026940
21	5.30 a.m.	2173	37 57 00	72 34 00	400	39.7	69	57	1.0273	1.026940
21	5.30 a.m.	2173	37 57 00	72 34 00	500	39.5	69	57	1.0273	1.026940
21	5.30 a.m.	2173	37 57 00	72 34 00	600	38.7	69	57	1.0274	1.027040
21	5.30 a.m.	2173	37 57 00	72 34 00	700	38.7	69	60	1.0271	1.027100
21	5.30 a.m.	2173	37 57 00	72 34 00	900	38.1	69	57	1.0274	1.027040
22	8.30 a.m.	2175	39 33 00	72 18 30	Surface.	68	72	68	1.0244	1.025536
22	8.30 a.m.	2175	39 33 00	72 18 30	25	50.5	72	60	1.0262	1.026200
22	8.30 a.m.	2175	39 33 00	72 18 30	50	51.3	72	60	1.0268	1.026800
22	8.30 a m	2175	39 33 00	72 18 30	100	50.6	72	62	1.0263	1.026570
22	8.30 a.m.	2175	39 33 00	72 18 30	200	44.1	72	66	1.0273	1.027180
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	Surface.	69	71	70	1.0250	1.026450
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	25	57	71	64	1.0266	1.027148
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	50	52.8	71	62	1.0262	1.026470
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	100	50.7	71	62	1.0270	1.027270
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	200	44.2	71	59	1.0273	1.027180
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	300	40.7	71	57	1.0274	1.027040
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	400	40.2	71	58	1.0274	1.027160
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	500	40	71	59	1.0272	1.027080
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	600	39.6	71	60	1.0272	1.027200
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	700	38.7	71	58	1.0274	1.027160
23	5.00 p.m.	Hyd. 533	39 23 45	71 43 00	800	38.7	71	58	1.0275	1.027260
Aug. 2	12.00 m.	.....	39 57 49	70 56 30	Surface.	69	70	80	1.0224	1.025560
3	12.00 m.	.....	39 50 27	71 08 00	...do	68	69	80	1.0222	1.025360
3	7.00 p.m.	Hyd. 544	39 55 00	71 07 00	...do ...	68	70	72	1.0240	1.025764
3	7.00 p.m.	Hyd. 544	39 55 00	71 07 00	25	64.3	70	68	1.0256	1.026736
3	7.00 p.m.	Hyd. 544	39 55 00	71 07 00	50	51.8	70	63	1.0262	1.026611
3	7.00 p.m.	Hyd. 544	39 55 00	71 07 00	100	51.8	70	62	1.0268	1.027070
3	7.00 p.m.	Hyd. 544	39 55 00	71 07 00	224	42.3	70	66	1.0265	1.027340
4	11.00 a.m.	Dredge 2190	39 40 00	70 20 15	Surface.	73	73	74	1.0253	1.027386
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	...do	72	74	83	1.0236	1.027326
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	25	61.1	74	83	1.0240	1.027726
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	50	52.6	74	83	1.0240	1.027726
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	100	52.2	74	84	1.0240	1.027012
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	200	45.0	74	84	1.0236	1.027512
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	300	40.9	74	83	1.0238	1.027526
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	400	39.6	74	83	1.0238	1.027526
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	500	39.3	74	83	1.0237	1.027426
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	600	39.2	74	83	1.0238	1.027526
4	7.15 p.m.	Hyd. 545	39 47 00	70 16 30	700	38.9	74	83	1.0236	1.027326
5	7.45 p.m.	Dredge 2195	39 44 00	70 03 00	Surface.	74	76	85	1.0234	1.027600

A.—*Specific gravities of sea-water*—Continued.

Date.	Time of day.	Station.	Latitude N.	Longitude W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Reduced to 60° F.
1884.			° ′ ″	° ′ ″		°	°	°		
Aug. 6	11.38 a.m.	Dredge 2197	39 56 30	69 43 20	...do	74	78	78	1.0246	1.027408
6	11.38 a.m.	2197	39 56 30	69 43 20	25	49.8	78	78	1.0238	1.026608
6	11.38 a.m.	2197	39 56 30	69 43 20	50	52.8	78	78	1.0244	1.027208
6	11.38 a.m.	2197	39 56 30	69 43 20	70	52.3	78	70	1.0244	1.027363
19	12.00 m.	....	39 37 10	71 43 00	Surface.	73	72	82	1.0243	1.027820
20	7.00 a.m.	Dredge 2205	39 35 00	71 18 45	...do	73	68	81	1.0233	1.026639
20	12.00 m.	....	39 35 33	71 31 45	. do	75	75.5	82	1.0240	1.027520
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	...do	74	75	82	1.0240	1.027520
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	25	66.1	75	82	1.0242	1.027720
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	50	54.8	75	82	1.0243	1.027820
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	100	51.2	75	83	1.0239	1.027626
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	200	43.8	75	84	1.0235	1.027412
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	300	40.6	75	83	1.0237	1.027420
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	400	40.1	75	82	1.0238	1.027320
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	500	40.6	75	83	1.0236	1.027326
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	600	39.2	75	82	1.0237	1.027220
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	700	38.5	75	82	1.0237	1.027220
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	800	39	75	83	1.0238	1.027526
20	5.13 p.m.	Hyd. 549	39 34 00	71 34 30	925	38.6	75	83	1.0234	1.027126
21	7.00 a.m.	Dredge 2208	39 33 00	71 16 15	Surface.	71	72	84	1.0234	1.027312
21	12.00 m.	....	39 37 37	71 16 15	...do	74	77	83	1.0236	1.027326
22	8.00 a.m.	Dredge 2212	39 59 30	70 30 45	...do	71	74	84.5	1.0230	1.026993
22	11.45 a.m.	2213	39 58 30	70 30 00	...do ...	71	75	85	1.0231	1.027200
22	6.10 p.m.	2216	39 47 00	70 30 30	...do	71	77	83	1.0234	1.027136
23	8.00 a.m.	2217	39 47 20	69 34 15	...do	75	76	86	1.0230	1.027316
23	1.30 p.m.	2219	39 46 22	69 29 00	...do ,,	74	74	86	1.0228	1.027116
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	...do	75	75	80.5	1.0241	1.027339
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	25	63.2	75	80	1.0240	1.027760
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	50	55.9	75	80.5	1.0246	1.027769
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	100	52.5	75	81	1.0240	1.027939
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	200	44.3	75	81	1.0242	1.027539
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	300	40.7	75	80	1.0243	1.027460
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	400	39.3	75	80	1.0242	1.027360
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	500	40.6	75	80	1.0240	1.027160
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	600	39.2	75	81	1.0238	1.027139
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	700	39.1	75	80	1.0240	1.027160
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	800	38.6	75	70	1.0242	1.027183
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	900	.....	75	80	1.0242	1.027360
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	1,000	38.8	75	81.5	1.0240	1.027346
23	8.00 p.m.	Hyd. 552	39 40 05	69 23 00	1,089	38.3	75	80	1.0242	1.027760
Sept. 6	9.00 a.m.	Dredge 2221	39 05 30	70 44 30	Surface.	73	74	83	1.0233	1.027026
6	9.00 a.m.	2222	39 03 15	70 50 45	...do	74	70	83.5	1.0230	1.026807
7	7.00 a.m.	2223	37 48 30	69 43 30	.. do	81	78	87	1.0234	1.027009
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	.. do	82	78	86.5	1.0236	1.027099
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	25	82	78	87	1.0238	1.028369
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	50	79.8	78	87	1.0237	1.028269
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	100	72.7	78	88.5	1.0232	1.027088
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	200	57.3	78	88	1.0232	1.027004
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	300	44	78	87	1.0231	1.027009
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	400	45.6	78	86.5	1.0230	1.027399
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	500	40.5	78	86.5	1 0229	1.027299
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	600	39.6	78	88	1.0228	1.027504
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	700	39.6	78	87	1.0228	1.027309
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	800	39.5	78	86.5	1.0230	1.027399
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	900	39	78	86.5	1.0232	1.027509
7	7.00 p.m.	Hyd. 553	37 41 00	69 16 15	1,000	38.6	78	86.5	1.0235	1.027899
8	8.00 p.m.	Dredge 2224	36 16 30	68 21 00	Surface.	80	80	86	1.0240	1.028316
8	8.00 p.m.	2224	36 16 30	68 21 00	25	79.8	80	86	1.0238	1.028116
8	8.00 p.m.	2224	36 16 30	68 21 00	50	77.1	80	86	1.0238	1.028116
8	8.00 p.m.	2224	36 16 30	68 21 00	100	67.1	80	87.5	1.0236	1.028119
8	8.00 p.m.	2224	36 16 30	68 21 00	200	64.8	80	87.5	1.0236	1.028119
8	8.00 p.m.	2224	36 16 30	68 21 00	300	64.6	80	86	1.0238	1.028116
8	8.00 p.m.	2224	36 16 30	68 21 00	400	63.8	80	86	1.0237	1.028016
8	8.00 p.m.	2224	36 16 30	68 21 00	500	52.5	80	85.5	1.0238	1.027982
8	8.00 p.m.	2224	36 16 30	68 21 00	600	44.9	80	87	1.0228	1.027369
8	8.00 p.m.	2224	36 16 30	68 21 00	700	41	80	86	1.0229	1.027216
8	8.00 p.m.	2224	36 16 30	68 21 00	800	40.2	80	86	1.0230	1.027316
8	8.00 p.m.	2224	36 16 30	68 21 00	900	39.5	80	86	1.0238	1.028116
8	8.00 p.m.	2224	36 16 30	68 21 00	1,000	39.5	80	86.5	1.0238	1.028199
9	4.00 p.m.	2225	36 05 30	69 51 45	Surface.	81	82	80	1.0250	1.028160
9	4.00 p.m.	2225	36 05 30	69 51 45	25	78.8	82	80	1.0250	1.028160
9	4.00 p.m.	2225	36 05 30	69 51 45	50	71.9	82	79.5	1.0251	1.028161

A.—*Specific gravities of sea-water*—Continued.

Date.	Time of day.	Station.	Latitude N.	Longitude W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Reduced to 60° F.
1884.			° ′ ″	° ′ ″		°	°	°		
Sept. 9	4.00 p.m.	Dredge 2225	36 05 30	69 51 45	100	67.6	82	80	1.0253	1.028460
9	4.00 p.m.	2225	36 05 30	69 51 45	200	64.7	82	80	1.0252	1.028360
9	4.00 p.m.	2225	36 05 30	69 51 45	300	64.8	82	79	1.0254	1.028383
9	4.00 p.m.	2225	36 05 30	69 51 45	400	60	82	79	1.0249	1.027883
9	4.00 p.m.	2225	36 05 30	69 51 45	500	51.1	82	79	1.0244	1.027383
9	4.00 p.m.	2225	36 05 30	69 51 45	600	44.7	82	80	1.0242	1.027360
9	4.00 p.m.	2225	36 05 30	69 51 45	700	41.4	82	79.5	1.0252	1.028261
9	4.00 p.m.	2225	36 05 30	69 51 45	800	40.2	82	80	1.0245	1.027660
9	4.00 p.m.	2225	36 05 30	69 51 45	900	39.6	82	80	1.0240	1.027160
9	4.00 p.m.	2225	36 05 30	69 51 45	1,000	39.2	82	80	1.0244	1.027560
10	7.00 p.m.	2227	36 55 23	71 55 00	Surface.	81	81	80	1.0253	1.028460
10	7.00 p.m.	2227	36 55 23	71 55 00	25	82.2	81	80	1.0252	1.028360
10	7.00 p.m.	2227	36 55 23	71 55 00	50	77.1	81	80	1.0252	1.028360
10	7.00 p.m.	2227	36 55 23	71 55 00	100	71.4	81	80	1.0254	1.028560
10	7.00 p.m.	2227	36 55 23	71 55 00	200	65.2	81	79.5	1.0252	1.028261
10	7.00 p.m.	2227	36 55 23	71 55 00	300	62.8	81	79.5	1.0252	1.028261
10	7.00 p.m.	2227	36 55 23	71 55 00	400	57.7	81	79.5	1.0254	1.028461
10	7.00 p.m.	2227	36 55 23	71 55 00	500	54.7	81	79.5	1.0242	1.027261
10	7.00 p.m.	2227	36 55 23	71 55 00	600	42.5	81	79.5	1.0242	1.027261
10	7.00 p.m.	2227	36 55 23	71 55 00	700	40.4	81	79	1.0242	1.027183
10	7.00 p.m.	2227	36 55 23	71 55 00	800	39.3	81	79.5	1.0240	1.027061
10	7.00 p.m.	2227	36 55 23	71 55 00	900	39.2	81	80	1.0242	1.027360
10	7.00 p.m.	2227	36 55 23	71 55 00	1,000	39.1	81	80	1.0244	1.027560
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	Surface.	79	80	79	1.0226	1.025583
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	25	76	80	78.5	1.0246	1.027486
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	50	63.2	80	77.5	1.0250	1.027695
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	100	63.8	80	77	1.0249	1.027518
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	200	48	80	77	1.0248	1.027418
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	300	40.3	80	76	1.0247	1.027132
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	400	39.7	80	76.5	1.0244	1.026908
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	500	39.4	80	76.5	1.0244	1.026908
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	600	39.3	80	77	1.0244	1.027018
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	700	39.1	80	76.5	1.0248	1.027308
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	800	38.8	80	76.5	1.0248	1.027308
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	900	.....	80	76	1.0246	1.027032
11	2.00 p.m.	Hyd. 554	37 22 53	73 06 30	1,000	38.7	80	76.5	1.0246	1.027108
12	7.00 p.m.	Hyd. 556	39 40 00	73 03 00	Surface.	76	70	71	1.0234	1.025006
12	7.00 p.m.	Hyd. 556	39 40 00	73 03 00	25	61.8	70	71	1.0244	1.026006
12	7.00 p.m.	Hyd. 556	39 40 00	73 03 00	50	52.4	70	71.5	1.0250	1.026679
12	7.00 p.m.	Hyd. 556	39 40 00	73 03 00	100	49.3	70	71	1.0250	1.027206
12	7.00 p.m.	Hyd. 556	39 40 00	73 03 00	200	43.5	70	71.5	1.0254	1.027079
12	7.00 p.m.	Hyd. 556	39 40 00	73 03 00	300	40.4	70	71.5	1.0252	1.026879
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	Surface.	72	65	78	1.0234	1.026208
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	25	65.8	65	77.5	1.0244	1.027095
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	50	61.8	65	78	1.0235	1.026308
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	100	53.5	65	78.5	1.0234	1.026286
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	200	43.1	65	78.5	1.0234	1.026286
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	300	40.6	65	77.5	1.0243	1.026995
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	400	39.7	65	77	1.0244	1.027018
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	500	39.2	65	77	1.0244	1.027018
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	600	39.1	65	78	1.0242	1.027008
13	7.00 p.m.	Hyd. 557	39 08 30	72 12 30	700	38.7	65	77.5	1.0243	1.026905
28	9.54 a.m.	Dredge 2259	40 19 30	69 29 10	Surface.	61	67	80	1.0226	1.025760
28	12.50 p.m.	2261	40 04 00	69 29 30	...do	66	69	80	1.0233	1.026460
28	2.51 p.m.	2262	39 54 45	69 29 45	...do	66	75	78	1.0230	1.025883
Oct. 18	1.10 p.m.	2263	37 08 00	74 33 00	...do	66	68	80	1.0226	1.025766
19	8.18 a.m.	2268	35 10 40	75 06 10	...do	69	67	82	1.0220	1.025520
19	12.00 m.	2273	35 20 30	75 17 30	...do	72	68	81	1.0224	1.025739
19	5.16 p.m.	2282	35 21 10	75 22 40	.. do	69	67.5	81	1.0226	1.025939
20	9.36 a.m.	2292	35 27 20	75 16 30	...do	71	71	85	1.0212	1.025300
20	12.00 m.	.....	35 32 41	75 04 30	...do	72	76.5	85	1.0220	1.026100
20	5.30 p.m.	2300	35 41 30	74 48 30	...do	71	71.5	85	1.0218	1.025900
21	8.45 a.m.	2305	35 23 00	74 51 30	...do	69	77	84	1.0230	1.025912
21	5.30 p.m.	2308	35 43 00	74 53 30	...do	70	72	84	1.0220	1.025912
22	6.00 a.m.	Cape Henry, Virginia.			...do	60	61	84	1.0168	1.020712
22	1.25 p.m.	Point Lookout, Maryland.			...do	65	73	83	1.0106	1.014326
22	2.50 p.m.	Blackiston's Island, Maryland.			...do	65.5	75	81	1.0075	1.010839
22	5.00 p.m.	Upper Cedar Point, Maryland.			...do	65	74.5	79	1.0044	1.007383
22	6.00 p.m.	Maryland Point, Maryland.			...do	64	64	74	1.0034	1.005486
23	7.30 a.m.	Quantico, Virginia.			..do	62	51	63	1.0008	1.000491

B.—*Experiments with the optical densimeter with distilled water.*

[Value of micrometer divisions . 00007026.]

Date.	Corrected temperature.	Micrometer reading.	Micrometer reading reduced.	Date.	Corrected temperature.	Micrometer reading.	Micrometer reading reduced.
	°				°		
Aug. 15	67.3	312	330.9	Sept. 6	82.8	260	328.9
17	79	273	328.5	7	89.2	230	324
18	75.9	285.5	330.5	8	90	230	326.7
19	82.7	260.5	329.1	9	90.5	220	318.8
20	84.1	256	329.8	9	85.8	239	319.2
20	76.3	285	331.3	9	90.7	220	319.6
21	76.6	282.5	329.8	10	89.7	229	324.5
28	80	273	332	11	80.7	263	324.3
28	71.1	302	331.9	11	79.5	265	322.2
29	82.8	264	333	12	83.2	254.5	325.7
30	83.4	260	331.2	14	83	262	331.7
Sept. 8	71.4	301	331.8				

C.—*Record of specific gravities determined by the optical densimeter compared with those obtained with the salinometer.*

[The constant for distilled water was determined before each series of observations.]

Date.	Station.	Latitude N.			Longitude W.			Depth.	Specific gravity at 60° by densimeter.	Specific gravity reduced to 60° F. by salinometer.
1884.		°	′	″	°	′	″			
September 6	Dredge 2221	39	05	30	70	44	30	Surface.	1.026383	1.027026
September 6	2222	39	03	15	70	50	45	....do	1.026087	1.026807
September 7	2223	37	48	30	69	43	30	.. do	1.027562	1.027999
September 7	Hyd. 553	37	41	00	69	16	15	....do	1.027394	1.027999
September 7	Hyd. 553	37	41	00	69	16	15	25	1.027745	1.028309
September 7	Hyd. 553	37	41	00	69	16	15	50	1.027750	1.028209
September 7	Hyd. 553	37	41	00	69	16	15	100	1.028539	1.027988
September 7	Hyd. 553	37	41	00	69	16	15	200	1.027696	1.027904
September 7	Hyd. 553	37	41	00	69	16	15	300	1.027232	1.027609
September 7	Hyd. 553	37	41	00	69	16	15	400	1.026902	1.027399
September 7	Hyd. 553	37	41	00	69	16	15	500	1.026916	1.027299
September 7	Hyd. 553	37	41	00	69	16	15	600	1.026944	1.027504
September 7	Hyd. 553	37	41	00	69	16	15	700	1.026829	1.027309
September 7	Hyd. 553	37	41	00	69	16	15	800	1.026853	1.027899
September 7	Hyd. 553	37	41	00	69	16	15	900	1.026965	1.027599
September 7	Hyd. 553	37	41	00	69	16	15	1000	1.027696	1.027899
September 8	Dredge 2224	36	16	30	68	21	00	Surface.	1.027626	1.028316
September 8	2224	36	16	30	68	21	00	25	1.028002	1.028116
September 8	2224	36	16	30	68	21	00	50	1.028209	1.028116
September 8	2224	36	16	30	68	21	00	100	1.028707	1.028119
September 8	2224	36	16	30	68	21	00	200	1.028434	1.028119
September 8	2224	36	16	30	68	21	00	300	1.027991	1.028116
September 8	2224	36	16	30	68	21	00	400	1.027703	1.028016
September 8	2224	36	16	30	68	21	00	500	1.027527	1.027982
September 8	2224	36	16	30	68	21	00	600	1.028811	1.027309
September 8	2224	36	16	30	68	21	00	700	1.027260	1.027216
September 8	2224	36	16	30	68	21	00	800	1.026958	1.027316
September 8	2224	36	16	30	68	21	00	900	1.027837	1.028116
September 8	2224	36	16	30	68	21	00	1000	1.028054	1.028199
September 9	2225	36	05	30	69	51	45	Surface.	1.027706	1.028160
September 9	2225	36	05	30	69	51	45	25	1.027981	1.028160
September 9	2225	36	05	30	69	51	45	50	1.027963	1.028161
September 9	2225	36	05	30	69	51	45	100	1.028005	1.028460
September 9	2225	36	05	30	69	51	45	200	1.027654	1.028360
September 9	2225	36	05	30	69	51	45	300	1.027822	1.028383
September 9	2225	36	05	30	69	51	45	400	1.027654	1.027883
September 9	2225	36	05	30	69	51	45	500	1.027162	1.027883
September 9	2225	36	05	30	69	51	45	600	1.027134	1.027360
September 9	2225	36	05	30	69	51	45	700	1.028216	1.028261
September 9	2225	36	05	30	69	51	45	800	1.027162	1.027660
September 9	2225	36	05	30	69	51	45	900	1.027190	1.027160
September 9	2225	36	05	30	69	51	45	1000	1.027148	1.027560

C.—*Record of specific gravities determined by the optical densimeter, &c.*—Continued.

Date.	Station.	Latitude N.			Longitude W.			Depth.	Specific gravity at 60° by densimeter.	Specific gravity reduced to 60° F. by salinometer.
1884.		°	′	″	°	′	″			
September 10	Dredge 2227	36	55	23	71	55	00	Surface.	1.028075	1.028460
September 10	2227	36	55	23	71	55	00	25	1.027977	1.028360
September 10	2227	36	55	23	71	55	00	50	1.028047	1.028360
September 10	2227	36	55	23	71	55	00	100	1.028258	1.028560
September 10	2227	36	55	23	71	55	00	200	1.027086	1.028261
September 10	2227	36	55	23	71	55	00	300	1.028160	1.028261
September 10	2227	36	55	23	71	55	00	400	1.028314	1.028461
September 10	2227	36	55	23	71	55	00	500	1.027260	1.027261
September 10	2227	36	55	23	71	55	00	600	1.027155	1.027261
September 10	2227	36	55	23	71	55	00	700	1.027196	1.027183
September 10	2227	36	55	23	71	55	00	800	1.027085	1.027001
September 10	2227	36	55	23	71	55	00	900	1.027036	1.027360
September 10	2227	36	55	23	71	55	00	1,000	1.027096	1.027560
September 11	Hyd. 554	37	22	53	73	06	30	Surface.	1.025377	1.025583
September 11	554	37	22	53	73	06	30	25	1.027030	1.027486
September 11	554	37	22	53	73	06	30	50	1.027759	1.027695
September 11	554	37	22	53	73	06	30	100	1.027478	1.027518
September 11	554	37	22	53	73	06	30	200	1.027689	1.027418
September 11	554	37	22	53	73	06	30	300	1.027014	1.027132
September 11	554	37	22	53	73	06	30	400	1.026860	1.026908
September 11	554	37	22	53	73	06	30	500	1.027141	1.026908
September 11	554	37	22	53	73	06	30	600	1.027211	1.027018
September 11	554	37	22	53	73	06	30	700	1.027141	1.027308
September 11	554	37	22	53	73	06	30	800	1.027211	1.027308
September 11	554	37	22	53	73	06	30	900	1.026930	1.027032
September 11	554	37	22	53	73	06	30	1,000	1.026930	1.027108
September 12	556	39	40	00	73	03	00	Surface.	1.024457	1.025000
September 12	556	39	40	00	73	03	00	25	1.026242	1.026000
September 12	556	39	40	00	73	03	00	50	1.026523	1.026670
September 12	556	39	40	00	73	03	00	100	1.027225	1.027206
September 12	556	39	40	00	73	03	00	200	1.027000	1.027079
September 12	556	39	40	00	73	03	00	300	1.026944	1.026879
September 13	557	39	08	30	72	12	30	Surface.	1.026060	1.026208
September 13	557	39	08	30	72	12	30	25	1.026874	1.027095
September 13	557	39	08	30	72	12	30	50	1.026171	1.026308
September 13	557	39	08	30	72	12	30	100	1.026150	1.026286
September 13	557	39	08	30	72	12	30	200	1.026361	1.026286
September 13	557	39	08	30	72	12	30	300	1.027014	1.026995
September 13	557	39	08	30	72	12	30	400	1.026144	1.027018
September 13	557	39	08	30	72	12	30	500	1.026070	1.027018
September 13	557	39	08	30	72	12	30	600	1.026951	1.027008
September 13	557	39	08	30	72	12	30	700	1.027014	1.026995

REPORT OF THE NATURALIST, MR. JAMES E. BENEDICT.

The work of the Albatross for the year 1884 began with a long cruise among the West India Islands and in the Caribbean Sea, under the direction of the Bureau of Navigation, Navy Department. A series of soundings and various observations was to be made for this Bureau, which were necessarily to take precedence of zoological work. However, opportunities were to be given for collecting while the ship was in port, and some dredgings were to be made at sea.

The cruise began on the 10th of January, when the Albatross sailed from Norfolk, Va., for St. Thomas, where the anchor was dropped at about noon on the 17th in the harbor of Charlotte Amalie. The island seemed very beautiful to those of us who saw a tropical country for the

first time. The red roofs of the town, as it extended up the side of the hill, where deep gullies divide its upper edge into three sections, make a fine contrast with the water on the one side, and the green shrubs, which densely cover the hill rising high above it, on the other.

St. Thomas lies nearly east and west, and is about 12 miles in length by from 2 to 3 in width. A range of steep hills extends its entire length. The proportion of anything like level ground is inconsiderable. In many places the shore is bold and jagged; in others it slopes down gently to the water's edge. Here and there an indentation in the shore-line affords protection to animal life from the force of the waves. Towards the eastern end of the island is a large lagoon, with shores and islands lined with mangrove trees. The roots and stolons of these trees are covered with sponges, ascidians, oysters, and aquatic plants. These in turn afford a hidingplace for worms, crabs, and many other free swimming animals. The hills are covered with small trees and shrubs, often interspersed with large cactus plants of several species, making the thicket difficult to penetrate in some localities.

In the afternoon of the first day we began to collect, and continued this every day until the ship sailed. We found no mammals, and were informed that with the exception of a small rodent no mammals were indigenous to the island. I take it for granted, however, that exception should also be made to one or more species of bats, though we did not see any.

Birds were not numerous, only thirty-five specimens being taken during our stay, representing ten species, identified by Mr. Ridgway as follows:

Mimus gilvus, Vieill.
Dendroica petechia (Linn.).
Certhiola portoricensis, Bryant.
Phonipara zena (Linn.).
Icterus vulgaris, Daud.
Tyrannus dominicensis (Gm.).
Crotophaga ani, Linn.
Coccyzus minor (Gmel.).
Tinnunculus caribæarum (Gm.).
Chamæpelia passerina (Linn.).

Twenty-five skins were made, the remainder being preserved in alcohol.

The only snake obtained was brought on board alive by one of the sailors, it being harmless, as all of the reptiles on the island are said to be.

Lizards were very plentiful, and several species were taken. One species of rather small size was abundant on trees and fences, and were easily obtained by the small boys, who sometimes accompanied us a short distance on our excursions, by means of a blade of tough grass, the end of which they skilfully formed into a noose. The lizards watch the slow movements by which this is put over their heads with great curiosity, and only realize what is going on when they dangle in the air or are being placed in a jar of alcohol. I found a very small wire much better than a blade of grass for my use. It seemed impossible to capture the much larger ground lizards in this way, as upon seeing any one

they ran about uneasily, suspicious of every movement. I made use of a charge of dust shot in a 32-caliber shell, with good effect, not materially injuring the specimens.

Insect life was not abundant, owing perhaps to the season of the year, though I should think that the large numbers of lizards served somewhat to keep them down. Spiders and centipedes were preserved whenever secured.

Fish are taken by the fishermen in wicker-baskets, made and used on the same principle as our lobster-traps. I was informed that the greater supply of the fish in the market was obtained by means of these traps, though some fish are caught by still-baiting with hook and line and by trolling in the lagoon. I saw a fish-basket taken up which contained a number of highly-colored fish, and from which I obtained a fair selection for the Commission. One of these baskets was obtained for the National Museum.

We collected some interesting crustaceans; one, a small squill, which lives in cavities under stones and corals, where it fastens its eggs and stands guard over them. One species of crab is found everywhere along the shore, running out of the water and resting on the rocks. Mr. Nye found that he could catch one only by running up as a wave dashed over it, and landing it with a scoop-net in some open place before it could climb out of the net, which it does with surprising agility. These crabs run without apparent difficulty up the perpendicular sides of a rock.

We made it a rule to save the smaller fishes, mollusks, crustaceans, worms, &c., in large numbers whenever they could be obtained, in the hope of finding something new or rare, especially as our very limited time did not permit us to discriminate closely. Some dredgings were made at the entrance of the harbor and a little way outside, with a small boat-dredge, which we put over from the dinghy in tow of the captain's gig. This was hard work; but the additional specimens obtained well repaid us for the trouble. We were very kindly treated by the people of St. Thomas, and, through the courtesy of Baron Eggers, we were allowed to shoot on his land, it being against the law to shoot indiscriminately in the highways and woodlands.

On January 24 we left St. Thomas and stood out to sea on a southerly course. The first soundings in the Caribbean Sea were made in sight of St. Thomas. Here and elsewhere during the cruise, when the water was deep enough to necessitate the use of a sounding-shot, the sounding-cup would, as a rule, come up filled with ooze. This was carefully labeled and put into bottles, sometimes as it came up and sometimes after having been washed; only the foraminifera, pteropod shells, and sponge spicules being saved, as each seemed to require.

The color of the ooze brought up from the deep water of the Caribbean Sea is very much lighter than that from a similar depth in the Atlantic Ocean off our eastern coast. This is no doubt the natural result of the shores being largely made up of coral formations. It is well known

that in some of the shallow bays a violent wind will stir up the bottom until the water is almost milk-white with particles of coral. We found the proportion of foraminifera in the ooze to be large. As was to be expected, a greater number of these belonged to the genus *Globigerina*. *G. rubra* was conspicuous.

Pteropod shells in many localities were very numerous, much to our surprise, as I do not remember having seen a single shell of this group taken in the sounding-cup in the Atlantic, and but comparatively few in the dredgings. We saw the explanation of the number of these shells on the bottom when near Trinidad, where for some distance we steamed through water alive with them. A large number were caught in a scoop-net and were found to belong to the genus *Styliola*.

On January 27 the large beam-trawl was put over in 683 fathoms, Station No. 2117, being the first haul in the Caribbean Sea, and a very successful one. Among the things brought up were several forms of coral, one of them a beautiful cup coral of a species new to our collections; also many shells related to the pectens. These shells were very thin and transparent, showing the animal quite distinctly. Echinoderms were represented by starfish, brittle-stars, sea-urchins, and sea-cucumbers. Sponges, both siliceous and horny, worm-tubes with long glass spicules attached, and many small crustaceans, &c., made up the material in the trawl-net. The mud-bag, which was attached to the end of the trawl-net, was nearly filled with ooze, which yielded a large percentage of foraminifera. This foraminifera is in better condition than any we have before saved in quantity, as the coral ooze from which it was washed leaves the shells clean and perfect.

On January 28, one haul was made with the large beam-trawl, Station No. 2118, in 690 fathoms. The water deepened so rapidly that no bottom specimens were brought up. However, several interesting crustaceans were taken from the wing-nets. At Station 2119, on January 29, in 1,140 fathoms, the trawl was lost. Station 2120 in 73 fathoms, January 30, the dredge was put over, but only a small amount of material was taken.

The Albatross came to anchor in the harbor of Port of Spain, Trinidad, late in the afternoon of January 30. After dark the electric light was used to collect surface specimens. A gill-net was set near the ship without result. The next day the collectors went along the shore in different directions, in order to cover as much ground as possible during our very short stay. The water is very shallow along the shore, on either side of the town. The bottom is a soft mud, in which grows quantities of eel-grass. On the shore, just out of reach of an ordinary tide, is a low bank filled with the burrows of crabs. We dug out some of these, and sifted a good deal of sand and mud from high-water mark to as far out as we could wade, for shells, crustaceans, and worms. While we were collecting in this way, Captain Tanner obtained information which led to the successful hunting of the remarkable guacharo bird

(*Steatornis caripensis*). This bird is commonly known as "fruit eating hawk," "fat-bird," "oil-bird," "cave-bird," and in Spanish, guacharo bird.

At half past 7 on the morning of February 1, Captain Tanner and four members of the scientific staff left the ship, in the steam-launch for Mono Island, 10 miles distant, and near where the birds we were in search of live in caves. When nearly there, Mr. Garrett and Mr. Ackerman were left on a small island to collect until the return of the launch. The others kept on to Mono Island, where the captain found Mr. Morrison, to whom he had been directed as the best guide to the caves. Mr. Morrison consented to go with us in search of the birds, and also offered to show us where we could shoot a peculiar bat, known as the "fishing-bat." Under his guidance we steamed around to the western side of the island, where the shore is formed by a huge and nearly perpendicular wall of rock many feet high. Several of us went in a small boat to as near the cliff as was safe, when Mr. Morrison pointed out a fissure in which the bats lived. According to his direction, several charges of shot were fired into the fissure, when the bats literally swarmed out. Mr. Nye was in readiness, and killed a number, only six of which were picked up, the others falling nearer the cliff than it was safe to go, as the waves were dashing up against it with considerable force. Those we did get were put into alcohol, a supply of which was brought with us in the launch. These bats are large, having an expanse of from 22 to 24 inches from tip to tip. We saw them afterward in the evening flying slowly along close to the water. They are said to catch fish with the sharp claws of the hind limbs, aided by the membrane between them, which is very full. I examined the contents of the stomach of one of these animals and found, by the aid of a microscope, the scales of fish and also the scales from the wings of lepidopterus insects. The stomach contained but little, as they were killed some hours after their feeding time. From this place we steamed around the island to Trinidad, and tried to enter a cave there, inhabited by the guacharo birds. The larger caves on Huevos Island were then too much exposed to the ocean to be accessible, and at any season can be approached only on occasional days, when the water is very smooth.

We found the cave on the western side of Trinidad too much exposed to enter with anything like safety, though several attempts were made. We were finally obliged to give it up, to our great disappointment. The entire floor of the cave is water. As a swell advances inward, innocent at first, it becomes angry and dangerous long before it reaches the farther end, where it brings up with a heavy booming sound, leaving jagged rocks briefly exposed in its wake. The entrance to the chamber where the birds live is about 10 feet high, 12 feet wide at the bottom, and 50 feet long. The chamber is about 40 feet in diameter at its base and 35 feet high. A colored man was employed to take us in in his canoe. Mr. Morrison assisted in the management of it, while Mr.

Nye and myself held our guns in readiness. We were backed in about 35 feet when a breaker boarded us, half filling the canoe with water, and we came out as soon as possible. The canoe being too heavily loaded, I got out, and the others went in again. This time Mr. Nye succeeded in shooting two birds, but before he could secure them another breaker boarded them and again partly filled the boat. The swells becoming heavier, we considered it unsafe to venture into the cave again; however, being very desirous of obtaining the birds, we adopted another plan, which was to shoot them as they came out at night. Captain Tanner thought well of this, and went back to the ship, leaving Mr. Nye and myself to carry out the plan, with Mr. Morrison's assistance, at whose house the greater part of the afternoon was pleasantly spent. Towards night we went into a grove of cocoanut-palms and killed a number of birds. Before dark we were again at the cave in a canoe. Mr. Nye landed and obtained as good a position as the nature of the ground would allow, while I remained in the boat near the cave to shoot as best I could against the face of the precipitous hill which rises above it. The birds did not come out until after dark, when it was possible to see them only against the sky. Nevertheless, Mr. Nye killed two, only one of which was recovered, and that after it had been in the water for half an hour. The night was passed at Mr. Morrison's house, where we were treated to the novel sensation of having a light burn all night as a protection against the bites of small bats which were liable to enter.

Early in the morning we left for Port of Spain on a small steamboat running between Mono Island and that place. In the evening of the same day the Albatross anchored in a harbor of Mono Island. Mr. Nye landed as before, and killed several birds, only one, however, being recovered. The skins of both birds are in good condition for mounting and the bodies are preserved in alcohol. When the heads were reached in the operation of skinning a large number of parasites were found under the eyelids.

The list of birds from Trinidad and vicinity, as made out by Mr. Ridgway, is as follows:

Certhiola luteola, Licht.
Tanagra sclateri, Berlepsch.
Tanagra palmarum (Max.).
Tachyphonus melaleucus (Sparrm.).
Tyrannus melancholicus, Vieill.
Contopus brachytarsus, Scl.
Thamnophilus atricapillus (Gm.).
Diplopterus navius (Gm.).
Engyptila verreauxi (Bps.).
Pelecanus fuscus (Linn.).
Fregata aquila (Lin.).
Sula leucogastra (Bodd.).
Sula piscator (Linn.).
Sterna maxima (Bodd.).

Late at night the electric light was put over, and among other things a small squid was captured.

We put to sea from Mono Island on February 3. Two hauls were made during the day. Station 2121, in 31 fathoms, taking a small

amount of material. The bottom was mud and unsuitable for a large variety of animals. Among the shrimp-like forms Prof. S. I. Smith made out the following: *Parapenæus politus*, *P. constrictus*, and *Solenocera siphonocera*. Station 2122, in 34 fathoms, taking a fine Astrophyton, shells, crabs, and *Parapenæus politus* again.

The Albatross came to anchor in Santa Ana harbor, Curaçao, on the 10th of February. Curaçao is about 40 miles in length and 10 in width. The surface is hilly, and with the exception of the mangrove trees on the southwestern side of the islands in the harbor, almost no trees are to be seen. Exposed rocks and ledges show fossil shells and corals in abundance. Large rocks on the shores in the harbor are eroded on all sides by the water, and look as if they were standing on narrow pedicels ready to topple over. The wind blows from the northeast the greater part of the year, and keeps the water more or less rough. On the windward shores the waves erode the lower parts of the banks until the banks project over the water and often break off. On this side also the bottom for some distance from the shore is hard and rocky, while the leeward side is muddy, and the shore is lined with mangroves. One of the most interesting features of these islands are the pits excavated by men from the town getting sand for building material. In these places a large number of fossil corals and shells are strewn about. Small bushes near the water are often covered with land shells of the family *Pupidæ*.

Birds are not abundant in the part of the island where we were, which is due in part, perhaps, to the lack of trees. On our collecting excursions we often carried guns, and some birds were collected, though no especial effort was made to do so. The following is a list of the species taken, four of which have been described as new by Mr. Ridgway in the Proceedings of the National Museum:

Mimus gilvus rostratus, Ridgw.
Dendroica rufopileata, Ridgw.
Icterus curasoënsis, Ridgw.
Zenaida vinaceo-rufa, Ridgw.
Chamæpelia passerina (Lin.).
Ardea herodias (Lin.).

The boat-dredge was used in the harbor with little or no success, as either it came up filled with a soft mud, in which little or nothing lives, or it was caught as soon as it reached the bottom. We also tried to use it outside of the harbor, but with the same result, except that when it was not caught on the bottom it came up filled with coral sand. We found it greatly to our advantage to have a guide acquainted with the different localities. On one occasion this man bought for ten cents all of the small fish and crustaceans from several hauls of a large seine. I hired a man to make several large torches for night-collecting around the shores of the island, and with the guide and two colored men, who volunteered to go with us, set out at night for the island. We captured several fish and crabs, but the principal catch was the octopus, or "sea-cat," as it is called here. Fifteen specimens were taken during the

evening and put into alcohol, which we always carried with us on our excursions. One of the crabs was the large *Cardiosoma*, so common in the West Indies. Large sponges were often seen, but we had no means of preserving them. One sponge, not far from the shore, was seen to cause the water at the surface, some 18 inches above it, to boil up with some force. This was rolled ashore and cut up for the crustaceans, which were to be found living in the large canals. This sponge was not less than three feet through and nearly spherical. Coral was abundant, but we could preserve only the small specimens. Large specimens can be preserved to advantage only when they can be left in the sun to dry until dead and then put in water until the animal matter is dissolved out. This takes time, and our stay would not permit it. Lizards of larger size than those taken at St. Thomas were shot. Our guides caught small ones and brought us stones with their eggs attached to the under surface.

The Albatross sailed from Curaçao on the 18th of February. On the same day two hauls were made: Station 2124, in 122 fathoms, with the dredge, taking but little material; and Station 2125, in 208 fathoms, with the small beam-trawl, taking a number of sponges, echinoderms, and a new shrimp-like crustacean, since described by Prof. S. I. Smith in the Proceedings of the National Museum as *Hymenopenæus robustus*.

The haul at Station 2126, in 1,701 fathoms, February 19, was moderately successful in the amount of material taken; Station 2127, on February 25, in 1,639 fathoms, taking an interesting octopus and a few other things. Although in these hauls the amount of material taken was small, the forms were very different from any we had before dredged, making them in reality of considerable value.

On the 26th of February the Albatross came to anchor in the harbor of Santiago de Cuba, and remained there until the next day. No shore collecting was done. On the 27th eight hauls were made with the tangle in sight of the entrance to the harbor of Santiago de Cuba. Stations 2128 to 2135, inclusive, the depth of water ranging from 175 to 400 fathoms. Four or five large specimens of a crinoid (*Pentacrinus*) were taken in water from 250 to 290 fathoms. In addition to these we obtained many other echinoderms, corals, crabs, and shrimp. On the 29th three hauls were made on a bank to the eastward of Jamaica, Stations 2136–2138, inclusive, in 52, 47, and 23 fathoms, respectively.

We arrived in Kingston, Jamaica, March 1. At this place we made large collections. With a small seine, made of mosquito netting, we took many small fish and crustaceans. Larger fish were bought of the fishermen for small sums. Three specimens of a large crustacean, *Scyllarus æquinoxialis*, were bought of fishermen who had taken them in fish-baskets in from 25 to 40 fathoms. This animal is known as the "sea-roach."

One night an excursion was made with some men, hired for the purpose, to a place several miles from the ship, where shrimp are caught

for the Kingston market. I had a good opportunity to see how this was done, as we saw several parties at work. The place was reached at dark and proved to be a sheltered sheet of water along a swamp grown up to large trees. The water was little more than waist deep. The net used was about 15 feet long, 8 feet wide, one-half inch mesh, and was made of small twine. Light poles were fastened across the ends. The men grasped the poles and walked along parallel to the shore, holding the net at an angle of 45 degress, the net just clearing the bottom. After walking along 25 or 30 feet, the net was suddenly elevated to a horizontal position and the shrimp, fish, and crabs shaken down to the center and then thrown into the boat, which one of the men had been dragging behind him by fastening the painter around his waist. This is carried on in perfect silence. Several parties passed us working in exactly the same way.

After shrimp enough had been obtained, with some small fish and crabs, we lighted torches and landed, going into the swamp in search of land crabs, which are said to come out of their holes at night. Several very large ones were captured, also a large frog, much to the surprise of the men, who could see no use in collecting anything beyond what could be eaten or sold, and this frog, they said, "was not good to eat." On another excursion, coral was detached from the bottom and brought up in a body by means of a hook fastened to the end of a long pole. From this coral we obtained a number of small animals, among them a beautiful crab, an addition to our list. Several land crabs were dug out of their burrows in a mangrove swamp. When the spade cut through the upper layer of leaves and roots a quantity of very obnoxious gas would sometimes issue and compel us to abandon the digging. Hermit crabs of the genius *Cenobita* were common on a sandy ridge running through the swamp.

Kingston harbor was the first place where starfish were taken in any numbers. Here a 16-gallon tank was filled with fine specimens of an *Oreaster*. An excursion was made upon the mountain to the place where water is turned into the aqueduct which supplies the city of Kingston. Here we collected two species of crawfish, two species of fish, and some shells.

The Albatross sailed from Kingston March 11th. But three hauls were made between that port and Savanilla, where we arrived on the 16th. Excursions were made every day along the shores while there. The boat-dredge was used several times with fair results. One day was spent in hunting birds. Mr. Ridgway identified the following:

Ceryle torquata (Linn.).
Chrysotis amazonica (Linn.).
Ochthodromus wilsonius rufinucha (Ridgw.).
Ægialites semipalmata (Bp.).
Ereunetes pusillus (Linn.).
Ereunetes occidentalis (Lawr.).
Totanus melanoleucus (Gmel.).
Phalacrocorax brasiliensis (Gmel.).

Sailing from Savanilla on March 22, we arrived at Aspinwall on the 25th. Three dredgings were made on the way. Station 2143, in 155 fathoms, on the 23d, and a new crustacean allied to our common lobster was obtained, since described by Prof. S. I. Smith as *Eunephrops Bairdii*. During our stay no one was allowed to go on shore, as the city was unhealthy. The only collections made were by Mr. Nye, who in one way and another caught twelve or fourteen species of fish and two species of crabs from over the side.

We sailed from Aspinwall April 2. When 5 or 6 miles from the city, at Station 2145, a haul was made with the dredge in 25 fathoms. The dredge came up partly filled with mud and sand. On being washed out the following things were found: Three specimens of a small crustacean related to Hippa, but smaller and much more flattened than the Hippas we have collected on this cruise. They burrow in the mud with some ease, but I think from their actions they live in holes; one sea-urchin, much like Schizaster in appearance, with many dead and broken tests of the same; two species of brittle stars; worms (Eunicidæ and Terebellidæ); mollusks, many dead and few living. One of the latter is a *Yoldia*, very slender and delicate. Also a gorgonian coral, which consists of a single white stem, and seems to grow in the mud much like Pennatula. Station 2146, in 34 fathoms, was made the same day with the small beam-trawl, which came up with the net nearly torn from the frame by its rough contact with the bottom. The weight remaining in the net was considerable. As soon as possible a rope was made fast just above the load, and it was hoisted safely on board. The bulk of the material consisted of sponges and dead fragments of coral, the latter overgrown with bryozoa, and with here and there a living coral. One of the sponges was as large as could be preserved in a 16-gallon tank. This sponge was somewhat cylindrical in shape, with a deeply-concaved top. The surface was hard and unyielding; below this crust it was quite soft. A very much larger specimen of this sponge was too much broken to save. However, many brittle stars and worms were found hiding in its canals. Good specimens of five or six other sponges were picked out and placed in alcohol. Several specimens of a small *Fissurella* were found living in a sponge. Prominent among the treasures of this haul were the free crinoids. Three specimens of a large species were in excellent condition. The five rays divide at the disk into two parts. Each part subdivides into three and often four rays, making about forty stout rays rising close to the disk, and 6 or 7 inches in length. The dorsal aspect of the disk, the inner third of the dorsal cirri, and the ends of the pinnæ are yellow; otherwise the animal is a very dark brown, almost black.

Besides the foregoing, there were two smaller species, one of which we had taken before. The third is highly colored, its rays being variegated with red and yellow. Unlike *Antedon dentatum* these specimens all remained entire after having been placed in alcohol. A little octo-

pod was taken from its retreat in a piece of coral. It was not over two inches long. Its body was thickly sprinkled with reddish-brown spots, interspersed with innumerable specks of the same color. The spots extend in a double row part way to the ends of the arms, and some specks the entire length. Among the crustaceans was one related to *Callianassa*, also a spider-crab with a long, slender sponge growing to its carapace. Station 2147, in 34 fathoms, the same day was made with the tangle-bar, taking several species of slender gorgonian corals, bryozoa, compound ascidians, small crabs, brittle stars, &c. Station 2148 was also made the same day, in 130 fathoms, with the tangle-bar and dredge. Some soft mud adhered to the tangle and dredge, but no animals came to the surface.

During the afternoon of April 3, a school of fish was seen with a large flock of birds hovering over them. Occasionally the fish made the water white with foam. Mr. Nye observed them through a glass and had a fair view of their forms, as now and then one jumped from the water. In his opinion they closely resembled the common bluefish of our coast. In the evening of the same day, when the ship stopped to sound, several flying-fish were caught with the aid of the electric light. These fish were uninjured when taken and moved their fins with great rapidity through a small arc, while in my hands. Station 2149, in 992 fathoms, April 4, with the beam-trawl, taking in the net two shrimp, but no specimens from the bottom.

The Albatross dropped anchor in the harbor of Old Providence Island late in the afternoon of April 4. Like most of the islands we have visited on this cruise, it is hilly and rough. Cocoanut groves occupy the occasional strips of low land near the water. Grass is abundant and the cattle are the best we have seen. In one place the hillside is covered with a cotton-bearing shrub 6 to 8 feet in height. The cotton is said to bring 8 cents a pound.

The shores are in some places low; in others great rocks and ledges extend out into deep water. The rocks are for the most part a conglomerate from the surface of which the softer substances have been eroded by the action of the waves, leaving holes and recesses into which chitons, neritas, and turbas hide in large numbers. Far-outlying reefs protect the shores and surrounding waters from the severity of storms, making a large area of good feeding-ground for fish, upon which the inhabitants depend for a large proportion of their food.

A volunteer crew composed of officers and men made several hauls with the caplin seine, taking fish enough to supply the whole ship's company for some time. In one haul taken near the landing there were four or five bushels of a small fish called "sprat." After we had picked out all we wanted for food and bait, the people living near by carried away all that they could use. From the different hauls Mr. Miner picked out many specimens for preservation. The small mosquito net was used whenever practicable. Some species of small fish living about

corals and rocks we could not get by any means at our command. A large species of land crab (*Gecarcinus ruricola*), used as an article of food by the inhabitants, lives high up on the hills, far away from any water during the greater part of the year, and makes short burrows under stones and roots, from which it is easily taken. It is called by the people here the "black crab," though in reality it is purple. A stranger thing to me was finding hermit-crabs (*Cenobita*) living on the very tops of the hills, whither they climb carrying the heavy turba shells in which they almost invariably live. The first one of these crabs I saw was in a place to which I could climb only by taking hold of the shrubbery and pulling myself up by degrees. These hermit-crabs are used in large numbers for bait, for which purpose they are kept in confinement and fed on anything at hand, animal or vegetable. A number were kept on the ship many months, being fed principally on bread and fruit. We found large crawfish (*Palæmon Jamaicensis*) in the bed of what is a good-sized stream in the rainy season. Freshwater mullets and some other fish were seined. Snakes grow to a large size on the island, and are sometimes eaten. We collected three small specimens of as many species.

Bats live in a cave on the western side of Santa Catalina, an island separated from Old Providence by a narrow channel. A stop was made there on one of our excursions, and as many specimens procured as could be safely kept in a gallon of alcohol. Upon throwing gravel into their hidingplaces in the roof of the cave numbers flew about, carrying their young with their hind limbs. These bats are insectivorous, and belong to the group having leaf like appendages on the nose. The tide flows into the cave for a distance of 44 feet, beyond which there is a small sandy beach. The entrance at the base is about 25 feet, and 16 feet in height. In the sand at the farther end we found a few specimens of Hippa, much lighter in color than those common on the beaches outside. Under the loose stones, a little way in from the mouth, a number of starfish were taken, ranging in color from orange to reddish and purple. This cave is situated not far from what had once been a strongly fortified position of buccaneers, as the number of cannon strewn about would indicate, and it is not at all improbable that it was made use of by these outlaws.

One day was spent in hunting birds. But four species were killed, all of which have since been described as new by Mr. Ridgway in the Proceedings of the National Museum, viz: *Certhiola tricolor*, Ridgw., *Vireosylvia grandior*, Ridgw., *Vireo approximans*, Ridgw., and *Elainea cinerescens*, Ridgw.

We sailed for Key West on the morning of April 9. Station 2150, in 382 fathoms, was made the same day with the tangle and dredge, taking few foraminifera and shells. Station 2151, in 653 fathoms, on the 10th was made with the small beam-trawl, taking small crustaceans and some small fish, but no bottom specimens.

The Albatross arrived at Key West, Fla., April 15, and remained until the 27th. The time was used by collectors, as in more distant parts, in making a collection of fishes and marine invertebrates. However, more laboratory work was done here than anywhere else on the cruise. Scrapings from the wharfs—sponges, dead corals, and rotten wood—were placed in dishes day after day, and very many worms, crustaceans, and echinoderms, with some shells, sea-anemones, and other things, were taken as they came from their hidingplaces, and were killed in various fluids. Three large Oreasters were brought to the ship, which would not go into our largest tanks. The starfish were wrapped in cheese-cloth and put into a large dish-pan; a second pan of the same size was then inverted over the first, and they were soldered together. This improvised tank was then filled with alcohol through a small hole. Sponges, as is well known, are very abundant in the waters about Key West. Many small vessels are engaged in taking the species used in commerce. This work is much more laborious than formerly, as the supply has been, in a great measure, exhausted from the more shallow water. Now they are commonly taken from a depth of forty feet. I went about among the men at work in the sponge sheds and on the wharves, and made inquiry as to the cultivation of sponges. Men claiming to know all about the sponge fisheries of the whole Florida coast and the Bahama Islands declared that they had never known a sponge to be raised for the market. However, they seemed to have no doubt of the possibility of it, if it was desirable. All seemed to think that if sponge beds were laid out by the State, no matter how fairly they might be distributed at first, they would all eventually fall into the hands of a few, and the condition of the men employed in the fisheries be much worse than at present. Consequently, all were opposed to this experiment in any form.

Sailing from Key West on the 27th, we arrived in Havana early on the 28th. On the 30th we steamed out of the harbor and made twelve hauls with the tangle-bar, Stations 2152–2163, inclusive. Going into the harbor at night we continued the work outside on the following day, making six hauls, Stations 2164–2169, inclusive. These stations are all to the eastward and in sight of Morro Castle, in water from 29 to 387 fathoms in depth, where the bottom is very rough, often catching and holding the tangle-bar, making it necessary to maneuver the ship a good deal to free it. The object of search was the stalked crinoid (*Pentacrinus*). Upwards of one hundred specimens were brought up in the tangles. We found it necessary to put them in strong alcohol as soon as possible after they were taken from the water to prevent their going to pieces. Good specimens of free crinoids were also obtained at the same time, but none so striking as those dredged off Aspinwall. In addition to the crinoids there were hydroids, bryozoa, sponges, corals, brittle stars, and crustaceans of various groups. From off Havana the Albatross sailed for Cape San Antonio, the extreme western end of Cuba, where some

hydrographic work was done. In the evening of the 4th of May we came to anchor on a shoal near the cape. The electric light was put over the side, and myriads of small crustaceans taken by its help. While the ship remained at anchor the next day a tangle was used from the side, made by fastening short pieces of chain to an iron bar about two feet long. Short wires were twisted into the links of the chain to make it take hold of the bottom. This was thrown as far as possible away from the ship and then pulled in. This tangle worked well, and several dishes were filled with sponges and dead shells, from which many small animals came out as the water became stale. Among the worms I recognized *Podarke obscura*, described by Professor Verrill in U. S. F. C. Report, 1871–'72. It is very common at Wood's Holl, and appears to be quite as common off this cape. This was the last collecting done on the cruise. From Cape San Antonio we sailed for Key West, Fla., arriving on the 7th instant. Leaving the latter place on the 10th, we sailed for Washington, D. C., where we arrived on the 16th instant at 4.10 p. m.

The next cruise of the Albatross commenced on the 19th of July, at Norfolk, Va., and ended on the 26th of the same month, at Wood's Holl, Mass. During this cruise thirteen hauls were made, all of which were successful in taking specimens from the bottom. Shortly after leaving our first station, 2170, I was informed that we had passed several cuttle-fish which were floating dead on the surface. I reported this to Captain Tanner, and when another was seen he stopped the ship and ordered a boat to be lowered to pick it up. I went in the boat, and with a scoop-net procured four specimens. They proved to be octopods (*Alloposus mollis*). One was in sufficiently good condition to bear handling, and seems to be yet in a fair state of preservation. The others were too much decomposed to amount to anything, though we saved them in fragments as best we could. A little later in the day a good specimen was procured which was not removed from the scoop-net until it could be turned into a large tank of alcohol. When out in the boat several fragments of the octopus were seen, but our specimens when taken were to all appearances entire. It was impossible to make any measurements; however, some idea of their size can be given, as one just about filled a common water pail. These large cephalopods were sighted in varying numbers for a distance of 75 miles. The ship was sounding and dredging in the mean time, occupying portions of two days in making that distance. It is not unreasonable to suppose that the area covered by these animals extended over the square of this distance, and allowing ten animals to the square mile, which is not a large estimate, as seven or eight were frequently seen at one time, would give a total number of 56,250 animals.

On the morning of the 21st, several squid were picked up with a scoop-net from the ship's side, all more or less mutilated. I made them out to belong to the genus *Calliteuthis*. Two squid (*Ommastrephes*)

were taken alive with a scoop-net in the evening of the same day as they came up to the ship, attracted by the arc light. On the morning of the 23d, a large octopod was taken in the trawl-net. It is no doubt the *Eledone verrugosa* of Verrill, but it is much larger than the type specimens of that species. Besides the foregoing, several other interesting cephalopods were taken during the cruise. On the 23d we filled a large tank (16 gallons) with crabs, *Geryon quinquedens*. At Station 2176 we filled a 4-gallon tank with ophiurans, and nearly filled another of the same size with fine sea-urchins (*Schizaster*). Among the other invertebrates were a number of cup corals, genus *Flabellum*, one of unusual size and shape; pennatulæ; starfish (*Zoroaster* and *Archaster*); many shrimp; a few shells; several species of holothurians; and many surface animals. During the cruise quite a number of fish were preserved, some of them being rare.

On the 24th the ship put into Newport, R. I., and having procured bait, sailed on the following day for Cox's Ledge, where all of the lines in the ship were put to use and a large number of cod and other fish were taken during the short time we remained there. On the morning of the 26th we arrived in Wood's Holl, Mass.

We left again on the 31st for Newport, R. I., to procure bait, and on the following day started for Cox's Ledge, where several hours were spent fishing with hand-lines. Many dogfish were caught, with now and then a cod or a hake. The naturalists were busy during the fishing in collecting parasites and examining the stomachs of fish. According to instructions the different glands of the dogfish desired by Mr. Peters were preserved in Müller's fluid. The morning of August 2d found us on the tilefish ground. Two long trawl-lines were baited in readiness, one of which was set in the morning and one in the afternoon. The fish taken in the morning were identified by Mr. Parker as follows: *Phycis tenuis*, 97 specimens; *Phycis chuss*, 6; *Merlucius bilinearis*, 2; *Raia lævis* ♂, 1; *Squalus acanthias*, 49. Those in the afternoon were: *Phycis tenuis*, 65 specimens; *Phycis chuss*, 3; *Raia lævis*, 3; *Raia ocellata*, 2; *Merlucius bilinearis*, 4. Four hauls of the beam-trawl were made during the day with the following results: Station 2183, in 195 fathoms, worms and worm-tubes, brittle stars, starfish, and fish as follows: *Macrurus carminatus*, 4 specimens; *Glyptocephalus cynoglossus*, 2; *Halicutæa senticosa*, 2. Station 2184, in 136 fathoms, resulted in our getting a few invertebrates; *Phycis tenuis*, 2 specimens; *Glyptocephalus cynoglossus*, 1; *Scorpæna dactyloptera*, 3. Station 2185, in 129 fathoms: *Ophiomusium Lymani*, a number; *Lætmatonice armata*; *Phycis tenuis*, 2; *Phycis chuss*, 5; *Paralichthys oblongus*, 1; *Raia radiata*, 1. Station 2186, in 353 fathoms: *Acanella Normani*; *Polynoe acanella*; Actinias. Fish—*Macrurus Bairdii*, 25; *Phycis Chesteri*, 4; *Merlucius bilinearis*, 1; *Cottunculus torvus*, 3; *Halicutæa senticosa*, 1; *Centroscyllium Fabricii*, 1; *Glyptocephalus cynoglossus*, 4; *Synaphobranchus pinnatus*, 2; *Amitra liparina*, 2. The trawl-line was again set on the following day,

and fish taken as follows: *Phycis tenuis*, 96; *Phycis chuss*, 2; *Merlucius bilinearis*, 15; *Raia lævis*, 1 ♂ and 2 ♀; *Squalus acanthias*, 1. Station 2187, in 420 fathoms: *Acanella Normani*, worm-tubes, Archasters in large numbers, 8 *Octopus Bairdii*. Fish—*Phycis Chesteri*, 3; *Merlucius bilinearis*, 6; *Glyptocephalus cynoglossus*, few; *Macrurus Bairdii*, few; *Raia radiata*, 2; *Lycodes Verrillii*, 1; *Nemichthys scolopaceus*, 1; *Amitra liparina*, 2; *Scopelus*, sp. 4; *Synaphobranchus pinnatus*, 4; *Cottunculus microps*, 1; *Sebastes marinus*, 1. Station 2188, in 235 fathoms: few invertebrates. Fish—*Scopelus*, 4. Station 2189, in 600 fathoms, used beam-trawl: few invertebrates; *Macrurus Bairdii*, 8; *Haloporphyrus viola*, few; *Cottunculus torvus*, 1; *Synaphobranchus pinnatus*, 1; *Glyptocephalus cynoglossus*, 1. Station 2190, in 480 fathoms, on August 4: no invertebrates. Fish—*Berycidæ*, 1; *Cyclothone lusca*, 4. Station 2191, the trawl was lost. Station 2192, in 1,060 fathoms, August 5; the trawl came up with large lumps of mud filled with the burrows of some unknown animal. When broken up, some small corals and a number of worms were found in the burrows. The mud was hard and contained a small amount of sand. The only invertebrates not saved were the large holothurians, *Benthodytes*. Fish—*Alepocephalus*, sp. 1; *Coryphænoides carapinus*, 2; *Stomias*, 1. Station 2193, in 1,122 fathoms: *Ophiomusium Lymani*; Pycnogonids; *Lithodes*; *Benthodytes*. Fish—*Macrurus asper*, few; *Haloporphyrus viola*, many. Station 2194, in 1,140 fathoms. Fish—*Synaphobranchus pinnatus*, 1; *Cottunculus microps*. Station 2195, in 1,058 fathoms: cup corals, starfish, Pycnogonids. Fish—*Haloporphyrus viola*, 20; *Macrurus asper*, 6. Station 2196, in 1,230 fathoms, on August 6: large crabs (*Lithodes*); corals (*Flabellum*); *Ophiomusium Lymani*; *Benthodytes*; a large number of Pycnogonids. Fish—*Macrurus asper*, 1; *Haloporphyrus viola*, 16; *Coryphænoides rupestris*, 5. Station 2197, in 84 fathoms: sponges, worms, crabs, shells. Fish—*Phycis chuss*; *Sebastes marinus*; *Paralichthys oblongus*; *Raia eleganteria*. Station 2198, in 84 fathoms; few sponges only. Station 2199, in 78 fathoms; sponges and worms. Fish—*Phycis chuss*, 6; *Citharichthys arctifrons*, 3; *Lophius piscatorius*, juv. 1; *Paralichthys oblongus*. Station 2200, in 148 fathoms: sponges, worms, crabs, and shells. Fish—*Macrurus carminatus*, 3; *Merlucius bilinearis*, 1; *Raia radiata*, 1; *Scorpæna dactyloptera*, 1. Trawl-line, August 6: *Squalus acanthias*, 7; *Scyllium retiferum*, 1; *Phycis chuss*, 15.

We arrived in Wood's Holl on the 7th.

On August 18 the Albatross again put to sea for a short dredging cruise, returning on the 24th, having made 19 hauls with the beam-trawl and one with the Blake dredge. The average depth of the hauls were 833 fathoms. Surface work was carried on every day with some very interesting results. The flying squid, *Sthenoteuthis Bartramii* (Verrill), uncommon in collections and supposed to be much more southern in its range, was taken at night with the squid jig, the Edison light being lowered two feet below the surface of the water to attract

them and their food to the ship. These squid appear to go in schools, as they appeared and disappeared together in numbers varying from ten to fifty. One hundred and twenty-five of various sizes were preserved in alcohol. Twenty-five taken on the night of the 23d were placed alive in a large tub, and the water was kept fresh during the night by a continuous flow from the deck pump. In the morning nearly all were found to be dead, and all were badly mutilated by the beaks of their fellows. One evening a flying-fish was captured with a scoop-net and was killed in alcohol with its fins extended.

At about 10.45 one night Mr. Nye saw a phosphorescent mass near the ship and tried to bring it on board with a scoop-net. In this he did not succeed, but in his effort captured a shrimp of the deep red color so characteristic of many of the deep sea crustaceans. This is the only specimen of this color we have ever taken from the surface. The question naturally comes up, Could not this one have been dredged and been in the scoop-net or on the deck where the net was emptied? I am sure that it could not; for although shrimp of this color have been taken from every haul made in deep water, I have never seen one alive, while the one taken from the surface lived half an hour in a dish. This shrimp was not in the least phosphorescent. *Acanella Normani* came up plentifully in some hauls. It has been a common thing to find single egg-cases about the size of a nutmeg attached to this coral. Until this cruise no embryos have been found far enough advanced to determine to what they belonged. We found one, however, with a well-advanced embryo of an octopod. This, with the egg-shell and case still attached to the coral, is preserved, and it may be possible to determine the genus and perhaps the species. The Anthozoa from the various hauls were valuable. One Pennatula is at least new to our coast and perhaps to science. Echinoderms were numerous, and I believe several new forms will be found among them. The list of mollusks will be large. The principal things in the various hauls were as follows: Station 2201, in 538 fathoms, August 19: Archasters; crabs (*Geryon quinquedens*); shrimp, several species. Just after this haul several large dead octopods were seen on the surface as on a previous occasion. A boat was lowered and a portion of one picked up. It proved to be *Alloposus mollis* (Verrill). Station 2202, in 515 fathoms: *Geryon quinquedens*, numerous; *Eledone verrugosa;* shrimp, worms, and worm-tubes; foraminifera; 12 species of fish. Station 2203, in 515 fathoms: trawl came up with a heavy load of mud; one large *Lithodes Agassizii* ♀; *Geryon quinquedens;* large soft sea-urchins (*Phormosoma*); starfish; cup corals; *Macrurus Bairdii;* and 8 other species of fish. Station 2204, in 728 fathoms: *Geryon quinquedens; Flabellum;* starfish; sea-urchins; 9 species of fish. Station 2205, in 1,073 fathoms, August 20: *Benthodytes gigantea*, 60 large specimens; *Acanella Normani; Anthoptillum;* 3 species of Cephalopods; and 8 species of fish. Station 2206, in 1,043 fathoms: *Geryon quinquedens; Echinus norvegicus;* soft sea-urchins (*Phormosoma*); and 8 species of

fish. Station 2207, in 1,051 fathoms; large load of mud, with worms and brittle stars. After this haul 48 flying squid were taken around the electric light, with a squid-jig. Station 2208, in 1,178 fathoms, August 21: *Acanella Normani* and *Echinus norvegicus*, with a few worms, shells, and fish. Station 2209, in 1,080 fathoms: *Echinus norvegicus*, *Phormosoma*, shrimp, shells, and eight species of fish. Station 2210, in 991 fathoms: a good haul of Anthozoa, among them one form new to the Albatross collections; sea-urchins, starfish, shells, worms, and ten species of fish. Station 2211, in 1,064 fathoms: much material, small shrimp, starfish, and four species of fish. Station 2212, in 428 fathoms, August 22: a heavy load of mud, with worms, shells, and some starfish; also, five species of fish. Station 2213, in 384 fathoms: contents of net, same as previous haul. Station 2214, in 475 fathoms: one sea-urchin, worms, shells, and four species of fish. Station 2215, in 578 fathoms: worms, brittle stars, and four species of fish. Station 2216, in 956 fathoms: large flat sea-urchins, cup coral, and eight species of fish. Station 2217, in 924 fathoms, August 23: *Ophiomusium Lymani*, starfish, worms, shells, soft sea-urchins, and one fish. Station 2218, in 948 fathoms, with Blake dredge: mud, worms, and shells. Station 2219, in 948 fathoms: very few invertebrates, and two species of fish. Station 2220, in 1,054 fathoms: sea-urchins, shells, and two species of fish.

We arrived in Wood's Holl on August 24.

On the 5th of September the Albatross again put to sea for a cruise in the deep waters between Wood's Holl and the Bermuda Islands and in the region of the Gulf Stream, returning on the 14th of the month. Eighteen hauls were made with the beam-trawl in an average depth of 1,360 fathoms; the maximum depth being 2,574 and the minimum 243 fathoms. Surface collecting was carried on in the usual manner with nets, and at night with the aid of the electric light. The flying squid (*Sthenoteuthis Bartramii*) was not abundant, only two specimens being taken on the cruise

On the 6th two hauls were made, Stations 2221 and 2222 in 1,525 and 1,537 fathoms, respectively. The former brought up a heavy load of mud and ooze. From this we washed out a large amount of foraminifera. An ophiuran of small size was very abundant, as were shells of several species. For the first time we found a species of brachiopod numerous. *Gersemia longiflora*, Verrill, was abundant. Several very large specimens of *Benthodytes gigantea*, Verrill, were preserved. In lesser numbers were shrimp, ascidians, and starfish. At the second haul we did not obtain so much ooze and mud, but the same species of ophiurans, so abundant in the first haul, were more abundant in this. Shells were not numerous. *Gersemia longiflora* and *Benthodytes* were again preserved. Several bricks, with mortar attached, were dredged at this station, also a very large number of small fragments of the same material. The mortar appears to have been exposed to fire. Four species of fish were taken also at this station. At Station 2223, on the

7th instant, the trawl was put over in the Gulf Stream. The current was very strong, and we were unsuccessful in obtaining bottom specimens, although the shrimp and cephalopods show that the trawl was near the bottom. The wing-nets, however, contained a good number of small things. The depth of water at this station was 2,516 fathoms. While the rope was out Captain Tanner saw a large octopod floating on the surface, and ordered the dinghy to be lowered to pick it up. This was successfully done. Owing to the strength of the current the dinghy was unable to regain the ship until the trawl was in, some two or three hours afterwards, and the vessel ran down and picked us up. The octopod proved to be a badly mutilated specimen of *Alloposus mollis*. Last season no large octopods were found on the surface, while this season we have found *Alloposus mollis* on every cruise floating dead—sometimes badly mutilated and sometimes nearly whole. During the evening of the same day, while some of the men were jigging for squid, a shark was seen swimming about near the light. A large hook was at hand and the shark was soon caught. It measured seven feet three inches in length, and was identified as *Aprionodon punctatus* ?. Five young were taken out and preserved. Another shark of this species was caught on the 13th, which measured seven feet seven inches in length. From this specimen parasites both external and internal were taken. At another time a small shark thirty inches in length was taken under the light.

The following is a partial list of the invertebrates taken during the cruise: Station 2224, in 2,574 fathoms, September 8, taking mud-bag half filled with ooze; trawl contained *Ophioglypha convexa;* shrimp; one large *Galicantha;* a few species of mollusks; one whole and several fragments of cephalopods. Station 2225, in 2,512 fathoms, September 9: *Ophioglypha convexa;* shells; 1 cephalopod; clay and ooze. Station 2226, in 2,021 fathoms, September 10: three large specimens of *Aristeus tridens*, and also several small shrimp; Archasters and other starfish; *Ophiomusium armigerum; Ophioglypha convexa.* Station 2227, in 2,109 fathoms, September 10; trawl lost. Station 2228, in 1,582 fathoms, September 11: a heavy load of clay, with bryozoa, hydroids, and sponges. Station 2229, in 1,423 fathoms: *Benthodytes gigantea; Archaster grandis;* brittle stars; sponges; shells; foraminifera. Station 2230, in 1,168 fathoms, September 12: *Anthomastus grandiflorus* attached to stones; *Benthodytes gigantea*, 15 specimens. Station 2231, in 965 fathoms: a load of mud and ooze, with some small worms and shells. Station 2232, in 243 fathoms: *Octopus Bairdii*, two specimens; brittle stars; starfish; shrimp; and shells. Station 2233, in 630 fathoms: load of mud, with two specimens of *Archaster Agassizii;* one specimen of *Geryon quinquedens;* few shells. Station 2234, in 816 fathoms, September 13: *Geryon quinquedens; Phormosoma uranus; Flabellum;* shells; shrimp. Station 2235, in 707 fathoms: *Geryon quinquedens*, numerous; *Phormosoma uranus;* shells. Station 2236, in 636 fathoms: *Geryon quinquedens*, one specimen;

worms; and few shells. Station 2237, in 520 fathoms; same as previous haul. Station 2238, in 904 fathoms; trawl empty.

We arrived in Wood's Holl on the 14th. On the 25th we sailed for a short cruise in the shallow waters south of Martha's Vineyard. On the 26th, eight hauls were made in water from 32 to 122 fathoms in depth. The general character of the bottom was green mud and sand. As was to be expected, the fishes and invertebrates were well known. Large numbers of *Pecten tenuicostatus; Archaster americanus; Ophioglypha Sarsii, Asterias vulgaris,* and *Lætmatonice armata* were saved for distribution. The electric light was used at night, and 177 specimens of the flying-squid, *Sthenoteuthis Bartramii* were caught with the jig. On the 27th nine hauls were made in water from 18 to 78 fathoms in depth. The first five or six hauls were much similar to those of the day before, but gradually the bottom became more sandy, and we began to take the sand-dollars, *Echinarachnius parma*, a few at first, and more and more until the last haul, when the table sieve was heaped up with them. On the 28th, 7 hauls were made in water from 30 to 250 fathoms in depth. The first haul brought us a large number of sand-dollars and a few shells. Later we obtained many beautiful specimens of *Asterias vulgaris*. The last haul was in 250 fathoms, and was the largest haul of worm-tubes we have ever taken. We returned to Wood's Holl on the 29th, and on October 8th we left for New York, where we arrived the following day. We remained at the latter place until the 17th, when we sailed on our final cruise off Cape Hatteras. On the 18th three hauls were made; the second and third remarkable for the large numbers of Munidas and other forms which had been common on the tilefish ground before that fish disappeared. On the following day twenty-one hauls were made, mostly in shallow water. At Station 2267, in 68 fathoms, the trawl- net was torn. The few specimens taken were highly colored echinoderms and corals, showing that the trawl had caught on a reef. The tangles were put over in the same place and additional specimens of the same kind taken. After this haul the water became shallower and the trawl-net brought up only a few specimens of crabs and starfish and broken shells. The mud-bag came up well filled with mud, from which we sifted large numbers of dead shells. This continued all day, interrupted only by haul 2,280, which brought up a large quantity of corals, shells, crabs, &c. On the 20th fourteen hauls were made, the first part of the day, with about the same results as on the previous day. Station 2297, in 49 fathoms, was a surprise to us. A large lobster (*Homarus americanus*) made its appearance and a very large number of crabs (*Cancer borealis* and *C. littoralis*). On the 21st the tangles were used on the reef that we had found two days before, with good results.

We then started for Washington, where we arrived October 23d,

Dredging and Trawling Record of the United States Fish Commission steamer Albatross, Season of 1884.

ABBREVIATIONS USED IN THIS TABLE: m., mud; s., sand; g., gravel; co., coral; sh., shells; p., pebbles; sp., specks; c., clay; st., stones; r., rock; bk., black; wh., white; yl., yellow; gy., gray; bu., blue; dk., dark; lt., light; gn., green; br., brown; hrd., hard; sft., soft; fne., fine; crs., coarse; brk., broken; lrg., large; sml., small; rky., rocky; stk., sticky; oz., ooze; for., foraminifera; glob., globigerina; L. B. T., large beam-trawl; S. B. T., small beam-trawl; Tgl. bar, tangle-bar; Bl. Dr., Blake dredge; Sh. Dr., Ship's dredge. Bl. Dr. = D. S. (deep-sea dredge), and Sh. Dr. = M. B. (mud-bag).

Serial No.	Date.	Time.	Positions.		Temperatures.			Depth in fathoms.	Character of bottom.	Wind.		Drift.		Instrument used.
			Latitude N.	Longitude W.	Air.	Surface.	Bottom.			Direction.	Force.	Direction.	Distance.	
	1884.		° ′ ″	° ′ ″									*Miles.*	
2117	Jan. 27	1.59 p.m.	15 24 40	63 31 30	84	78	80.75	695	yl. m. fne. s.	ENE.	2	NW. by W.	2.5	L. B. T.
2118	Jan. 28	8.15 a.m.	13 32 40	62 54 00	76	77	.....	690	gy. m. bk. s	SE.	2	ENE.	1.7	Do.
2119	Jan. 29	1.07 p.m.	11 48 30	62 17 30	75	77	39.25	1,140	gy. m	NE.	3	SW.	2.5	Do.
2120	Jan. 30	6.30 a.m.	11 07 00	62 14 30	76	76	.....	73	bu. m	E.	2	N.	0.2	Dr. Tgl.
2121	Feb. 3	6.37 a.m.	10 37 40	61 42 40	76	77	67	31	dk. slate-col. m	NW. by W.	2	.....	.....	L. B. T.
2122	Feb. 3	7.18 a.m.	10 37 00	61 44 22	77	77	73	34	dk. slate-col. m	NW. by W.	2	.....	.....	Do.
2123	Feb. 3	8.45 a.m.	10 42 02	61 46 48	78	78	64.5	117	bu. m	NE. by N.	2	.....	.....	Do.
2124	Feb. 18	2.03 p.m.	11 34 30	60 02 10	77	74	59.5	122	fne. sh. gn. m	E. by S.	2	NW. by N.	.....	Sh. Dr.
2125	Feb. 18	4.31 p.m.	11 43 00	60 09 30	75	74	50.7	208	yl. m. s. bk. sp	E. by N.	2	W. by S.	.....	S. B. T.
2126	Feb. 19	10.11 a.m.	13 17 45	70 01 00	78	77	39.3	1,701	yl. m. crs. s. for	ENE.	3-4	NNE.	.....	Do
2127	Feb. 25	3.11 p.m.	19 45 00	75 04 00	78	77	.....	1,639	gn. m	WSW.	3	W. ¼ S.	.....	L. B. T.
2128	Feb. 27	10.58 a.m.	19 55 46	75 49 23	78	78	49.5	400	bu. m. fne. s	SE.	1	E. to ENE.	.....	Tgl. bar.
2129	Feb. 27	12.25 p.m.	19 56 04	75 48 55	77	78	.....	274	bu. m. fne. s	SE.	2	E. to ENE.	.....	Do.
2130	Feb. 27	1.04 p.m.	19 56 25	75 49 49	77	79	.....	175	gy. m. s. brk. sh	SE.	2	E. to ENE.	.....	Do.
2131	Feb. 27	2.00 p.m.	19 56 44	75 50 49	78	79	.....	202	hrd. crs. s	SE.	3	E. to ENE.	.....	Do.
2132	Feb. 27	3.33 p.m.	19 55 38	75 49 16	78	79	.....	478	yl. m. brk. sh	SE.	3	E. to ENE.	.....	Do.
2133	Feb. 27	4.30 p.m.	19 55 55	75 48 03	79	79	.....	290	wh. s. brk. sh	SE.	3	E. to ENE.	.....	Do.
2134	Feb. 27	5.37 p.m.	19 56 06	75 47 32	77	78	.....	254	.	SE.	3	ESE.	.....	Do.
2135	Feb. 27	6.31 p.m.	19 55 58	75 47 07	77	77	.....	250	hrd. co	SE.	3	ESE. to SSE.	.....	Do.
2136	Feb. 29	2.04 p.m.	17 43 40	75 38 25	81	78	.....	52	co. brk. sh	SE.	3	NW. by W. ¾ W.	.....	Do
2137	Feb. 29	2.29 p.m.	17 44 50	75 39 20	81	78	.....	47	co. brk. sh	SE.	3	NW. by W. ¾ W.	.....	Do.
2138	Feb. 29	5.36 p.m.	17 44 05	75 39 00	78	78	.....	23	co. brk. sh	SE.	3	S. ¼ E.	.....	Do.
2139	Mar. 11	2.56 p.m.	17 32 00	76 45 30	80	79	82.3	215	bk. m	ESE.	4	.....	.....	Do.
2140	Mar. 11	7.18 p.m.	17 36 10	76 46 05	80	78	39.7	966	s	E.	3	ENE. ¼ E.	.....	S. B. T.
2141	Mar. 12	11.29 a.m.	17 25 00	75 59 55	78	77	.....	5	co. s	E	5	S. by E. ¼ E.	.....	Tgl. bar.
2142	Mar. 23	4.05 p.m.	9 30 15	76 20 30	81	81	.....	42	gn. m. s	WNW.	2	W. ¼ S.	.....	S. B. T.
2143	Mar. 23	5.01 p.m.	9 30 45	76 25 30	80	80	.....	155	gn. m	NNW.	2	W. ¼ S.	.....	Do.
2144	Mar. 25	6.46 a.m.	9 49 00	79 31 30	78	79	.....	896	gn. m	N.	1	SSW.	.....	L. B. T.
2145	Apr. 2	10.41 a.m.	9 27 00	79 54 00	80	79	.....	25	gn. m. brk. sh	NNE.	4	.....	.....	Sh. Dr.
2146	Apr. 2	12.03 p.m.	9 32 00	79 54 30	80	79	.....	34	brk. sh	NNE.	4	.....	.....	L. B. T.
2147	Apr. 2	12.46 p.m.	9 32 20	79 54 45	80	79	82.5	34	co	NNE.	4	.....	.....	Tgl. bar.

2148	Apr. 2	1.39 p.m.	9 35 00	79 55 30	81	79	78.25	130	lrd	NNE.	4			Do.
2149	Apr. 4	9.31 a.m.	13 01 30	81 25 00	80	78	39.7	992	yl. m	NE. by N.	3			Do.
2150	Apr. 9	9.15 a.m.	13 34 45	81 21 10	82	78	45.75	382	wh. crs. s	NNE.	3			Dr. & Tgl. bar.
2151	Apr. 10	11.03 a.m.	15 28 39	80 36 00	79	78	40.2	633	yl. for. oz	NE. to ENE.	3			L. B. T.
2152	Apr. 30	6.05 a.m.	24 m. NW. of Havana Light.		71	77	49	387	co	ESE.	1			Tgl. bar.
2153	Apr. 30	7.11 a.m.	23 10 19	82 23 10	74	77	55.8	283	co	ESE.	2			Do.
2154	Apr. 30	8.08 a.m.	23 10 16	82 22 54	76	77	59.6	310	co	ESE.	2			Do.
2155	Apr. 30	9.09 a.m.	23 10 21	82 22 44	76	77		300	co	ESE.	3			Do.
2156	Apr. 30	10.42 a.m.	23 10 35	82 21 55	78	77	58.8	278	co	E. by N.	4			Do.
2157	Apr. 30	11.40 a.m.	23 10 04	82 21 07	78	77		29		ENE.	3			Do.
2158	Apr. 30	12.07 p.m.	23 10 25	82 20 36	78	77		86		ENE.	3			Do.
2159	Apr. 30	1.05 p.m.	23 10 39	82 20 08	80	77		98	co	ENE.	3			Do.
2160	Apr. 30	2.04 p.m.	23 10 31	82 20 37	79	77		167	co	ENE.	4			Do.
2161	Apr. 30	2.48 p.m.	23 10 36	82 20 28	78	78		146	co	ENE.	4			Do.
2162	Apr. 30	3.36 p.m.	23 10 30	82 20 25	79	78		122	co	ENE.	4			Do.
2163	Apr. 30	4.24 p.m.	23 10 31	82 20 29	79	78		133	co	ENE.	4			Do.
2164	May 1	6.21 a.m.	23 10 39	82 20 29	71	77		192	co	ESE.	2			Do.
2165	May 1	7.19 a.m.	23 10 39	82 20 28	71	77		200	co	ESE.	2			Do.
2166	May 1	8.27 a.m.	23 10 36	82 20 30	74	77	71.9	196	co	ESE.	3			Do.
2167	May 1	9.33 a.m.	23 10 40	82 20 30	80	78		201	co	ESE.	3			Do.
2168	May 1	10.24 a.m.	23 10 36	82 20 20	80	78		122	co	ESE.	3			Do.
2169	May 1	10.46 a.m.	23 10 28	82 20 27	79	78		78	co	ESE.	3			Do.
2170	July 20	11.40 a.m.	37 57 00	73 53 30	72	71		155	gy. s	NE.	2			Do.
2171	July 20	1.25 p.m.	37 59 30	73 48 40	75	75	39.5	444	gn. m	NNW.	2			Do.
2172	July 20	3.45 p.m.	38 01 15	73 44 00	76	76	39	568	gn. m	NW.	1			Do.
2173	July 21	6.26 a.m.	37 57 00	72 34 00	70	70	37	1,000	glob. oz	NNW.	1			Do.
2174	July 21	2.59 p.m.	38 15 00	72 03 00	73	76		1,594	gy. m	W.	4			Do.
2175	July 22	9.03 a.m.	39 33 00	72 18 30	69	68	40.5	452	gn. m	WSW.	4			Do.
2176	July 22	12.34 p.m.	39 32 30	72 21 30	71	68	41	302	bk. m	WSW.	3			S. B. T.
2177	July 22	3.40 p.m.	39 33 40	72 08 45	71	68	52	87	gn. m. s	W. by N.	3			L. B. T.
2178	July 22	5.16 p.m.	39 29 00	72 05 15	70	68	42.3	229	gn. m. s	WSW.	4			Do.
2179	July 23	4.02 a.m.	39 30 10	71 50 00	68	67	39.5	510	bk. m	WSW.	4			Do.
2180	July 23	6.48 a.m.	39 29 50	71 49 30	72	68	39.5	523	bk. m	WSW.	3			Do.
2181	July 23	9.42 a.m.	39 29 00	71 46 00	75	68	39	693	gy. m. fne. s	WSW.	3			Do.
2182	July 23	12.58 p.m.	39 25 30	71 44 00	70	68	39	861	gn. m	SW.	5			Do.
2183	Aug. 2	11.52 a.m.	39 57 45	70 56 30	69	68	44.5	195	gn. m. s	SE.	1	NE.	.75	Do.
2184	Aug. 2	1.08 p.m.	40 00 15	70 55 30	71	70	48.9	136	gn. m. s	SE.	1	NE.	1	Do.
2185	Aug. 2	2.12 p.m.	40 00 45	70 54 15	54	69	51	129	gn. m. s	SE.	1	N. by E.	1	Do.
2186	Aug. 2	6.12 p.m.	39 52 15	70 55 30	70	69	39.7	353	gn. m. s	SW.	1	WNW.	.50	Do.
2187	Aug. 3	10.44 a.m.	39 49 30	71 10 00	70	68	39.7	420	gn. m. s	ESE.	3	ENE.	.75	Do.
2188	Aug. 3	1.54 p.m.	39 54 30	71 08 00	73	70	42.7	235	gn. m. s	ESE.	2	E. by S.	.75	Do.
2189	Aug. 4	4.16 a.m.	39 49 30	70 26 00	71	71	39.7	600	gn. m. s	WSW.	3	ESE.	1	Do.
2190	Aug. 4	10.42 a.m.	39 40 00	70 20 15	74	73		1,180	glob. oz	SSW.	4	ENE.	1	Do.
2191	Aug. 4	2.46 p.m.	39 45 30	70 17 00	74	73		961	gn. m	SW.	5	NE.	1	Lost trawl.
2192	Aug. 5	5.45 a.m.	39 46 30	70 14 45	76	72	38.6	1,060	gy. oz	SSW.	4	NNE.	.75	L. B. T.
2193	Aug. 5	11.04 a.m.	39 44 30	70 10 30	79	73	38.4	1,122	gn. m	SSW.	5	S.	1.5	Do.
2194	Aug. 5	2.54 p.m.	39 43 45	70 07 00	77	74	38.4	1,140	oz	SSW.	4	S. by E.	1.25	Do.
2195	Aug. 5	6.42 p.m.	39 41 00	70 03 00	83	74	38.4	1,058	gn. m	SSW.	4	S.	1.5	Do.
2196	Aug. 6	4.45 a.m.	39 35 00	69 44 00	74	74	38	1,230	gn. m	SSW.	3	NNW.	1.5	Do.
2197	Aug. 6	11.24 a.m.	39 56 30	69 43 20	77	74	52.3	84	s. brk. sh	S.	2	NE.	1.5	Do.
2198	Aug. 6	1.17 p.m.	39 56 30	69 43 20	78	74	52.3	84	s. brk. sh	SSW.	2	NE.	2	Do.
2199	Aug. 6	2.03 p.m.	39 57 30	69 41 10	77	74		78	gy. s	SSW.	2	WSW.	1	Do.

Dredging and Trawling Record of the United States Fish Commission steamer Albatross, Season of 1884—Continued.

Serial No.	Date.	Time.	Positions.		Temperatures.			Depth in fathoms.	Character of bottom.	Wind.		Drift.		Instrument used.
			Latitude N.	Longitude W.	Air.	Surface.	Bottom.			Direction.	Force.	Direction.	Distance.	
	1884.		° ′ ″	° ′ ″									*Miles.*	
2200	Aug. 6	4.38 p.m.	39 53 30	69 43 20	77	74	45	148	crs. s. blk. sp	SSW.	2	SE. by E.	2	L.B.T.
2201	Aug. 19	6.10 a.m.	39 39 45	71 35 15	69	66	39.5	538	bu. m	NNE.	5	W.	2	Do.
2202	Aug. 19	9.23 a.m.	39 38 00	71 39 45	70	67	39.1	515	gn. m	N.	6	WSW.	1.75	Do.
2203	Aug. 19	12.29 p.m.	39 34 15	71 41 15	74	74	38.9	705	gn. m. s	NNW.	6	WSW.	2.5	Do.
2204	Aug. 19	4.32 p.m.	39 30 30	71 44 30	71	74	39.1	728	br. m	W.	4	WSW.	2.5	Do.
2205	Aug. 20	4.37 a.m.	39 35 00	71 18 45	68	73	38.1	1,073	gy. oz	NW.	4	W. by S.	1.25	Do.
2206	Aug. 20	9.16 a.m.	39 35 00	71 24 30	71	74	38.4	1,043	gn. m	NW.	2	NNE.	1.25	Do.
2207	Aug. 20	1.01 p.m.	39 35 33	71 31 45	77	74	32.6	1,061	gn. m	W.	1	NNE.	1.25	Do.
2208	Aug. 21	5.02 a.m.	39 33 00	71 16 15	75	74	38.4	1,178	gn. m	W by N.	3	WSW.	1	Do.
2209	Aug. 21	9.42 a.m.	39 34 45	71 31 30	76	74	39.5	1,060	gn. m. s	WNW.	2	E.	1.25	Do.
2210	Aug. 21	1.18 p.m.	39 37 45	71 18 45	75	74	38.1	991	glob. oz	SW.	5	S. by W.	1.5	Do.
2211	Aug. 21	4.45 p.m.	39 35 00	71 18 00	74	74	38.3	1,064	gy. oz	SW by S.	3	S. by W.	2	Do.
2212	Aug. 22	4.48 a.m.	39 59 30	70 30 45	72	71	40	428	gn. m	SSW.	2	E.	.5	Do.
2213	Aug. 22	8.04 a.m.	39 58 30	70 30 00	73	71	39.5	384	gn. m	SSW.	2	S. by W.	1.5	Do.
2214	Aug. 22	11.30 a.m.	39 57 00	70 32 00	74	74	39.5	475	gn. m	SW.	3	SSW.	1.75	Do.
2215	Aug. 22	3.13 p.m.	39 49 15	70 31 45	77	74	.....	578	lost ther	SSW.	4	SW.	1.5	Do.
2216	Aug. 22	5.38 p.m.	39 47 00	70 30 30	81	71	39.5	963	gn. m	SSW.	2	S.	1.75	Do.
2217	Aug. 23	4.49 a.m.	39 47 20	69 34 15	75	73	38.1	924	gy. m	SW.	3	S.	1.25	Do.
2218	Aug. 23	10.41 a.m.	39 46 22	69 29 00	72	74	38.8	948	gy. m	SW.	2	SE. by S.	1.75	
2219	Aug. 23	1.36 p.m.	39 46 22	69 29 00	72	74	38.8	948	gy. m	SW.	2	SE. by S.	1.75	
2220	Aug. 23	4.18 p.m.	39 43 30	69 23 00	75	74	38.3	1,054	gy. m	SW.	3	SE. by S.	1.5	
2221	Sept. 6	9.01 a.m.	39 05 30	70 44 30	77	75	36.9	1,525	gy. oz	WSW.	2	SW. ½ S.	1.25	
2222	Sept. 6	2.20 p.m.	39 03 15	70 50 45	74	73	36.9	1,537	gy. oz	WSW.	3	SW. ½ S.	2	
2223	Sept. 7	5.07 a.m.	37 48 30	69 43 30	79	75	36.4	2,516	glob. oz	NW.	3	SE.	2	
2224	Sept. 8	8.31 a.m.	36 16 30	68 21 00	78	79	38.8	2,574	glob. oz	NW.	2	W.	3.5	
2225	Sept. 9	5.47 a.m.	36 05 30	69 51 45	77	78	38.7	2,512	yl. oz	WSW.	2	SW. ½ S.	2.5	
2226	Sept. 10	5.06 a.m.	37 00 00	71 54 00	78	80	38.8	2,045	glob. oz	SW.	4	S.	1	
2227	Sept. 10	12.24 p.m.	36 55 23	71 55 00	81	82	36.8	2,109	glob. oz	SW.	3	SSW.	2	Lost trawl.
2228	Sept. 11	5.10 a.m.	37 25 00	73 06 00	77	77	36.8	1,582	br. m	SW.	3	S.	2	L.B.T.
2229	Sept. 11	4.12 p.m.	37 36 40	73 16 30	79	75	37.7	1,423	glob. oz	SW.	2	W. ½ N.	2	Do.
2230	Sept. 12	4.37 a.m.	38 27 00	73 02 00	75	75	36.8	1,168	gy. oz	WSW.	2	W.	1.5	Do.
2231	Sept. 12	9.42 a.m.	38 29 00	73 09 00	77	75	36.8	965	gy. oz	W.	3	NW.	1.5	Do.
2232	Sept. 12	2.48 p.m.	38 37 30	73 11 00	72	74	42.8	243	gn. m	NE.	4	NNE.	1.5	Do.
2233	Sept. 12	4.16 p.m.	38 36 30	73 06 00	69	73	39.2	630	gn. m	NE.	5	NNE.	1.5	Do.
2234	Sept. 13	4.30 a.m.	39 09 00	72 03 15	71	69	38.6	810	gn. m	ENE.	3	NE. by N.	1.75	Do.
2235	Sept. 13	7.33 a.m.	39 12 00	72 03 30	76	72	38.8	707	gn. m	NE.	4	NE. by E.	1.25	Do.
2236	Sept. 13	9.49 a.m.	39 11 00	72 08 30	68	72	39.5	636	gn. m	NNE.	4	N. by E.	1.5	Do.
2237	Sept. 13	11.42 a.m.	39 12 17	72 09 30	70	72	39.5	520	gn. m	NNE.	4	SW.	1.5	Do.

2238	Sept. 13	2.26 p. m.	39 06 00	72 10 00	71	72	38.7	904	gy. m.	N.	5	NNW.	1.75	Do.
2239	Sept. 26	5.05 a. m.	40 38 00	70 29 45	62	62	....	32	gn. m.	NNE.	5	SSW.	1	Do.
2240	Sept. 26	7.29 a. m.	40 27 30	70 29 00	62	61	....	44	gn. m.	NNE.	6	SSW.	1	Do.
2241	Sept. 26	9.20 a. m.	40 21 00	70 29 15	63	63	51.4	50	gn. m.	NE.	6	SW.	1	Do.
2242	Sept. 26	11.33 a. m.	40 15 30	70 27 00	63	63	51.4	58	gn. m	NE.	6	SW.	1	Do.
2243	Sept. 26	1.13 p. m.	40 10 15	70 26 00	65	64	52.4	63	gn. m	NE.	6	SW.	1	Do.
2244	Sept. 26	3.11 p. m.	40 05 15	70 23 00	66	71	52.9	67	gn. m. s	NE.	6	SW.	1	Do.
2245	Sept. 26	4.50 p. m.	40 01 15	70 22 00	61	61	50.9	98	gn. m. bk. s	NE.	6	WNW.	1	Do.
2246	Sept. 26	6.42 p. m.	39 56 45	70 20 30	64	71	48.8	122	gn. m	NE.	6	NE. by N.	1.25	Do.
2247	Sept. 27	4.57 a. m.	40 03 00	69 57 00	61	70	51.9	78	gn. m. s	E.	3	ESE.	.5	Do.
2248	Sept. 27	6.50 a. m.	40 07 00	69 57 00	64	70	52.4	67	gn. m. bk. s	E.	3	N. by E.	.75	Do.
2249	Sept. 27	8.24 a. m.	40 11 00	69 52 00	64	70	51.4	53	gn. m. fne. s.	E.	4	E.	1	Do.
2250	Sept. 27	10.04 a. m.	40 17 15	69 51 45	63	68	51.4	47	gn. m. fne. s.	E.	4	E.	.75	Do.
2251	Sept. 27	12.02 p. m.	40 22 17	69 51 30	62	65	50.9	43	gn. m. fne. s	E.	3	NNE.	.5	Do.
2252	Sept. 27	1.46 p. m.	40 28 00	69 51 00	62	63	50.3	38	gn. m. fne. s	SE.	2	NNE.	.5	Do.
2253	Sept. 27	3.11 p. m.	40 34 30	69 50 45	61	61	52.9	32	gy. s. bk. sp	E.	2	NNE.	.75	Do.
2254	Sept. 27	4.39 p. m.	40 40 30	69 50 30	61	61	54.4	25	gy. s. bk. sp	E.	2	NNE.	.75	Do.
2255	Sept. 27	6.10 p. m.	40 46 30	69 50 15	61	60	55.9	18	fne. s. bk. sp.	E.	1	NNE.	.75	Do.
2256	Sept. 28	5.42 a. m.	40 38 30	69 29 00	62	61	52.9	30	yl. s.	SSW.	2	SSE.	1	Do.
2257	Sept. 28	7.17 a. m.	40 32 30	69 29 00	62	61	51.9	33	yl. s. bk. sp.	SW.	2	S. by W.	1	Do.
2258	Sept. 28	8.34 a. m.	40 26 00	69 29 00	63	61	51.2	36	gy. s. bk. sp	SW.	2	S. by W.	.75	Do.
2259	Sept. 28	9.56 a. m.	40 19 30	69 29 10	64	61	50.2	41	gy. s. bk. sp	SW.	2	S. by W.	.75	Do.
2260	Sept. 28	11.13 a. m.	40 13 15	69 29 15	68	65	50.2	46	gy. s	SW.	3	S. by W.	.75	Do.
2261	Sept. 28	12.52 p. m.	40 04 00	69 29 30	69	66	53.9	58	gy. s. bk. sp	SW.	4	S. by W.	.75	Do.
2262	Sept. 28	2.51 p. m.	39 54 45	69 29 45	72	67	41.6	250	gn. m. s	SW.	4	S. by W.	.75	Do.
2263	Oct. 18	1.06 p. m.	37 08 00	74 33 00	67	66	....	430	gn. m.	W.	5	SSE.	1	Do.
2264	Oct. 18	2.37 p. m.	37 07 50	74 34 20	67	66	46.8	167	gy. s	W.	5	WSW.	1	Do.
2265	Oct. 18	3.47 p. m.	37 07 40	74 35 40	65	67	57.9	70	gn. m. gvl	W.	5	WSW.	1.5	Do.
2266	Oct. 19	6.00 a. m.	35 07 00	75 08 30	69	78	62.8	111	fne. s. bk. sp.	NE.	5	N.	.5	S. B. T.
2267	Oct. 19	6.39 a. m.	35 08 50	75 07 20	67	79	72.8	68	gy. m.	NE.	5	NE.	2	Tgl. bar.
2268	Oct. 19	7.43 a. m.	35 10 40	75 06 10	67	79	71.3	68	gy. m.	NE.	5	NE.	2	Do.
2269	Oct. 19	8.46 a. m.	35 12 30	75 05 00	70	75	77	48	crs. gy. bk. s.	ENE.	4	WNW.	2	Do.
2270	Oct. 19	9.40 a. m.	35 14 15	75 07 00	70	75	76.3	32	fne. gy. s. bk. sp.	ENE.	4	W.	1.75	D. S. dredge.
2271	Oct. 19	10.45 a. m.	35 16 00	75 09 00	70	75	....	26	crs. gy. s. bk. sp.	ENE.	4	W.	2	S. B. T.
2272	Oct. 19	11.57 a. m.	35 20 10	75 14 00	69	75	....	15	gy. s. bk. sp	ENE.	3	WSW.	2	Do.
2273	Oct. 19	12.45 p. m.	35 20 30	75 17 30	69	72	72.3	17	gy. s. brk. sh	ENE.	3	WNW.	2	Do.
2274	Oct. 19	1.22 p. m.	35 20 35	75 18 05	68	71	....	16	gy. s. brk. sh	NE.	2	WSW.	1.5	Dr. S. dredge.
2275	Oct. 19	1.43 p. m.	35 20 40	75 18 40	67	71	....	16	gy. s. brk. sh	NE.	3	WNW.	1	Dr. & M. B.
2276	Oct. 19	2.08 p. m.	35 20 45	75 19 15	67	71	....	15	gy. s. brk. sh.	NE.	3	WNW.	1	Do.
2277	Oct. 19	2.21 p. m.	35 20 50	75 19 50	67	71	....	16	gy. s. brk. sh	NE.	3	WSW.	.75	Do.
2278	Oct. 19	2.45 p. m.	35 20 55	75 20 20	67	71	....	16	gy. s. brk. sh	NE.	3	WSW.	.75	L. B. T.
2279	Oct. 19	3.36 p. m.	35 20 55	75 20 55	67	71	....	16	gy. s. brk. sh	NE.	3	WSW.	.75	Do.
2280	Oct. 19	4.15 p. m.	35 21 00	75 21 30	67	70	....	16	gy. s. brk. sh	NE.	3	WSW.	.75	Do.
2281	Oct. 19	4.35 p. m.	35 21 05	75 22 05	67	70	....	16	gy. s. brk. sh	NE.	3	WSW.	.75	Do.
2282	Oct. 19	5.13 p. m.	35 21 10	75 22 40	68	70	....	14	bk. s	NE.	3	NW. by W.	.75	Do.
2283	Oct. 19	5.41 p. m.	35 21 15	75 23 15	68	70	....	14	gy. s	NE.	3	N. by W.	.5	Do.
2284	Oct. 19	6.09 p. m.	35 21 20	75 23 50	67	70	....	13	crs. gy. s	NE.	3	WNW.	.5	Do.
2285	Oct. 19	6.40 p. m.	35 21 25	75 24 25	67	70	....	13	crs. gy. s	NE.	3	WNW.	.75	Do.
2286	Oct. 19	7.13 p. m.	35 21 30	75 25 00	67	70	....	11	crs. gy. s	NE.	2	WNW.	.5	Do.
2287	Oct. 20	6.15 a. m.	35 22 30	75 26 00	68	69	....	7	crs. gy. s	ESE.	2	E. by N.	.5	Do.
2288	Oct. 20	6.45 a. m.	35 22 40	75 25 30	68	69	....	7	crs. s. brk. sh.	ESE.	2	E. by N.	.5	Do.
2289	Oct. 29	7.15 a. m.	35 22 50	75 25 00	70	69	....	7	crs. s. bk. sp.	ESE.	2	E. by N.	.5	Do.

Dredging and Traveling Record of the United States Fish Commission steamer Albatross, Season of 1884—Continued.

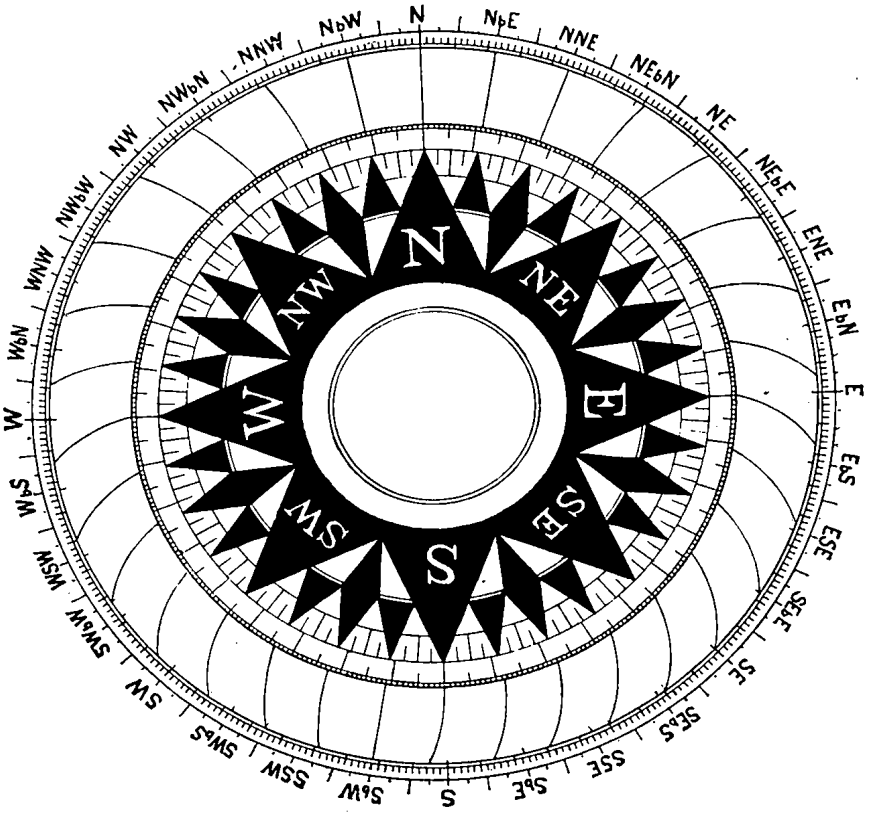
Serial No.	Date.	Time.	Positions.		Temperatures.			Depth in fathoms.	Character of bottom.	Wind.		Drift.		Instruments used.
			Latitude N.	Longitude W.	Air.	Surface.	Bottom.			Direction.	Force.	Direction.	Distance.	
	1884.		° ′ ″	° ′ ″									Miles.	
2290	Oct. 20	7.45 a. m.	35 23 00	75 24 30	70	69	.....	04	s. brk. sh	ESE.	2	ENE.	.5	L. B. T.
2291	Oct. 20	8.45 a. m.	35 25 30	75 20 30	70	69	.....	15	gy. s. brk. sh	ESE.	2	ENE.	.5	Do.
2292	Oct. 20	9.32 a. m.	35 27 20	75 16 30	72	70	.....	17	gy. s. brk. sh	ESE.	2	E. by N.	.5	Do.
2293	Oct. 20	10.25 a. m.	35 29 10	75 12 30	71	71	.....	18	crs. s. bk. sp	ESE.	2	E. by N.	.5	Do.
2294	Oct. 20	11.18 a. m.	35 31 00	75 08 30	73	71	.....	19	crs. gy. s	ESE.	2	E. by N.	.5	Do.
2295	Oct. 20	12 03 p. m.	35 32 41	75 04 30	76	73	.....	22	crs. gy. s	ESE.	2	E. by N.	.5	Do.
2296	Oct. 20	1.15 p. m.	35 35 20	74 58 45	75	71	.....	27	crs. gy. s	SE.	2	E. by N.	.5	Do.
2297	Oct. 20	2.18 p. m.	35 38 00	74 53 00	75	73	.....	49	bk. m. brk. sh	SE.	1	E. by N.	.75	Do.
2298	Oct. 20	2.55 p. m.	35 39 00	74 52 00	74	73	.....	80	bk. m. brk. sh	SE.	1	E. by N.	.75	Do.
2299	Oct. 20	3.50 p. m.	35 40 00	74 51 30	74	73	.....	296	bk. m	SE.	1	E. by N.	.75	Do.
2300	Oct. 20	5.20 p. m.	35 41 30	74 48 30	71	71	.....	671	bk. m	SE.	1	E. by N.	1	Do.
2301	Oct. 21	6.10 a. m.	35 11 30	75 05 00	73	77	75	59	crs. s. bk. sp	SE.	1	NNE.	.5	Tgl. bar.
2302	Oct. 21	6.45 a. m.	35 14 00	75 03 00	74	77	71.4	49	s. co	ESE.	2	NE.	.25	Do.
2303	Oct. 21	7.11 a. m.	35 17 00	75 01 00	74	77	.....	41	fne. gy. & bk. s	ESE.	2	NE.	.25	S. B. T.
2304	Oct. 21	7.40 a. m.	35 19 00	74 58 00	74	77	.....	37	fne. gy. & bk. s	ESE.	2	E.	.5	Do.
2305	Oct. 21	8.36 a. m.	35 23 00	74 51 30	77	79	66.2	58	fne. gy. & bk. s	ESE.	2	E.	.5	Do.
2306	Oct. 21	11.00 a. m.	35 21 30	74 52 00	76	79	41.7	322	gy. m	ESE.	2	E.	.5	L. B. T.
2307	Oct. 21	4 11 p. m.	35 42 00	74 54 30	76	70	57.3	43	gy. & bk. s	ESE.	2	NE.	1	Do.
2308	Oct. 21	5.17 p. m.	35 43 00	74 53 30	72	71	.....	45	gy. & bk. s	SE.	1	NE.	1	Do.
2309	Oct. 21	6.08 p. m.	35 43 30	74 52 00	72	71	.....	56	gy. s. brk. sh	SE.	1	NE.	.5	Do.
2310	Oct. 21	6.59 p. m.	35 44 00	74 51 00	76	71	.....	132	bk. m. fne. s	SE.	1	NE.	.5	Do.

Table of Serial Temperatures, 1884.

Serial No.	Date.	Position. Latitude N.	Position. Longitude W.	Depth.	Temperature. Air.	Temperature. Surface.	Temperature at— 25 fathoms.	50 fathoms.	100 fathoms.	200 fathoms.	300 fathoms.	400 fathoms.	500 fathoms.	600 fathoms.	700 fathoms.	800 fathoms.	900 fathoms.	1,000 fathoms.	1,100 fathoms.	1,200 fathoms.	1,300 fathoms.	Bottom.
	1884.	° ′ ″	° ′ ″	Fathoms.																		
Hyd. 46	Jan. 24	17 51 00	65 08 25	2,423	80	77	77	77	77	60	51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.1
Hyd. 47	Jan. 24	17 46 30	65 10 25	1,482	78	77	77	78	67	.....	.....	45	.....	.....	40	.....	40	.....	.....	.....	.....	38.8
Hyd. 57	Jan. 25	17 49 06	65 29 00	2,188	77	77	77	77	67	59	.....	.....	43	.....	.....	.....	40	.....	.....	.....	.....	38.8
Hyd. 62	Jan. 25	17 32 40	65 52 20	2,017	77	77	77.5	78	66.3	58.5	48	.....	44	.....	.....	.....	40	40	.....	.....	40	....
Hyd. 64	Jan. 26	16 59 00	65 19 20	2,543	76	77	77.5	77	65.3	.....	62.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hyd. 66	Jan. 26	16 28 00	64 42 30	2,192	73	77	77.8	76	65	55	47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.8
Hyd. 71	Jan. 27	15 44 10	63 42 10	950	76	77	78	77.3	67	54.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.8
Hyd. 80	Jan. 28	13 56 55	63 02 60	684	75	77	77	72.5	61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.5
Hyd. 82	Jan. 28	13 29 00	62 42 40	1,051	80	77	.....	.....	.....	.....	44.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.3
Hyd. 83	Jan. 28	13 23 00	62 34 15	1,686	77	78	76	68	61.3	50	45	43	.....	40.5	40	40	.....	39.5	.....	.....	.....	39.5
2119	Jan. 29	11 48 20	62 17 30	1,140	75	77	75	68.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.3
Hyd. 116	Feb. 5	14 21 44	63 58 45	1,615	78	77	77.5	72	62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.3
Hyd. 120	Feb. 6	16 01 01	65 56 20	2,492	76	77	77.5	.....	64.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.8
Hyd. 121	Feb. 6	16 36 20	66 41 00	2,501	76	77	77	77	67	55	47.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.5
Hyd. 123	Feb. 7	15 49 00	67 36 40	2,616	76	77	77.3	77.3	67	55	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Hyd. 124	Feb. 7	15 02 00	67 13 20	2,747	80	77	77.8	78	66.5	53	.....	.....	.....	.....	40.5	39.8	39.5	.....	.....	.....	.....	....
Hyd. 127	Feb. 8	13 25 04	66 25 00	2,844	77	77	77.8	77.8	55.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Hyd. 128	Feb. 8	12 54 40	66 11 10	2,766	81	78	77.5	.....	61.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.5
Hyd. 133	Feb. 9	11 33 20	66 19 00	535	77	75	70.5	65	58	48.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40.8
Hyd. 134	Feb. 9	11 18 50	66 24 20	656	79	76	71.8	65	58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40
Hyd. 135	Feb. 9	11 05 00	66 30 00	239	78	76	71	64.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43.3
Hyd. 139	Feb. 9	11 01 00	67 14 15	605	75	75	.....	.....	.....	.....	.....	.....	40.5	.....	.....	.....	.....	.....	.....	.....	.....	....
Hyd. 145	Feb. 10	11 52 00	68 35 46	630	78	76	76	68.5	59.8	49.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Hyd. 150	Feb. 18	11 56 00	68 56 00	733	77	76	76	68	63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.6
Hyd. 151	Feb. 18	11 50 45	68 56 30	738	77	76	75	66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.6
Hyd. 152	Feb. 18	11 40 25	68 57 36	321	76	75	.....	.....	.....	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45.2
2126	Feb. 19	13 17 45	70 01 00	1,701	78	77	76	66.5	65.5	.....	47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.3
Hyd. 162	Feb. 19	13 40 20	70 10 45	2,694	75	76	76	69	62	53	46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.6
Hyd. 165	Feb. 20	15 55 00	71 03 00	2,209	76	77	76	74	67.5	.....	47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.6
Hyd. 166	Feb. 20	16 42 00	71 18 30	2,028	76	77	.....	.....	66	.....	54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40.1
Hyd. 170	Feb. 21	17 48 00	72 12 20	2,434	77	77	77.5	77	69	.....	51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Hyd. 171	Feb. 21	18 01 30	72 23 00	1,929	81	79	77	76	67	.....	51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.6
Hyd. 172	Feb. 21	18 07 00	72 29 00	1,538	80	79	77.5	77	67	.....	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.6
Hyd. 179	Feb. 22	17 36 30	72 56 60	2,423	78	77	.....	77	70.5	.....	51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.7
Hyd. 180	Feb. 22	17 45 30	73 04 00	2,391	79	77	.....	.....	.....	.....	51.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Hyd. 188	Feb. 23	17 51 40	74 36 36	894	75	77	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....

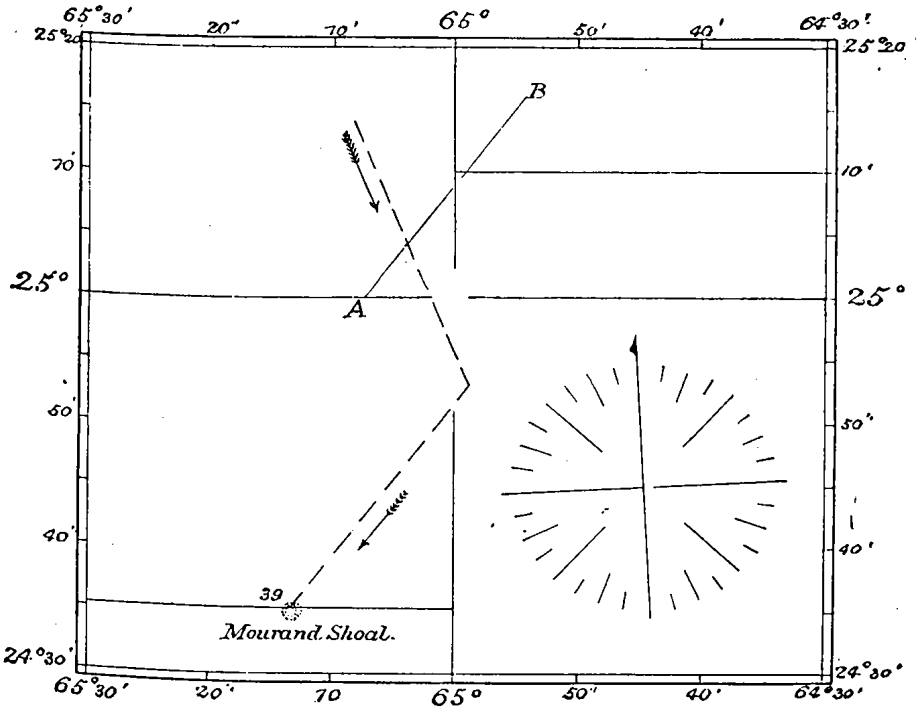
Table of Serial Temperatures, 1884—Continued.

Serial No.	Date.	Position. Latitude N.	Position. Longitude W.	Depth.	Temperature. Air.	Temperature. Surface.	Temperature at— 25 fathoms.	50 fathoms.	100 fathoms.	200 fathoms.	300 fathoms.	400 fathoms.	500 fathoms.	600 fathoms.	700 fathoms.	800 fathoms.	900 fathoms.	1,000 fathoms.	1,100 fathoms.	1,200 fathoms.	1,300 fathoms.	Bottom.
	1884.	° ′ ″	° ′ ″	*Fathoms.*																		
Hyd. 190	Feb. 23	17 33 30	74 45 00	955	76	77	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hyd. 197	Feb. 24	18 45 00	74 32 40	1,347	78	77	77.5	76	72	.....	61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hyd. 198	Feb. 24	18 50 00	74 12 00	1,537	84	79	78	77	68.5	.....	58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hyd. 199	Feb. 24	18 56 00	73 51 00	1,974	80	79	78	77.4	68.2	.....	51.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.7
Hyd. 205	Feb. 25	19 40 00	74 42 00	1,923	77	77	78	74.6	66.7	.....	54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.7
2127	Feb. 25	19 45 00	75 04 00	1,639	78	77	77.6	76	69	61	54.2	47.5	43.5	40	39	.....	39.7	.....	.....	.....	.....	.....
Hyd. 206	Feb. 25	19 43 21	75 15 30	1,745	76	77	77	76	71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.7
Hyd. 215	Feb. 28	18 54 30	74 16 30	1,486	77	78	78.4	78	74.4	.....	51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.9
Hyd. 216	Feb. 28	18 32 30	75 06 00	870	78	78	.....	78.4	.....	.....	52.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.7
Hyd. 217	Feb. 28	18 34 00	74 21 00	1,015	79	78	77.8	77.6	68.7	.....	49.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.7
Hyd. 346	Mar. 23	9 48 00	76 18 30	255	81	82	.....	72.2	62.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hyd. 353	Mar. 24	9 44 40	77 56 00	550	79	79	76	72.2	61.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	41.8
Hyd. 354	Mar. 24	9 47 00	78 09 30	630	79	78	78.7	72.5	61.4	51.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hyd. 355	Mar. 24	9 48 00	78 24 00	1,017	79	79	.....	72.1	61.4	52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hyd. 363	Mar. 25	9 45 15	79 34 00	370	80	79	.....	75	56.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hyd. 371	Apr. 3	11 20 00	80 42 10	1,892	80	79	78	74	63.8	51.6	46.6	44.8	40.4	40.5	39.5	39.6	39.5	39.2	.....	.....	.....	39.8
2151	Apr. 10	15 28 39	80 36 00	653	79	78	78.8	77.8	67.9	55.3	47.8	42.7	41.4	.....	.....	.....	.....	.....	.....	.....	.....	40.2
Hyd. 419	Apr. 14	23 48 14	84 06 55	1,356	79	79	78.6	77.9	67.9	57.1	51.4	44.6	.....	40.9	40.1	40	.....	39.8	.....	.....	.....	39.7
2172	July 20	38 01 15	73 44 00	368	76	76	58.8	55.4	51	45.1	40.7	40	.....	.....	.....	.....	.....	.....	.....	.....	.....	38.6
2173	July 21	37 57 00	72 34 00	1,669	70	68	53	51.7	51.7	51.7	39.7	39.7	39.5	38.7	38.7	38.7	38.1	38.1	.....	.....	.....	37
2175	July 22	39 33 00	72 18 30	452	69	68	50.5	51.3	50.6	44.1	40.6	40.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	40.7
Hyd. 503	July 23	39 23 45	71 43 00	992	70	69	57	52.8	50.7	44.2	40.7	40.2	40	39.6	38.7	38.7	38.6	.....	.....	.....	.....	38.6
Hyd. 514	Aug. 3	39 55 00	71 07 00	221	71	68	64.3	51.8	51.8	..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40.3
Hyd. 545	Aug. 4	39 47 00	70 16 30	784	74	72	61.1	52.6	52.2	45.9	40.9	39.6	39.3	39.2	.....	.....	.....	.....	.....	.....	.....	.....
2197	Aug. 6	39 56 30	69 43 30	84	77	74	69.8	52.8	52.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	52.3
Hyd. 549	Aug. 20	39 34 60	71 34 30	925	75	74	66.2	54.8	51.2	43.8	40.6	40.1	40.6	39.2	39.5	39	.....	.....	.....	.....	.....	38.6
Hyd. 552	Aug. 23	39 40 05	69 23 00	1,098	75	74	63.2	55.9	52.5	44.3	40.7	39.3	40.6	39.2	39.1	38.6	.....	38.8	.....	.....	.....	38.3
Hyd. 553	Sept. 7	37 41 00	69 15 16	2,704	79	81	82	79.8	72.7	57.3	44	45.6	40.5	39.6	39.6	39.5	39	38.6	.....	.....	.....	36.3
2224	Sept. 8	36 16 30	68 21 00	2,574	79	80	79.8	77.1	67.1	64.8	64.6	63.8	52.5	44.9	41	40.2	39.5	39.5	.....	.....	.....	36.8
2225	Sept. 9	36 05 30	69 51 45	2,512	77	81	78.3	71.9	67.6	64.3	64.8	60	51.1	44.7	41.4	40.2	39.6	39.2	.....	.....	.....	36.7
2227	Sept. 10	36 55 23	71 55 00	2,109	81	82	82.2	77.1	71.4	65.2	62.8	57.7	52.7	42.5	40.4	39.3	39.2	39.1	.....	.....	.....	36.8
Hyd. 554	Sept. 11	37 22 53	73 06 30	1,600	78	74	76	63.2	63.8	48	46.3	39.7	39.4	39.3	39.1	38.8	.....	38.7	.....	.....	.....	36.8
Hyd. 556	Sept. 12	39 40 00	73 03 00	474	70	74	61.8	52.9	45.3	43.5	40.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.7
Hyd. 557	Sept. 13	39 08 30	72 12 30	851	66	72	.....	66.8	53.5	43.1	40.6	39.7	39.2	39.1	38.7	.....	.....	.....	.....	.....	.....	38.7



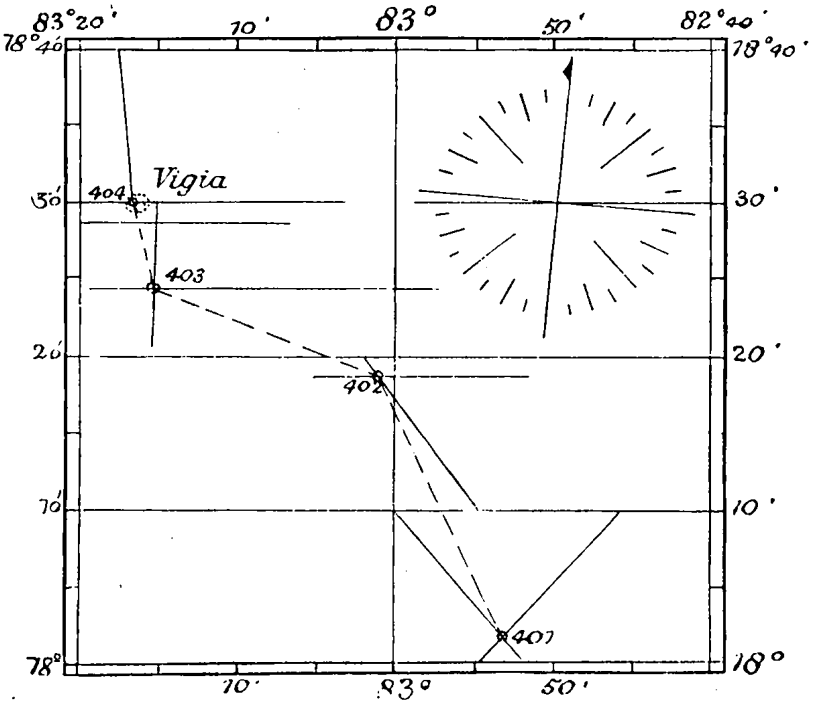
Steering-card. Gulf of Paria, February, 1884.

CASE I.

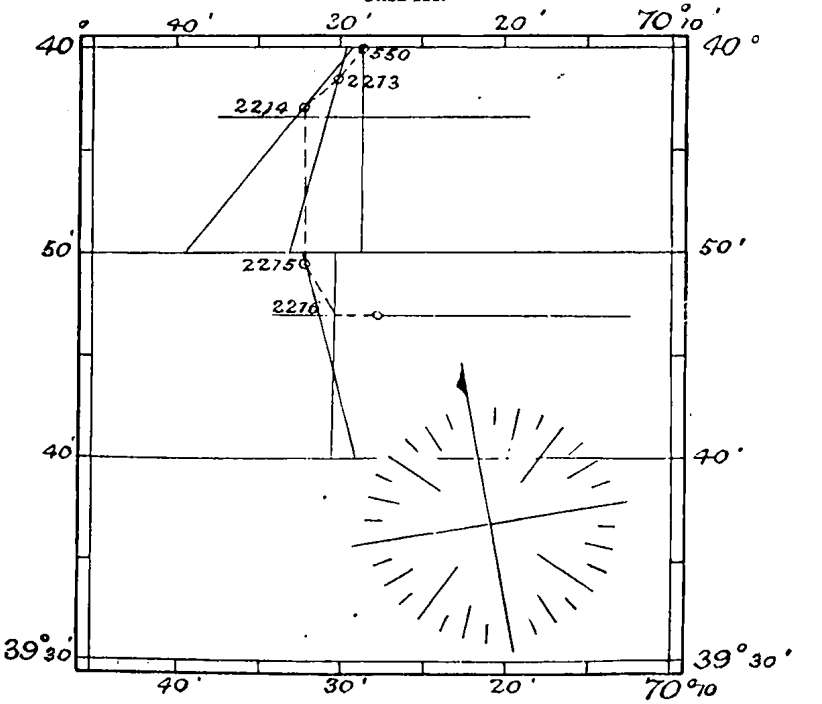


Illustrative case in navigation.

CASE II.



CASE III.



Illustrative cases in navigation.

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[NOTE.—The references are to page-figures in brackets.]