TREASURY DEPARTMENT

UNITED STATES REVENUE-CUTTER SERVICE

R. C. S. BULLETIN No. 1

REPORTS OF VESSELS ON ICE PATROL IN THE NORTH ATLANTIC OCEAN

APRIL, MAY, JUNE, 1913

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1913

INSTRUCTIONS FOR THE ICE PATROL.

INSTRUCTIONS TO THE COMMANDING OFFICERS OF REVENUE CUTTERS ON ICE PATROL, 1913.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
Washington, March 29, 1913.

1. For the purpose of safeguarding lives and property at sea the *Seneca* and *Miami* have been detailed to proceed to the vicinity of the tail of the Grand Banks of Newfoundland and establish a patrol of the ice fields and icebergs drifting down into those waters.

2. The object of the patrol is to locate the icebergs and field ice nearest to the trans-Atlantic steamship lane. It will be the duty of patrol vessels to determine the southerly, easterly, and westerly limits of the ice and to keep in touch with these fields as they move to the southward in order that radio messages may be sent out daily, giving the whereabouts of the ice, particularly the ice that may be in the immediate vicinity of the regular trans-Atlantic steamer lane.

3. The patrol will begin in April and continue until the ice no longer constitutes a danger to navigation in the trans-Atlantic steamship lanes. The ice season is usually three months—April, May, and June.

4. While on this patrol the vessels will obtain fuel and other necessary supplies at Halifax, Nova Scotia. The two vessels will make alternate cruises of about 15 days in the ice region, the 15 days to be exclusive of time occupied in going to and from Halifax. The senior commanding officer will so regulate the movements of the vessels that on the fifteenth day after reaching the ice region the vessel on patrol will be relieved by the second vessel, if possible, at which time the first vessel will proceed to Halifax, replenish her coal supply, and return in time to relieve the other vessel at the end of the latter's 15-day cruise. It is important that the patrol be continuous, and the vessel on patrol must not leave her station until relieved by the other vessel unless it is absolutely necessary to do so.

5. Having located the ice, the patrol vessel will send the following daily radiograms. All times in radiograms will be in seventy-fifth meridian time.

(*a*) At 6 p. m. (seventy-fifth meridian time) ice information will be sent broadcast for the benefit of vessels, using 600-meter wave length. This message will be sent three times with an interval of two minutes between each.

18621

(*b*) At 6.15 p. m. (seventy-fifth meridian time) the same information will be sent broadcast three times in similar manner, using 300-meter wave length.

(*c*) At 9 p. m. (seventy-fifth meridian time) a radiogram will be sent to the branch hydrographic office, New York City, defining the ice danger zone, its southern limits, or other definite ice news. An endeavor will be made to communicate this message to the Newport or Boston radio stations. If unable to communicate with either of these stations direct the message should be relayed to the Newport station through any convenient steamer. If unable to relay by steamer, the message should be sent via any Canadian or other radio station. If this daily radiogram is communicated direct to the Newport or Boston station or relayed to Newport by steamer, it should be preceded by the address "For Hydrographic." If it is necessary to send the message via a Canadian or other shore station, it should be addressed, "Hydrographic, Maritime Exchange, New York."

(*d*) Ice information will be given at any time to any ship with which the patrol vessel can communicate.

6. Ice information will be given in as plain, concise English as practicable, and will state in the following order:

(*a*) Ice (berg or field).

(*b*) Date.

(*c*) Time (seventy-fifth meridian time).

(*d*) Latitude.

(*e*) Longitude.

(*f*) Other data as may be necessary.

7. Attention is called to circular letter No. 122, the provisions of which will be followed in radiograms sent to the Hydrographic Office. (See par. 5 (*c*) of this order.) In radiograms sent to vessels other than revenue cutters, the words "latitude" and "longitude" will not be omitted.

8. Each patrol vessel will keep a remark book in which will be entered all data and information concerning the ice that can be collected.

9. Each vessel on being relieved by the other vessel will deliver to the relieving vessel copies of all radiograms sent to or received from the Hydrographic Office during the cruise, and copies of all instructions received from the department by radio.

10. At the end of each cruise a full report in duplicate will be sent to the department.

11. Each vessel will plot on H. O. Chart No. 955 the positions and extent of the ice as located from time to time. This data will also be plotted on a duplicate chart, and this duplicate chart will be delivered to the relieving vessel.

SHERMAN ALLEN,
Assistant Secretary.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
DIVISION OF REVENUE-CUTTER SERVICE,
Washington, March 29, 1913.

SUPERINTENDENT OF RADIO SERVICE,
United States Naval Radio Station, Radio, Va.

SIR: 1. For the purpose of safeguarding life and property at sea the revenue cutters *Seneca* and *Miami* will be detailed on April 1 to proceed to the vicinity of the Grand Banks of Newfoundland, and establish a patrol of the ice fields and bergs drifting down into those waters.

2. It is important that the maritime world be advised promptly as to ice conditions, and as this can be best accomplished through the Hydrographic Office, it is desired to communicate daily with the branch hydrographic office at New York City.

3. The vessels on patrol will therefore endeavor each evening at 9 o'clock (seventy-fifth meridian time) to communicate with the Newport or Boston radio stations. This daily radiogram will be preceded by the address "For Hydrographic," and it is requested that instructions be issued to the radio stations at Newport and Boston to listen at 9 o'clock each evening (seventy-fifth meridian time) for the ice messages from the *Seneca* or *Miami;* to receive this message and immediately telegraph it by land wire to the branch hydrographic office at New York, using as a telegraphic address the following. "Hydrographic, Maritime Exchange, New York."

Respectfully,

E. P. BERTHOLF,
Captain Commandant.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
DIVISION OF REVENUE-CUTTER SERVICE,
Washington, March 29, 1913.

The HYDROGRAPHER,
Navy Department, Washington, D. C.

SIR: 1. For the purpose of safeguarding lives and property at sea the revenue cutters *Seneca* and *Miami* have been detailed to proceed to the vicinity of the Grand Banks of Newfoundland and establish a patrol of the ice fields and bergs drifting down into those waters.

2. The *Seneca* will leave New York April 1 for this duty and will arrive at the ice regions about April 6. Later she will be relieved by the *Miami*, and during the months of April, May, and June (and as much longer as may be necessary) these two vessels will alternate on patrol.

3. While on this duty the patrol vessel will endeavor, by means of daily radio messages, to keep ships at sea advised of the limits of the ice fields, etc.

4. It is also important that the maritime world generally be advised promptly as to ice conditions, and, as it is believed that this can be best accomplished by the Hydrographic Office, your cooperation to this end is requested.

5. It is therefore proposed that the patrol vessel send a daily radiogram, defining the ice danger zone, its southern limits, and other definite ice news, to the radio stations at Newport or Boston. This message will be sent at 9 o'clock each evening (seventy-fifth meridian time), and will be preceded by the address "For Hydrographic." The Superintendent of Radio Service, United States Navy, has arranged for this message to be forwarded immediately by land telegraph to the branch hydrographic office, New York City. If the patrol ship can not reach the Newport or Boston stations she will send the daily ice message to the branch hydrographic office through a Canadian radio station or by relaying the message through some convenient trans-Atlantic steamer.

6. There are inclosed for your information two copies of "Instructions to the Commanding Officers of Revenue Cutters on Ice Patrol, 1913." There are also inclosed two copies of circular letter No. 122, referred to in paragraph 7 of the "Instructions."

7. It is requested that a copy of the daily ice message received by the branch hydrographic office at New York, be mailed promptly to this office.

8. It is requested that you make public through the daily hydrographic bulletins, etc., the arrangements for the ice patrol, to the end that the various trans-Atlantic steamers may understand when to listen in for the daily ice message from the patrol ship. The patrol vessel will be glad to receive radio messages concerning ice from any ship in the ice regions. The radio calls of the patrol vessels are as follows:

Name of ship	Call letters.	Power in kilowatts.	Wave length in meters.
Miami	N R Q	2	300-600-725
Seneca	N R E	2	300-600-750

It is requested that the foregoing be given as early consideration as possible.

Respectfully,

E. P. BERTHOLF,
Captain Commandant.

REPORTS OF VESSELS ON ICE PATROL.

U. S. REVENUE CUTTER "SENECA,"
Halifax, N. S., April 23, 1913.

Subject: Report of first cruise on ice patrol.

SIR: 1. In obedience to department instructions creating an ice patrol, I sailed with my command from Tompkinsville, N. Y., April 3, 1913, and arrived on patrol grounds April 8. On the 6th I began sending out three times daily requests for all vessels to report to me any ice seen on the trans-Atlantic routes, and upon arrival on station I sent out daily notices broadcast of the information received and also sent daily reports to the branch hydrographic office at New York, relaying them through steamers, as we were unable to communicate with the coast stations in the United States at any time east of longitude 55. I am informed by the commanding officer of the *Miami* that some of my reports "For Hydrographic" failed to reach destination. One was sent every day at the time specified in my orders.

2. From the 9th to the 13th instant, inclusive, we had clear weather, and I put in the time from daylight to dark running parallel lines 15 miles apart from latitude 41 northward, between meridians 49 and 50. I availed myself of the services of two steamers crossing to the westward to take lines parallel to mine, thereby saving one day's work. On the night of the 11th I had reached the tail of the Grand Bank and anchored there resuming search to the northward next day. On the 12th the British trawler *Scotia* arrived on patrol grounds to the westward of the *Seneca*, having come by way of Flemish Cap. She reported several bergs in the vicinity of Flemish Cap, but no other ice. She left the next day for St. Johns and I heard nothing further from her.

3. Two bergs had been reported on the 10th in latitude 44–17, longitude 48–36, and latitude 44–07, longitude 48–32. These reports were given me by Cape Race. Proceeding on the assumption that the bergs would drift southward, I made thorough search for them, but found no trace to the southward. On the 13th, however, I found them to the northward, both in latitude 44–36, one longitude 48–09, the other 48–27. On March 22 the *Venango* reported having passed two similar bergs in latitude 42–33, longitude 49–53, and latitude 42–40, longitude 49–54. I am satisfied that these were the same bergs and that they moved with the Gulf Stream at the rate of about 6 miles a day to the north and east, the one nearest the Grand Bank being retarded, while the other constantly gained on it, so that while on March 22 they were almost on a north-and-south line, on April 13 they were due east and west from each other. On March 31 the *Oscar II* reported having seen a berg in latitude 45–34, longitude 41–22, which is the easternmost one reported. On April 12 the *Drumlanrig* reported seeing one small berg in latitude 44–30, longitude 49–00. This is the westernmost reported and was probably grounded on the edge of Grand Bank. The *Scotia*, *Arabic*, and *Virginian* all reported passing several large and small bergs between Grand Bank and Flemish Cap and all around the latter spot for some 50 miles. No report whatever of field ice was received. The season seems to be exceptionally open.

4. On the 12th we fell in with the advance guard of the French fishing fleet, bound from Brittany to the Grand Bank. I am informed that this fleet consists of about 300 vessels carrying about 10,500 men. The vessels are mostly topsail schooners and barkentines. On the night of the 13th the fog closed in and we had continuous fog

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and rain for a week. I kept the vessel just to the eastward of the eastern berg and warned several Frenchmen of their presence. They all put about and stood to the southward.

5. On the 18th we opened communication with the *Miami* and made arrangements for meeting her and turning over the patrol to her. On the 20th we met in latitude 44-00, longitude 49-30, and held a short conference. I then turned the duty over to Capt. Gamble. The 19th was stormy.

6. I left patrol grounds shortly before noon on the 20th instant and arrived at Halifax at 10 a. m. this 23d instant. I expect to take coal and provisions and leave on the 28th.

Respectfully,

C. E. JOHNSTON, *Commanding.*

U. S. REVENUE CUTTER "MIAMI,"
OFF GREAT BANKS OF NEWFOUNDLAND,
May 2, 1913.

Subject: Report of first cruise on ice patrol.

SIR: I have to report that this vessel established radio communication with the *Seneca* on April 18, probable distance 200 miles; I informed her commanding officer our speed, half at that time before moderate west gale, state of weather, and noon position. On 19th, reported noon position to *Seneca*, and as weather had cleared so that sights could be taken on both vessels, our course was shaped to position on Banks, where *Seneca* had arranged to meet us. On same day I reported to department arrival of *Miami* on Banks and that communication had been established with the *Seneca*.

2. The *Seneca* anchored at 3 p. m. the 19th in latitude 44, longitude 49-30, the *Miami* anchoring near by the next morning at 8 a. m., 27 fathoms of water, 60 fathoms port chain. I reported to the senior officer and received track chart, copies of radiograms sent, and information as to drift and position of nearest bergs.

3. Lieut. of Engineers O'Connor, of this command, had been sick and off duty since the 15th; upon the recommendation of *Seneca's* surgeon and with the approval of the senior officer, he was transferred to that vessel, where he could receive medical attention.

4. The *Seneca* having been relieved, departed for Halifax at noon same day. Fog set in during the afternoon, sea comparatively smooth, so vessel remained at anchor. The next day, the 21st, current observations were made, results of which will be given in a later paragraph. A dory from the French barkentine *St. Christophe* brought on board a part of trawling gear that had been broken; as there were no other means of repairing it and as the machine was wholly disabled without it, repairs were made by the engineer force, much to the gratitude of the fishermen.

5. On the 22d the *Miami* cruised to the northeast to locate a berg reported on the 12th in latitude 44-40, longitude 49. Anchored at dark 12 miles northwest of reported position, not having sighted berg; during the night current observations were taken. At daylight ice was sighted bearing north-northwest true, visible from deck and bridge; by distance steamed it was 12 miles distant. It had apparently drifted 24 miles north-northwest in 10 days. Trash ice and small pans, the latter large enough to start a seam in a steel vessel, were encountered 5 miles to the southward of the berg. Whistle and ship's bell were sounded as we approached the berg; but no echo returned until we were within 2,000 feet, four seconds between time of blast and that of echo. No birds were seen near by. The temperature of the surface water a hundred fathoms away was 29° F., 12 miles away it was 31° F., the condenser water reading 32° F. in both positions. Upon approaching and leaving the berg no difference in horizon above the berg was noticed, though the top of its surface was as flat as an ice pan and covered with pure white snow, and the sun shining brightly. In steaming away it was dropped from main deck, height 10 feet, distant 12 miles; hurricane deck, height 18 feet, distant 14 miles; bridge deck, height 26 feet, distant

16 miles; signal yard, 65 feet, distant 20 miles. This berg must have been 50 feet high, with a diameter of 400 feet, just tilted sufficiently that its flat top could be seen from deck. It was adrift in 37 fathoms of water. Calms and light variable airs prevailed during the day.

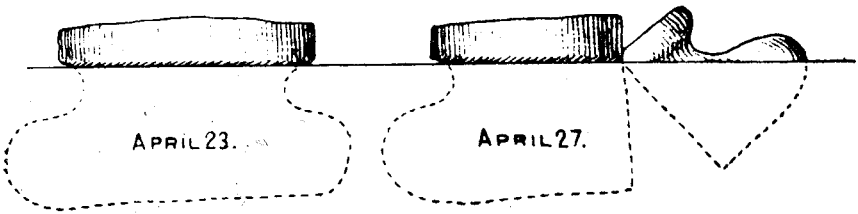
6. At 2.50 p. m. a larger berg was passed close alongside; surface water again dropped to 29° F. Hundreds of gulls were flying about the trash ice to the southward, and a mile north as many more were resting on the water. A sounding near by gave 87 fathoms.

As in both cases the bergs were drifting ahead of the smaller pieces, it would seem that they were influenced by a stronger undercurrent setting northeast. The surface temperatures would indicate a set from the northward.

7. Remained at anchor the 24th, dense fog, ship drifting to westward, in 37 fathoms of water, with 100 fathoms of 6-inch line to 600-pound kedge. Wind moderate southeast and east. Took current observations. *Scotia* reported her position about 100 miles to the westward, latitude 45–24, longitude 51–25.

8. The fog lifted partly on the 25th and vessel got underway and stood to the eastward to locate bergs sighted by the *Seneca;* fog closed in thicker at 11 a. m., so *Miami* anchored and took current observations. Received a radiogram from the senior officer at Halifax, via Cape Race, to forward hydrographic reports at 4 a. m. instead of 9 p. m.

9. Underway at 5.30 a. m., the 26th, and proceeded to position where large iceberg was reported on April 23. Morning time sight indicated that vessel had dragged



20 miles while at anchor on the 24th. This berg was not sighted, but the steamship *Mount Royal* reported it at 5 p. m., 15 miles northeast of original position. The *Miami* stood off to the eastward hoping to pick up the bergs located by the *Seneca*, drifted that night, and on the morning of the 27th, stood to the southward and westward. Fog set in about 11 a. m., and engines were stopped. The *Scotia* passed close enough to make out our fog signals, but was not sighted. She reported no ice to the southward. Fog lifted shortly after noon and our course was continued. At 3.30 p. m. passed close alongside the first berg sighted the 23d. From sights taken afterwards, it was found to have drifted 25 miles northeast since the 23d. It had cracked across the top and one part had turned over on its side, showing the effect of the dissolution and erosion.

The edges of the pan-shaped top showed the original lines of fracture at time of calving; the under-water part, exposed after one end had listed over, was as smooth as finished marble.

A 6-pound shot was fired against the vertical wall of the berg and had no other effect than to shake down a barrelful of snowlike dust. A blue vein was noticed running through the berg, which added to its resemblance to marble. At another point earth had lodged on top, from which a muddy stream had poured over the edge, leaving a brown streak on the wall.

10. From 24 current observations, made April 21, 22, 23, 24, 25, and 28, from latitudes 44 to 45–40 and between longitudes 48–52 and 49–31 at all stages of tide the current varied from imperceptible drift to a rate as high as 14 knots per day. Ship was at anchor, and set was measured by floating oar near immersed with weight at blade.

At low water, calm, April 22, current set south by east 13 miles. On the 25th, at low water with west airs, current set 6 miles southeast by south. The temperatures registered 29°, 31°, and 33° F., with no perceptible difference at depth of 25 fathoms. This would indicate that we were in water brought down by the Labrador current.

Four observations on the quarter and half ebb, with calms, taken 21, 22, and 25, indicated a set of 8 to 14 miles from northeast by north to east-northeast. Three observations, taken 23, 24, and 25, at half ebb, showed a current half as great setting to north-northwest. So they all had a northerly set and a preponderance to the east over the west.

Of six observations, taken 21, 23, 24, and 28, with tide flooding, all except one had westerly set from 12 miles northwest at last of flood to 6 miles south-southwest at first of flood. A seventh flood-tide observation, with light west-northwest airs, showed 6 miles south-southeast. All except this last one had westerly set, varying from northwest to south-southwest.

From these observations, which of course were very crude with what means were available, assuming same stages of tide as those at Cape Race, it would seem that the floods set to the westward and the ebbs to the northeastward. Tests were made with wind with force 1 and 0, temperatures 29° to 31° and 33° F., depths 27 to 37 fathoms.

11. At no time during the patrol of the *Miami*, April 20 to May 1, was ice reported within 200 miles of the lanes followed by steamers between United States ports, Fastnet, and the Channel. On the westward-bound lane from Glasgow, the nearest berg was reported 90 miles to the northward April 24.

12. In the rectangle formed by parallels 46 and 49 and meridians 41 and 49, daily ice reports were received during clear weather from vessels either on Mercator or great circle courses for Canadian and United States ports, respectively, the first passing over and the second to the northward of Flemish Cap. After April 23 no ice has been reported south of Flemish Cap or east of forty-third meridian.

13. At 9.15 a. m. April 30 a radiogram was received from the senior officer, directing that *Miami* proceed to latitude 45 N., longitude 50 W.; got under way at 1 p. m., and at 7 p. m. anchored in as near that position as could be judged by dead reckoning; foggy weather had prevailed since the 28th.

14. The *Seneca* ran up her reckoning to meeting point at 9 a. m. May 1, and from that hour until dark, in what she supposed to be our vicinity, she cruised continuously. The *Miami* fired a gun each hour and radio key was pressed simultaneously in the hope that the other vessel might get our distance and direction, but the vessels were not at any time within hearing distance; dense fog. The ice limits and positions of bergs located by this vessel were reported to the senior officer by wireless, and as conditions continued most unfavorable for a meeting, that officer directed the *Miami* to proceed to Halifax. In obedience to these instructions, received at 9 p. m. May 1, the *Miami* left the banks at 4 o'clock the next morning.

Respectfully,

A. L. GAMBLE, *Commanding.*

U. S. REVENUE CUTTER "SENECA."
Halifax, Nova Scotia, May 19, 1913.

Subject: Report of second cruise on ice patrol.

SIR: 1. Leaving Halifax in the forenoon of April 28, 1913, we had fine weather for about two hours outside of the harbor entrance. It then shut down with a dense fog that persisted all the way across to patrol grounds. On our way to Halifax we experienced a southerly set, so I allowed for that on the return trip. Apparently the current was all or northward, for we were so far out of our reckoning when we reached Grand Bank that we were unable to find the *Miami* after a whole day's search. I then instructed Capt. Gamble by radio to proceed to Halifax next morning, May 1. Inasmuch as important papers would be unnecessarily delayed by remaining at

Halifax for my indorsement, I told Capt. Gamble to forward his mail to the department direct, stating that we were unable to effect a meeting. I then anchored in 40 fathoms on Grand Bank and lay there until May 3, awaiting clearing weather. When we finally got a sight we found we were about 20 miles to the northward of our supposed position.

2. On May 4 the fog lifted, and we started out to the eastward to look for bergs. Saw nothing that day. Stopped and lay by for the night. On the morning of May 5 the fog closed in again and we ran to 45–30 N., 49 W., and anchored in 31 fathoms. Tried to catch some cod, but met with no success. During the day I received many reports of bergs all around Flemish Cap, and thence west and south to 45 N., 49 W. Water temperature 35°, 3° higher than last month (April 15). On May 6, about noon, the fog lifted with a westerly shift of wind, and we resumed our hunt. About sunset we observed four bergs. Ran to the nearest and stopped to examine it in 45–47 N., 48–12 W. I shall call this No. 3, Nos. 1 and 2 having been seen April 13. On two faces No. 3 was almost perpendicular, and these faces gave strong echos; slanting faces gave no echo. I will state here that in all my experiments with echo on bergs I found the ordinary law of reflection to hold good; perpendicular faces reflect sound back, while slanting faces reflect sound away. The berg gives no more or no less echo than any structure of similar shape. Very close aboard of an irregular-shaped berg we could get a reverberation of sound, but not a proper echo. All of the bergs in this vicinity were in water of temperature 35°. We could get no change up to a ship's length of the bergs. Close to the bergs, with a small boat, we found a drop of 3° in the surface water. Hundreds of gulls were perched on top of the berg, mostly of the Hagdon or Shearwater variety. The general surface of the berg was white, but it had a very distinct blue vein running across one end. At twilight the berg seemed to take on a beautiful ultramarine hue. No signs of calving, but one end was melting rapidly. At nightfall we ran about 2 miles to the southward. As long as there was any appreciable daylight we could see the berg with the naked eye (there was no moon), but when night fell dark we could no longer make it out. Turning on the searchlight we picked it up readily. We tried to find others in the vicinity with the searchlight, but 2 miles was about as far as we succeeded by this means. During the night the fog closed in again and a light southeast wind drifted the *Seneca* toward the berg. At 4 a. m., daylight, the wash of the waves could be heard on the berg, and a faint echo could be raised. The sound of the waves was much stronger than the echo. In about 15 minutes the outline of the upper part of the berg could be made out. Shortly thereafter the waves could be seen washing against the base of the berg. The fog was thin overhead, blue sky showing in the zenith. With a thick fog I have found that the base is the first part seen. We were probably 300 yards from the berg when it could be seen. We worked the engine ahead and passed clear. Fog getting heavier, I ran over to the bank and anchored. On the 8th it was foggy all day. The *Scotia* reported by radio that she was in 46–38 N., 46–40 W., and had just passed two large bergs.

3. On the 9th of May clear weather returned and continued for two days. It being evident that the bergs were working to the southward along the east side of the bank, I ran to the south and west, sighting and examining six of them, the southernmost being in 44–35 N., 48–49 W., and the westernmost in 44–58 N., 49–20 W. Two of these were off soundings, but the others were in from 45 to 65 fathoms and were probably grounded. The sea water was uniformly 36°. Any of these bergs could be seen 12 miles from the bridge, about a mile farther from the crow's nest, and a mile still farther from the signal yard. The weather was clear and visibility excellent. All of the bergs showed much erosion and several small growlers were seen. The smaller bergs seemed to be working more to westward than the big ones, which makes me think the big ones were grounded.

4. The 11th was foggy. On the 12th we resumed search to the south and east and at 9.15 a. m. raised a berg. Running 14 miles we were alongside it and recognized

it as the first one we saw on April 13 in 44–36 N., 48–27 W. Its position now was 44–01 N., 48–46 W. I shall call this one No. 1. Its general shape was the same as when we first saw it and the dirty streak on one side was even more prominent. Much erosion and melting had taken place. Temperature of sea 36°, 1° warmer than April 13. Deep gullies and one cavern had been washed into the sides of the berg, and instead of its old solid appearance it now looks soft and dirty. The water line a month ago was flush, but now it is concave, overhanging in places 5 or 6 feet. About 2,000 murro and many other sea birds—gulls, Arctic tern, a few plover, and some very small birds, probably lesser auk—were resting on top of the berg or flying around it. I should estimate its diminution in a month as 25 per cent. It is now about 40 feet high, the smallest berg we have seen.

5. On the 13th we cruised about to the southward and then back to No. 1. In 24 hours it had drifted 6 miles S. 16 E. true. I counted seven good-sized pieces recently broken off. Erosion takes place in two distinct forms. In one the waves wash up over the sloping sides of the berg and the receding water cuts deep gullies in the ice until the end sloughs off, as shown in figure 1. In the other case the waves wash along the edges of a steep side, gradually melting and cutting it away, and calving takes place along the dotted lines shown in figure 2. We observed both forms of erosion on berg No. 1 and saw where the ends sloughed and the sides broke off. Where the ends sloughed off spurs projected out under water for 20 feet or more, these spurs showing milky white in the blue water.

FIG. 1.

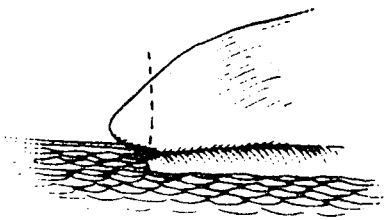
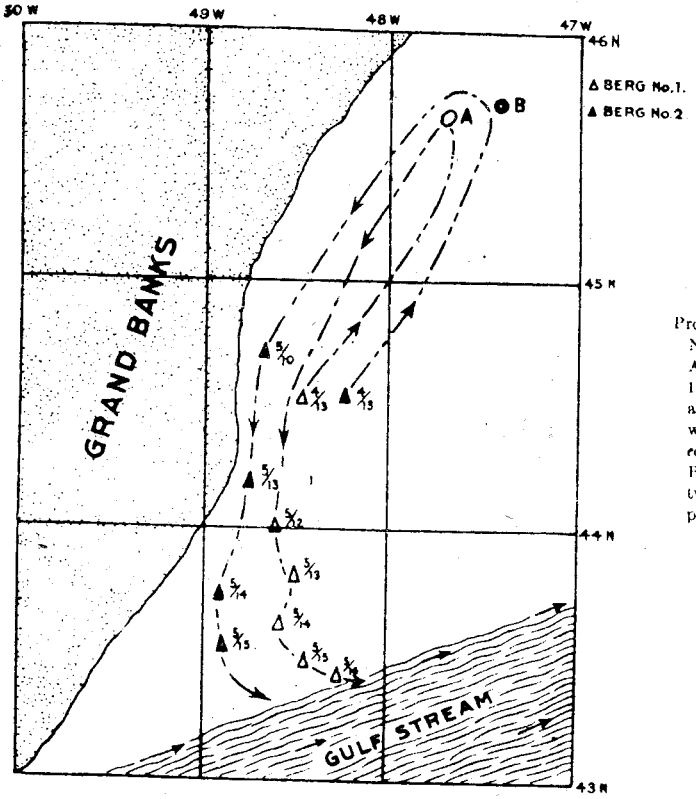


FIG. 2.

6. On the afternoon of May 13 we stood to the northwest and picked up in 44–13 N., 48–51 W., berg No. 2, which we saw just a month before in 44–36 N., 48–09 W. At first we thought it was a new one, but upon getting another view it was recognized by a peculiar forked blue streak through one side. It has lost fully 25 per cent of its bulk and was calving rapidly. The height had dwindled from about 70 to about 40 feet and the sharp pinnacled top had become round and smooth. A cavern had been broken through one side and the water rushed in and out with a mighty roar.

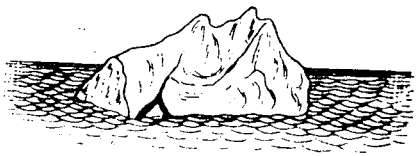
7. On the 14th and 15th we kept Nos. 1 and 2 constantly in sight and visited each one daily at close range to study them. From the 13th to the 14th No. 1 drifted south by west about 6 miles and No. 2 went almost south 32 miles. From the 14th to the 15th No. 1 went south 14 miles, east 15.5 miles, and No. 2 south 12.5 miles. Both are in the influence of the Gulf Stream, the water in the vicinity of No. 2 having risen from 36 to 50°. Off to the eastward we could see a distinct break in the horizon where the cold and warm currents came together. The horizon line over the cold water was about one minute of arc higher than over the warm water. On the morning of the 15th a large pinnacle at one end of No. 2 dropped off and the shift in the center of gravity caused thereby toppled the berg over 90° in one plane and 45° in a plane perpendicular to the first. Its water line of the day before now stood at 45° from the horizontal and its former underwater body was now awash.

8. On the morning of the 16th of May No. 1 had moved east-southeast 13 miles. It is rapidly curving to the influence of the Gulf Stream. No. 2 was still moving southward at sundown 15th, and we lost it in the fog and haze. No. 1 tipped over during the night.



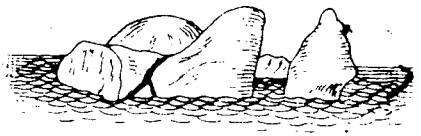
Probable track of Bergs No. 1 and No. 2, from April 13 to May 16, 1913. Where dates are marked the bergs were seen by the *Seneca*. Positions A and B are places where two bergs were reported about May 1.

No. 1, as seen Apr. 13, 1913.

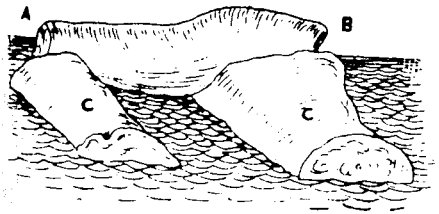


No. 2, as seen Apr. 13, 1913.

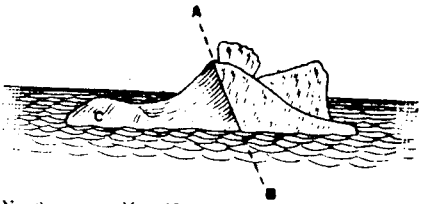
No. 1, as seen May 12, 1913, showing broken side and erosion



No. 2, as seen May 13, 1913. The pinnacle on right broke off next morning.



No. 1, as seen May 16, 1913, after it toppled over. A B is old water line. C is old underwater body



No. 2, as seen May 15, 1913, after it upset. A B is old water line. C is old underwater body.

of the 15th, and on the morning of the 16th it lay on what had been its side. Both No. 1 and No. 2 show by the tapering of the old underwater body that melting under water has gone on rapidly, more rapidly the deeper down it projected, which would seem to indicate that the water beneath was warmer than at the surface. This seems reasonable, for it is at this locality that the Labrador current tries to override the Gulf Stream. I append hereto a set of sketches showing the comparative appearances of Nos. 1 and 2 on different dates and a probable track of each for the period from April 13 to May 16, 1913.

9. On the morning of May 16 the weather became hazy and at times foggy, later partly clearing under the influence of a strong northwest breeze. At about 8 a. m. we saw to the northwest another berg and ran in that direction. It was a large massive block of ice about 400 feet long and 70 feet high. We had not seen it before and it is probably only one of several that are coming down with the summer trend of the Labrador current. It is now a question how far they will go to the southward before the Gulf Stream takes charge and carries them back to the east and north.

10. The *Miami* having arrived on the scene on the morning of the 16th, I made preparations to start for Halifax. Before we sighted each other the weather had become stormy and the sea was too rough to lower boats, so I turned the patrol over to Capt. Gamble by radio and started westward, arriving at Halifax this morning, May 19, at 11 o'clock. I expect to start back on the 28th so as to relieve the *Miami* on the 31st.

Respectfully,

C. E. JOHNSTON,
Commanding.

U. S. REVENUE CUTTER "MIAMI,"
Halifax, Nova Scotia, June 4, 1913.

The SECRETARY OF THE TREASURY,
Washington, D. C.

Subject: Report of second cruise on ice patrol.

SIR: 1. I have to state that this vessel reported position and course to the senior officer on patrol at 11.45 p. m., May 14, and received reply directing that it proceed to 44 N. 49 W., where the *Seneca* was lying by bergs. At 8 p. m., May 15, *Miami* again reported position, heading, and speed; the *Seneca* replied at 9.40 p. m., fixing appointment in 43-20, 48-50, near a berg.

2. The *Seneca* was relieved by radio at 3.30 p. m., sea becoming too rough for the use of boats. The *Miami* hove to at 4 p. m., 8 miles east of a small berg and growler, 43-25, 49-10. At 11 p. m. underway and steamed 6 miles to eastward to avoid a small berg closing in on us. It was either drifting from the northwest or it may have been our drift to the northeast, or both. This berg was a small one with two peaks. It was first sighted at dusk, 6.30, about 6 miles northwest. It was not sighted again until 9 p. m., about 3 miles distant. The direct rays of the moon were upon the face of the berg and its outline could be distinctly made out. At 11 p. m. it was about a mile from the ship. The searchlight was used, but proved an interference rather than an aid to vision. The wind was gentle westerly at the time and the berg must have been traveling much faster than the ship. Water fell in its proximity from 38° to 34°. These two bergs did not compare in size and form to those sighted a month ago. Those were square in outline, these peaked, showing the effect of dissolution.

3. On the 17th wind blew a moderate gale from south and southwest, barometer 29.40. The *Miami* lay to, practically in the trough of the sea. An effort was first made to hold her up with main staysail and mainsail, and later to pay her off under fore staysail. Both efforts were unsuccessful, and she insisted in laying in the trough. As she was comfortable and the economical expenditure of coal is essential to keeping a safe surplus on hand, the engine was not used.

4. At 6.30 a. m., 18th; position was fixed by observation in 43-45, 47-35, vessel having drifted and set by current since the 16th, 65 miles east-northeast; water had changed from 34 to 54°, and no bergs in sight. Went ahead west by south true at 7 a. m., half speed, strong west wind, rough sea. At noon the *La Touraine* passed 5 miles to the northward, in 44-04, 48. At 8 a. m. surface water was 52, condenser 56; after making 8 miles, west by south true, surface 36, condenser 37, a drop of from 16 to 19°. This second reading in about 44, 47-40. In foggy weather, the impression would have been the near approach of an iceberg, while it was the passing from the Gulf into the Labrador Stream. The nearest ice reported that day was by *La Touraine* in 44-23, 47-07. No berg was sighted on course, but at 7 p. m. vessel stopped for the night, with a large berg on the horizon, bearing northwest.

5. At 8 a. m., May 19th, observation showed that vessel had drifted east-northeast, over a mile an hour. Continued on course to the westward and again picked up berg, but at 10 sighted a larger one to the southward and stood for it. When alongside, 43-45, 48-50, it was observed to be a large pan-shaped berg, one that had never turned over, but its edges were very irregular, showing the effects of calving. Considerable drift was found in its wake, half a dozen pieces large enough to be dangerous. This is probably the large berg reported by the *Seneca* May 16, as the air was clear, and any berg would have been visible, as was one to the northwest, over 20 miles away. *Miami* then stood southwest in search of other bergs, until 2.30 p. m., when, owing to haze obscuring the horizon, engines were stopped. When 25 miles from berg, it was dropped below the horizon, but mirage again lifted it, until it appeared no farther distant than when a mile away. Wind light south-southwest, barometer 30.10.

6. May 20, morning sights showed vessel had drifted east-northeast true about 10 miles, wind south-southwest. Underway at 8 a. m., and stood west-northwest (true) on course which should have passed within sight of bergs seen 16th and 19th. The latter was sighted well to the northward of position of previous day. No other bergs were seen. Those of the 16th had probably been blown into the Gulf and set to northeastward. The bergs are set to the southward by the Labrador current, along the east edge of the banks, until near the end, when they are caught by the Gulf Stream. Vessel anchored at 4 p. m. in 30 fathoms, 90 fathoms on 6-inch line, in 43-45 N., 49-40 W., having cruised from 8 a. m. from 43-20 N., 48-30 W. The next day was spent at anchor; weather very hazy; moderate wind and sea from west to northwest; vessel dragging in the meanwhile 6 miles to the eastward.

7. On May 22, stood to the eastward, passing close at 11 a. m. a small, wedge-shaped berg in 43-45 N., 48-30 W. This berg showed considerable effects of dissolution and erosion, the different water lines at which it had floated being deeply scored into its sides. The water fell in its close proximity 2°; but as we passed to leeward a quarter of a mile temperature of atmosphere fell 10°. Vessel then stood to 45-25 N., 48-30 W., and then westward to the banks, horizon visible at all times and in all directions and no bergs in sight. On the 23d search was continued to southwest as far as 42-55 N., 49-30 W., and then to the northeast.

8. On the 23d stood northeast along edge of Gulf Stream, water close to 50°. As westerly winds predominate I am of the opinion that the bergs sighted the 16th have been blown across the Labrador current, which extends approximately 40 miles from the edge of the banks, thence into the Gulf Stream, and must ere this have been melted. *Miami* lay to the night of the 23d. The 24th dawned foggy. As positions at best are very doubtful after 12 hours without observations, stood west for the banks, to anchor until position could be determined, 43-32, 49-45, dead reckoning.

9. The 25th continued foggy, the vessel lying to, two kedge anchors lashed shank to shank, riding to 100 fathoms 6-inch line, mainsail set, wind and sea a point forward the beam. Wind moderate to strong, moderate sea southwest; vessel drifting to eastward. In the afternoon two French fishermen in dory, who had lost their ship in fog, were taken on board. This rescue is reported in another letter. The *Miami*

dragged until 4 a. m. the 26th, when anchors were found to be away. Hove them up and stood to southwest, fog lifting temporarily at 8 a. m. The barkentine *Aralia*, to which the rescued fishermen belonged, was sighted a couple of miles distant. The men were returned to the *Aralia*. The fog set in soon afterwards, so vessel anchored at noon.

10. Fog lifted with a shift of wind to the northward during the night; observations were taken, and at 5.30 a. m. vessel continued search for bergs. The waters between latitudes 42–40 and 43–25 and longitudes 48–40 and 50–00 were patrolled. The steamship *Columbia* at same time stood 72° from 42–26, 50–01, at noon. At 8 p. m. she reported no ice. On May 28 the *France*, on a parallel course, but 50 miles south, sent in same report.

11. On the 27th, between the two latitudes 43–55 and 43–10, in longitude 49–10, the water temperature fell from 50 to 36°.

On the 28th, in 43–28, 48–30, heading east, temperature rose from 38 to 50°. On this day the *Miami* searched the waters between latitudes 43–20 and 44–00, and longitudes 48–20 and 49–50; no ice in sight. Vessel anchored for the night. The 29th came in drizzling and later changed to dense fog; wind fresh from south-southeast; vessel dragging to north-northwest.

12. A radio message from the *Seneca* was received at 5.40 p. m. when about 300 miles west by south. I informed the senior officer that our position at the time could not be determined, as it had been foggy since anchoring and the *Miami* had dragged miles to the northward. By arrangement the *Miami* got under way at 4.30 the next morning and steamed to the westward, in the hope of intercepting the *Seneca* as she steamed to the eastward along the 44th parallel. She was sighted dead ahead at 4.45 p. m. Both vessels lay to at 5.15 p. m. while track chart and copies of radiograms were delivered to the senior officer, after which both vessels proceeded on their respective ways.

Respectfully,

A. S. GAMBLE,
Commanding.

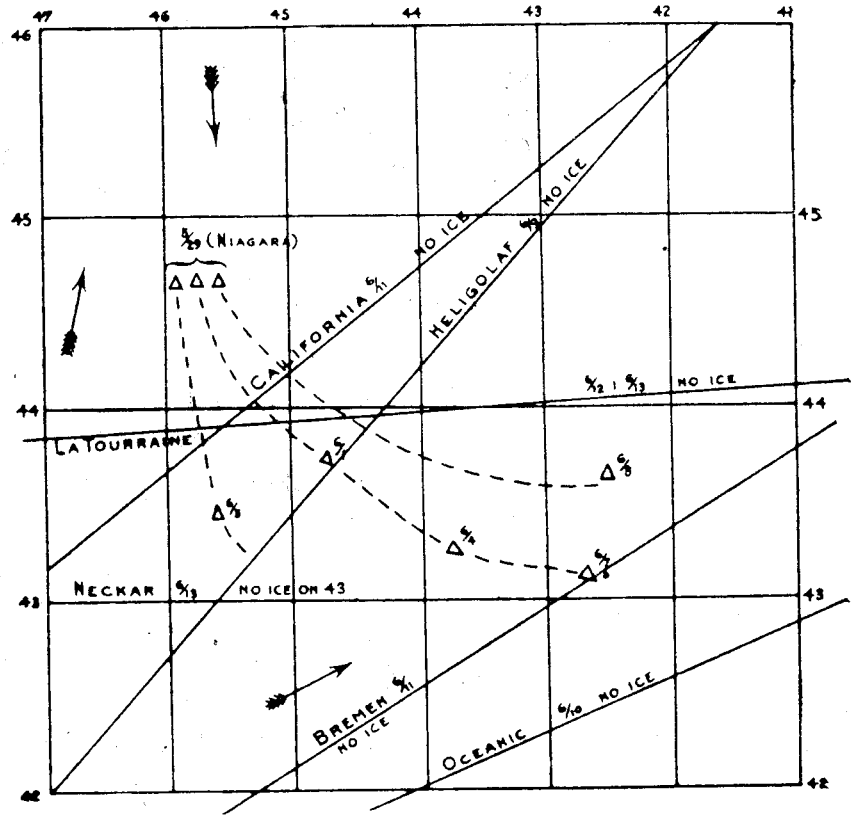
U. S. REVENUE CUTTER "SENECA,"
Halifax, Nova Scotia, June 19, 1913.

Subject: Report of third cruise on ice patrol.

SIR: The *Seneca* left Halifax on May 28, 1913, in a fog and reached Grand Bank May 31, having had high shifting southerly winds and rain most of the way. On the 31st it cleared and I directed the *Miami* to meet us on parallel 44, which she did. After receiving charts and reports I relieved the *Miami* and she proceeded to Halifax. Fog closing in again, I anchored on the 30 fathom bank. On June 1 the wind came out heavy from the southwest and I got under way for fear of parting the chain.

2. On June 2 the weather cleared and moderated and I stood out to the south and east to look for bergs. Capt. Gamble reported the last berg he saw was in 43–30 N., 48–30 W., and from his sketch of it I recognized the berg I have previously called No. 2. It was north of where I last saw it. That was May 22. I worked down to the position mentioned, and from there I cruised between the Grand Bank and the north branch of the Gulf Stream, working to the northward. I found the current to be north 40 east, about a mile an hour. Continuing the search to the northward, nothing was seen until May 4, when we sighted the berg previously reported aground in 44–56 N., 49–16 W. It had apparently turned over twice and bore no resemblance to the berg we saw there before. It was rapidly breaking up. Sea water 42° at surface, 40 at condenser intake. The day was very clear and we picked up the berg at 18 miles. Fog closing down later, I ran to the westward and anchored. On the 5th we ran back to the berg during a drizzling rain and could then see it plainly 2 miles and indistinctly half a mile farther. Water temperature is 5° higher than a month ago. Current north 26 east, three-fourths mile an hour.

3. Proceeding to the north and east we cruised from the 6th to the 11th between the bank and meridian 46, finding no ice. Reports from vessels indicated that there was practically no ice south of 47, but many bergs north of 48 from meridian 45 to St. Johns. Between June 1 and June 9 bergs were reported in five positions between parallels 43 and 44, meridians 42 and 46. I sent information of these broadcast three times a day and individually to all vessels on southern lanes, requesting them to keep a lookout for the ice and to report to me their courses over this stretch. I received reports from the *Helig Olaf*, *Oceanic*, *Bremen*, *California*, *Neckar*, and *La Tourraine*, all of which crossed in clear weather and reported no ice. I also had reports from other vessels crossing in foggy weather. The tracks of these vessels are repre-



Bergs between 42° and 46° W., 43° and 44° N., June, 1913. Also steamer tracks afterwards.

sented on a sheet herewith, also positions of bergs reported. All of the bergs are well north of the conventional lanes and apparently in the north edge of the northeast current, which should take them toward the north of Ireland. They apparently are the same bergs, three in number, reported on May 29 by the *Niagara* in 44–40 N., between 45–45 and 46–00 W. The summer current runs southward from Flemish Cap to the Gulf Stream, dives under and emerges again in Sargasso Sea. This would carry these three bergs to the Gulf stream, which in turn would carry them eastward and northward. Allowing about 15 miles a day for drift, the bergs must have gone much as shown in the accompanying diagram. The probabilities are that all but one of them are well east of 41

4. On the 8th of June, being satisfied that the usefulness of the patrol was at an end for the season, I recommended by radio that it be discontinued. It seemed impracticable and unnecessary to try to patrol the scattering bergs across the ocean.

5. On the 11th I worked back to the westward as far as the position where we last saw the berg aground, but it was not in sight. During that night we drifted well to the northward and on the morning of the 12th a berg was seen through the haze 5½ miles to the northeast. We ran over to it and found it was a part of the berg we were looking for. Experimented on it for visibility under various conditions, particularly at night with searchlight. The results are given in another part of this report. On the morning of the 13th the weather cleared and we saw to the eastward the rest of the berg. The larger piece was in 44-58 N., 48-40 W.; the smaller piece in 44-56 N., 49 W. Their drift has been parallel to the edge of the bank. Both pieces are now in deep water. On the 14th we remained near the large piece, making observations and filling ice boxes. We find this ice far superior to manufactured ice in lasting qualities. During this day the berg drifted north 72 east (true), 9 miles in 20 hours. Practically all of the ice that breaks off melts inside of 24 hours. Surface water 39°.

6. The 15th came in foggy and I worked slowly to the westward to meet the *Miami*. During the day I received a radio from the captain commandant directing a search of the rectangle between meridians 42 and 46, parallels 43 and 45. I instructed the *Miami* to make this search.

7. On the morning of the 16th we met the *Miami* and I turned the patrol over to Capt. Gamble, together with all the information in my possession. I intended to stop at St. Pierre on my way to Halifax, but dense fog setting in, I abandoned that plan and stood to the westward.

8. I submit herewith a résumé of data and deductions from the observations I have made during the three cruises.

C. E. JOHNSTON, *Commanding.*

U. S. REVENUE CUTTER "MIAMI,"
GREAT BANKS OF NEWFOUNDLAND,
LATITUDE 43-35, LONGITUDE 52-54,
July 1, 1913.

Subject: Report of third cruise on ice patrol

SIR: 1. On June 15 radio communication was established between the two patrol vessels and our 8 a. m. position was reported to the *Seneca* lying at the time to the eastward of the banks in latitude 45, near a grounded berg, which had afterwards broken in two, forming two distinct bergs, which were drifting to the northeastward. At noon same day vessels exchanged noon positions and Capt. Johnston appointed a meeting for next day on parallel 45. Vessels met at 5 a. m. the next day and lay to until 6 a. m.; the senior officer delivering to me diagram of bergs sighted and reported to date and copies of ice reports forwarded from the *Seneca*. That vessel, upon being relieved soon afterwards, stood to the westward. The *Miami* stood to the eastward for those waters in which search was to be made, in accordance with department's radiogram of the 9th instant.

2. At 1 p. m., the 17th, in latitude 45-00, longitude 46-26, a small berg was passed close aboard, water 47°, a fall of 1°. This berg floated about 10 or 15 feet above the water and was hardly 200 feet in length. Its top was furrowed and gullied through in many places, and appeared on the point of breaking up. As it pitched in the swells the seas broke in spray on the bluff ends, while others swept unbroken through the gullies across its top. Considerable trash ice was floating to leeward. Though our track had been in latitude 45, nothing was seen of the bergs near which the *Seneca* had been lying two days before. Fog set in, engine was stopped at 3 p. m., and vessel drifted.

3. The 18th, 19th, 20th, and 21st the *Miami* cruised along latitude 44-45 to longitude 42-15, then south to latitude 43-15, then west to longitude 45-45, then north and east

to latitude 43–45, longitude 45–10, when vessel stopped at dark to drift until daylight the morning of the 22d. Up to this time no bergs had been sighted and none had been reported by steamers crossing the rectangle between parallels 43 and 45 and meridians 42 and 46. These tracks had covered every quarter of the zone. On the evening of the 21st, the *Cambrian* reported a berg in latitude 44–30, longitude 45–25. Up to date, this is the only berg in the rectangle since the three reported in southeastern corner the first week in June, which have not been reported again, though that locality is crossed several times each day by the many vessels using the lanes to the English and Irish Channels.

4. The 22d came in foggy; but partly clearing before 8 a. m., got under way and stood for reported position of berg sighted by *Cambrian* the night before. After standing to within 10 miles of position of berg, engine was stopped and vessel allowed to drift. A dense fog had set in which made further search for the time useless. The *Cambrian* had reported the drift of this berg as south-southeast, as the smaller pieces lay to the north-northwest. This is not always proof of the line of drift of the berg, as the wind at the time was moderate southeast, and the small pieces are likely to be blown and washed to leeward. Wind shifted to southwest, blowing fresh, attended with moderate sea. Weather continued so until 6 a. m., when fog cleared, and vessel stood to the northward. Noon position by observation on the 22d placed the vessel in latitude 45–30, showing a drift of over 60 miles to the northward since the 21st. We had been set beyond the range of radio communication with vessels on the lanes to the southward. Course was set to the southeastward, to get into warmer water, where chances of fog are less, radio communication could be reestablished, and the search continued.

5. The *Cambrian* found a south-southeast drift at time of sighting berg on the 21st; between the 21st and 23d the *Miami* found a drift of 60 miles to the north-northeast, wind having shifted to southwest. From this I was persuaded that this berg must have been set to the northward of forty-fifth parallel; but with search frequently interrupted by fog, among variable currents, whose drift can only be determined by observations, lacking in thick weather, ship possibly influenced by surface current while berg is drifting with a cross or counter undercurrent, all make plotting of positions and forecasting of drift of ice most uncertain.

6. On the 23d cruised to southeastward to latitude 44–30, longitude 43–30; and on the 24th to the southwestward to latitude 43–50, longitude 45–00. The track of the *Miami* and those of the many vessels reporting by radio had brought all of rectangle under observation except the extreme western edge, the berg sighted by the *Cambrian* being the only berg in the rectangle since those sighted by the *Winifridian* on June 9 in extreme southeast corner.

7. The 25th began with light westerly breezes and partly cloudy. Observations had accurately fixed position the day before, so I planned to drift for several days in the hope of getting some line on set of current when not confused with vessel's leeway. This plan was interrupted at 11 a. m. by a radiogram from the *Columbia* reporting passing a berg eight hours earlier in latitude 44–01, longitude 45–05, which should have been within sight of the *Miami*, but was not. We cruised in that vicinity for four hours until fog set in. The wind coming out from southeast backing into and blowing fresh from the east, *Miami* lay to and drifted to the westward. We have found that the east winds hold on and may increase after sunset; the west winds moderate and lull soon after sunset. This day, standing to the westward in latitude 44, longitude 45, water dropped from 58° to 40° at the condenser, 56° to 42° at the surface. Vessel drifted all the 26th.

8. At 11 p. m., the 25th, disconnected portions of a radiogram from the *Seneca* were received, seeming to refer to her departing for New York and the discontinuance of patrol. All efforts to obtain confirmation proved unsuccessful. At 9.05 p. m., the 26th, received following radiogram from senior officer, quoting telegram from department: "Search rectangle between meridians 41 and 42, parallels 42 and 43–30. If you find no large icebergs, discontinue patrol and return to New York; *Seneca* ordered New York."

9. Got under way at 1.30 a. m., the 27th, and stood to the southeastward to complete search as directed. Arrived in those waters the 28th, where a thorough search was made. Sea was smooth, sky and atmosphere clear with light northerly breeze. Here we found the finest weather since leaving Key West in March; water 58°, atmosphere, dry bulb, 58°, wet bulb, 54°. No bergs could have been set across the tracks on the lanes without being reported. Seven steamers reported courses through eastern rectangle on the 27th and five the 28th. If any bergs had gotten across in foggy weather their existence would have been a short one in such temperatures. Here the most satisfactory service of the *Miami's* part of the patrol was rendered, the ships reporting their courses, positions, and conditions. With information thus collected, there was no reservation in answering the queries of ships coming in to the rectangle with the information gathered from those that had just passed out. At 4 p. m., the 28th, having searched the waters prescribed and found no ice therein, course was set for the banks, with Halifax in view as port of destination, but with St. Johns close at hand if reduced coal supply and strong westerly winds should make a visit to latter port the choice of alternatives.

10. Only three bergs were sighted and reported during last two weeks of patrol, that sighted by *Miami* in latitude 45-00, longitude 46-26, on the 17th; that by the *Cambrian*, the 21st, latitude 44-30, longitude 45-25; that by the *Columbia*, the 25th, latitude 44-01, longitude 45-05. These three positions are on a line bearing southeast true and running through the position of the bergs sighted by the *Niagara* on May 29 and supposed to have drifted about 120 miles farther to the south and east, where they were sighted by the *Winifridian* a week later, a daily rate of about 15 miles per hour. If the three bergs sighted the 17th, 21st and 25th had been one and the same berg, it would have shown the same set and rate, 15 miles per day southeast. The trend of the drift swings in a broad curve more to the eastward as it reaches lower latitudes, a resultant of the cold current setting approximately south, prevailing westerly winds, and the warm Gulf current setting to the north of east.

11. While a sharp drop in temperature does not necessarily indicate presence of ice in vicinity, it does show that vessel is entering a cold current from the north, which, from its direction of flow, is likely to bear bergs and from its lower temperature likely to be accompanied with fog, further increasing the dangers of ice.

12. Of the bergs sighted during the *Miami's* patrol, great difference was noted between those sighted in April, May, and June as to size and general appearance. The first sighted, April 23, looked as if freshly calved from its glacier; its walls nearly perpendicular; its top flat, smooth, and as white as a field of snow; and with but little erosion at water line. It gave the appearance of a berg in its first stage. On the 26th it was again observed after breaking across its top, one part tilting over about 45° and what had been its wall becoming the top of a new berg, producing a saddle-shaped outline, which after further melting would give a double-peaked effect—a berg in its second stage, such as sighted May 16. The immersed part of this berg, after melting faster than the part above water, would again roll over and bring what had been the edge of fracture uppermost, presenting a wedge-shaped berg, such as sighted May 22, showing the two old water lines at which it had previously floated—a berg in its third stage. The berg sighted June 17 was peaked and gullied in many places and was rapidly breaking up. Though by far the smallest berg observed, it was accompanied by a much greater quantity of small ice in its vicinity. These stages illustrate how easily an observer might mistake same berg for as many different bergs sighted at intervals of several weeks.

13. The *Miami* reached the Great Banks this day, July 1. The weather since the 28th of June has been average, as good as could be expected, and the expenditure of coal has been kept within such limit that a trip to St. Johns will not be necessary, so course was set for Halifax, Nova Scotia.

Respectfully,

A. L. GAMBLE,
Commanding.

UNITED STATES REVENUE-CUTTER SERVICE.

STATISTICS AND DEDUCTIONS FROM OBSERVATIONS AND REPORTS ON THE ICE SITUATION, SEASON OF 1913.

(A) *Kind of ice, its amount, dimensions, etc.*—All of the ice seen on or near the Grand Banks this season has been of the Greenland type in berg form. No ice was seen or reported except near the coast of Newfoundland of the field or slob variety. During the month of April I had reports of about 100 bergs south of latitude 50 north, mostly in a congested area around Flemish Cap and thence westward to the Grand Banks. Scattering bergs were reported as far east as 48–50 N., 40–40 W.; south to 44–07 N., 48–32 W.; west to 44–50 N., 49–10 W. In May there were reported to me 114 bergs south of latitude 50. They had moved westward and southward and were mostly on or near the eastern side of the Grand Banks, many being grounded thereon. Eastern limit for May, 48–00 N., 40–18 W.; southern limit, 43–18 N., 48–33 W.; western limit, 44–56 N., 49–16 W. Up to June 16 I had reports for that month of 35 bergs south of latitude 50, mostly confined between 48 and 49 N., 45 and 50 W. A few scattering bergs were reported as far east as 49–30 N., 41–45 W.; south to 43–02 N., 42–49 W.; west to 48–28 N., 49–33 W. Many bergs were reported off St. Johns, Newfoundland, and grounded near that port. Throughout the season there have been reports of numerous bergs north of 50, but I have kept no account of them. The largest berg we saw was about 400 feet long by 300 feet wide, by 70 feet high, out of water; the smallest was about 225 feet long, 100 feet wide, and 35 feet high. All were white in color, some having one or more distinct veins of blue ice running through them, these veins ranging from 18 inches to 6 feet in width. As to shape, no two bore any striking resemblance to each other. There were round tops, flat tops, sloping tops, and pinnacled tops; sloping sides, sheer sides, craggy sides; regular shapes and extremely irregular shapes. The only type we did not see is the kind popularly pictured in schoolbooks, with high, overhanging, craggy pinnacles. I have read in recent newspapers of ships reporting bergs half a mile long and 300 feet high. I am not prepared to refute such statements, but we saw nothing of that size. I estimate 150 feet as the highest berg we saw. It looked at a distance like the pictures of Matterhorn. One berg had a protuberance on its side that bore such a striking resemblance to the profile of the late Queen Victoria that several officers exclaimed in unison, "Victoria!"

(B) *Visibility of ice and means of detecting its presence.*—The greatest distance we observed ice was 18 miles. The day was clear, with light easterly winds and a tendency to mirage. It seemed to suddenly jump into view and could be plainly seen from the bridge as soon as from the crow's nest. On ordinary clear days the average berg can be seen 12 to 15 miles from the bridge, about a mile farther from the crow's nest, and a mile still farther from the signal yard. On a cloudy day with good visibility, deduct about 2 miles from the foregoing. In clear weather with hazy horizon we have seen a big berg 11 miles, its top being visible well above the horizon; in light fog, 2 miles; dense fog, 200 yards; drizzling rain, 2½ miles. In bright moonlight, with naked eye, 2½ miles; moon shining through thin mackerel clouds, 2 miles; starlight, 1 mile with naked eye, 2 miles with glasses; overcast and dark, but with horizon visible, one-half mile with glasses. In the last case the berg looms up dark; in the other cases its effulgence shows lighter than the surrounding space. With the searchlight we were able to see a berg about 3 miles on a dimly moonlight night, and 2 miles after the moon set. In using the searchlight we found that an observer standing behind or under the beam could see practically nothing, but that 15 feet away to one side he could see readily. With the beam turned on a berg abreast the ship and 2 miles away, I could see it as plainly as an illuminated store front from the quarterdeck, about 100 feet abaft the light. Another point to be noted is that the beam must be drawn to a fine focus. A flaring beam blinds the

observer. Owing to the blinding effect of a searchlight on the observer, I should not recommend its general use for a vessel under way. On a dark night or in thick weather a vessel in the vicinity of bergs should slow so as to be able to maneuver within the limit of visibility.

A berg may or may not give an echo. If its sides are steep or perpendicular an echo will probably be heard from some directions, but not from others, according as the face presented to the ship is normal or slanting. Any slanting face will reflect sound away. We were not successful in getting echo farther than half a mile. About 90 per cent of our attempts were without result. The existence of an echo indicates an obstruction, but its absence proves nothing. In one case we were between a berg and a growler; the growler gave an echo, but the berg none.

Sudden changes of temperature mean nothing, so far as bergs are concerned. The sea water is streaky as a rule, and where its temperature is constant we found no change up to a ship's length of a berg. The coldest water we found was 31°, on the tail of the Bank in April, about 100 miles from the nearest ice. Surface temperatures are about 2° higher than the injection. Close to a berg the water at surface falls from 2° to 4°. With a maximum and minimum thermometer we found no change from temperature of injection down as far as 20 fathoms. At 30 fathoms the pressure broke the bulb of the thermometer.

In a light, low fog, an observer can see a berg from aloft sooner than from deck, but in a dense fog we found that the lookout was best kept from the spar deck, as the first sight of the berg was the lapping of the water on its base.

Speaking about lookouts, it occurs to me that on a very large ship, with decks some 70 feet above water, bridge some 20 feet higher, and lookout posted higher up still, the lookout might well be higher than the top of a small berg, and hence on a dark night he would have an unobstructed view of the horizon over a berg half a mile or a mile away. In that case he might easily miss seeing the obstruction until too late to avoid it.

As a rul we found little or no change in temperature of the air near a berg.

As to birds, I make little claim to expert knowledge of ornithology, but to the best of my judgment these are all the birds we have seen in the ice regions: 1 puffin and 3 mallard ducks, flying and not near any berg; hagdon gulls in large numbers, singly and in flocks, some around bergs, but more likely to be near some fishing vessel; Arctic fulmar, plentiful, singly or in small flocks, cruising about everywhere, irrespective of bergs; petrel, two varieties, in small numbers, following ships or resting on bergs; jaeger, few, usually near some fisherman; plover, few, around bergs (probably lost in fog); Arctic tern, plentiful in May, few in June, near bergs; red phalarope, few, around bergs; lesser auk, few, around bergs; murre, large species, in great flocks around bergs in May, few of a smaller species in June; no gulls of the ordinary harbor, herring, or kittiwake varieties. In some instances a berg would be literally covered with birds and again there might not be a bird in sight. I should regard the presence of murre as indicative of bergs, but should pay no attention to the others.

We saw an occasional whale or blackfish and several schools of porpoise, mostly in or near the Gulf Stream. We saw only two hair seals, and they were on the fish banks. A seal would have a hard time climbing upon the average berg or of staying there if he once got up.

The presence of growlers or small chunks of ice indicate a berg to windward.

The roar of breakers on a berg and the rumbling of breaking ice can be heard as far as a mile on a calm day.

(C) *Behavior of ice, its drift, etc.*—So far as our observations went, the bergs drifted with the surface currents. Where two currents meet, the dominant one eventually takes charge.

Disintegration of bergs takes place slowly in water of 34° or below. At 36° melting and erosion are quite noticeable, and at 50° the changes can be noticed from

hour to hour. We had under observation for several days two bergs as they approached the Gulf Stream. Both turned over the day they entered the warm water, showing that melting of the under-water body was going on more rapidly than above. I estimated the daily diminution at 5 per cent in water of temperature 50°. Melting above water is going on slowly all the time, the water trickling down the declivities in small streams. One large berg had a small waterfall on one side, under which it would have been practicable to hold a boat for the purpose of watering ship. The temperature of the air was 48°. As I have stated in a previous report, erosion takes place by water dashing up on slanting sides of bergs and by scoring out the water line of steep sides. In the first case the ice is disintegrated by sloughing and in the second by calving. Large fissures may be seen at times in the sides of bergs, and as these increase in size great chunks are likely to fall off in the form of growlers.

At the rate of 5 per cent disintegration a day a berg would last only about 20 days in the Gulf Stream; but the larger the berg the slower it seems to melt, and I have no doubt some of the largest would last two months.

The southern movement along the east side of the bank seems to be largely a matter of weather conditions. For many days the bergs remained almost stationary between Flemish Cap and the bank, then after a northerly blow with heavy northerly swell they started to the southwest. Many grounded on the bank, while others continued south. The highest daily movement we observed was 32 miles in 24 hours, in the vicinity of 44 N., where the bank rises quite abruptly from 1,000 to 21 fathoms. Ten miles farther east another berg moved south only 6 miles the same day. As they approached the northern arm of the Gulf Stream, both of these bergs curved eastward. Fog and high winds then shut them from view. Six days later the westernmost one was seen again, about 12 miles north-northeast of the position where it entered the influence of the Gulf. I presume both of these bergs melted early in June.

After running southward for about two weeks, the current was overcome by a spell of southwesterly wind, and the bergs then returned to the north—all but one which was grounded in a deep pocket near parallel 45, where it broke in two some 10 days later and floated away in two pieces.

In the matter of currents, it seems that the winter cold stream comes down the coast of Newfoundland and at the north end of the Grand Bank it splits in two, one part running between the bank and the island to the west and south, while the other follows the general trend of the east side of the bank. The current running out of St. Lawrence Bay joins the branch first mentioned, and accelerates its movement to the southward. Between the tail of the bank and the Gulf Stream, about 2° farther south, there is much rough water, caused, no doubt, by the conflict of the two currents. Here is where the bergs usually change direction in April or May, as the Gulf becomes stronger than the Labrador current, and are carried back northward. From my observations of the effect of winds upon currents, I conclude that a cold winter, which is always accompanied by much northerly wind, sets up a strong southerly current, and the bergs go far south; a warm or mild winter, on the other hand, is accompanied by much southerly wind, which weakens the Labrador current and strengthens the Gulf Stream, and as a consequence the bergs do not go far south. This theory is borne out by the seasons of 1912 and 1913. The first was a very cold and stormy winter, while the second was a mild season, its gales being largely from the southwest. The first was the worst season in many years for icebergs around the tail of the bank, while the second was one of the lightest on record, only two bergs having been reported south of latitude 43.

My observation of currents on the Grand Banks is that they are almost wholly tidal. In a general way they flood to the northward and ebb to the southward. Winds drive them to the eastward or westward, sometimes overcoming the strength of the tidal current.

The weather this spring has been mild, with much fog. In April we had about 50 per cent, May 60 per cent, and June about 30 per cent of foggy days. In April there were two days of wind over a force of 8; May, three days, and up to June 16 only one day. We have had much ground swell, the swell being entirely out of proportion to local winds. I have anchored all over the eastern side of the bank, using bower anchor and about twice as much chain as the depth of water. In heavy winds we drag some, but there is plenty of room and the bottom is hard and smooth. I tried a kedge, but it was little better than nothing.

Referring to the matter on pages 9 and 10 of the pamphlet, reprint No. 2, North Atlantic Ice Movements, the signs of the proximity of ice seem to be more applicable to ice fields than to bergs. I have seen most of those phenomena around the ice floes of Bering Sea and the Arctic, but none around the bergs. The only "blink" I have seen this year was when we were in the western edge of the Gulf Stream looking westward over water about 20° colder. For a distance of about 30° along the horizon there was a perceptible blink, rising about 1° above the horizon. I have spent two seasons around the Arctic ice flows, and I am prepared to say that this blink was in every way similar to the ice blink, except that there was no ice under it, only cold water. This would seem to indicate that the blink is a phenomenon of refraction rather than of reflection. This point would seem to be further borne out by the fact that as an ice floe is approached the blink usually turns into a mirage.

(D) *Safety in ice regions.*—In my opinion the only safe way to navigate regions of icebergs is to stop during thick weather and to run very slowly on dark nights. In clear weather icebergs are not dangerous. I believe that a vessel might drift against a berg in ordinary weather without much damage. The British steamer *Mount Temple* is the only one I have heard of this season that sustained any considerable damage from icebergs. She is reported to have drifted against one while stopped during a fog. In sheering to avoid a berg it must be borne in mind that with engines working ahead the vessel is pivoted on her stem, so that as soon as the bow is clear of the berg the helm should be shifted in order to throw the stern away from the berg. At night and in thick fog I should post the lookout as low down as circumstances would permit. In addition to this, the vigilance of the officer of the watch should be unremitting.

(E) *Soundings on Grand Bank.*—I have found that little reliance can be placed on the charts of the Grand Bank so far as concerns soundings. The 30-fathom bank south of latitude 45 seems to be getting shoaler, particularly on its west side; the tail of the bank shows deeper water than we found. On the east side of the bank at latitude 45 we found a deep indentation with no bottom at 100 fathoms near longitude 49 and 50 fathoms as far west as 49–15. On the west side of the bank near latitude 45 we got a sounding in 22 fathoms, but owing to foggy conditions I am unable to locate it with any degree of accuracy. I believe that the bergs are scouring out parts of the east side of the bank and that the sand dug out is piling up in other places. I do not believe that bergs bring down any considerable quantity of solid matter, but it is doubtless true that the melting of field ice deposits a considerable amount of sand, gravel, and earth.

(F) *Fishing on Grand Bank.*—We had no success in catching fish anywhere on the bank. The French fishermen use trawls with a thousand hooks on a line and bait with clams, whelks and colored rags. They report a poor season thus far, but look for good fishing in July, August, and September. They lie at anchor most of the time. The fishermen say that they seldom see bergs on the banks. My observation is that bergs of ordinary size will ground in 35 fathoms, so that none but the very smallest will ever get upon the shoal parts of the bank where fishing is carried on.

(G) *Sea birds as food.*—For the benefit of persons remaining long in this region or in Bering Sea, I will give the recipe for cooking gulls, murre, eider duck, and other sea fowl that are inclined to be tough and fishy. This recipe is used with success by

William Landgraff, cabin steward of the *Seneca*, who has had experience around the northern parts of the Scandinavian Peninsula. Recipe: Let the birds hang in the feather for three days, then draw and skin them. Soak in fresh water for three days more, on the third day adding a tablespoonful of vinegar to each quart of water. Fry the birds brown in a very hot skillet, then put them in a saucepan and half cover with water. For five or six birds season with one onion, two cloves, two bay leaves, six whole black pepper berries, two tablespoonfuls of vinegar and salt to taste. Cover and simmer until water has evaporated. Serve.

Respectfully,

C. E. JOHNSTON,
Commanding.