TREASURY DEPARTMENT
UNITED STATES COAST GUARD

Bulletin No. 7

International Ice Observation and Ice Patrol Service

in the

NORTH ATLANTIC OCEAN

Seasons of 1916 and 1919

WASHINGTON
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INTERNATIONAL ICE OBSERVATION AND ICE PATROL SERVICE.

The International Ice Observation and Ice Patrol Service was undertaken by the Coast Guard in 1913 and was continued during the seasons of 1914, 1915, and 1916. In 1917, due to international complications which culminated in the United States entering the war, no ice observation or ice patrol was made, and on account of actual war conditions in 1918, no steps were taken to resume the patrol that year. Active hostilities having terminated with the armistice in November, 1918, the service was reestablished in 1919. During the war the Coast Guard was operating as a part of the Navy, under the direction of the Secretary of the Navy, in accordance with law, and continued to so operate until August 28, 1919, when the service was returned to the jurisdiction of the Treasury Department by Executive order.

This volume contains the instructions and reports of both years, 1916 and 1919. In addition to such observations as may be made by navigators, scientific observations were made during both seasons by Mr. A. L. Thuras, formerly of the Bureau of Standards but now regularly employed by the Coast Guard. In 1916 Mr. H. W. Nightingale, of the Bureau of Fisheries, collected biological data in connection with the ice patrol.

In 1916 the patrol was performed by the cutters *Seneca* and *Tampa* (formerly the *Miami*). The *Tampa* was sunk, presumably by an enemy submarine, in September, 1918, and the *Seneca* was still in European waters in the early part of 1919. Consequently the cutter *Androscoggin* was detailed to replace the *Seneca* and the *Tallapoosa* to take the place of the *Tampa* during the season of 1919.

DISSEMINATION OF ICE INFORMATION.

The Hydrographic Office of the United States Navy cooperated with the Coast Guard in the dissemination of ice information as in former years. Daily ice reports were made by the patrol vessels to the branch Hydrographic Office, New York, and necessary steps were taken by that office to give publicity to the reports. The branch office forwarded the messages to the main office at Washington which incorporated them in the Daily Memorandum, which is freely circu-

lated in sections having maritime interests. The patrol vessels themselves sent out ice information at stated intervals and in addition furnished special reports to such vessels as made request therefor.

COOPERATION OF OTHER BUREAUS.

The Weather Bureau, Bureau of Standards, and Bureau of Fisheries have heartily cooperated with the Coast Guard in making plans and devising instruments for carrying on the work of ice observation.

SEASON OF 1916.

INSTRUCTIONS FOR ICE OBSERVATION.

TREASURY DEPARTMENT,
UNITED STATES COAST GUARD,
Washington, February 2, 1916.

COMMANDING OFFICER COAST GUARD CUTTER "SENECA,"
Tompkinsville, N. Y.

SIR: 1. When the *Seneca* is in all respects ready for sea, she is detached from the New York Division and assigned to duty in connection with the International Ice Observation and Ice Patrol Service. You will, on February 15, 1916, or as soon as possible thereafter, leave New York with the vessel under your command, proceed to the Grand Banks of Newfoundland and locate the ice fields and positions of the icebergs. You will then keep in touch with the ice situation, making such observations as practicable on the quantities of ice, its kind, extent, and drift, and obtain any other information that may seem to be of value.

2. The service to be performed is primarily the ascertainment of the locations and the progressive movement of the limiting lines of the regions in which icebergs and field ice exist in the vicinity of the Grand Banks of Newfoundland, and the dissemination of the information so ascertained for the guidance and warning of navigators; and, coordinately with these primary duties, the making of such oceanographical and meteorological observations as will form a contribution toward the knowledge of the causes why the limiting lines assume their observed locations.

3. Observations at recorded times, extending from the surface to the bottom, should be made in well determined geographical positions throughout the patrolled region for determining:

(*a*) The temperature and salinity of the water by readings in series at definite intervals of depth.

(*b*) The direction and rate of movement of the waters in the different depths.

(*c*) The repetition of these observations in the same localities when these localities are revisited.

4. At intervals of four hours, there should be recorded the reading of the barometer, the temperature of the air, the humidity, the direction and force of the wind, the percentage of cloudiness, and the state of the weather and the sea.

5. Scientists will be detailed to the *Seneca* as soon as practicable for the purpose of carrying on these observations, and in addition, certain instruments will be forwarded to the *Seneca* at New York or Halifax. You will afford the scientists every facility for, and assistance in, making such observations and collecting such data as they may desire, bearing in mind the main duty of the *Seneca* is to keep track of the ice movements; and this practical work of the *Seneca* must not be subordinated to the work of scientific investigation. It should also be borne in mind, however, that the work of ice observation is highly important, and it is believed that most valuable data can be collected from these observations without in any way interfering with the primary duty of the *Seneca*. Until such time as the scientists above mentioned report on board, you will make and record such observations as your equipment will permit.

6. During the period of ice observation, the *Seneca* will be the only vessel employed on this duty and you will make such ports as you deem expedient for coal, water, and other supplies and in cases of emergency.

7. The experience of previous years has shown that a continuous ice patrol should be established about April 1 and should continue throughout the season of dangerous ice conditions. It is the intention to detail an additional vessel for that purpose and to have the ice patrol commence on April 1, next, unless information should be received from you that, in your opinion, the constant patrol should commence at an earlier date. Instructions for the ice patrol will be issued when the additional vessel is detailed to that duty.

8. On your passage to the eastward, you will report your position daily to Headquarters through coast naval radio stations as long as practical and thereafter through Canadian Marconi stations. If not practicable to send by any of these stations, you will relay through any vessel within reach. After locating the ice, you will discontinue reports to Headquarters and will make these radio reports to the Hydrographic Office, New York City. These reports for the Hydrographic Office will be sent by you daily at 4 a. m., seventy-fifth meridian time, and addressed "Hydrographic, New York." The ice information to be sent to the Hydrographic Office at New York will be in as plain and concise English as practicable and will state the following, all numbers to be spelled out:

(*a*) Ice (berg or field).
(*b*) Date.
(*c*) Time (seventy-fifth meridian time).
(*d*) Latitude.
(*e*) Longitude.
(*f*) Other data as may be necessary.

When practicable these ice reports will be sent via Cape Race Marconi station.

9. Ice information will be given at any time to any ship, with which the *Seneca* can communicate. You will notify the Marconi radio stations through which you communicate that they are at liberty to forward a copy of your ice reports to the proper Canadian authorities.

10. While on ice-observation duty, you will make reports in triplicate to Headquarters from time to time as opportunity is afforded.

11. Mail, express, and freight matter for the *Seneca* will be addressed to Halifax, Nova Scotia, and you will make necessary arrangements with the proper authorities at that port for the delivery of the same.

12. The work of the *Seneca* on this duty will be of international character, and as the various maritime nations of the world have intrusted the management of the ice observation and ice patrol service to the United States, it is important that this work be done as thoroughly and satisfactorily as possible in order that the record of the United States, and the Coast Guard in particular, for efficiency, shall be sustained.

Respectfully,

E. P. Bertholf,
Captain Commandant.

INSTRUCTIONS FOR THE ICE PATROL.

TREASURY DEPARTMENT,
UNITED STATES COAST GUARD,
Washington, March 15, 1916.

To the Commanding Officers of Coast Guard Cutters on Ice Patrol, 1916.

1. The object of the patrol is to locate the icebergs and field ice nearest to the trans-Atlantic steamship lanes. 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 lanes.

2. The patrol will 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.

3. 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.

4. 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.

(*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 4 a. m. (seventy-fifth meridian time) a radiogram will be sent to the branch Hydrographic Office, New York City, through Cape Race radio station, defining the ice danger zone, its southern limits, or other definite ice news. The telegraphic address of the branch Hydrographic Office is "Hydrographic, New York." If unable to send via Cape Race send by most convenient route.

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

5. 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.

6. 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 Coast Guard cutters, the words "latitude" and "longitude" will not be omitted.

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

8. 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 Headquarters by radio.

9. At the end of each cruise each vessel will forward to Headquarters a full report in triplicate. These reports should not include any matters of purely ship's business which do not relate to the ice patrol. Each vessel will send these reports direct to Headquarters and furnish a copy of such reports to the other vessel on patrol.

10. Each vessel will plot on tracing paper used in connection with H. O. Chart No. 955, the positions and extent of the ice as located from time to time. Such data will also be plotted on a duplicate tracing paper, and this duplicate will be delivered to the relieving vessel.

11. If, in an emergency, it becomes necessary for the junior commanding officer to communicate directly with Headquarters, in order to avoid delay, a copy of all such communications will be furnished to the senior commanding officer.

12. Upon the discontinuance of the ice patrol, further instructions will be issued by Headquarters.

E. P. Bertholf,
Captain Commandant.

REPORTS OF COMMANDING OFFICERS.

ICE OBSERVATION.

COAST GUARD CUTTER "SENECA," CAPT. FRANCIS A. LEVIS—CRUISE FEBRUARY 19 TO MARCH 12, 1916.

The *Seneca* sailed from New York on February 19 to take up the duty of ice observation on the Grand Banks of Newfoundland. We ran to the eastward on the back of a strong westerly gale and arrived at the tail of the bank on February 24. The course was then set to the northward along the eastern edge of the bank and a sharp lookout was maintained for ice, as the steamer *Brindilla* had reported field ice in 48° N., 49° 28′ W., and later in 46° 55′ N., 51° 37′ W. At noon, 25th, we were in 45° 54′ N., 50° 18′ W., and no ice in sight. Set course northwest, passing 20 miles south of Virgin Rocks and running through streaks of soft field ice early on the morning of the 26th. At 10 a. m., 26th, in 46° 15′ N., 53° 10′ W., ice becoming so thick and heavy that the *Seneca* made very slow progress through it, and Cape Race having informed me that the ice was packed close against the coast of Newfoundland, I turned to the southwest and worked out to the southern edge of the ice and then along it to the westward. At 3 p. m. reached the western limit of the field and stood along the edge to the northward. The night of the 26th was foggy with moderate southeast gale and the *Seneca* was running through patches of soft field ice until 1 a. m. of the 27th.

At 11 p. m., 27th, the *Seneca* anchored in 36 fathoms of water on St. Pierre bank during a thick fog which continued until 4 p. m., when weather cleared but looked very threatening. Got under way and lay to during a moderate southeast gale which followed. On the 28th steamed to St. Pierre and anchored at 2.30 p. m.

At St. Pierre ice reports were sent broadcast to vessels in the vicinity of Grand Banks, giving them the location of the ice fields. The weather at St. Pierre was very cold and stormy during our stay, and owing to the low temperatures the water supply froze up, resulting in delay in filling our fresh-water tanks. A fierce northeast gale blew on the night of March 4 and a very heavy sea ran into the harbor, causing the fishing schooner *Montana*, anchored near the *Seneca*, to part both cables and drift toward the rocky shore on the west side of the roadstead at 6 p. m. The searchlight of the *Seneca* was immediately thrown on the shore line and along it to a smooth-looking beach near the head of the harbor, where the master of the schooner was able to ground her. The crew landed safe, aided by townspeople brought to the scene by the display of the searchlight, but the hull of the schooner was pounded to pieces.

On the morning of the 6th the *Seneca* stood out from St. Pierre and to the southeast, entering a field of soft ice at 7 p. m. Later

this field became so heavy that we were obliged to work out of it by steering southwest, getting clear at 2 a. m. on the 7th. Our course was then laid to the eastward along the forty-sixth parallel, which course continued until 6 a. m. on the 8th, when the *Seneca* was in 45° 37′ N., 48° W. From this position we ran to the southward in the axis of the Labrador current and searched for patches of ice reported by an unknown steamer in latitude 44° N. We found no ice south of 45° 37′ N. and continued on to the southward and then turned to the westward after passing the tail of the bank.

The temperature of the sea surface water near the ice fields at the northern part of the bank was 29°; in the Labrador current east and south of the bank, 29° to 33°, and in 43° N., 51° 48′ W., it was 38°. No icebergs were seen during this cruise and none were reported by passing vessels. On the 10th the course of the *Seneca* was laid for Halifax, where we arrived at 5 p. m., March 12.

ICE PATROL.

Coast Guard Cutter "Seneca," Capt Francis A. Levis—First Cruise April 5 to 19, 1916.

Sailed from Halifax April 5, arriving on the eastern edge of the Grand Bank on the 8th. Anchored in 44° 26′ N., 49° 56′ W., April 9. The 10th was very foggy and the vessel remained at anchor. On the 11th began searching for ice in the Labrador Current, east of the bank. No ice was sighted and passing vessels reported none. Cape Race reported that on April 1 there were two bergs about 100 miles ENE. of St. Johns, in 48° 10′ N., 50° 34′ W. These bergs were far from the steamer tracks and were the only ones reported during this cruise.

From April 11 to 18 the *Seneca* was either anchored on the eastern edge of the bank or searching for ice, covering the Labrador Current as far as 45° N., 48° W. Passing vessels were informed about ice conditions and many special reports were sent in answer to special inquiries.

On the morning of the 19th the *Seneca* met the *Tampa* in 44° 05′ N., 51° 42′ W. Turned over the patrol to Capt. Satterlee and set course for Halifax, arriving on the 21st.

Coast Guard Cutter "Tampa," Capt. Charles Satterlee—First Cruise April 19 to May 1, 1916.

The *Tampa* relieved the *Seneca* of the ice-patrol duty on the morning of April 19. I reported to Capt. Levis, senior officer, and after a conference with him the *Seneca* left the patrol grounds for Halifax. The *Tampa* proceeded eastward along the forty-fourth parallel to about the fifty-first meridian, where the vessel was stopped and allowed to drift.

The *Seneca* had sighted no ice and none had been reported by passing vessels. This information was sent broadcast by radio at the prescribed hours. On the 27th a report was receive of ice near latitude 42, just west of the forty-seventh meridian. This was the only time that ice was reported near this locality and it must have disappeared quickly.

On the 29th bergs were reported well to the north in latitudes 48° and 49°, one berg in longitude 50° and the other near the forty-ninth meridian. Two days later, on May 1, bergs were reported near latitude 47°, longitude 48°. These are in about the latitude of Flemish Cap and later may drift down toward the trans-Atlantic steamship track.

On the 30th we ran off to the eastward of the bank. The atmosphere was remarkably clear, but no ice was sighted and passing vessels reported none.

The prevailing winds during the cruise have been easterly. There has been no northerly wind of account. The last two days the wind shifted to the northwest, bringing clear, pleasant weather.

Several French fishermen from Brittany were sighted during the cruise. The master of one, which we visited, reported that the fish this season were plentiful enough in numbers, but were of small size. He left France on March 9.

On May 3, in the afternoon, spoke the *Seneca*, and Capt. Levis took over the patrol. Set a course for Halifax, arriving on the evening of the 5th. I expect to leave for the Grand Banks on the 15th.

"Seneca," Second Cruise, May 1 to 21, 1916.

Left Halifax May 1, and on May 3 relieved the *Tampa* in 44° N., 52° W. Several reports of ice had been received by the *Tampa*, but all was north of parallel 46, save one report from the *Australian*, which stated that she had seen four bergs on April 27 in 41° 58′ N., 47° 16′ W. The *Seneca* shaped course for that position, but no ice was found there. The temperature of the surface water was 63°, and the vessel was set 30 miles to the northward while engaged in this search.

On the evening of May 5 fog set in and the *Seneca* ran up on the bank and anchored, remaining at anchor during the 6th and 7th on account of prevailing fog. There were about 50 French fishing vessels at work on the bank.

Whenever the fog lifted the *Seneca* would run off to the eastward and search for ice in the Labrador Current, covering thoroughly the waters between the bank and the Gulf Stream as far as 45° N., and finding no ice. Field ice from the Gulf of St. Lawrence was reported by the *Virginian* on May 5 in 43° 15′ N., 62° 29′ W., which information was broadcasted for several days. On May 11 the *Glenely* reported a berg in 46° 34′ N., 48° 11′ W., and on May 14 the *Carthagenian* reported same berg in 46° 46′ N., 48° 08′ W. On May 17 Cape Race reported that there were several bergs in Cabot Straits, 47° 37′ N., 59° 47′ W.

The *Seneca* found the Labrador Current east of Grand Bank, south of latitude 45°, very weak, while the Gulf Stream was strong and close to the bank, indicating that no ice will drift southward into the steamer lanes this season. The temperature of surface water on the Grand Bank varied from 38° on the eastern edge to 42° in the central and western parts of the bank.

At 10 p. m. May 17 the *Tampa* relieved the *Seneca*, and we headed for Halifax, arriving at 8 a. m. May 20.

"Tampa," Second Cruise, May 15 to June 6, 1916.

Left Halifax May 15, and on the 17th relieved the *Seneca* in 44° N., 53° 06′ W. The *Seneca* had found no ice south of parallel 45 and none has been reported south of 46. Arrived on the 30-fathom bank next afternoon and allowed the vessel to drift.

With the exception of a large berg in 47° 03′ N., 48° 38′ W., and one in 47° N., 47° 02′ W., both reported on the 18th, and several icebergs reported near Cape Race on the 19th, no reports of ice were received until the 24th, when the *New Sweden* reported a large berg and several small growlers in 46° 12′ N., 47° 05′ W.; on the same date Cape Race reported eight bergs and numerous growlers between 46° 22′ N., 54° W., and 46° 27′ N., 53° 47′ W.

On the 26th Cape Race reported a large berg in 47° 12′ N., 50° 42′ W. The day being clear, the *Tampa* steamed to the eastern edge of the bank. On the 27th and 28th steamed eastward of the bank looking for ice when it was clear enough to do so. On the 29th the *Sardinian* reported a large berg and several growlers in 47° 11′ N., 51° 17′ W. The 30th was foggy all day. Stood to the westward and stopped upon reaching soundings on the eastern edge of the bank.

On May 31 steamed to the southward looking for growlers which the *Korea* reported sighting at 3.12 p. m. May 30, in 42° 48′ N., 49° 36′ W. While engaged in this search received a radiogram from the *Madioen* reporting a berg in 42° 52′ N., 49° 27′ W. Immediately changed course to the northward and stood for the position. The fog, which had been lifting at intervals, now became dense. At 5.20 p. m. a berg loomed through the fog on the port bow, close aboard. The dim outline of two pinnacles could be discerned, the higher rising to an altitude of possibly a hundred feet. Diagonally across the face of the berg ran a dark streak or vein. The *Tampa* lay to in a dense fog that night. Next morning there were clear patches at intervals and we steamed about on various courses hoping to pick up the berg again and obtain photographs of it, but the fog shut in again in the afternoon and the search had to be abandoned.

On June 2 the fog was dense all day. On the 3d established radio communication with the *Seneca* and stood to the northward along the western edge of the bank. Shortly before 8 p. m. a faint whistle was heard ahead, and in another hour the *Seneca* was close aboard. Capt. Levis took over the patrol, and at 9.35 p. m. our course was set for Halifax, where we arrived at 11 a. m., June 6.

"Seneca," Third Cruise, June 1 to 20, 1916.

Sailed from Halifax June 1 and relieved the *Tampa* on June 3. Ice having been reported near the tail of the bank, ran to the southeast and began to search between the tail of the bank and parallel 42. Early on the morning of the 6th sighted a large berg in 42° 19′ N., 49° 22′ W. This berg had a dark blue diagonal streak across one side, which identified it as the one the *Tampa* had sighted on May 31 in 42° 52′ N., 49° 27′ W. We stood by this berg on the 6th, 7th, and 8th, losing it in a fog on the 9th and finding it again on the 10th. Another berg was reported on the 10th by the *United States* in 42°

47′ N., 50° 46 W., and as the day was clear and pleasant the *Seneca* ran for that position, finding a small berg in 42° 43′ N., 50° 42′ W., and running back to the first berg before dark.

On the 11th the large berg broke up, separating into three small bergs and four large growlers in 41° 50′ N., 49° 10′ W. The surface water at this position was 57° F., and these pieces began to break up rapidly and drift to the eastward in the Gulf Stream. At 10 a. m. on the 12th the *Seneca* steamed away and began to search for the berg to the northward and westward, but a thick fog set in and we were unable to find it.

At 8 p. m. on the 12th received a report from the *Wyncote* that a small berg and three growlers had been sighted in 42° 03′ N., 51° 12′ W., but the thick fog on the following day prevented our finding it. It was going to the eastward in warm water.

The steamer *Cufic* reported on the 11th that she had sighted a berg in 44° 28′ N., 49° 10′ W., which position was on the Grand Bank and if the iceberg was of any size it would ground. The *Seneca* sighted this position on the 16th, but failed to find the berg, although the weather was perfectly clear. There were several French fishing vessels in that vicinity.

On the 17th the *Oscar II* reported a small berg and two growlers in 42° 30′ N., 50° 50′ W. The *Tampa* relieved the *Seneca* on that date and we returned to Halifax.

"Tampa," Third Cruise, June 15 to July 5, 1916.

Sailed from Halifax June 15 and relieved the *Seneca* on the evening of the 17th in 43° 50′ N., 50° 40′ W. The *Seneca* reported that the large berg sighted by the *Tampa* on May 31 had broken up on June 11.

At 5 p. m. on the 17th the *Oscar II* reported one small berg and two growlers in 42° 30′ N., 50° 50′ W. The *Tampa* headed for this position and at dark on the 18th found a small berg about 25 feet high in 42° 10′ N., 50° 32′ W. The berg was pure white and first came into view at a distance of 11 miles. The next morning the berg had changed shape and diminished in size about one-half. Small fragments were breaking off and melting rapidly. The temperature of the sea water was 52° and the weather clear and warm. On the 20th the berg had completely disappeared and the *Tampa* steamed back to the Grand Bank. No other ice was seen or reported during the cruise.

We experienced much fog, intersperced with spells of clear weather, after leaving the tail of the bank. At noon, July 3, the *Seneca* took over the patrol in 44° 55′ N., 56° W., and the *Tampa* laid a course for Halifax. Late that evening a radiogram from the *Seneca* announced the discontinuance of the patrol.

SUMMARY OF ICE OBSERVATION AND ICE PATROL, SEASON OF 1916.

The season of 1916 was remarkable for the little ice of any sort that menaced the trans-Atlantic steamship lanes. In February, when one might expect large quantities of field ice in the vicinity of the tail of Grand Bank, practically none was found. In fact there was no ice which would interfere with free navigation south of latitude 45°. During the ordinary season of icebergs, months of April, May, and June, few bergs found their way as far south as the tail of the bank and comparatively few were seen south of Cape Race.

Due to war conditions there was an unusually small number of vessels using the regular trans-Atlantic lanes and consequently fewer reports were received than would ordinarily be the case. However, a sufficient number of vessels did pass that way to develop the fact that the season was one of the most open character.

Two reports of the patrol vessels are of absorbing interest. The *Tampa* reported that on June 18, in 42° 10′ N., 50° 32′ W., a small berg was found in the edge of the Gulf Stream, the temperature of the sea water being 52°. The berg was breaking up and melting so rapidly that on the 20th, only two days later, it had entirely disappeared. A similar report from the *Seneca* states that on June 6, in 42° 19′ N., 49° 22′ W., with sea water at 57°, a large berg was found and kept under observation for several days. On the 11th, in 41° 50′ N., 49° 10′ W., the berg broke into three pieces and several growlers, all of which rapidly disintegrated. It is regrettable that fog conditions did not permit the *Seneca* to secure data as to the final disappearance of this large berg, but from the foregoing data furnished by the *Tampa* it is highly probable that the berg did not last more than three or four days after it first broke in pieces. These reports give a more definite idea of the period of disintegration of a berg when it drifts into the influence of the Gulf Stream than any information previously obtained.

The belief seems to be gaining that the relative strength of the Labrador Current and the Gulf Stream in the vicinity of the Grand Banks is governed more by barometric pressures than by wind currents. Comparatively high pressure in the Arctic regions would result in a strong southerly set of the Labrador Current and at the same time would probably induce northerly or northwesterly wind. The combination would almost certainly start the bergs on their southerly course.

As an incident to the ice patrol, medical aid was rendered by the patrol vessels to 37 French and one Portuguese fishermen. It was remarked that the personnel of the French fishing fleet consisted largely of men who were ineligible for military service, being too young or too old or suffering from some form of physical disability. The French hospital ship which usually tends the fishing fleet was not seen on the banks this season.

SEASON OF 1919.

INSTRUCTIONS—ICE PATROL.

NAVY DEPARTMENT,
OFFICE OF NAVAL OPERATIONS,
Washington, March 7, 1919.

From: Chief of Naval Operations.
To: Commodore Commandant, United States Coast Guard.
Subject: Ice patrol, Coast Guard cutters *Androscoggin* and *Tallapoosa.*

1. On March 3, 1919, the President approved the recommendation that the International Service on Ice Observation and Ice Patrol, discontinued February 14, 1917, be again established.

2. The Coast Guard cutter *Androscoggin*, now attached to the first naval district, and the Coast Guard cutter *Tallapoosa*, now attached to the forces based on Halifax, have been detached from their duty and assigned to temporary duty under the Commodore Commandant, United States Coast Guard, for the purpose of maintaining the ice patrol. The *Androscoggin* is now in the vicinity of Boston and the *Tallapoosa* has been ordered to proceed to Boston, both to be prepared for this duty as directed by you.

3. Take the necessary steps to establish the ice patrol, to begin not later than April 1, 1919. Furnish the Chief of Naval Operations with copies of all orders issued to the *Androscoggin* and *Tallapoosa* respecting this duty.

4. In addition to any reports these vessels may be directed to make to the Commodore Commandant, the Department desires that they be directed while on patrol to make a daily report by radio to the Hydrographer of the Navy respecting ice conditions while on patrol. The Hydrographer will arrange to broadcast these reports daily.

J. S. McKEAN, *Acting.*

NAVY DEPARTMENT,
UNITED STATES COAST GUARD,
March 12, 1919.

From: Commodore Commandant.
To: Commanding Officer *Androscoggin.*
Subject: Ice patrol.
Refeernce: (*a*) Instructions to commanding officers, 1919.

1. The *Androscoggin* and *Tallapoosa* have been assigned to duty in connection with the International Ice Observation and Ice Patrol Service.

2. On March 27, 1919, or as soon thereafter as conditions permit, proceed with your command to the vicinity of the Grand Banks of Newfoundland and carry out the instructions contained in reference (*a*).

3. On your passage to and from the Grand Banks and up to the time you locate ice, make daily reports of your noon position to Headquarters by dispatch. After locating the ice discontinue reports to Headquarters and make your reports in accordance with paragraph 4 (*c*) reference (*a*), to the branch Hydrographic Office, New York City. Ice information will be given at any time to any ship with which the *Androscoggin* can communicate.

4. This duty being of international character and the various maritime nations of the world having intrusted its management to the United States, it is of the utmost importance that the work be done as thoroughly and as satisfactorily as possible.

E. P. BERTHOLF.

NOTE.—Similar instructions were given to the *Tallapoosa*.

INSTRUCTIONS FOR THE ICE PATROL.

NAVY DEPARTMENT,
UNITED STATES COAST GUARD,
Washington, March 12, 1919.

To the Commanding Officers of Coast Guard Cutters on Ice Patrol, 1919.

1. 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.

2. The patrol will 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.

3. While on this patrol the vessels will obtain fuel and other necessary supplies at Boston, Mass. 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 Boston. 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 Boston, 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.

4. Having located the ice, the patrol vessel will send the following daily radiograms. All time 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.

(*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 4 a. m. (seventy-fifth meridian time) a radiogram will be sent to the branch Hydrographic Office, New York City, through Cape Race radio station, defining the ice danger zone, its southern limits, or other definite ice news. The telegraphic address of the branch Hydrographic Office is "Hydrographic, New York." If unable to send via Cape Race send by most convenient route.

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

5. 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.

6. Attention is called to article 3235 (*c*), Regulations, 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 Coast Guard cutters the words "latitude" and "longitude" will not be omitted.

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

8. Each vessel upon being relieved by the other vessel will deliver to the relieving vessels copies of all radiograms sent to or received from the Hydrographic Office during the cruise and copies of all instructions received from Headquarters by radio.

9. At the end of each cruise each vessel will forward to Headquarters a full report in triplicate. These reports should not include any matters of purely ship's business which do not relate to the ice patrol. Each vessel will send these reports direct to Headquarters and furnish a copy of such reports to the other vessel on patrol.

10. Each vessel will plot on tracing paper used in connection with H. O. Chart No. 955 the positions and extent of the ice as located from time to time. Such data will also be plotted on a duplicate tracing paper, and this duplicate will be delivered to the relieving vessel.

11. If in an emergency it becomes necessary for the junior commanding officer to communicate directly with Headquarters, in order to avoid delay, a copy of all such communications will be furnished to the senior commanding officer.

12. Upon the discontinuance of the ice patrol further instructions will be issued by Headquarters.

E. P. Bertholf,
Commodore Commandant.

NAVY DEPARTMENT,
UNITED STATES COAST GUARD,
March 12, 1919.

From: Commodore Commandant.
To: Commanding Officer, *Androscoggin.*
Subject: Ice patrol—Scientific observations.

1. Mr. A. L. Thuras, scientific observer, United States Coast Guard, will be assigned to duty on the *Androscoggin* for the purpose of making scientific observations in relation to oceanography and meteorology. Various instruments and other material will be shipped to you for his use. You will give Mr. Thuras such assistance as may be necessary to carry on his work and afford him every proper facility in setting up his instruments. These instruments and this material will be under his charge, and he will be responsible for their care and preservation. They need not be taken up on the property return of the *Androscoggin.*

2. The scientific observations will be carried on with as little interference as possible with the work of patrol, which is the primary duty of your command. When the primary duties permit, you will use your best endeavors to facilitate the work of the scientific observer.

E. P. BERTHOLF.

ICE OBSERVATION.

The resumption of the ice patrol was not determined upon in time to make preliminary observations in February and March, 1919, as had been done in former years, so that the only observations made this season were in connection with the ice patrol.

REPORTS OF COMMANDING OFFICERS.

ICE PATROL.

COAST GUARD CUTTER "ANDROSOGGIN," CAPT. H. G. FISHER—FIRST CRUISE, APRIL 1 TO 19, 1919.

The *Androscoggin* sailed from Boston, Mass., March 28, 1919, at 12.45 p. m., and arrived off the tail of the Grand Bank on the afternoon of April 6.

Ice warnings, giving reported location of bergs and field ice, were broadcasted daily at the usual time, beginning April 3.

A heavy field of ice and several large bergs were encountered off Cape Race, Newfoundland, on the 3d and 4th of April.

On the morning of April 4, the topsail schooner *Cariad*, of St. Johns, Newfoundland, was found caught in the ice pack to the westward of Cape Pine, Newfoundland, and was released with considerable difficulty. The schooner was caught in the pack on April 1.

After releasing schooner and observing the extent of the ice field, stood over across the Bank and arrived at the tail of the Bank as before stated.

Remained in the vicinity of the southern part of the Grand Bank until the night of April 10, when stood to the northward and eastward, along the eastern edge of the Bank, looking for ice.

Steaming along the eastern edge and northern part of the Bank until April 13. No ice sighted until afternoon of the 13th, when made contact with field ice and several very large bergs off Newfoundland coast, just north of Cape Race.

Save for the ice seen by this vessel and three reports, made previously to the arrival of the *Androscoggin*, no ice has been reported.

On the afternoon of April 15 the *Androscoggin* was relieved by the *Tallapoosa* and proceeded to Boston, Mass., arriving there at 12.01, April 19.

Among the ice fields the usual bird life was observed, the murre (*Uria troile*) being by far the most numerous, while about a dozen King eider (*Somateria spectabilis*) constituted the least number of any one specimen observed. Also on the floes of the heavy pack of field ice was observed, by count, 17 seals (*Phoca groenlandica*). Most of these were of a dirty white or yellowish color while several were dark brown.

Several vessels requested special reports on the ice danger, among them being the S. S. *Alaska* (French), S. S. *Turret* (British), S. S. *Bergensfjord* (Norwegian), the U. S. S. *Pocahontas*, and U. S. S. *George Washington*.

From observation and reports there has been, up to this time, practically no ice which constitutes a menace to navigation; but from the number and size of the bergs observed off Cape Race it would seem as though there will be some later on.

During the cruise good weather has been scarce. For the most part we encountered heavy gales of wind and much fog and rain. This of course greatly impedes the work of locating the ice.

Coast Guard Cutter "Tallapoosa," Capt. J. L. Ahern—First Cruise, April 15 to 30, 1919.

The *Tallapoosa* sailed for Boston, Mass., April 11, at 3.15 p. m., and relieved the *Androscoggin* in latitude 44°, longitude 55°, on April 15, taking over the duties of the ice patrol.

On the night of the 15th a strong northerly gale made up a heavy sea and the vessel was hove to on the Banks, remaining hove to until the morning of the 17th, when wind and sea moderated. Vessel stood to the southward and eastward along the western edge of the Great Bank to tail of the Bank; took departure and ran to the southward to pick up the northern edge of the Gulf stream and also to locate a berg reported on March 28.

Crossed the northern edge of the Gulf stream at 10 a. m. on the 18th in latitude 42° 26′ N., longitude 49° 43′ W. This showed that the stream was very far north for this season of the year, being about 42 miles north of the position of the stream as found by the *Seneca* on the 1914 cruise. As a berg was reported 50 miles to the southward on March 28, believed it would have melted away before this date. Sent a broadcast message to all steamers to send their positions, course, and temperature of sea water, as well as ice sighted. During the day nine steamers reported to this vessel, and from this data was able to verify the limits of the Gulf stream as well as to reduce the cruising area to the southward of the Bank.

Stood to the eastward in edge of stream until 2.05 p. m. of the 18th, when course was set to northward and eastward, running between the eastern edge of the Bank and dead water.

On the 19th at 3.20 p. m. in latitude 45° 20′ N., longitude 47° 53′ W., sighted small berg. Stopped, took drift and position of same, and continued on course until 5.20 p. m., when a large berg was sighted. The fog shutting in thick, lay to and drifting during the night.

Found that the bergs were drifting very slowly and in the direction of the current as laid down by the *Seneca* on previous patrols. However the Labrador Current seems to be somewhat dammed owing to the fact that the Gulf stream is unusually far to the northward.

Continued in the Labrador cold stream to the northward and eastward, visiting two and three bergs each day and taking their positions and drift. Steamed as far as the Flemish Cap in clear weather and accurately located all ice as far east as the warm north stream, ascertaining that there was no ice to the eastward of the Cap, below the forty-seventh parallel.

On the 21st sighted the largest berg thus far, about 20 miles south of Flemish Cap, drifting about WSW. very slowly. This berg was calving rapidly and for a radius of 10 miles there were small growlers and small ice.

From the 21st to the 24th steamed a course 25 miles to southward of ice located and found that there was no ice to the southward of

our line. Continued receiving reports from steamers with requests for safe courses through the field. Sent a broadcast at times specified giving the limits of danger area and instructions to steamers already crossing danger area as to best course to clear bergs.

From the 24th to the 28th worked along eastward edge of Great Bank, but cruising was bad owing to dense fog. From the 28th to the 30th worked across the Bank to westward, encountering strong gales with fog and rain.

On the 1st of May at 10.45 the *Androscoggin* relieved this vessel and took over the patrol, the *Tallapoosa* proceeding to Boston, Mass., arriving at 12.30 a. m., May 4.

During the above cruise this vessel located five bergs and visited an additional five. Ice warnings, giving reported location of bergs, were broadcasted at the usual time, beginning April 15.

"Androscoggin," Second Cruise, May 1 to 15, 1919.

Sailed from Boston, April 27, and on May 1 relieved the *Tallapoosa* and assumed the ice patrol.

Stood up across the Grand Banks and toward Cape Race. On May 2 and 3 made contact with icebergs in vicinity of Cape Race. This was all the ice sighted during the cruise, although reports of scattered bergs were received from a few passing vessels. The bergs sighted were large but few in number compared with what might be expected during this cruise. All were moving slowly to the westward and appeared to be melting rapidly, although the temperature at this point was not far above freezing.

On the evening of May 3 anchored in Aquefort Harbor, Newfoundland. Sailed from Aquefort May 4 and stood across toward Flemish Cap and position of bergs reported by *Tallapoosa*.

On the 5th of May the wind, from a fresh northwest breeze, increased to gale force and continued without abating until the morning of May 12. During the entire time the visibility was excellent, and, although careful watch was kept, no signs of ice were observed.

Tests of salinity and temperature disclosed the fact that the Gulf Stream is well north of its normal track. This will no doubt account for the scarcity of bergs south of latitude 43°, there being but one report of a berg there.

Ice warnings were broadcasted daily at 6 p. m. seventy-fifth meridian time and warnings were furnished as requested at other times to passing vessels.

There seems to be but little, if any, more ice than was observed and reported on the first cruise of this vessel and the *Tallapoosa*. From observation of bergs in the vicinity of Cape Race and the scarcity of bergs in other places it would seem as though most of the ice is being carried around Cape Race. This may be due in part to the fact that the Gulf Stream has forced the Labrador Current farther to the westward than usual.

No field ice was seen nor was any reported. It was noted that the bird life, so plentiful in April, was conspicuous by its absence. Practically no birds of any kind, save for a very few Mother Cary chickens, were seen at all.

The daily warnings broadcasted are no doubt of great value to shipping in the vicinity of the Grand Banks, for it must be a great relief to all on board to know the exact location of the ice and that there is a patrol being maintained for the express purpose of keeping shipping advised regarding same. And there appears to be an unusual amount of traffic passing the Banks now, including a large number of United States transports.

While the weather was for the most part clear, indeed quite unusually so for this vicinity, it was, during the greater part of the cruise, very rough and uncomfortable and made the duty very trying and arduous for all on board.

The vessels of the French fishing fleet have arrived on the Banks and are engaged in making their annual catch.

On the morning of May 15 the *Tallapoosa* relieved the *Androscoggin* and we proceeded to Boston, arriving there at 9 a. m., May 17.

"Tallapoosa," Second Cruise, May 15 to 30, 1919.

Left the Boston Navy Yard May 11. The *Androscoggin* was located in latitude 43° N., longitude 58° 35′ W., on the morning of the 15th and relieved of the duties of the ice patrol.

Ice warnings were broadcasted daily at the specified times, beginning May 15, as was also a request to all steamers in the vicinity of the Grand Banks to send their position, course, temperature of sea water, and ice information.

Stood across Great Bank to the southward and eastward for a berg reported May 9 in latitude 42° 42′ N., longitude 49° 20′ W. Reached this position at 2.25 p. m. on the 17th, and ascertaining that the steamer *Orthia*, 14 miles south of our position, was proceeding on course 63° true, placed *Tallapoosa* on parallel course. No ice was located in this vicinity, although the weather was clear and visibility excellent.

Stood to eastward and northward and searched for a berg in the vicinity of latitude 43° 40′ N., longitude 45° 50′ W., running as far north as 44° 30′ without success. Subsequently received information that this berg had been caught in the warm northerly current and had broken up into small pieces close to the forty-fifth parallel.

Set course to northward and eastward, and on the evening of the 20th located a berg in latitude 44° 50′ N., longitude 47° 40′ W., this berg having been previously located by this vessel on April 20, 46 miles to the northward. It was considerably smaller, calving continuously, with sides markedly concavo-concave, from the action of the surface water.

The Labrador Current is much stronger than it was at the same period last month and the temperature 6° colder for the same parallel, this being probably due to the fact that the winds for the first half of May were strong northerly ones. However, the warm north current is farther to the westward and the ice is coming down very close to the edge of Great Bank.

During the 21st the vessel ran to the southward along the eastern edge of the Bank and on the evening of that day located a small berg in latitude 43° 45′ N., longitude 49° W. The weather shutting in thick, drifted. With weather clearing on the morning of the 22d

found that there were two small bergs within sighting distance of each other. As the edge of the Bank was only 6 miles distant, stood in and anchored with bergs in sight, observing drift during the 23d, when it was clear enough for observation.

On the 24th steamed to the northward and eastward to observe two reported bergs, just south of the forty-fifth parallel and found these bergs just before sunset, when fog shut in thick. They were small and rapidly disintegrating, but moving to the southward about 12 miles a day.

A beautiful bicuspid formation was characteristic of all the bergs sighted, with one exception. From a distance they appear to be separate bergs.

At 6 a. m. of the 25th, there being a dense fog, received an S O S from the British ship *Cassandra*, stating she had struck an iceberg in latitude 47° 31′ N., longitude 51° 22′ W. Proceeded full speed for her position, informing the vessel via Cape Race that we were 160 miles to eastward and southward. At 8 a. m. received a message from the *Cassandra* that she needed no assistance and later that she was making for St. Johns, Newfoundland.

From the 26th to the 30th worked to westward in dense fog, riding out a northeast storm on the 30th and 31st. On account of strong northerly winds and rough sea the *Androscoggin* relieved this vessel at 9. p. m. of the 31st, by wireless. Set course for Boston, ariving at 8.57 a. m. June 3.

There is but one report of ice below parallel 43 and the three sighted south of parallel 45 will not be a menace for a very long period. However, there are many reports of ice in the vicinity of Cape Race, Newfoundland, between the forty-sixth and forty-seventh parallels.

Fifty-six vessels cooperated with the *Tallapoosa* during the first and second ice-patrol cruises. All these vessels crossed the Bank or very close to the danger areas and reciprocated with information. It is worthy of note that the S. S. *Cassandra*, the only known vessel that failed to cooperate or to heed the warnings sent out relative to danger areas, met with an accident by striking a berg.

"Androscoggin," Third Cruise, June 1–15, 1919.

Sailed from Boston at 9.45 p. m. May 28, and at 9 p. m. May 31 relieved the *Tallapoosa* by radio, the weather being stormy, with rough sea and a strong northeast gale.

Stood over toward the Grand Banks, and at 4.20 a. m. June 3 sighted a small berg with three pinnacles in latitude 44° 39′ N., longitude 55° 06′ W. Remained in vicinity of berg until 11 a. m. At 8 a. m. the berg lost its northeast pinnacle and slowly turned over. This berg was moving slowly in a west-southwest direction and showed signs of rapid disintegration.

Steaming to the northward and eastward toward Cape Race, early on the morning of June 4 sighted several bergs close in under the Newfoundland shore, to the westward of Cape Race, all moving slowly to the westward. Stood around Cape Race and to the northward observing icebergs. There were about 15 bergs, several ashore under the land, and others moving slowly toward the Cape.

Remained in the locality between Cape Broyle and Cape Race until 6 p. m. June 5, observing the bergs.

At 5 p. m. June 5 stood across the Grand Banks to southward and eastward, and early on the morning of June 8 sighted three icebergs on the eastern edge of the Banks in latitude 45°. These bergs were drifting slowly along the eastern edge of the banks. their direction being about 195° true and their speed from 1 to 1¼ knots per hour. They all showed signs of much disintegration, and were surrounded by many small pieces of ice, too small to be classed as growlers, for a distance of about 1 mile.

Followed these bergs along, and on June 9 sighted two more bergs in latitude 44° N., on the eastern edge of the Banks. These bergs were moving in the same general direction, but their rate of speed was apparently less than 1 knot per hour. These five bergs were the only ones sighted during the cruise to the eastward of the Banks. One berg was reported on June 2 in latitude 41° 40′ N., longitude 44° 32′ W., but was not reported subsequently to that date. Followed the southernmost berg and about 6 p. m. June 11 it was seen to break in two parts. Shortly after this the weather became foggy, and no more bergs were visible.

Steamed slowly to the southward until the 13th, when stood to northward and westward. No further reports of bergs were received. The weather during the entire cruise has been remarkable. After the northeasterly gale moderated on the night of June 1 the force of the wind never became greater than 2, and for the most part it was calm; and most remarkable of all was the fact that until the evening of June 11 it was perfectly clear and fine, which appears most unusual for the Grand Banks. From the 11th until the morning of the 17th it was constantly foggy.

That the patrol is of value is clearly shown by the fact that on more than one occasion the ice warning, broadcasted by this vessel at 6 p. m., would be repeated by some receiving vessel and still further repeated by others, thus giving the warning a wide area.

The *Androscoggin* arrived in Boston at 10.10 p. m.June 17.

"Tallapoosa," Third Cruise, June 13 to July 2, 1919.

The *Tallapoosa* sailed from Boston, June 13, at 7.55 a. m. and relieved the *Androscoggin* in latitude 42° 51′ N., longitude 60° 24′ W., on June 15, after consulation with the commanding officer of that vessel.

The weather for the entire cruise from 13th to the 29th, with the exception of the 21st and 26th, prevented constant cruising owing to the dense fogs, rain, and winds.

On June 20 sighted iceberg in latitude 44° N., longitude 49° 12′ W., and found that it was grounded in 30 fathoms on eastern edge of Great Bank. During the day stood out into cold stream and then south, following the line of small pieces of ice until the evening, when dense fog set in, so stood in to the Bank and anchored to await clear weather.

At 3 a. m. on the 21st, with clear weather and excellent visibility, stood off the Bank and continued course to southward until warm water was reached, when stood to northward and westward, and at

3 p. m. sighted four bergs, two large and two medium sized. The characteristics of these bergs lead to the conclusion that they are the ones sighted by the *Androscoggin* during her last patrol.

On the 22d, the weather setting in thick, stood clear of bergs and drifted, the weather remaining bad until the 26th, when stood back and verified drift of ice. There was very little change in the positions of the bergs. From the 27th to the 29th stood to northward and westward, but owing to thick weather very little area to the westward of the Bank was covered.

On the evening of the 29th received an urgent request from Sable Island for medical assistance. Stood to westward and anchored off the island on the morning of the 30th. There was a heavy swell breaking on the shore and the life-saving station stated that their boat was not large enough to go through the surf. Sent our surf boat, and landing was made successfully and medical aid rendered.

Requested authority to proceed to Boston, which was granted. Stood in for Boston, arriving at 10.30 a. m., July 2.

During the cruise 37 vessels cooperated with this vessel.

REPORTS OF MR. A. L. THURAS, SCIENTIFIC OBSERVER, SEASON OF 1919.

I wish to submit the following report on the scientific work of the ice patrol this year and the investigational problems in physical oceanography which are now in progress at the Bureau of Standards.

The scientific work of the patrol consisted of three cruises made during the months of April, May, and June. The determinations of temperature, salinity, and density were made at 72 stations. Each station consisted of making observations at four to seven levels from the surface to 600 meters or to the bottom. The stations were taken as nearly as possible to the locations laid out by Dr. Bigelow and Dr. Moore, and also additional stations were taken across the Labrador Current and at the northern part of the Grand Banks. The stations were always taken in as direct a line as possible so that a cross section of the currents could be made.

An effort was made to try out a new recorder, giving a continuous record of the surface salinity of the ocean, but the manufacturers were unable to construct the recording part of the apparatus in time to be used.

The instruments sent by the Weather Bureau were set up and the requested observations were made. Assistance was given during the May cruise to the Weather Bureau representative in his work with balloons in measuring the velocity and direction of the upper air currents.

All of the deep-sea thermometers used to measure the temperature of the ocean water were either calibrated at the Bureau of Standards previous to the patrol or were checked on board ship by standard laboratory thermometers. The saline content of the sea water collected with the Greene-Bigelow water bottle was determined at sea by a new density method and also by the regular titration method when the vessel came into harbor after each cruise. During the first cruise there was some difficulty in making the density determinations due to the large amount of air contained in the sea water. This difficulty was overcome by heating the sea water previous to making a measurement. The measurements of the May and June cruises agreed fairly well with the titration determinations. However, as some difficulty was noted in obtaining consistent readings with the titration method, several samples of sea water were sent to the Bureau of Standards to be measured by hydrostatic weighing. The values obtained by the Bureau of Standards did not agree as well with the titration method as was expected, so it was decided, after consultation with Dr. Bigelow, that a careful comparison of the

titration, submerged-bobbin, and hydrostatic-weighing methods should be made at the Bureau of Standards after the completion of the ice patrol.

LABORATORY WORK AT THE BUREAU OF STANDARDS.

A convenient laboratory has been secured at the Bureau of Standards and the necessary equipment has been obtained to carry on investigations on oceanographic instruments. The apparatus for titration, submerged-bobbin and electrical conductivity measurements has been set up and preparations are being made to compare these various methods as to their relative accuracy and convenience in measuring the salinity of sea water.

Some preliminary measurements have been made on the electrical conductivity method and it seems that this method might be the best to use on shipboard to obtain salinity most rapidly and accurately. Rapidity in making measurements is much to be desired.

The physical observations taken on the ice patrol have been plotted in sections and profiles and are now ready for examination and study.

COMPARISONS MADE AT THE BUREAU OF STANDARDS.

The work consisted of the measurement of 24 samples of sea water for density, electrical conductivity, and chlorine content. Since the composition of the salts in sea water is very uniform throughout changes in concentration, these various methods are comparable to measure the total salts in grams per kilogram of sea water, which is called salinity.

The densities of the samples of sea water were measured at 27° C. by the Bureau of Standards method of hydrostatic weighing. The density or salinity was also measured by a submerged-bobbin method, using a calibrated glass bobbin. The bobbin, which has a density slightly less than sea water, is placed in the sample to be measured and the sample is heated until the sea water is of the same density as the glass bobbin. From this equilibrium temperature the density or salinity of the sample can be easily determined if the glass bobbin has been previously calibrated.

The electrical conductivity was measured in ohms per centimeter cubed by use of 60 cycles alternating current and an alternating current galvanometer as detector. By the use of the very nearly linear curve obtained from the relation between conductivity and salinity, the salinity of the samples was easily determined. The conductivity of only 6 samples was made, as there was not sufficient sea water in the other samples for the large type of cell used.

The titration determinations were made with the utmost care by the regular method. The determinations from No. 16 to No. 24 were made by the Bureau of Fisheries, using standard sea water from Copenhagen to standardize the silver nitrate solutions. The other titrations were made by using water which had been standardized by the Bureau of Standards method of hydrostatic weighing.

The Bureau of Standards density determination at 27° C. has been converted into terms of salinity by use of Knudsen's hydrographic tables.

Sample No.	Bureau Standards.	Titration.	Bobbin.	Electrical.	Differences.	
					Titration.	Bobbin.
1	28.22	28.19	28.25	28.17	−0.03	+0.03
2	32.02	31.94	32.03	32.01	− .08	+ .01
3	33.53	33.48	33.50	33.54	− .05	− .03
4	34.38	34.31	34.37	34.39	− .07	− .01
5	35.44	35.37	35.41	35.46	− .07	− .03
6	38.17	38.12	38.21	38.16	− .05	+ .04
7	32.23	33.13	32.24	.....	− .10	+ .01
8	.....	34.87	34.92	.....	.....	.....
9	32.94	32.86	32.90	.....	− .08	− .04
10	.....	34.99	35.03	.....	.....	.....
11	35.86	35.81	35.80	.....	− .05	− .06
12	33.48	33.44	33.46	.....	− .04	− .02
13	33.53	33.46	33.49	.....	− .07	− .04
14	33.21	33.14	33.17	.....	− .07	− .04
15	33.54	33.46	33.51	.....	− .08	− .03
16	33.08	33.01	33.09	.....	− .07	+ .01
17	29.56	29.39	29.58	.....	− .17	+ .02
18	29.96	29.79	29.98	.....	− .17	+ .02
19	30.74	30.50	30.78	.....	− .24	+ .04
20	32.67	32.54	32.66	.....	− .13	+ .01
21	33.58	33.44	33.57	.....	− .14	− .01
22	34.97	34.88	34.94	.....	− .09	− .03
23	35.61	35.53	35.56	.....	− .08	−. 05
24	36.38	36.25	36.36	.....	− .13	− .02

NOTES.

All measurements were made independent of each other.

Measurements made at the beginning and end of the comparisons showed that no appreciable change in salinity had taken place in the samples.

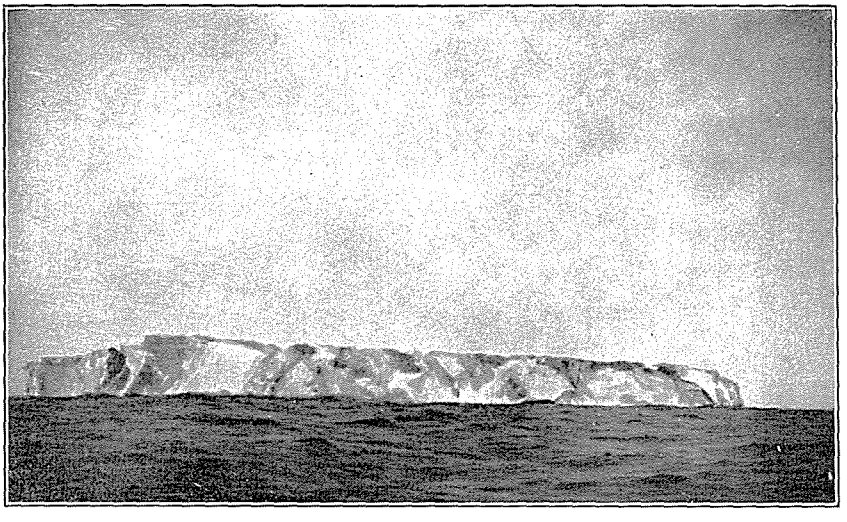
In the submerged-bobbin method the calibration curves made two years previously to these tests were used.

A copy of the determinations made by the Bureau of Standards is appended.

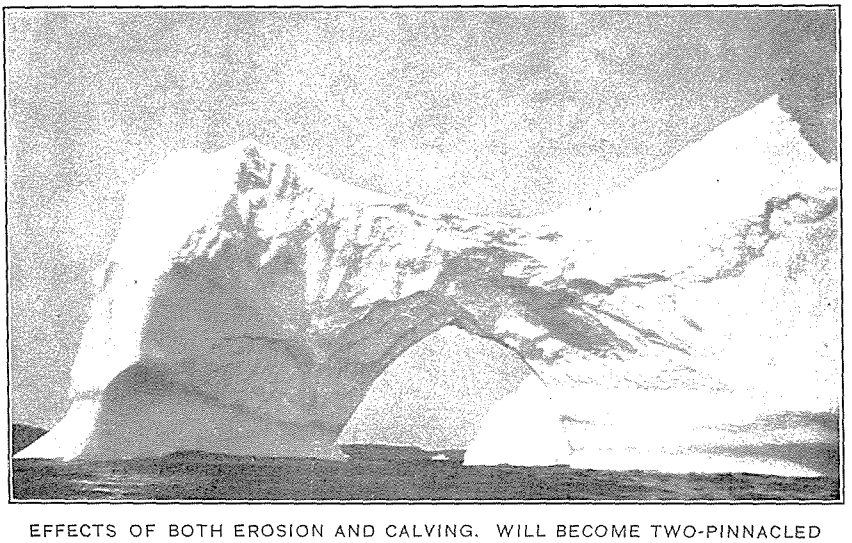
No Bureau of Standards tests of Nos. 8 and 10 were made, as there was not sufficient sea water in the samples.

Densities determined by Bureau of Standards.

Sample No.	Density at 27° C.	Sample No.	Density at 27° C.
1	1.01765	14	1.02139
2	1.02050	15	1.02163
3	1.02163	16	1.02130
4	1.02228	17	1.01866
5	1.02308	18	1.01896
6	1.02512	19	1.01954
7	1.02066	20	1.02099
9	1.02119	21	1.02167
11	1.02339	22	1.02271
12	1.02158	23	1.02320
13	1.02162	24	1.02378



MASSIVE PAN-SHAPED BERG, SHOWING LITTLE EROSION.



EFFECTS OF BOTH EROSION AND CALVING. WILL BECOME TWO-PINNACLED BERG WHEN BRIDGE BREAKS DOWN.

SUMMARY OF THE ICE PATROL, SEASON OF 1919.

By Capt. H. G. Fisher, Senior Officer.

The ice patrol for the season of 1919 differs little, if any, from the patrols of preceding years, save for the fact that the experience gained in former patrols was invaluable in planning and carrying on this one.

As usual, the number of bergs sighted by patrol vessels was comparatively small, by far the greatest number of bergs being sighted by passing vessels and reported to the patrol vessels.

It appears to be the rule for bergs to reach the vicinity of the tail of the Grand Banks not before the middle of May. From then on until the end of June might reasonably be looked upon as the "danger season."

While the winter preceding was one of the mildest experienced in years the effect upon the movement of icebergs appears to have been negligible.

During the entire period of patrol icebergs were observed but once on the eastern edge of the Banks by the *Androscoggin*. These bergs were observed during the June cruise and were close to the eastern edge of the Bank and moving parallel to it in a direction a litle south of west (true), their movements being apparently governed by the Labrador Current. These same bergs were observed by the *Tallapoosa* during her June cruise, they having rounded the tail of the Bank and being carried to the northward and westward. During the April cruise several bergs were sighted by the *Tallapoosa* near Flemish Cap, but as far as can be ascertained these never got farther south than parallel 44.

From my observation, by far the greatest number of bergs coming down the Newfoundland coast, round Cape Race and move to the westward, thus practically eliminating themselves from becoming dangerous in the trans-Atlantic steamship lanes. Enough pass to the eastward, however, to form a grave danger.

Icebergs reported at certain seasons can be counted upon to move in certain directions. For instance, bergs reported in the vicinity of Flemish Cap in March seem reasonably certain to move in a true southerly direction. Or a berg reported on the eastern edge of the Banks in June would appear to move in a direction of about 190° true until the tail of the bank is reached. Here it rounds the Bank and moves in a direction of about 300° true with much less velocity. Of course an occasional berg will get farther east and at times will enter the Gulf Stream and move east. But once in the warmer zones disintegration increases to a marked degree and it soon ceases being a menace to navigation. In illustration of the last statement the following case is cited: On June 2 a berg was sighted in latitude 41° 40′ N., longitude 44° 32′ W., and so reported by a passing vessel.

This berg was at the time well in the Gulf Stream and must have been moving eastward at the rate of not less than 30 knots every 24 hours. Neither its condition nor its size was reported, but no doubt it was disintegrating rapidly and soon ceased to be a menace to navigation, for nothing was heard of it again.

The weather was the usual Banks weather, mostly stormy during the first patrols and foggy during the latter. One marked exception to this was noted. During the June cruise of the *Androscoggin* for a period of about 10 days the weather was either calm or light variable airs and there was never the slightest trace of fog. From all reports it would appear that this state of affairs is quite unusual. Indeed, with one exception, the patrol vessels relieved each other in a dense fog or in very stormy weather.

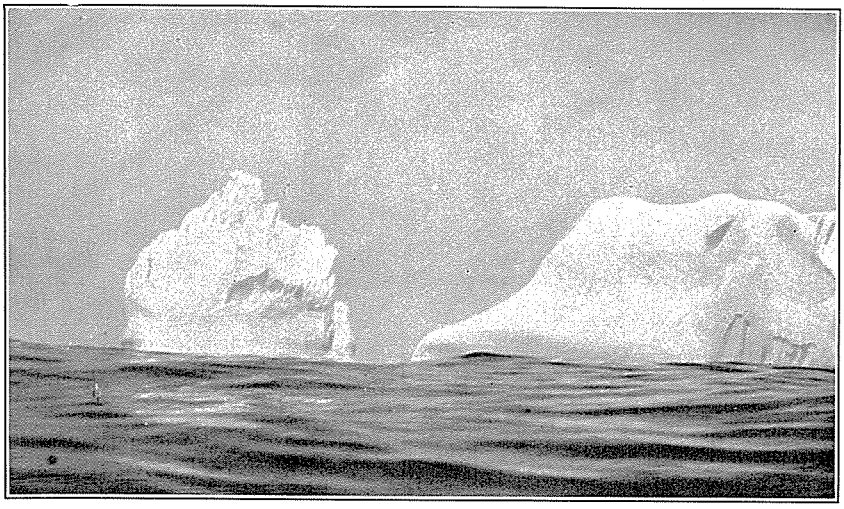
That the patrol is of value goes without saying and that it is appreciated by vessels passing through this zone at this time is beyond question. The efficiency of the patrol is of the highest, and considering the handicaps under which it is maintained deserves the highest praise. But the perfection of some recent inventions would serve to increase the service in a marked degree. Patrol vessels should be equipped with the wireless telephone. While on the Grand Banks the *Androscoggin* distinctly heard a conversation between the *George Washington* and the land station at New Brunswick, N J. On another occasion the *George Washington* tested out its set and the test was excellent. The *Androscoggin* was distant from the *George Washington* at the time about 300 miles. This phone service would be of great value between patrol ships when relieving and also between vessels equipped with telephones, as most vessels will surely soon be. The radio compass, another recent invention, should be installed. A temporary compass was erected on the *Androscoggin* by means of which we were able on two occasions to meet the relief ship in a dense fog with very little difficulty.

It seems to me a splendid practical use can be made of aeroplanes of the type which flew across the Atlantic, the NC type of plane. Two of these, one being for a relief vessel stationed at Trepassy Bay, Newfoundland, could with practically no trouble at all make a flying observation of the Banks and locate reported and unreported bergs during the short periods of clear weather, when a vessel of the type used on patrol could cover but a tenth of the distance and be further hampered by weather conditions at the surface.

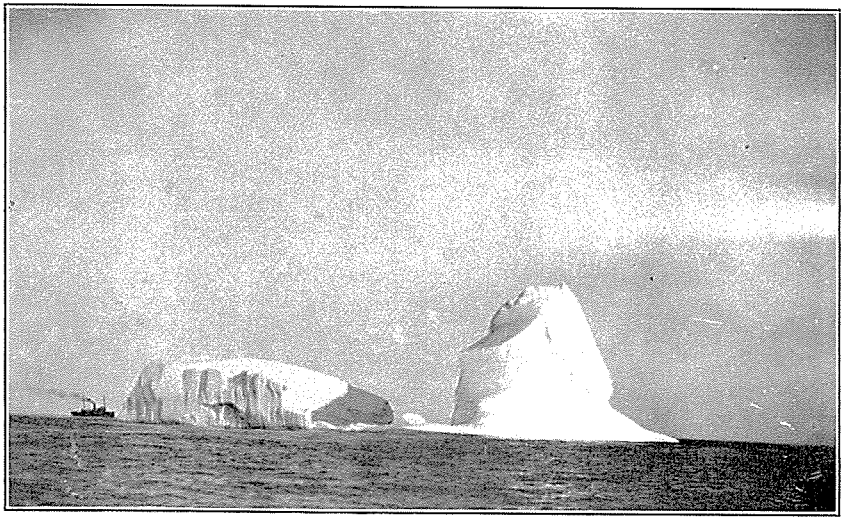
It was possible to devote considerable time to oceanographic work without in any way affecting the efficiency of the ice patrol. During the cruises of the *Androscoggin* soundings in deep and shallow water were obtained at no less than 72 stations and it is believed that much information of high scientific value will result from this part of the season's work. Nothing new regarding currents was found. There were three instances when natural phenomena were noted which are deemed worthy of special mention.

First, on May 5, 1919, between 7 and 7.30 a. m. a brilliant solar halo was observed, and this manifestation was followed by a westerly gale of marked intensity, which set in on the afternoon of May 8 and lasted four days, passing off through the northerly quadrant.

Second, on the forenoon of June 5, 1919, while passing among the icebergs off the eastern coast of Avalon Peninsula, Newfoundland,



TWO-PINNACLED BERG. PART ON RIGHT SHOWS EROSION, THAT ON LEFT SHOWS RECENT CALVING.



EFFECTS OF EROSION. CUTTER "TALLAPOOSA" IN THE DISTANCE.

remarkable mirage effects, locally known as "looming," were observed. Icebergs would assume various fantastic appearances, low, flat growlers towering into pinnacle bergs and larger bergs apparently rising and falling to the ocean swell (although it was practically smooth) and then floating in the air above the sea, while distant vessels, below the horizon, appeared as though but a few miles away with their inverted image above, these phenomena continuing for over an hour and constantly changing with kaleidoscopic rapidity.

Third, on the evening of June 13, 1919, about 8 o'clock, while in the Gulf Stream and the moon being at its full, remarkable triple lunar halo was observed, the three rings being complete and perfectly distinct and the colors well defined.

Ice warnings were broadcasted daily at 6 o'clock p. m., seventy-fifth meridian time, on 300-meter and 600-meter wave length. It is my opinion that the 300-meter broadcast can be eliminated without affecting the value of the warning in the least. The ice warning broadcasted daily from Arlington on 2,500 meters was of great assistance to the work of the patrol ship.

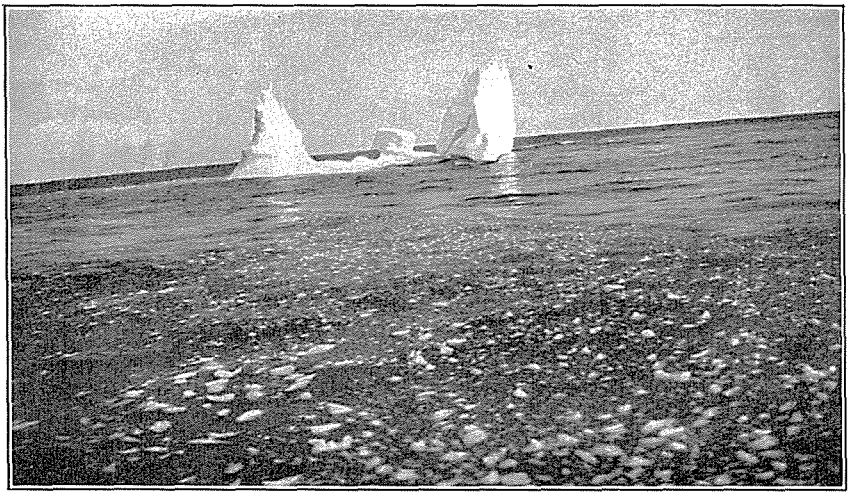
NOTES ON THE ICE PATROL, SEASONS OF 1916, 1919.

By Senior Capt. C. E. JOHNSTON, Coast Guard Headquarters.

When the patrol was discontinued, July 3, 1919, there were four bergs being reported from time to time in the vicinity of 43° N., 50° 50′ W., and these were seen by the *Tallapoosa* on her last patrol. The various reports indicated that the bergs were grounded on the Tail of the Bank, in which case they might remain in that vicinity for several weeks, and it was not deemed worth while to continue the patrol on their account. In connection herewith it may be noted that from time to time as late as the latter part of August bergs were reported near the Tail of the Bank. It is assumed that these four bergs gradually disintegrated and that as they lost sufficient bulk to rise clear of the bottom they drifted off the bank and were seen and reported by passing vessels.

Mention is made in the reports of patrol officers that on April 27, 1916, a berg was reported in the vicinity of 42° N., 47° W., but was not again reported. On May 4, 1916, the *Seneca* visited this location and found no ice, the temperature of the sea water being then 63° and the vessel having experienced a strong northerly set. On June 2, 1919, a berg was reported in 41° 40′ N., 44° 32′ W., but no further reports were received of ice in that vicinity.

These reports seem to add strength to statements made in the second paragraph of my summary of the patrol season of 1914 (Bulletin No. 3), to the effect that the first northerly branch of the Gulf Stream leaves the main stream in the vicinity of 43° N., 49° W., passes east of Flemish Cap, thence northward, washing the west coast of Greenland; that a second branch of the Gulf Stream breaks off farther to the eastward and flows in a northeasterly direction, crossing parallel 48 in the vicinity of the fortieth meridian, and washing the shores of Iceland; and that between these two warm streams flowing northward there is an ice-bearing cold stream which comes down from the east coast of Greenland until it strikes the Gulf Stream somewhere between the forty-seventh and forty-eighth meridians and near parallel 43, then curves to the southward and eastward and finally eddies back to the northward immediately west of the Iceland stream in a manner similar to that in which it has been established that the Labrador Current eddies back to the northward just west of the West Greenland warm stream. The analogy between these two cold currents seems to be strong, with the exception that the East Greenland current bears fewer bergs than the Labrador Current. Arguing from this analogy, it would be expected that a berg seen in the vicinity of 42° to 43° N., 44° to 47° W., would take a course similar to that followed by a berg seen between 42° and 43° N., 49° to 50° W.; it would soon pass to the northward on the east side of the cold eddy. I am inclined to



BREAKING UP RAPIDLY. SMALL ICE DRIFTING TO LEEWARD

believe, from a study of the situation, that that is exactly what does happen in almost every case, and that the bergs do not, as a rule, disappear through rapid disintegration. The line of demarcation between the warm and cold streams is very clear, temperatures of sea water often changing from 20 to 30 degrees in a couple of miles as a ship passes from one stream to another. An error of a few miles in a reported latitude, which is by no means uncommon, might make it seem that a berg was in warm water while in reality it was in cold water. Of course, cases may happen in which bergs do drift into warm water and break up rapidly, particularly near the end of the season of ice.

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