CHAPTER III

The Hydrographic Survey of Canada from the First World War to the Commencement of the Canadian Hydrographic Service, 1915-1927

With the outbreak of hostilities in Europe in August 1914, hydrographic and ships' officers began enlisting in the armed forces, and by 1918 the regular staff had been reduced to one-half of its pre-war strength. While on active service their positions were held in abeyance until their return to duty, and when overseas their salaries remained unchanged. What was not paid by the armed forces was supplemented from the hydrographic vote. In 1915 the auxiliary schooner *Naden* on the Pacific coast was laid up for the want of a crew, and in \9\6La *Canadienne* ended her charting days in the Great Lakes. To assist the Atlantic coast patrol of the Canadian navy, in 1917 the steamers *Acadia, Bayfield* and *Carder* were commandeered for the duration. The enforcement of the *Military Service Act* in 1917 further increased staff and labour problems, and in 1918 no hydrographic ships were in commission. An indication of the war trend from peacetime to wartime activity is reflected in the hydrographic vote in 1918, that only 40 per cent of the 1914 figure, and a close second to the all time low ($84,435, in 1908).

In October 1916, an order-in-council was approved forbidding the appointment of government employees not exempt from military service. To maintain maximum support for the war effort, the recruitment of women was intensified, a policy that developed as the war progressed. In 1917 daylight saving time and federal income tax were introduced for the first time, and in December the Halifax explosion brought the first toll of war dead to the doors of the home front. In recognition of extra work, with a wartime classification, many civil servants were paid a small bonus until the end of the war. This bonus was applicable to technical personnel in the hydrographic survey, and it varied in range depending on the recipient's contribution and married status. A typical case in the survey was one officer-in charge receiving in 1919a bonus of $132 per annum, while his first and second assistants (both active servicemen) received bonuses of $320 and $420, respectively. Basic salary and bonus for the officer-in-charge was only $38 less than that of his first assistant - a staff anomaly that did not promise the best interests to all concerned.

In keeping with election promises of December 1917, the government in 1918 authorized a general reorganization of its Civil Service Commission across Canada. By this amended *Civil Service Act* the Outside Service was brought under the commission's jurisdiction, ending for all times a half-century of staff inequalities and injustices. This was followed by a reclassification of government positions by the Arthur Young, and Griffinhagen Investigators of the United States. Proposed new grades for the hydrographic survey were, like others in the government service, promptly and successfully applied in 1920. In December of that year, all personnel of the survey on the Outside Service were made permanent in accordance with the blanketing-in regulation of the *Civil Service*

Amendment Act, 1919. For the first time since 1890 the entire professional and technical staff of the survey were eligible for sick and retirement plan benefits.

Between the years 1920 and 1924, Canada experienced a mild but acute economic depression, and for reasons of economy the hydrographic survey underwent the following changes: transfer of copper plates engravers from the Printing Bureau, 1921; Return to the Department of Marine and Fisheries, 1922; and the departmental transfer of the Tidal and Current Survey Branch to the hydrographic survey, 1924. Between 1922 and 1927, when in the Marine and Fisheries department, fewer hydrographic ships were commissioned annually. When not engaged on survey work, they were occasionally detailed to other departmental duties, with two of them being loaned to the Department of National Revenue for the Preventive Service on the Atlantic coast. Another indication of the slow progress in the post-war years was the appointment of only three surveyors between 1921 and 1927. During these years, however, more staff were appointed to the chart drafting, and automatic gauges sections. In May 1925 Mr Stewart, the chief hydrographer, died suddenly, and was succeeded by his first assistant since 1893, Mr F. Anderson.

What the Griffinhagen Investigators failed to accomplish for the professional and technical employees of the hydrographic staff in 1919, was corrected in some measure during a reorganization of the Marine and Fisheries department in 1927. The following year (1928) the Hydrographic Survey of Canada became the Canadian Hydrographic Service - the commencement of the present era of Canadian charting.

THE FIRST WORLD WAR, FISCAL YEARS, 1915-1918

1915-16

ATLANTIC COAST SURVEYS, 1915

James Bay

The northern survey of James Bay was continued in 1915 by Mr J.P. Jobin, with assistant Mr L.T. Bowes. The party left Cochrane, Ontario, on 6 May in canoes, and arrived at Moose Factory on the 12th. Here the launch *Sea Louse* of the previous season was put in shape, and a small schooner chartered from the Reveillon Freres was used as a houseboat. Before moving on to Charlton Island to resume work in this area, a plan was made for the mouth of the Moose River. An automatic tide gauge was also installed in the mouth of this river for the Tidal and Current Survey Branch of the department, and the two months' records obtained from it were handed over to Dr W. Dawson Bell, the superintendent. When the party returned to Ottawa by the middle of October, it marked the end of Canadian charting in northern waters until 1923.

Nova Scotia.

Owing to "many complaints both from officers of the Royal Navy and the Merchant Marine, about the inaccuracy of soundings in the approach to Halifax Harbour, it was decided to undertake an accurate survey of offshore conditions and the area embraced between Sambro Island on the west and Egg Island on the east, and extending from 15 to 20 miles offshore." This work was undertaken in 1915 by Capt. F. Anderson in the *Acadia,* with the assistance of Messrs R.J. Fraser, L.C. Prittie and J.L. Foreman. Sailing Master was Capt. S.A. [sic, probably W.A.] Robson and chief engineer, Mr J.C. Kelly. Over an area of 700 square miles, some 1,400 linear miles of soundings were recorded. Bases for a triangulation network were

measured in the entrance to Halifax Harbour, and on the beach of Egg Island. Five chronometers were employed for determination of longitudes, with wireless signals from Arlington, Virginia. Improvements to Admiralty Chart No. 311 were submitted to the Admiralty, and a Canadian chart "will be issued showing the result of the offshore work, during the past summer." Another special project this season was the laying out of a measured mile in Bedford Basin, and a close examination of the narrow channel in its entrance for the information of the dockyard officials. These surveys were the commencement of systematic charting by Canadian hydrographers on the Atlantic coast of the maritime province, a task still in hand and difficult to keep abreast of with larger and deeper draught ocean vessels now frequenting these waters.

FIRST JOINT HYDROGRAPHIC-OCEANOGRAPHIC CRUISES

At the instigation of the Department of the Naval Service, two oceanographic cruises were carried out on the Atlantic coast from late May to July in 1915. The oceanographic party was headed by Dr Johan Hjort, Director of Fisheries of the Norwegian government, and also comprised representatives from the Fisheries Branch of the department, biologists from McGill University and the United States Biological Station at Boston, Mass. The hydrographic party was in charge of Capt. F. Anderson, officer-in-charge of the *Acadia,* with assistants (see above). The purpose of these cruises was a fisheries study of Atlantic waters between Halifax, Sable Island, the Gulf Stream, Newfoundland, Cabot Strait and the Strait of Canso. While oceanographic work was in progress, the hydrographic party rendered all possible assistance to the scientists. When survey work off Nova Scotia ended in the fall, Capt. Anderson made another special cruise to St John's, Newfoundland on behalf of Dr Hjort. This season five to six weeks were lost on account of boiler and engine troubles, delaying *the Acadia's* lay-up until late November.

ST LAWRENCE RIVER

Lower St Lawrence

The steamer *Carder* returned to the hydrographic survey from the Canadian navy early in 1915, and under Mr Savary's charge hydrographic work was resumed this season on the Gaspe Coast between Matane and Cap Chat, PQ. Assistants with Mr Savary were Messrs E. Ghysens, M.A. MacKinnon and F.C.G. Smith. Sailing master was Capt. H.J. McGough, and chief engineer, Mr J.E. Belanger. In his annual report for 1915 Mr Stewart wrote, "this work is just about completed", and a sheet embracing the area from Cap Chat and Pointe des Monts on the north shore, and Matane on the south shore, was drawn. En route to Quebec in October, the *Carder* located the main channel buoys at the head of the Saguenay River, below Chicoutimi, PQ. This season some 1,000 miles of ship and 410 miles of boat sounding were observed, and 90 miles of shoreline traversed. Mr F.C.G. Smith, who had been transferred to this survey from the automatic gauges section in May, enlisted in the fall with the Canadian Railway Construction Corps, and proceeded overseas to France. In 1917 he was commissioned Lieutenant, RNR, with the British Admiralty, and to the end of the war worked on naval hydrographic surveys in European waters.

St Lawrence River Current Measurement Surveys, 1915

These investigations, begun in the ship channel below Montreal in 1913, were resumed in 1915. The hydrographic staff employed on these measurements in the Lake St Peter area

were Messrs M. Cailloux, N. Wilson, R.A. Rogers and R.W. Bent. In the fall Mr Wilson and a summer assistant of the St Lawrence Commission, Mr Ian Stewart, were sent to St Mary's River in the North Channel, Lake Huron. Here with the aid of a hired launch and a pontoon, trial investigations were conducted on the river to determine the stream flow from Lake Superior, and its effect on the Chicago drainage systems. Early in 1916 Messrs Wilson and Rogers were commissioned in the Canadian engineers, and proceeded overseas.

GREAT LAKES SURVEYS, 1915

Lake Ontario

This survey was again in charge of Mr G.A. Bachand in the steamer *Bayfield* with assistants Messrs J.U. Beauchemin, E.B. MacColl and W.K. Willis. Sailing master was Capt. Wm McQuade, and chief engineer, Mr J. Nisbet. Work was centred in the west end of the Lake in the area of Hamilton Bay, Port Dalhousie, Port Credit, Oakville, and Bronte Harbours. In his annual report for 1915 Mr Stewart remarked, "this completes the survey of the lake, and charts of these harbours as well as the coast will be placed in the hands of the King's Printer this spring." Before laying up at the Dominion Lighthouse Depot at Prescott for the winter, the *Bayfield* began a new survey of Kingston harbour, Ontario.

Lake Superior

In 1915 Mr Parizeau extended this survey in *La Canadienne* with only two assistants, Messrs H.L. Leadman and F.R. Mortimer. During the winter of 1914, Mr H.H. Lawson had joined the armed services and was registered at Kingston, Ontario (Royal Military College). Sailing master was still Capt. W.C. Playter, and chief engineer, Mr N.C. Munro. Prior to sailing for Byng Inlet a few investigations were made at Owen Sound, the home port for hydrographic ships in the upper Great Lakes. The survey of Byng Inlet (begun the previous year) now completed, the ship proceeded to Little Current in the North Channel for buoy inspections. En route to Sault Ste Marie, soundings were checked in certain areas of False Detour Channel. As requested by the International Joint Commission, a new automatic water-gauge was installed in Michipicoten Harbour, Ontario, to study the water levels in Lake Superior. Hydrographic surveying was then resumed between Oiseau Bay and Copper Island, and in his annual report for 1915 Mr Stewart noted, "the survey of the north shore of Lake Superior is now completed from Pigeon Bay as far east as Otter Head, except for the large Nipigon Bay and Black Bays. There remains only one shoreline between Otter Head and Cape Gargantua and around Michipicoten and Caribou Islands." On 30 October, *La Canadienne* returned to Owen Sound for the winter.

BRITISH COLUMBIA

In 1915, with Lieutenant-Commander J.M. Knight, RN, and Mr J.H. [J.A.] Turner on leave with the armed forces, "it was decided to lay up the schooner *Naden* at New Westminster." Lieutenant-Commander P.C. Musgrave, RN, (recommissioned by the British Admiralty early in 1915), carried on with the *Lillooet,* witii assistance of Messrs O.R. Parker and L.R. Davies - just half the normal staff. Sailing master was Capt. F.H. Griffith, and chief engineer, Mr A.R. Borrowman. Surveys this season were made in Fisherman Bay, at Vancouver Island's north end, Queen Charlotte Islands, Hecate Strait, Dixon Entrance, Skidegate Channel and Browning Passage. Mr Stewart reported, "of the 168 working days sixty were lost through bad weather, of which twenty-six were rain; but on the whole the

season was rather better than in 1914, because the party had eighty days of actual work as compared with fifty in 1914." Of significance in 1915 was the presence aboard ship of an officer from the Geodetic Survey of Canada who cruised about the Queen Charlotte Group to select a point to start the main triangulation on that coast.

HEADQUARTERS STAFF, OTTAWA, 1915

Automatic Gauges

Along the St Lawrence River ship channel between Quebec and Montreal, sixteen units were in operation in 1915. Many of these records were later used by the Montreal Water Level Commission in its water-level studies. With five new installations in 1915, the automatic gauges section now had on the Great Lakes and St Lawrence River eleven units in operation all year, and twenty-seven during the open navigation season. This work was in charge of Mr C.A. Price with the assistance of Mr W.J. Miller (to August 1914) and Mr A.R. Lee. On 11 June 1915, Mr F.C.G. Smith, who had been temporarily assigned to this section since September 1914, was reassigned to the lower St Lawrence River survey under Mr Chas Savary. Major C.F. Hannington, C.E., then joined Mr Price's staff as a temporary replacement on July 12, 1915, and assisted with the compilation of record data for the Montreal Water Level Commission (discontinued in 1918).

Drafting room

Since March 1915, Mr G.L. Crichton had been in charge of this unit of the hydrographic survey and with the assistance of Messrs H. Melancon, P.E. Parent, and A.J. Pinet, kept abreast of current chart production, the upkeep of Admiralty copper plates for the Great Lakes, and work on the engraved sets of international boundary charts for the St Lawrence River and Great Lakes. Much of this latter knowledge was acquired by Mr Crichton when in Buffalo, N.Y., the previous five years. During Major F.J. Delaute's absence overseas, temporary chart assistance was invariably given Mr Crichton by field hydrographers.

1916-17

In the fiscal year 1916-17, with nine officers on active service, no replacements, and a tight money budget, the activities of the hydrographic survey were gradually being curtailed. In support of this statement, both Messrs Parizeau and Bachand were in agreement that their field season "was greatly hindered ... by lack of crew." Furthermore, Mr Stewart stated, "I am afraid that due to the unsettled conditions of the country, we will have great difficulty in making good headway." However, five ship and one shore-based parties were placed in the field. In Lake Superior the steamer *La Canadienne* grounded while entering Black Bay on the north shore. When she returned to Owen Sound from the Port Arthur drydock in the fall, her charting days were over.

ATLANTIC COAST.

In 1916 Capt. Anderson, with assistants Messrs Fraser, Prittie and Foreman, recharted the approaches to Halifax Harbour, NS, from Egg Island to Pennant Point. Offshore soundings were carried out by the steamer *Acadia* to a distance of twenty miles, and those inshore to a safe distance for the ship. About two dozen uncharted rocks were discovered, and Notices to Mariners issued concerning these. The main triangulation work of this survey was

extended northeastwards along the shore of Nova Scotia to Liscomb Harbour, and southwestward to Port Medway. Bases were measured in each of these harbours. A resurvey of Bedford Basin begun this spring was completed during the summer. An examination of Lockeport Harbour was also made, and some shoals found in its entrance. Observations for magnetic declination were observed at several localities with an unifilar magnetometer. The *Acadia* laid up at the Halifax dockyard on 24 November, her last field season until the end of the First World War. Canadian charts from these surveys were issued to the public two years later.

ST LAWRENCE RIVER

Lower St Lawrence

The *Cartier* was recommissioned in 1916 at the Marine Agency in Quebec City early in May, with Mr Savary in charge, and his assistants were Messrs Ghysens, MacKinnon and MacColl. The main triangulation network on the Gaspe coast was extended east to Marten River, and to Egg Island on the north shore. When work ended in the fall, the lower St Lawrence survey had reached Pointe des Monts, and a new Canadian chart was drawn, No. 218, "Pointe des Monts to Father Point" (printed September 1918, issued to the public two months later after the war ended in January 1919). When the *Cartier* returned to winter quarters in Louise Basin, Quebec harbour, it was to be her last field season until the end of the First World War. In the spring of 1917, Mr M. A. MacKinnon proceeded overseas with the Canadian artillery, and in the following year was commissioned lieutenant, RNR, with the British Admiralty.

Underwater experiments, 1915-16

During the season of 1915, Dr L. V. King (see Hudson Bay expedition 1910), professor of physics, McGill University, began a series of underwater experiments with a submerged oscillator from the *Cartier.* With telephone receiving apparatus suspended from survey launches moored at variable distances from the ship, successful tests were conducted to determine the velocity of sound in sea water. These transmission tests were continued in 1916 in the lower St Lawrence, and were the first of their kind in any Canadian hydrographic ship. The following quote is from the International Hydrographic Bureau publication *A Survey of Echo-Sounding Apparatus,* August 1939: "In 1916, an echo-sounding apparatus was tried out on the Canadian Surveying vessel *Cartier."* What resulted from Dr King's experiments are not known to the author, but it is known that in 1917, ships of the Canadian navy were being equipped with a model of hydrophone detecting apparatus, similar to ships of the Royal Navy.

St Lawrence River Current Measurement Surveys, 1916

With Messrs Wilson and Rogers on leave overseas, these investigations were continued in the Montreal area by Messrs M. Cailloux and R. W. Bent. This was Mr Cailloux's last field season until the end of this war. Early in 1917 he was granted leave to join the French army in Europe.

GREAT LAKES SURVEYS, 1916

Lake Ontario

The resurvey of Kingston harbour, begun by the *Bayfield* the previous fall, was resumed in 1916 by the former James Bay party, Messrs P. Jobin and L.T. Bowes. With the aid of the gasoline launch *D.P.W.,* only the entrance to this lake terminal was recharted, and for the want of local labour it could not be finished.

Lake Superior

Party No. 1: The *La Canadienne* left Owen Sound for the surveying grounds in 1916 for the last time. She was in the charge of Mr H.D. Parizeau, with assistants Messrs F.R. Mortimer and H.L. Leadman. Sailing master and pilot was Capt. W.C. Playter, chief engineer, Mr N. Munro. From the middle of May to early in September, Nipigon Bay was surveyed. On 13 September when entering Black Bay the *La Canadienne* ran aground, and sustained heavy hull damage. She was docked and temporarily repaired at Port Arthur, but since the season was too far advanced she returned to Owen Sound. In the meantime, Port Arthur and Fort William harbours wereresurveyed. As a result of the season's work, a chart of Nipigon Bay was prepared. When *La Canadienne tied* up at Owen Sound on 5 November, her charting days with the hydrographic survey were over, and before another field season rolled around, Mr F.R. Mortimer enlisted with the heavy artillery in Ottawa and proceeded overseas. Invalided home in 1918, he later died in the Military Hospital, London, Ontario.
Party No. 2: In order to hasten the resurvey of Lake Superior, the *Bayfield,* in the charge of MrG.A. Bachand, with assistants Messrs J.U. Beauchemin and W.K. Willis, was sent to the upper Great Lakes in 1916. This party completed the unfinished work around Otter Head to the eastward of Michipicoten Island. Owing to bad weather and boiler trouble, the *Bayfield* ended her field season on 25 October and two days later berthed in Owen Sound. From the surveys of Messrs Parizeau and Bachand, a new Canadian chart, No. 108, "Michipicoten Island to Oiseau Bay," with an inset for Quebec Harbour, was handed to the King's Printer, but was not printed until May 1919. Like other capital survey ships on the east coast, this was to be the last field season for the *Bayfield* until the end of the First World War.

BRITISH COLUMBIA

With Lieutenant-Commander Knight, Mr J. Turner, and now Mr O.R. Parker (Lieutenant RNR, 1917), on active service, the field staff of Lieutenant-Commander Musgrave had been reduced from three assistants in 1914, to one in 1916 - Mr L.R. Davies. For the want of a crew, the *Naden* was still laid up. The *Lillooet* left Esquimalt early in April and returned to this base after a seven-month field season. Areas visited and surveyed were Alice Arm, the Queen Charlotte Islands, Hecate and Skidegate Channels. The last-named area was closely investigated to give better access for fishing vessels operating in the Skidegate Channel region. In his annual report, Commander Musgrave expressed his gratitude to the Geodetic Survey of Canada for all assistance rendered to it in connection with his own and their triangulation station, thus giving more accurate astronomical positions as a "groundwork" for this coast.

HEADQUARTERS STAFF, OTTAWA, 1916

Administration.

Secretary to Mr Stewart in 1916 was Miss K.M. Edmonds (appointed clerk-stenographer, 1913); Mr Chas McGreevy, acting assistant to the chief hydrographer; Mr J.R. Dupuis, clerk of accounts, etc., and Mr A. Carbonneau, clerk and messenger. In September 1916, Miss C.A. Condon was appointed to the hydrographic staff, and assisted Miss Edmonds with typing and other related duties.

Automatic Gauges

This work was in charge of Mr Chas A. Price, who with assistants Messrs C.G. Hannington, C.E., and A.R. Lee, maintained eleven gauges on the Great Lakes, and eighteen on the St Lawrence River.

Drafting Room

Under Mr Crichton's supervision fifteen new Canadian charts, and twelve new editions of former issues were issued to the public. The compilation of the international boundary chart series was well in hand.

Publications

A third edition of the *St Lawrence Pilot below Quebec* was printed in 1916, and a *Report of the International Waterways Commission* describing the boundary line between St Regis, Quebec, and Pigeon River was published by the Printing Bureau, Ottawa.

1917-18

Owing to the European War, only one hydrographic ship was in commission in 1917, the *Lillooet.* This year the *Acadia, Bayfield* and *Cartier* were taken over by the naval branch of the department, as "Cruisers for wartime" and served for the duration with the Atlantic coast patrol. In spite of these setbacks, five shore-based parties were in the field this season, in addition to *Lillooet* - a total of six.

ATLANTIC COAST

With the *Acadia* on naval duty in 1917, and Capt. Anderson in Ottawa, a small shore-party comprised of Messrs R.J. Fraser and J.L. Foreman resurveyed several small harbours along the northwest coast of the Bay of Fundy. For transportation the former Hudson Bay launch *Sea Louse* was used. A triangulation network connected these harbours with one another, and with "the time ball at Saint John, N B." When this survey ended, Mr Fraser moved to the St Lawrence River to assist in bringing current measurement surveys along the ship channel to a temporary close.

ST LAWRENCE

Lower St Lawrence

With the assistance of Messrs Ghysens, Prittie, Beauchemin and Bent (part season), Mr Chas Savary resurveyed the South Traverse of the St Lawrence River in the launch *Brant.* A triangulation network was extended from Orignaux Point lighthouse to Goose Cape lighthouse, including Goose Island reef. The shoreline was also traversed between L'Islet and Ste Roche des Aulnais.

Termination of Current Measurement Investigations St Lawrence River 1917

Hydrographic current measurement studies in the St Lawrence River, begun in 1913, were brought to a temporary close in 1917. Early this season this work was resumed between Montreal and Sorel by hydrographers R. W. Bent and J.U. Beauchemin. When field work on the Atlantic coast ended in October, Mr R.J. Fraser joined Capt. F. Anderson and Mr Chas McGreevy in the St Lawrence River, and with the aid of the ship channel steamer *Bellechasse,* measured in detail fifteen sections of the river between Three Rivers and Montreal. Other important areas measured this season were the mouths of the Assumption and Ottawa Rivers, and certain channels between the islands opposite Sorel. These investigations were completed for the purpose of computing backwater above Lake St Peter to aid navigation from thereto Montreal Harbour. The following year (1918), the Montreal Water Level Commission disbanded.

GREAT LAKES, 1917

Lake Ontario

A small-boat party consisting of Messrs P. Jobin, in charge, and L.T. Bowes continued the survey of Kingston harbour with the use of the Public Works launch *D.P.W.* About 1 December the party returned to Ottawa with a plan of this important inland lake-port.

Lake Superior

With *La Canadienne* not in service in 1917, a shore party in the charge of Mr H.D. Parizeau, assisted by Mr H.L. Leadman and Capt. Wm McQuade, completed the recharting of Port Arthur and Fort William harbours in the first half of the season. The party then moved to the northwest shore of Black Bay and pitched camp. With the aid of the chartered motor launch *Ransom,* a triangulation of Black Bay was first completed before the shore was traversed and the waters sounded. This work was discontinued about the middle of October when the party returned to Ottawa for the winter.

BRITISH COLUMBIA

In 1917 the *Lillooet* was the only hydrographic ship in commission. Regular survey work was resumed by Lieutenant-Commander Musgrave and his two assistants, Messrs L.R. Davies and W.K. Willis (transferred from Ottawa in May). Smith Sound, Milbanke Sound, Schooner Passage, Hecate Strait, Petrel Channel, Swanson Bay, and Chatham Channel were visited, and later it was reported, "out of a total of 176 working days work was carried out on 70, of the remaining 82 days were prevented by rain."

HEADQUARTERS STAFF, OTTAWA 1917

Automatic Gauges

Two new automatic gauges were installed on the St Lawrence River in 1917, one at Iroquois, Ontario, and the other on the Morrisburg Canal. Before the year ended, Major C.F. Hannington was granted leave for military service overseas.

Drafting Room

As the European War progressed and the hydrographic vote dwindled, Canadian chart production became of prime importance. To meet these demands and keep abreast of current work, Mr Crichton had as assistants Messrs P.E. Parent, H. Melancon of his regular staff, hydrographers Messrs A.J. Pinet (on temporary loan) and E.B. MacColl (awaiting transfer to the Radio Telegraph Service) from the hydrographic survey. In addition to Mr MacColl, Mr Bachand was assigned to headquarters this season where he was occupied with "various necessary work." Nine new charts, and four new editions of former issues were printed in 1917, and work on the international boundary series was given greater attention.

Pilots and Sailing Directions, 1892-1917

The first Canadian volumes of sailing directions were written for the inland waters of Georgian Bay and the North Channel (Great Lakes) by Staff Commander J.G. Boulton, RN, in 1892. Five years later, in 1897, the first volume was written by a Canadian hydrographer - *Canadian Shores of Lake Erie,* by Wm J. Stewart. The first Canadian volume for the sea-coasts was written in 1912 - *St Lawrence River, Father Point to Quebec Harbour,* by Commander I.B. Miles, RN. The history of Canadian sailing directions and pilots by Canadian hydrographers therefore dates back to 1897. Twenty years later in 1917, Capt. F. Anderson, officer-in-charge of the *Acadia,* was in Ottawa writing a volume for the Canadian shores of Lake Superior, an area where he had carefully surveyed 1902-1909.

1918-19

The fiscal year 1918-19 was undoubtedly the "darkest period" in the history of the Canadian Hydrographic Survey, with half its staff on leave with the armed forces, no survey ships, and an appropriation that had been reduced by 60 per cent of its 1914 figure (from $213,400 to $87,608). In spite of these drastic curtailments, Mr Stewart did manage to place five shore parties in the field, maintain its automatic gauges unit without any appreciable reduction and increase the volume of Canadian charts, four of which were the first for the maritime provinces of Nova Scotia and New Brunswick.

ATLANTIC COAST

Early in 1918 Messrs R.J. Fraser, J.L. Foreman and L.C. Prittie were granted commissions with the RNR. and proceeded overseas. So that the Atlantic coast survey should continue, Capt. F. Anderson, with the assistance of Messrs G.A. Bachand and J.U. Beauchemin, returned to Nova Scotia and made special plans of Sydney and Halifax (Northwest Arm) Harbours for the Canadian navy, and just before the First World War ended (11 November),

the party returned to Ottawa for the winter.[1]

First Canadian Charts for the Atlantic Coast

Nova Scotia, i) No. 410, "Bedford Basin, Halifax Harbour." Scale 1:12,168. Printed March 1918, and issued to the public, Notice to Mariners No. 15, paragraph 33 dated 23 March 1918. Price 15 cents. This was the first Canadian harbour chart for the Atlantic coast of the maritime provinces.
ii) No. 41 1. "Egg Island to Pennant Point." Scale 1:97,216. Printed July 1918, and issued to the public. Notice to Mariners No. 89, paragraph 235, dated 13 November 1918. Price 15 cents. This was the first Canadian coast chart for the Atlantic coast of the maritime provinces.[2]
New Brunswick, iii) No. 413, "Bathurst Harbour, Chaleur Bay." Scale 1: 12,000. Printed May 1918, and issued to the public, Notices to Mariners No. 44, paragraph 113, dated 25 June 1918. Price 15 cents.
iv) No. 414, "Plans of Harbours (Bay of Fundy), Chance Harbour, Dipper Harbour, Musquash Harbour and Lorneville Harbour." Scale 1:12,031 to 1:17,996. Printed April 1918, and issued to the public, Notice to Mariners No. 56, paragraph 118, dated 2 August 1918. Price 15 cents. These were the first Canadian charts for Chaleur Bay and the Bay of Fundy, and coincidentally the first for the province of New Brunswick.

LOWER ST LAWRENCE

Summer headquarters in 1918 for the lower St Lawrence Survey was at St Joachim, PQ. This season Mr Savary, with the assistance of Messrs Ghysens and Bent, and the launch *Brant,* worked in the North Channel, off the east end of Orleans Island. In this area the new ship channel was being dredged to provide an alternative route around Coudres Island. This survey, as Mr Stewart later reported, proved the non-existence of a shoal on the Admiralty chart opposite Longue Pointe, and that "the North Channel is therefore, clear." About the middle of November, the party returned to Ottawa for the winter.

GREAT LAKES SURVEYS, 1918

Lake Ontario

The resurvey of Kingston harbour and approaches was almost completed in September of 1918 by Messrs P. Jobin and L.T. Bowes, with the aid of the Department of Public Works launch *D.P. W.* In the autumn, Mr P. Jobin, who had been with the hydrographic survey since its beginning in 1904, contracted the influenza that was raging at that time, and died.

[1] During the war years Captain Anderson was responsible for several special surveys in connection with submarine detection, and they were of strategic importance to the Canadian navy when the submarine menace off this coast (1917-18) was at its height. This was more so following the Halifax explosion on 6 December 1917. The next year anti-submarine patrols were being flown by US aircraft from Halifax.

[2] the first Canadian harbour and coast charts for the Atlantic coast were for Hudson Bay printed prior to the First World War. The date 13 November on Chart No. 411 has some significance. It was not issued to the public until two days alter the armistice of 11 November, probably because this area included wartime restricted waters in Halifax Harbour and its approaches. These were also the first Canadian charts for the province of Nova Scotia.

Lake Superior

This season was spent under canvas by Messrs Parizeau and Leadman, who completed the survey of Black Bay, Ontario, with the aid of the chartered launch *Ransom.* Late in October, the party returned to Ottawa for the winter.

BRITISH COLUMBIA

The year 1918 was the first occasion since 1907 that a single shore-party worked on this coast for the entire season. For the want of a crew and local labour, etc., the *Lillooet* could not be commissioned. Resurveys of Victoria and Esquimalt harbours were then taken in hand by Lieutenant-Commander Musgrave, with the assistance of Messrs Davies and Willis. Late in the season Mr W.K. Willis was granted a commission as a lieutenant, RNR, and proceeded overseas to England. This left the British Columbia party in the same situation as in 1916 - two regular hydrographers (one in charge, the other an assistant). Before the fiscal year ended, office quarters in HMC Dockyard at Esquimalt were moved to the BC Permanent Loan building in Victoria (now the Toronto-Dominion Bank Building).

Schooner *Naden,* 1918

In his annual report for 1918 Mr Stewart, wrote, "the schooner *Naden,* in New Westminster, being out of commission, was temporarily transferred to the Royal Naval College in Esquimalt, BC." An interesting note in the report of the Naval Service for 1918 reads as fol lows: "the Hydrographic Survey of the Department of the Naval Service gives preference to graduates of the Naval College in recommending appointments to their staff." Another comment in the Stores Branch report makes reference to the servicing of the Air Service, Examination Service, Radiotelegraph Service, Fishery Protection Service, hydrographic service, Tide and Current Surveys, Life-saving Service, Fish-breeding Service, etc. With the Meteorological Service, etal., is there any wonder by 1918 that the hydrographicswvejwas bound to become more familiarly known as the "hydrographic *service"!**

HEADQUARTERS STAFF, OTTAWA, 1918

Administration

In the fiscal year 1918-1919 the headquarters of the hydrographic survey were located in the Waller Street Public School in lower town, Ottawa. Its staff comprised the chief hydrographer, Mr Wm J. Stewart; two clerk-stenographers Misses K. Edmonds (secretary) and C.A. Condon; general clerks Messrs J.U. Dupuis and A. Carbonneau (also messenger); and Mr Chas McGreevy, C.E., acting general assistant to Mr Stewart.

Automatic Gauges

No new water-level gauges were installed by Mr Price and his staff in 1918. Their time was fully occupied in maintaining those units already built and in preparing for publication water-level bulletins and other pertinent data for the Great Lakes and St Lawrence River. Before this year ended Major C.F. Hannington had returned from overseas and resumed his

[1] Fmphasis added. [ED.]

temporary employment with this section.

Drafting Room

In 1918 the drafting room under Mr G.L. Crichton was the busiest section in the survey. Four new engraved charts, six photo-lithographic edition, and fourteen reprints of former charts were printed. Equally important was the publication of some thirty engraved International Waterways Commission non-navigation charts for the St Lawrence River and Great Lakes, in containers. These sheets showed the delineation of the international boundary line between St Regis, PQ, and Pigeon Bay, Ontario, in Lake Superior. They were compiled by authorization of Article 14 of the Boundary Treaty between Canada and the United States dated 11 April 1908.

THE POST-WAR FISCAL YEARS, 1919-1927

1919-20

By October 1919, most hydrographic officers had returned from overseas and were slowly adjusting themselves to "civvy street." Those reporting back for duty in Ottawa were Messrs Cailloux, Wilson, Smith, Fraser, MacKinnon, Prittie and Rogers, and in British Columbia, Messrs Parker, and Willis. In the automatic gauges section, Mr Wm J. Miller and Major C.F. Hannington were back on the job, and in the drafting room Major J.F. Delaute was once again assistant to Mr G.L. Crichton. Of greater concern to these "vets" and other personnel who carried on for the duration was the re-organization of the Civil Service Commission this year, and the reclassification of the hydrographic survey that was to be approved a year later (backdated to 1 April 1919).

ATLANTIC COAST

With the return of the *Acadia* from the Canadian navy in 1919, ship work on the southeast coast of Nova Scotia suspended in 1916 was resumed by Capt. F. Anderson with assistants Messrs Beauchemin, Bent and Prittie. Sailing master of the *Acadia* was Capt. S.A. [sic, probably W.A.] Robson, and chief engineer, Mr A. Shortt. Offshore sounding was limited to a twenty mile range, with inshore surveying extended beyond Egg Island to Liscomb Harbour. A triangulation network was also made from Liscomb Harbour east to Canso Harbour, including Cranberry Island Lighthouse. Magnetic observations were also recorded for declination at six points along this coast. While ship sounding, offshore experiments were conducted to position *Acadia* by radio direction finding bearings from stations located at Chebucto (entrance Halifax harbour) and Canso. These were the first trials of electronic ship-positioning in the hydrographic survey. Radio and a model of an echo sounder were inventions from the First World War, and the use of radio to aid coastal navigation was being tried in the post-war years. Its results were not accurate enough for hydrographic purposes, but in his annual report Mr Stewart noted, "there is a possibility of this method being perfected."

LOWER ST LAWRENCE

Owing to considerable repairs being required to make her seaworthy, the *Carder* was not ready for survey work until July. She was again placed in the charge of Mr Chas Savary, who had for assistants in 1919 Messrs E. Ghysens, L.T. Bowes, J.L. Foreman and F.C.G.

Smith. Sailing master was Capt. H.J. McGough, and chief engineer, Mr J.E. Belanger. The charting of the river estuary suspended in 1916 was resumed, with the ship working on the Gaspe coast in the vicinity of Ste Anne des Monts. En route to Quebec in the fall of the year, the *Cartier* completed the necessary sounding surveys in the North Channel for a new Canadian chart from St Jean wharf, Orleans Island, to Stone Pillar.

GREAT LAKES SURVEYS, 1919

Lake Ontario

The resurvey of Kingston harbour was completed in 1919 by Messrs R.J. Fraser and L.T. Bowes. Early in June, the *Bayfield* returned to the hydrographic survey from the Canadian navy, and while undergoing a refit at the Kingston dockyard, assisted this party in bringing to a close the work begun by Mr P. Jobin in 1917.

Lake Erie

The *Bayfield* in 1919 was in the charge of Mr H.D. Parizeau, with assistants Messrs H.L. Leadman and N. Wilson. Sailing master was Capt. N. Barrett, and chief engineer, Mr J. Nisbet. En route to Lake Superior, a small hydrographic survey of Point Pelee was undertaken for the Department of Justice, "to determine the amount of erosion that was taking place at said point."

Lake Superior

The *Bayfield* reached Caribou Island in late July and was joined by an advance party sent there earlier. This island and the waters in between to Michipicoten Island were surveyed, "with an extensive system of buoys ... successfully operated." For the survey of Caribou Island, the former Hudson Bay launch *Sea Louse* was shipped to Sault Ste Marie from Saint John, N B, and during the winter 1919-20 laid up on the lock wall of the "Soo" canal. Early in November the *Bayfield* reached Owen Sound for the winter.[4]

BRITISH COLUMBIA

The Victoria office now up to its pre-war strength, regular survey work was resumed as in former years. Once again the *Lillooet* was in service under Lt- Cdr P.C. Musgrave, RN (Ret'd), with assistants Commander J.H. Knight, RN (Ret'd), and Messrs L.R. Davies, W.K. Willis and O.R. Parker. Sailing master was Capt. F.H. Griffith; and chief engineer, Mr A.R. Borrowman (since 1911). The ship reached Prince Rupert harbour about mid-May and for the next four months worked in the Hecate Strait area. This was followed by a small survey in the entrance of the Fraser River, with triangulation stations supplied by the Geodetic Survey of Canada. From work concluded in Victoria harbour this season, a new chart of this Pacific coast seaport was drawn.

[4] The launch *Sea Louse* remained with the Lake Superior survey until the spring of 1921 when it was shipped from Port Arthur to New Brunswick for work in Northumberland Strait.

Obituary

On 17 February 1920, Lieutenant-Commander P.C. Musgrave, RN (Ret'd), the first officer-in-charge of the Victoria office, died there unexpectedly in hospital. Mr H.D. Parizeau, his former first assistant, 1907-1910, was sent from Ottawa on 11 March to replace him. Mr Parizeau then remained in charge of all hydrographic work in British Columbia until his retirement as supervising hydrographer, Pacific coast, in December 1945.

HEADQUARTERS STAFF, OTTAWA 1919

The field season of 1919 was well advanced when Messrs Fraser, MacKinnon and Rogers returned from overseas, and until the following season they were assigned to various duties at headquarters. In addition to her regular duties as stenographer, Mr Stewart reported that Miss K.M. Edmonds continued "to keep the records and track of the necessary filing for this office, to check over all accounts that come in from the various parties and keep the office record of such expenditures. She has also to supervise the issue of the charts and this is no small matter." In the last half of the First World War, the hydrographic staff was at its lowest ebb, and to carry on the routine office work, Mr Stewart was obliged to designate these and other duties to his stenographic assistants Miss K. Edmonds and Miss Catherine Condon (since 1916).

Automatic Gauges

With Mr Wm J. Miller's return to this section, Mr Price now had three hydrometric recorders under his charge, Messrs Miller, Hannington and A.R. Lee. This was an increase of one since 1914. Field work this season was restricted to the maintenance of water-gauges already installed on the Great Lakes and St Lawrence River, and in the office several bulletins and allied water-level sheets were published.

Drafting Room

Under Mr G.L. Crichton's supervision eight new engraved and ten photo-lithographic charts were printed; sixteen reprints of former charts were also issued to the public. Upon Mr Cailloux's return from field duty on the *Cartier,* he was assigned to the drafting room. Other draftsmen in this section in 1919 were Messrs Parent, Pinet, Melancon, and the "assistant" to Mr Crichton, Mr J.F. Delaute.

THE CIVIL SERVICE OF CANADA AND THE HYDROGRAPHIC SURVEY, 1919-1920

The amended *Civil Service Act, 1908,* established the present Civil Service Commission, and under this authority most civil servants at headquarters in Ottawa were reclassified from the Outside to the Inside Service in the Civil Employment List. With the exception of the staff at the Victoria office, most professional and technical personnel of the hydrographic survey were now permanent and qualified for staff benefits as defined by this Act. From then until the First World War the staff was greatly increased with new employees, but until this war ended their temporary status remained unchanged. Although their employment was of a continuous nature their future in this category was a most frustrating one. They were ineligible for most staff benefits their fellow-workers enjoyed, and what annual increases they did receive from time to time were on the recommendations of the chief hydrographer to the deputy minister without any redress to the Civil Service Commission.

Subsequent to an election pledge in 1917, the *Civil Service Act* was again amended in 1919, and by it the jurisdiction of the Civil Service Commission was extended beyond the restricted Ottawa area to the whole of Canada. This was followed by the first general reclassification of the entire government service. The first significant move came with an election campaign by the Union government in December 1917 when it promised if elected "to abolish patronage and reform the Civil Service."[5] Subsequently, orders-in-council were approved in February and May 1918 authorizing a complete reorganization of the Civil Service Commission, and a reclassification of all government civil servants. To carry out these reforms and investigations, the government entered into contract with the well-known American firm Arthur Young and Company, with offices in New York, Chicago and Toronto. Investigations of several government departments (including the naval service) were carried out by fellow associates headed by E.O. Griffenhagen. In June 1919 these experts completed their report entitled, "Classification of the Civil Service of Canada," one that brought thousands of appeals across the entire civil service. In spite of their recommendations, alterations were made to this report to make it more workable. When amended it became known as the "Report of Transmission." It was submitted to Parliament in the fall of 1919, to be effective 1 April. Inside Services were placed under the jurisdiction of the new Civil Service Commission - thus ending for all times the class distinctions of "Outside Service" and "Inside Service." It also went far in substituting political patronage by a merit system in the government service.

Griffenhagen Report, June 1919

When the proposed recommendations in this report were finalized, they contained few financial benefits to the professional and technical employees in the hydrographic survey. In summary the theme of their investigations were fewer position classifications, with only slight increased remuneration for the new grades. Instead of the three present classifications of hydrographers, assistant hydrographers, and junior hydrographers, it was proposed to change this category of employees into two classes, namely hydrographic engineers, and junior hydrographic engineers. Existing salaries, without bonuses, ranging from $1,500 to $3,400 per annum, were to be $1,680-$3,180 for these two classes. Mr Stewart's present classification as chief hydrographer and consulting engineer to the Department of External Affairs was to be changed to senior hydrographic engineer, with a salary range $3,600-$4,200 (only $200 more than his present salary). The officer-in-charge, automatic gauges, was renamed junior hydrometric engineer, with a salary range $ 1,680-$2,040 (same as junior hydrographic engineers), and the title of chief draughtsman was to remain unchanged with increased salary range from $2,100-$2,800 to $2,640-$3,000.

Appeals and Reclassifications, 1920

As was to be expected, the Griffenhagen Report was vehemently challenged and promptly appealed by Mr Stewart, and by order-in-council P.C. 1048, 14 May 1920, the first adjustments were approved. The proposed title senior hydrographic engineer became chief hydrographer, with an increased salary $4,800 maximum, hydrographic engineers were again hydrographers, assistant hydrographers and junior hydrographers with salary ranges of $2,880-$3,480, $2,280-$2,760 and $1,680-$2,040 respectively. A second order-in-

[5] R.M. Dawson, *The Civil Service of Canada*, (1929), 90.

council, P.C. 1302, 10 June 1920, authorized the appointment of a new class of hydrographic assistant with a salary range of $1,320-$ 1,560, "to meet the cases of young college graduates entering without any previous experience ... qualifications: graduates in engineering from a school of applied science of recognized standing The next promotion above this class was junior hydrographer, et al., and in the early 1920s this classification was better known as "instrument man."

Blanketing-in regulations, 1920

What was of more significance to the hydrographic service was P.C. 2958, 16 December 1920. In accordance with Section II (2) of the *Civil Service Amendment Act, 1919,* the Civil Service Commission was instructed "to submit to His Excellency in Council lists showing the temporary employees who were occupying positions regarded by the Civil Service Commission and by the Department concerned as of a permanent nature ... assigned to the said positions prior to November 10th, 1919 being the date on which the Civil Service Amendment Act 1919 became law Accordingly, hydrographic field officers of the Outside Service of the department were granted permanent status, effective 1 April 1921, and this included personnel at the Victoria office ineligible in 1908. These officers were now eligible for statutory increases, promotions and retirement plans, some of which dated back to 1 April 1919.*

1920-21

ATLANTIC COAST SURVEYS

Nova Scotia

This season *Acadia,* with Capt. F. Anderson in charge and assistants Messrs J.U. Beauchemin, R.W. Bent, L.C. Prittie and R.A. Rogers, carried offshore soundings between Liscomb Harbour and Canso some distance to seaward. As reported "to more accurately define the banks fronting that part of the Nova Scotia coast." Radio direction finding experiments were continued this season with the hope of improving offshore ship positioning. Mr Stewart stated, "it is hoped to use those stations for examining the banks off the Nova Scotia coast than land survey stations will allow." Before the fiscal year ended Mr L.C. Prittie, who had been with this survey since 1913, resigned.

Magdalen Islands

Early in September the *Acadia* proceeded to the Magdalen Islands in the Gulf of St Lawrence, "where various reported and uncharted shoals were investigated." From Capt. Anderson's findings, and in view of the inaccuracy of the old Admiralty charts, it was decided "that a detailed survey be made of the Magdalen Islands and the waters surrounding

* In 1920 the civil service retirement acts to this time were amended as the *Public Service Retirement Act,* and became better known as the "Calder Act." This was superseded a few years later by the *Superannuation Act. 1924.* Contributors to the retirement plan over the years were given the privilege of transferring to the new superannuation plan. Many old timers at that time did make this election, while others were to regret their folly a decade later in the years of the Depression.

them" - the first Canadian Hydrographic investigations in the Magdalens.[7]

Prince Edward Island

About the middle of September, *the Acadia* was back in Northumberland Strait (Gulf of St Lawrence). Here detailed surveys were made at the car-ferry terminals of Cape Tormentine, NB, and Port Borden, PEL A section of soundings was also carried across the strait between these harbours. Large-scale plans of both harbours are shown as insets on Canadian chart No. 418, "Cape Tormentine to Borden, PEI,"(Notice to Mariners No. 45 paragraph 120,23 July 1921). Price 15 cents. This was the first published Canadian chart for Prince Edward Island, and it has been said that while making these surveys some of the ship's crew of the *Acadia* "mutinied" for better working conditions and higher pay.

LOWER ST LAWRENCE

The *Cartier,* in the charge of Mr Chas Savary, with assistants Messrs E. Ghysens, J.L. Foreman, L.T. Bowes, M. Cailloux and F.C.G. Smith, made Ste Anne des Monts their summer headquarters. One unit of this party worked along the Gaspe coast between Martin and Magdalen Rivers (Messrs Ghysens and Smith). Boat and ship soundings were carried off this coast "to determine the 100-fathom line." On the North Shore of the estuary a water-triangulation was used to connect Pointe des Monts to Pentecote River. This season about 1,000 linear miles of ship and 1,400 miles of boat soundings were observed, and 70 miles of the coast were traversed. This survey of Seven Islands in 1920 can be said to be the actual commencement of Canadian recharting of the north shore of the Gulf of St Lawrence - a major undertaking. With the aid of aerial photography after 1930, it was completed to the Strait of Belle Isle when the Second World War began in 1939.

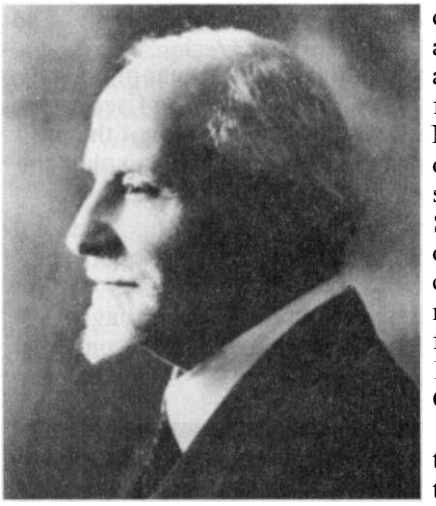
GREAT LAKES SURVEY

With Mr Parizeau's transfer to Victoria this spring, Mr R.J. Fraser was placed in charge of the Great Lakes survey. Assistants with him on the *Bayfield* were Messrs H.L. Leadman, M.A. MacKinnon and N. Wilson. The ship reached Michipicoten Harbour in Lake Superior on 15 May. From then until 23 September the east coast of this lake was surveyed between Gargantua Harbour and Point Isacor, and plans made for Michipicoten and Gargantua Flarbours. Owing to the need for a new boiler, the *Bayfield* was obliged to leave for Port Arthur earlier than anticipated. When she tied up at the lakehead, it brought the resurvey of Lake Superior to a temporary close, and coincidentally the first Canadian recharting of the Great Lakes. Another link with the past was severed before the fiscal year ended. Mr John Nisbet, chief engineer of *Bayfield* I from 1886 to 1902, and *Bayfield* II since 1903, was retired as per regulations of the *Public Service Retirement Act, 1920,* or better known as the "Calder Act."

BRITISH COLUMBIA

On 11 March 1920, Mr H.D. Parizeau arrived in Victoria to assume charge of the British Columbia survey. From then until 1937 he would "lock shop" each summer, and supervise the season field activities from the survey ships under his command. Labour troubles

[7] Stewart. Report DNS 1920.



Henri Delpe Parizeau
photo courtesy CHS

delayed the sailing of the *Lillooet* until early in June, and in the meantime further work was completed in the approaches to Victoria harbour. One of Mr Parizeau's first tasks in the *Lillooet* was a resurvey of First Narrows, Vancouver harbour, where "sweeping operations were undertaken with a wire sweep, and several lumps were located." Ocean Falls and Hecate Strait were then visited, and in the latter area, "a series of large buoys were moored as far offshore as circumstances would permit of their being fixed." This method of carrying soundings across Hecate Strait was found to be highly satisfactory. Assistants with Mr Parizeau on the *Lillooet* were Messrs W.K. Willis and O.R. Parker.

At the end of March 1920 the auxiliary steam tug *Restless* of the Canadian navy was transferred to this survey for hydrographic work. It was placed in the charge of Commander J.H. Knight, with assistant Mr L.R. Davies. Engineer-in-charge was Mr T. Salmon, and to sail her from Victoria to Quatsino Sound on the northwest coast of Vancouver Island. Pilot C. Moore was engaged "to pilotage C.G.S. *Lillooet...* $100.00."* Like the *Lillooet,* the *Restless* was also beleaguered with post-war labour troubles, and spent most of this season in Quatsino Inlet resurveying the area in the vicinity of Port Alice where pulp and paper mills were located. Current observations were also recorded northeast of Limestone Island.

HEADQUARTERS STAFF, 1920

Automatic Gauges

Under Mr Price's charge, thirty-three automatic gauges were in operation in 1920, twenty-two of which were open all year round. This season five new ones were installed on the St Lawrence River, and in Lake Superior, "a remarkable seiche" was recorded on 10 June, (Sault Ste Marie gauge). A previous Lake Superior seiche had been recorded at Michipicoten Harbour on 27 August 1917. These seiches are said to be carried down Lake Superior, and "their vertical variation is increased by contraction of the shoreline into the narrowness of the St Mary's River."

Drafting Room

This unit was responsible in 1920 for ten new engraved charts, a new photo-lithographic edition of Halifax Harbour, and twenty-two reprints of former charts, including No. 405 for Hudson Bay. About this time Mr W.L. Andrews, a draftsman, was added to Mr Crichton's staff.

* Report, Auditor General, 1920.

Expenditure, 1920

Hydrographic expenditure in 1920 had increased by only $60,000 from the year previously ($250,000), and it was approximately the same amount voted in the following fiscal year, 1921 ($315,000). These figures have some significance. They were indicative of the mild economic depression Canada was passing through at that time, and they partially explain the reason why the hydrographic survey did not expand as rapidly as in the pre-war years.

1921-22

ATLANTIC COAST SURVEYS

Nova Scotia

Early in June the *Acadia,* under command of Capt. F. Anderson, with assistants Messrs J.U. Beauchemin, R.W. Bent and R.A. Rogers, arrived off Cape Canso where survey work was extended to the northeast of this cape. Owing to fog little progress was made during this month. About the middle of July Capt. Anderson returned to Ottawa for briefing and instructions on the Lake Melville Survey in Labrador, and during his absence Mr J.U. Beauchemin was in temporary charge of the *Acadia.* About the middle of October, the ship returned to Halifax from Labrador, and here the extra assistants of the party and other government officials disembarked. From then until early in November, the *Acadia* ran trial sounding lines across the approaches to the Bay of Fundy from Cape Sable, NS. A study of 600 miles of sounding in this area, [found that] reports of inaccurate depths were unjustified when compared with current Admiralty charts. This season the radio direction finding [RDF] stations at Chedabucto, NS, and Red Head, NB, were calibrated.

Labrador (Lake Melville)

Early in June 1920 a request was received from the Department of Justice for a special survey of Lake Melville in Labrador. Since this was an urgent necessity to commissioners studying the limits of the Newfoundland boundary, it was decided to suspend temporarily the work in Nova Scotia and reassign the *Acadia* to this area with an enlarged field staff. To supplement the regular party of Messrs Beauchemin, Bent and Rogers, Mr G.A. Bachand was sent from headquarters, and a Mr J.B.T. Lewis was engaged as an instrument man. Representatives from the Departments of Justice, and Mines, were Mr Plaxton and Dr Kindle, respectively. The *Acadia,* under Capt. Anderson's charge, sailed from Halifax on 3 July and when in the Gulf of St. Lawrence, Messrs E.A. Ghysens, F.C.G. Smith and L.T. Bowes were detached from the *Carder* party and joined the ship's company.

On 13 July a tide-gauge was installed at Indian Harbour, Hamilton Inlet. At Rigolet, Messrs Ghysens and Smith were quartered in houses of the Hudson's Bay Company, with instructions to survey the narrows connecting Hamilton Inlet with Lake Melville. Here Dr Kindle and party also disembarked to commence their own investigations. On 15 July, the *Acadia* anchored off the west end of Lake Melville, and here Messrs Bowes and Lewis were quartered in the old mills on the eastern shore of Carter Basin. When at Northwest River on 17 July, Mr Plaxton was landed and supplied with a launch for his personal explorations. Automatic tide-gauges were installed at Epinette Point and Rabbit Island by Mr Bowes and "this party traversed Goose Bay and the upper part of Lake Melville and sounded out that

body of water, made observations for tides and measured the currents observed."[9] In the meantime Capt. Anderson, with Mr Bachand, et al., on the *Acadia* handled the necessary triangulation surveys and ship work to complete the chart for this lake. When the last party was picked up on 28 September, the ship proceeded to the entrance to Hamilton Inlet for further work, and returned to Halifax, on 17 October. In Lake Melville an area of 910 square miles was sounded, involving 500 miles of ship and 1,000 miles from the boats and launches. Eight rivers were examined for tidal influence, and 411 miles of shoreline were traversed. In February 1922 a preliminary edition of Canadian chart No. 420, "Lake Melville" was printed on a scale 1:146,000-the first Canadian chart from Canadian surveys for the coast of Labrador.[10] The results of this hydrographic survey, and water-level investigations by the automatic gauges section and the Tidal and Current Survey in 1923, were most valuable data in determining the delineation of the Canada-Labrador boundary in 1929.

ST LAWRENCE

Lower St. Lawrence

The season began with Mr Chas Savary working on the Gaspe coast with assistants Messrs M.A. MacKinnon, J.L. Foreman and L.T. Bowes (part season). In the absence of Capt. H.J. McGough due to illness, Mr James Roach, first officer acted as sailing master of the *Cartier*. Until the arrival of the *Acadia* in July, Messrs E.A. Ghysens and F.C.G. Smith were fully occupied as a detached unit resurveying the Seven Islands area on the North Shore.

New Method of Ship Sounding, 1921

While Capt. Anderson was experimenting with RDF ship positioning on the Atlantic coast, Mr Savary in the *Cartier* was conducting his own experiment with another hydrographic invention - the mechanical sounder. Up to this time depths of sixty to seventy fathoms were recorded with a regular deep-sea line attached to a Walker's Deepsea Sounding Machine. Beyond these depths, use was made of the Lucas steam-sounding machine. This caused loss of time to bringing the ship to a standstill, and if in a tidal stream the ship would drift out of position. Instead of using a deep-sea line for depths of about 250 fathoms Mr Savary experimented with a fine wire that gave a speedier and a more economical result. These experiments proved highly successful and during the past two seasons (1920 and 1921), all ship sounding in the lower St Lawrence was done with wire and apparatus. "A submarine sentry was used as a sounding drum that carried 500 to 600 fathoms of wire. This wire weighed about 16 pounds per 1,000 feet, and with 300 fathoms paid out and hove in at the rate of 8 feet per second, wire tension found to be 125 pounds." With no difficulty, casts of over 225 fathoms could be obtained with this sounding apparatus, while the ship was travelling at a speed of 7 knots. Advantages gained were holding the ship on the desired course, increase of daily mileage of soundings, and economy of fuel.

Besides the leadline, other sounding instruments in common use at that time were the submarine sentry, the harpoon sentry, and the pressure type sounder. This is what dominion hydrographer N.G. Gray write about these early pieces of hydrographic equipment.

[9] Annual Report, Capt. Anderson. 1921.

[10] Labrador did not become part of Canada until 1949. [Ed.]

Submarine Sentry - It was frequently used by sailing masters of hydrographic ships when making a landfall, or examining submarine areas at fixed depths. The submarine sentry was basically a small winch filled with 1/8-inch wire, on the end of which was shackled a kite. This kite consisted of two flat pieces of wood fastened at right angles, a bridle to attach to the supporting wire and a trip arrangement on the lower and outer end. When thrown into the water from a moving ship, the kite would dive to a depth determined by the amount of wire paid out. For example, by paying out say 16 fathoms, the kite would maintain a depth of 10 fathoms. A table on the winch computed by manufacturers determined the amount of wire necessary to maintain a certain depth. When the kite hit bottom, the ship released one end of the bridle and the kite floated to the surface, and simply towed behind the ship. After striking bottom the strain came off the wire and rang a bell on the bridge to warn the officer of the watch.

Harpoon Sentry - This instrument was used for ship sounding when the depth of water was greater than could normally be managed by hand lead or by the fore-and-aft method aboard ship. The limiting depths for these methods were about 20 or 25 fathoms, beyond which it became impossible to get a straight up and down cast with the ship under way. A 70-pound lead, with the sounder attached immediately above it, was handled by a small winch driven by a two-cylinder steam engine. One-eighth-inch steel wire on the winch was adequate and soundings were easily obtained with the ship under way. A clapper fitted above the propeller of the sounder controlled its rotation and, consequently, the recording of the depth. As soon as the sounder struck the water, the clapper was raised, allowing the propeller to turn during its downward passage, on reaching bottom; the clapper engaged into a position preventing further rotation during the time the sounder was being hauled up. The depth was registered on the dials - one indicating 0 to 30 fathoms, while the other registered increments of 30 fathoms.

This equipment was used in Lake Superior in 1930 to sound the offshore area north of the International Boundary, where depths are generally over 100 fathoms. The maximum was 217 fathoms.

Pressure-type Sounder - As the name implies, this sounder registered the depth as a function of pressure. It was used in exactly the same way as the Harpoon Sounder. The reading scale was graduated from 0 to 110 fathoms and sounding was restricted to that depth of water.

Magdalen Islands

When the survey of the Great Lakes ended, it was decided to send the steamer *Bayfield* to the Gulf of St Lawrence to commence the recharting of the Magdalen Islands. This party, in the charge of Mr R.J. Fraser with assistants Messrs H.L. Leadman and N. Wilson, left Owen Sound early in the spring, and en route to the Gulf the *Bayfield* discovered an uncharted shoal in the entrance to Georgian Bay. When in Lake St Clair the boundary monuments which by order-in-council were placed under the jurisdiction of the hydrographic branch and which had been disturbed by the building of new roads, were

relocated." Before leaving Georgian Bay, both Capt. N. Barrett and the chief engineer, Mr John Nisbet, retired. They were replaced as sailing master by Capt. A. Fournier, and Mr S.C. Guenard as chief engineer.

Early in July the triangulation of the Magdalen Islands began, and large-scale plans were made of Amherst, Grindstone and Grand Entry harbours. Tidal records for these places were sent to Dr W. Bell Dawson, superintendent of the Tidal and Current Survey Division. When weather became unsuitable for work on the exposed coast of the Magdalens the *Bayfield* moved to the less exposed waters of Mirimichi Bay in Northumberland Strait. Here a small triangulation survey was made to connect work in the outer bay and the entrance channels with that of Public Works department, and noticeable changes in the dredged cut of the ship channel in the outer bay were found since the last survey in 1885. To assist with the inshore work of the Mirimichi River the Hudson Bay launch *Sea Louse* was shipped by rail from Lake Superior in the Great Lakes. On 28 October the *Bayfield* was laid up at Charlottetown, PEI, and the party returned to Ottawa. This season, 383 miles of ship and 465 miles of boat soundings were logged, and 22 miles of shoreline surveyed.

BRITISH COLUMBIA

This season the *Lillooet* and the auxiliary steamer *Restless* were in commission. The former, in the charge of Mr H.D. Parizeau with assistants Messrs Willis and Parker, began the season's work in Juan de Fuca Strait early in May. In company with the *Lillooet,* the *Restless* in the charge of Commander Knight, RN, with assistant Mr Davies, sailed for Seymour Narrows in Menzies Bay. Here a survey of Ripple Rock (demolished April 1958) was made for the Public Works department by the whole party. Work in Quatsino Sound was then extended by the *Restless,* and in Hecate Strait by the *Lillooet.* En route to Victoria in October, the *Lillooet* entered Vancouver harbour to inquire of the shoal spots removed in the First Narrows by the Public Works department, "so that a depth of 30 feet might be carried through ... with the exception of the small spot marking Parthia Shoal."

HEADQUARTERS STAFF, OTTAWA, 1921

Drafting Room

Six new engraved charts were printed, and eight others placed in the engraver's hands. Seven others were placed in the lithographer's hands, and twenty reprints made. At the end of the field season, Mr Cailloux of the *Carder* was reassigned to this section. Here he remained until he resigned about 1924.

Engraver's Section

Under agreement with the Printing Bureau, in December 1921 a small staff of copper-plate engravers was transferred to the hydrographic survey. This move was made to save commuting time between buildings in Ottawa, and for closer drafting-engraver relations. Five craftsmen were involved with this transfer: Mr W.C. Cunningham, chief engraver; senior engravers Messrs W. Watts, G. Silvers; junior engraver Mr W.A. Cunningham, and apprentice, Mr R.H. Cunningham.

Chart Distribution, 1921

A new edition of the catalogue of charts with index maps was prepared this year; and there were one hundred and thirty Canadian charts available to the public for Canadian waters. There was also a substantial increase in the demand for further editions.

1922-23

RETURN OF THE SURVEY TO MARINE AND FISHERIES

Four years had passed since the First World War ended, and echoes of departmental economics were quite audible on Parliament Hill. At that time the Department of the Interior was undergoing a reorganization, and to coordinate the armed forces better, the *National Defence Act, 1922,* became effective 1 January 1923. This new department came into being with the amalgamation of the old Department of Militia and Defence, the naval service and the Air Board. The future of the Canadian Hydrographic Survey was decided by order-in-council P.C. 1246, effective 1 July 1922. By it this branch of the naval service was returned to the Department of Marine and Fisheries, from which it came in 1910. Other technical branches under civilian command in the naval service were also transferred as follows: Wireless Telegraph (Radiotelegraph), Fisheries, and the Tidal and Current Survey. Ships and ship officers including crew etc. employed by these branches were also affected, and were likewise transferred to the Marine and Fisheries department. Hydrographic ships affected by this transfer were the *Acadia, Cartier, Bayfield, Lillooet* and *Restless,* and the *Gulnare* of the Tidal and Current Survey. On the Pacific coast, a launch and two scows were transferred to the British Columbia survey from the Esquimalt dockyard.

ATLANTIC COAST ACTIVITIES

Nova Scotia

The entire season of 1922 was spent by the *Acadia* on the Atlantic oast of Nova Scotia. Capt. Anderson, with assistants Messrs Leadman, Bent and Rogers sounded out the waters on the southeast coast between Liscomb Harbour and Canso and examined in close detail the offshore banks in this area. Early in September the ship moved to the southwest region of this coast to resound the offshore area between Lurcher lightship and Negro Point. Soundings were recorded to seaward to a distance twenty to forty miles over an area of 2,000 square miles. Later Mr Stewart reported, "the thirty and fifty fathom contours and several uncharted shoals are now accurately marked for the new chart." A plan of Yarmouth Harbour was also made this season, No. 422, printed May 1923 and drawn to a scale 1:12,000. Since 1919 *the Acadia* had experimented with RDF on the Atlantic coast, but only this year were the first actual trials made, "to locate offshore sounding, but owing to the distance of the stations results were not entirely satisfactory for the accurate location of the ship."[12] At the end of the field season, Mr R.A. Rogers, who had been with this Survey since 1913, was transferred to the Department of Mines.

[12] See below, Atlantic Coast, 1923.

Steamer *Acadia* and Winter Ice-breaking, 1922-1923

To curtail duplicate expenditures and to effect economies where feasible, the Department of Marine and Fisheries about that time seriously considered the amalgamation of hydrographic ships with others in the department. To this proposal the chief hydrographer, Mr Stewart, is believed to have taken a strong adverse stand, claiming that survey ships were specially designed and equipped for that specific purpose only and to use them for other marine purposes would not be in the best interests of the department. He even suggested that if this were to become a reality, the regular ship officers, and if possible a qualified hydrographer, should be aboard for cautionary reasons. One experiment with survey ships was made in the winter 1922-1923 - one that ended the brief career of the steamer *Acadia* as an ice-breaker.

In the fall of 1922 when the survey season ended, Capt. S.A. [sic, probably W.A.] Robson was instructed to keep in touch with various harbour authorities between Halifax and Cape Sable during the winter to keep them as free as possible from ice. This work began on 20 December and ended on 18 March when the rudder-stock was so badly damaged that further work was impossible. The weather proved unusually severe, making ice-breaking rather too heavy for a vessel of the *Acadia's* build. She was built forward so that she could run up on ice and bear through it with her own weight, but to hammer at sheet ice with her style of bow was likely to lead to disaster.[13]

ST LAWRENCE

Lower St Lawrence

In 1922 the *Carder* spent part of the season on the Gaspe coast working between Cape Magdalen and Cape Rosier, and then moved to the west end of Anticosti Island. Assistants with Mr Savary were Messrs Bowes and Foreman. Sailing master was Capt. J. Roach, and chief engineer, Mr J.E. Belanger.

Seven Islands Survey

A detached survey from the *Carder* was in the charge of Mr E. Ghysens, with assistant Mr F.C.G. Smith, and continued the resurvey of Seven Islands, begun the previous year. Chart No. 214, "Seven Islands," scale 1:48,000 was printed in February 1924, the first Canadian chart for the north shore, Gulf of St Lawrence.

Magdalen Islands Survey, 1922

In the interests of departmental economy, sufficient funds to make the *Bayfield* more seaworthy were lacking in 1922 and she was not commissioned. This meant the Magdalen Islands survey had to be temporarily suspended. A shore party was then organized by Mr R.J. Fraser, with Mr N. Wilson as assistant. With the aid of the former Hudson Bay survey launch *Sea Louse,* the survey of Mirimichi Bay, NB, was resumed. The outer and inner bays were sounded, and the coastline surveyed from Escuminac and Neguac Gully to the mouth of the Mirimichi River. Mr Wilson reported, "the last time I saw the *Sea Louse* was on the bottom of Chatham Harbour after an October storm." This could have been in the fall of

[13] Stewart, report D.N.S., 1922, 126.

1922, because certain evidence indicates this launch was used for water-level investigations in Hamilton Inlet the following year. It had been intended to move the party to Caraquet Harbour in Chaleur Bay when the Mirimichi work ended, but instead it was transferred to the Richelieu River, PQ, below Montreal.

St Lawrence River above Quebec

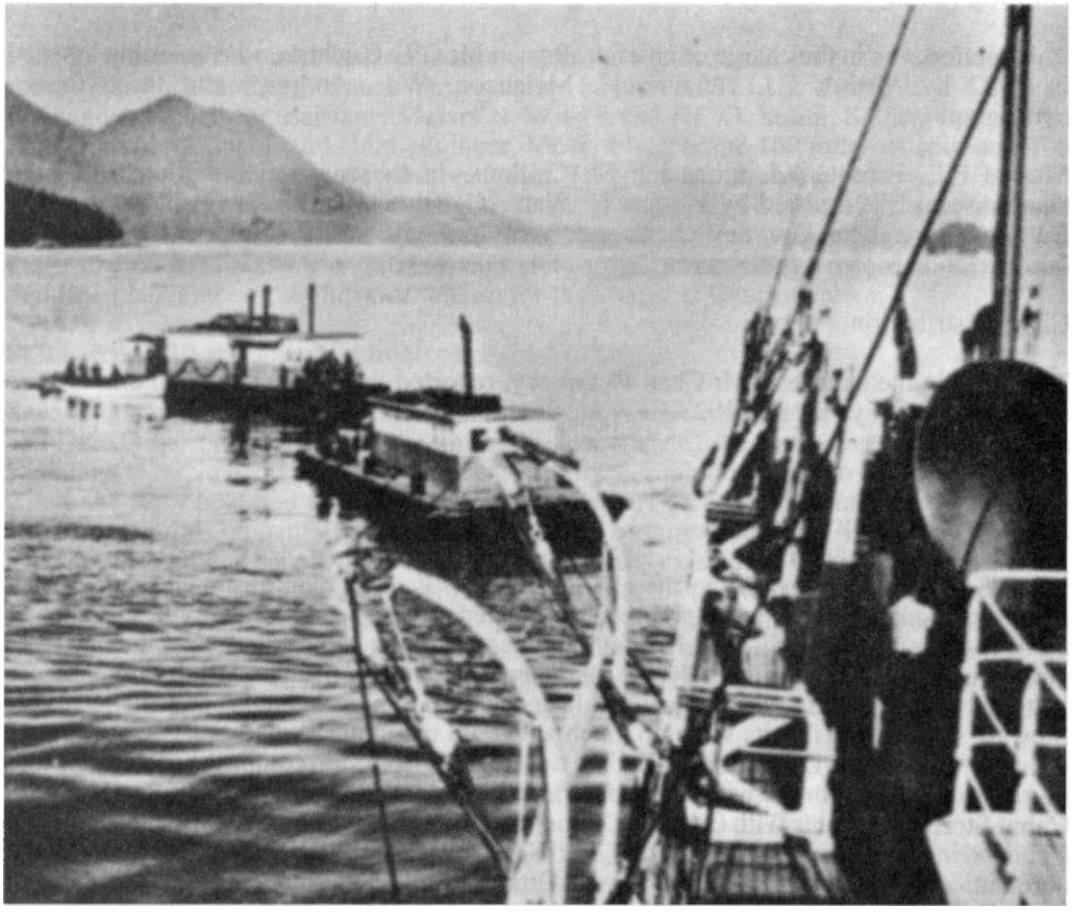
About the end of August 1922, the Magdalen Islands party arrived at Saint Jean, PQ, from Mirimichi Bay, and began a triangulation survey of the Richelieu River between Lake Champlain and the St Lawrence River. This work was necessary to tie in the various Public Works plans of this river into one modern chart. Buoys, lighthouses, permanent land marks, and other aids to navigation were located, and the whole survey was connected with the international boundary monuments at the foot of Lake Champlain, two geodetic survey stations, several church spires whose positions had been established, and the river triangulation at Sorel, PQ. Two sheets of the Richelieu River were prepared, No. 25 and 26, and published October 1923 and January 1924, respectively.

BRITISH COLUMBIA

The *Lillooet* and *Restless* in 1922 were again in service under the command of Mr H.D. Parizeau. This year Capt. J.J. Moore replaced Capt. F.H. Griffith (first sailing master, 1908); with Mr A.R. Borrowman still chief engineer (since 1911). Mr Parizeau, CGS *Lillooet,* was assisted by Messrs Willis and Parker from the Victoria office, and Messrs J.U. Beauchemin and J.B.T. Lewis on loan from headquarters. Work began in Vancouver harbour to assist Public Works engineers in locating and removing large boulders in First Narrows. Other areas visited by the *Lillooet* were Allison Harbour, Ocean Falls, Lockeport Harbour, Hecate Strait and Borrowman Bay where a camp was placed. Ship work ended with a resurvey of Kagan Bay, Skidegate Inlet. The *Restless,* in the charge of Commander Knight with assistant Mr Davies, worked this season in Johnstone Strait and Gunboat Passage, and in early November spent a brief period in Malaspina Strait with the *Lillooet.*

HMCS Stadacona and the Hydrographic Survey

In his annual report for 1922, Mr Stewart made passing reference to a suggested offer of a Canadian naval vessel for hydrographic surveying, but for want of funds it could not be had. "Upon breaking up of the Naval Service Department the *Stadacona* was handed over for surveying purposes. This boat, a sister ship of the United States Coast and Geodetic Survey vessel *Pathfinder,* would no doubt be useful for surveying purposes on the Pacific Coast. Unfortunately lack of funds for reconditioning her and for placing a survey party on board ... she was left with the Dockyard at Esquimalt." However, Mr Parizeau did acquire from the naval service three small units for surveying purposes: the 36-foot launch *Thistle,* the scow *Somass* on permanent loan, and another scow the *Fraser,* on temporary loan. The latter two were remodelled as houseboats and used on this coast until replaced by the new houseboat *Pender* in the early 1930s. The "camp launch" *Thistle* was also in service until 1928, when she became a total fire casualty.



The *Somass*
photo courtesy CHS

HEADQUARTERS STAFF, OTTAWA, 1922

Automatic Gauges

Due to ice and flood conditions the ten gauges on the St Lawrence River between Montreal and Quebec were kept in operation during the navigation season only. Between Montreal and Lake Ontario sixteen gauges were in operation all year round, and in the Great Lakes, with the exception of Port Dalhousie, there were eleven all year gauges. Twenty-eight were Haskell model gauges that gave a continual graph of the water's surface, and eight were Gurley printing gauges that recorded half-hourly readings on a strip of paper. This section was in the charge of Mr Chas A. Price, junior hydrometric engineer (since 1919) with assistance of hydrometric recorders Messrs Wm J. Miller, C.F. Hannington, C M . , A.R. Lee and A.S. Matthewman (January 1923).

Drafting Room

This section was in the charge of chief draftsman Mr G.L. Crichton, who was ably assisted in 1922 by Messrs F.J. Delaute, H. Melancon, W.L. Andrews and three former hydrographers

Messrs P.E. Parent, A.J. Pinet and M. Cailloux. In the engraver's section, Mr W.C. Cunningham was assisted by Messrs W. Watts, G. Silvers, and his two sons Walter and Robert Cunningham. Four new charts and twenty-one editions of older charts were printed this season.

Chart Distribution

This unit, in the charge of Mr Chas McGreevy, reported that 7,110 copies of charts were sold in the fiscal year 1922-1923.

1923-24

ATLANTIC COAST

In 1923 the steamer *Acadia,* in the charge of Capt. F. Anderson, resumed work off the southwest coast of Nova Scotia where she extended offshore sounding into the entrance of the Bay of Fundy to the 50- and 100-fathom lines. Currents in the entrance to the bay were also investigated and found to be very irregular. About the end of June, a radio compass was installed on the *Acadia* with a specially designed aerial. In his annual report for 1923, Mr Stewart stated, "the results were not such as would recommend it for survey purposes." Bearings from shore DF stations varied by two degrees from ship compass bearings. Before berthing at Halifax for the winter, the *Acadia* calibrated the DF station on St. Paul's Island, Cabot Strait. Assistants with Capt. Anderson in 1923 were hydrographers Beauchemin and Bent and instrument man W.T. Thorne (until September) and H.P. Williams (assigned to the automatic gauges section upon his return to Ottawa). Sai ling master *of the Acadia* was Capt. W.A. Robson, and this summer Mr John S. Cann replaced Mr T.A. Shortt as chief engineer.

ST LAWRENCE

Lower St Lawrence

With apparatus loaned to the *Carder* by the ship channel branch, a sweeping survey of the Saguenay River between St Fulgence and Chicoutimi was made in the summer of 1923 by Mr Chas Savary, assisted by Messrs Bowes and MacKinnon. About the middle of June, the *Carder* was again off the Gaspe coast working between Cap Rosier and Point Peter, and from the Southwest point to West Point, Anticosti Island. For the benefit of a new pulp industry, a survey of the Bersimis River was undertaken from its mouth to a point six miles up. This season the field staff was greatly reduced owing to the illness of both Messrs Ghysens and Foreman. However, some 13,000 linear miles of ship sounding and 400 miles in the boats were completed, together with 30 miles of traversing. The *Carder* returned to Quebec at the end of October and was placed in drydock for renewal of her decks.

Magdalen Islands

In 1923 the *Bayfield* underwent temporary repairs at Halifax, and early in July arrived off the Magdalen Islands to resume the resurvey begun in 1921. In charge was Mr G.A. Bachand, who had for assistants Messrs N. Wilson and F.C.G. Smith. Sailing master was Capt. J.C. MacDonald, and chief engineer, Mr R. Blair. Some 100 miles of ship and 400 miles of boat soundings were observed, and 35 miles of shoreline traversed. Early in October the *Bayfield* left for the Restigouche River at the head of Chaleur Bay, where she examined and remarked the channels between Campbellton and Dalhousie, N B. Seventeen miles of this river were triangulated, and sixty miles of soundings recorded. About the middle of November, the ship was laid up for the winter at Charlottetown, PEL

St Lawrence River above Montreal

Several complaints were received this season from vessels touching bottom between Sorel and Lake Ontario on account of the unusually low stage of the water level. These matters were then taken in hand by Mr R.J. Fraser. The first complaint was from Montreal harbour where the ferry boat had difficulty in reaching a wharf on St Helen Island (the site of the 1967 Centennial Exposition). Another was above Montreal between Morrisburg and the head of the Cornwall canal where only American charts existed for that portion of the river. In his annual report, Mr Stewart strongly recommended, "that a new survey of this part of the River be made without loss of time." The only charts, he claimed, "are from American sources ... made by the Lake Survey many years ago when the appliances for proper hydrographic work were not so fully developed as they are today. The channels are all on the Canadian side of the boundary line and nine-tenths of the traffic is Canadian in Canadian waters."

BRITISH COLUMBIA

In 1923 the Victoria office had its largest fleet to this time: *Lillooet; Restless;* houseboats *Somass* and *Fraser,* and the 36-foot cabin "camping launch" *Thistle.* The *Somass* and *Fraser* were commissioned this season to replace the usual camping party ashore. Mr H.D. Parizeau, CGS *Lillooet,* was assisted by Messrs Willis and Parker, and Commander Knight, CGS *Restless,* by Mr Davies. This season Mr H.L. Leadman was sent from Ottawa to take charge of *Somass, Fraser* and *Thistle,* and was assisted by Mr Lewis. For seven years Mr Leadman had been assistant to Mr Parizeau in Lake Superior (prior to his taking charge of the Victoria Office), and when the season ended he elected to return to Ottawa.

First surveys this year were in Victoria and Esquimalt harbours by *Restless* and *Somass.* During this time, *Lillooet* proceeded to Vancouver harbour to assist the Public Works department with its sweeping of First Narrows, and then visited Esperanza Inlet to examine some reported rocks. In the first week of June, the whole party left Victoria for Genoa Bay, and then Okisollo Channel and Surge Narrows. With the aid of *Somass,* Caamano Sound was surveyed in Borrowman Bay. Various areas of the Queen Charlottes and Skidegate Inlet were also investigated, and a commencement was made of a resurvey of Porlier Pass for the Department of Public Works. Commander Knight worked mainly in the area from Idol Point to Ocean Falls, and, as a result of this survey, many improvements were made in the charts of the British Columbia coast. When the party returned to Victoria on 15 November it took up new quarters in the British Columbia Loan Building.

During March 1924 Messrs O.R. Parker and J.B.T. Lewis resigned. Mr Parker had been with the survey since 1910. Mr Stewart noted that the departure of "men of such

experience from the staff is a distinct loss to the service because hydrographic surveyors cannot be picked up." From 1910 to 1911 Mr Parker was first officer, CGS *Lillooet,* and was transferred to the survey staff in 1911. During the war he served overseas as a lieutenant with the RNVR from 1916-19.

Economy and the British Columbia Survey, 1923

The following extract from Mr Stewart's annual report for 1924 indicates the trying times the Hydrographic Survey was passing through in the early 1920s. "The work of the Hydrographic Survey in British Columbia is particularly important, most of the old charts are very much out of date and new rocks are from time to time being reported. Calls are frequently made on the survey for examinations and much time is lost in running about to get this information. It is hard to see how such a condition can be avoided unless more funds are put at our disposal and the staff increased with additional steamers." The year 1923 was to be the last season for the *Restless* on hydrographic work. She was laid up in 1924, and sold out of government service in 1927.

HEADQUARTERS STAFF, OTTAWA, 1923

Automatic Gauges

In addition to regular maintenance in 1923 a few automatic gauges were installed in Hamilton Inlet on the Labrador Coast by Mr Price personally, with assistance of Mr J.R. Dupuis of the administration staff. This work was carried out in conjunction with other water-level investigations by Mr H.W. Jones of the Tidal and Current Survey Division, assisted by Mr G.L. Crichton of the hydrographic survey. Preliminary water-level observations had been made in Lake Melville by the hydrographic survey back in 1921, and these new investigations were undertaken to ascertain whether or not mean sea level was higher in Lake Melville than on the open coast, or vice versa. This work requested by the Department of Justice was most useful in determining the definition of the Canada-Labrador boundary a few years later. During Mr Price's absence in Hamilton Inlet, Mr Wm Miller was placed in temporary charge of the section, with assistance of Messrs Lee, Hannington and Matthewman. Early this year Mr W. A. Thorne was appointed an instrument man with the survey, and before being sent to the *Acadia,* spent a short period in this section. Following his resignation, he was replaced on the *Acadia* in September by Mr H.P. Williams, who was assigned to this section in the fall. Late in December 1923, Mr A.R. Lee, who had been with the automatic gauges section since 1914, resigned, and before the fiscal year ended he died from illness.

Drafting Rom

With Mr Crichton on special duty in Hamilton Inlet, the staff of the drafting room was fully occupied. Later Mr Stewart wrote, "the present staff is barely able to keep up with the ordinary routine, and advantage cannot be taken of photo-lithography." This fiscal year ten new charts, and forty-eight editions of older sheets were printed.

Chart Distribution

This year 10,000 charts were sold, and the demand for them was consistently increasing.

Hydrographic Expenditure, 1923-1924

The largest expenditure in its forty years of history was spent by the hydrographic survey in the fiscal year 1923-24, and this figure was not to exceed until the hydrographic service came into being in 1928. For the record here are a few statistics: Atantic coast, $65,824; Lower St Lawrence, $78,359; Magdalen Islands, $36,994; Pacific coast, $108,996; Automatic Gauges, $18,163; Headquarters & miscellaneous, $43,173. The total was $351,479.

1924-25

Three typical examples of departmental economy during the fiscal year 1924-1925 were of special significance to the hydrographic survey. First, its appropriation was reduced by one-quarter of its 1923 figure, secondly, three survey ships were laid up - over half the fleet, and thirdly, the Tidal and Current Survey Division was placed under the supervision of the chief hydrographer. For obvious reasons the tidal survey story shall conclude the hydrographic narrative for this fiscal year.

ATLANTIC COAST SURVEY

With the *Acadia* not in service, Capt. F. Anderson was assigned to headquarters to write a volume of sailing directions for Lake Superior - an area he resurveyed 1902-1908. To aid the fishing industry on the southwest coast of Nova Scotia, a shore party was organized with Mr R.J. Fraser in charge, and assistant Mr R.W. Bent. A plan was made of Lockeport harbour, and a partial survey completed for Lunenburg harbour. For this survey the Hudson Bay launch *Sea Louse* was used, and Mr Fraser reported, "her hull and engine worn out... laid to rest on the dockwall of the Naval Yard at Halifax."

ST LAWRENCE

Lower St Lawrence

Mr Savary had with him as assistants on the lower St Lawrence Messrs Ghysens, Beauchemin, MacKinnon, Foreman and Smith. A detached survey party consisting of Messrs Ghysens and Smith began the resurvey of the Mingan Islands. The *Cartier* worked on the coast of Anticosti Island from West Point to Southwest Point, and in Gaspe Bay and Harbour on the mainland. Near the end of the season, a special survey was made in Quatechu Bay, North Shore, by Mr J.U. Beauchemin, on behalf of the Feldspar Company. A revision of the lower St Lawrence Pilot covering all new work was in the hands of the King's Printer, and the French edition was also being revised to conform with the English revised edition.[14]

Magdalen Islands Survey

Due to lack of funds for badly needed repairs, the *Bayfield* was not in service in 1924. The recharting of the Magdalen Islands was resumed this season by Mr G.A. Bachand and assistants Messrs H.L. Leadman and N. Wilson. With the aid of small boats, the west and

[14] Stewart. Report M & F 1924. 118.

northwest parts of the islands between Grindstone Islands and Cape North were triangulated, traversed and sounded out, over an area of 55 square miles. This entailed 515 miles of boat sounding and 101 miles of coastline. Early in October the party moved to Chaleur Bay, where it completed the recharting of the north shore of the Restigouche River between Campbellton and Dalhousie. Continuous tidal recordings were obtained this season in both these localities.

BRITISH COLUMBIA

With the steam tug *Restless* laid up this season in the charge of the engineer Mr T. Salmon, only the *Lillooet* and house boat *Somass* were in service. Survey assistants with Mr Parizeau in 1924 were Commander Knight and Messrs Davies and Willis. The *Somass,* in tow of the *Lillooet,* began the season's work in Vancouver harbour where several shoal areas in First Narrows were swept for the Public Works department. Surveys were then taken up in San Mateo Bay and Barkley Sound. Work in Porlier Pass was ended, and a plan made of Port Neville. This season ended in Caamano Sound, and Cumshewa Inlet. In charge of the *Somass* was Commander Knight, who was assisted by Mr Davies. Current observations over a period of ninety-nine days were recorded for times of slack water in Meyers Passage.

Admiralty Charts for British Columbia and a New Hydrographic Steamer

In his annual report for 1924, Mr Stewart stated, "the work of the hydrographic survey in British Columbia is particularly important, for most of the Admiralty charts are very much out of date and new rocks from time to time being reported. Requests are frequently made for examinations so that much time is lost running about to get this information whereas if another steamer were available to carry on this important work, a great deal of time would be saved and better results obtained."

HEADQUARTERS AT OTTAWA, 1924

Automatic Gauges

Thirty-six automatic gauges were in operation in 1924 on the St Lawrence River and Great Lakes. This season a special water-surface transfer was made by Mr Price in the Lake Memphremagog district to connect Magog, PQ, with Vermont, USA. This information was requested by the superintendent, precise levelling, Department of Public Works. In the fall of 1924, Major C.F. Hannington, C.E., having been with this section since 1915, resigned, and Mr Price was obliged to carry on with the assistance of Messrs Miller, Matthewson and Williams.

Drafting Room

This unit in the charge of Mr G.L. Crichton, who was ably assisted in 1924 by Major F.J. Delaute and Messrs P.E. Parent, H. Melancon, A.J. Pinet and W.L. Andrews. In October, Mr J. Brown, a senior copper-plate engraver was added to Mr W.C. Cunningham's staff. Mr Stewart stated, "now the drafting room is quite able to keep pace with the returns from the field."

Chart Distribution

This section, in the charge of Mr Chas McGreevy with the assistance of Mr A. Carbonneau, clerk-messenger, distributed some 9,500 charts to the public, including eight editions of new charts and twenty-five new editions of older charts.

CHARTING CANADA'S SEA-COASTS, 1905-1924

For the records, the following extracts are taken from a sketch "Hydrography Past and Present" given in the annual report of Capt. F. Anderson, chief hydrographer.

> i) On the Atlantic coast the charting and examination of the bottom some twenty miles offshore, 25,000 square miles have been completed within the area Belle Isle to the Bay of Fundy, and 100,000 square miles still remain to be done.
>
> ii) Of this area the most urgent is the so-called north shore of the Gulf of St Lawrence from Pointe des Monts to the Labrador boundary, some 550 miles. This stretch includes the channel along the north side of Anticosti Island which is being extensively used.
>
> iii) That portion of the coast of Cape Breton from Cape Canso to Scateri Island is practically uncharted as yet.
>
> iv) The Magdalen Islands is only half-completed.
>
> v) The entrance to the Bay of Fundy was wel I sounded out in 1923 and the results show that the contours on the existing Admiralty chart were sadly out, and the cause of many complaints by ships' masters ...
>
> vi) Concerning the existing charts of the Gulf of St Lawrence, it is a misnomer to call them charts ... coastline on a very small scale, and a few soundings are more of a menace than a benefit as they are apt to mislead one ...
>
> vii) It appears unlikely but one can never tell when a demand will be made for a complete survey of the Labrador coast to Cape Chidley, some 700 miles, and also Hudson Bay and Hudson Strait, some 2,500 and 900 miles of coastline respectively.
>
> viii) On the Pacific coast conditions are much worse than on the Atlantic coast, some 5,500 miles of coastline remain to be completed, although 2,700 have been charted ... Charted areas on this coast has totalled 3,300 square miles, with 38,300 square miles to be charted.

In conclusion it was stated, "if Canada ... is to hold her place in the maritime nations of the world the hydrography of her shores must be pushed to completion to insure up-to-date charts to keep pace with the ever-increasing requirements of snipping."

One more event of hydrographic importance occurred in the fiscal year 1924-1925

that was to climax the regime of Mr Wm J. Stewart. This was the departmental transfer of the Tidal and Current Survey Division to the Canadian Hydrographic Survey.

THE TIDAL AND CURRENT SURVEY DIVISION AND ITS AMALGAMATION WITH THE CANADIAN HYDROGRAPHIC SURVEY, 1884-1924

The Tidal and Current Survey and the Canadian Hydrographic Survey had much in common with each another. Each had its commencement in the Department of Marine and Fisheries in the last quarter of the past century, and each was formed primarily to aid shipping and navigation in Canadian waters. As early as 1884 Staff Commander J.G. Boulton began recharting the waters of the Great Lakes in Georgian Bay, and in this year tidal and current investigations were conducted along the Hudson Bay route by Lieutenant Gordon, RN (commander, Hudson Bay expeditions 1884-1886). Lieutenant Gordon had been employed by Meteorological Service (Toronto Observatory) since August 1880 and in 1884 was loaned from this service to head the first Canadian expedition to Hudson Bay. He had with him a team of scientific observers from other observatories in eastern Canada, who were stationed ashore in seven harbours and anchorages along the Hudson Bay route between Port Burwell (first readings)and PortsNelson and Churchill. Under his direction, meteorological, ice, tidal and current, and other scientific observations were systematically recorded. The range of local tides was recorded and determined from staff gauge readings. A party aboard the steamer *Neptune* recorded preliminary data of the velocities and directions, offsets, of the tidal streams in critical sections along the Hudson Bay route. These are believed to be the first official tidal and current observations by Canadian authorities in Canadian waters, and they were the prelude of others that were soon to follow.

EARLY PETITIONS AND REQUEST FOR TIDE TABLES AND TIDE GAUGES, 1884-1886

While the Department of Marine and Fisheries was so occupied in 1884, and agitation for Canadian tide tables and tide gauges on the sea-coasts began with the British Association for the Advancement of Science. At a meeting in Ottawa this year with the minister of Marine and Fisheries (the Honourable Mr A.W. McLelan), a deputation from this association stressed the immediate need for both these requirements, and at the same time informed the minister that the United States government had already begun the publication of its own tide tables for the Atlantic and Pacific coasts. It further urged the minister that it would be in the best interests of Canadian shipping and navigation if the government would consider doing likewise. In reply, the minister advised this deputation of the heavy expenditures being made by his department on behalf of the Georgian Bay Survey, and the Gordon expedition in Hudson Bay. For the present, he would make no definite commitments.

Not too happy with this decision, another deputation from the British Association, and one from the Royal Society of Canada, backed by endorsements from the Montreal and Quebec Boards of Trade, again petitioned the Canadian government in 1885. At a meeting with the new minister of Marine and Fisheries (the Honourable Mr Geo.E. Foster), and the prime minister (Sir John A. Macdonald), held in Ottawa early in January 1886, it was hoped that a work so necessary and useful to the commercial interests of the country could commence in the near future.[15]

These were the first petitions and requests for Canadian tide tables and tide gauges,

" Dawson Report, M & F 1893. 29-42

and from them came the first intimation that the government had given these matters consideration. The first positive step in this direction came in 1887 and three years later (1890) the Tidal Service became a continuing function of the Meteorological Service.

PRELIMINARY TIDAL INVESTIGATIONS BY THE METEOROLOGICAL SERVICE IN EASTERN CANADA, 1887-1890

Tides

With the Hudson Bay investigations now ended, the minister of Marine and Fisheries authorized the director of the Meteorological Service, Mr Chas Carpmael, to have Lieutenant Gordon undertake a series of tidal comparisons on the east coast, for the purpose of checking the tidal predictions with the actual tides. These tests were conducted by Lieutenant Gordon, at Georgetown, PEI, (Charlottetown), Pictou Harbour, Port Hawkesbury (Strait of Canso), and Louisburg Harbour, NS. In his annual report "Respecting Tidal Predictions" dated 10 February 1888, Lieutenant Gordon pointed out "that in the 18 years from 1870 to 1887 the aggregate loss in shipping was over fifty million dollars, an average of $2,782,000 per annum, and in the same period there was a loss of 4308 lives, and average of 240 per year." He added that "if we could get a record of the narrow escapes, the delays, and the errors of position discovered when a fog clears away no further argument would be required."[16] He therefore recommended that three new tide gauges be purchased and that they be installed on the east coast: one, on the southwest coast of Nova Scotia; another, in the entrance to the Bay of Fundy; and a third, at some suitable location on the St Lawrence River. He also recommended that the old Admiralty staff gauge readings for Halifax (1860, 1861) be acquired from the Halifax archives, and they be worked up for better tidal predictions. For new tide tables and tidal stations, it was estimated the sum of $10,000 would be required.

Tidal Streams

During the navigation season of 1888, Lieutenant Gordon was busily occupied cruising the waters of the Gulf and St Lawrence River in department ships, making test observations of the tidal streams in strategic localities, and in acquiring first-hand information from shipping companies and experienced ship officers. In his second annual report, he recommended that a systematic study of the tidal currents in the Gulf of St Lawrence be started along the main steamer routes from the Atlantic Ocean, and that this work should not be delayed in commencing. It was estimated the sum of $ 140,000 would now be required for both current and tidal work - $40,000 for tidal current investigations, and $100,000 for ten consecutive years of tidal records from six ports of reference, or principal stations.

By December 1889, no official action had been taken on these recommendations. Political pressure was again exerted on the Government by these scientific associations, supported by a list of signatures from 393 masters and officers of vessels. Departmental action soon followed, and the Tidal Survey had its actual commencement the next fiscal year.

[16] [Cited in] Report Mr H.W. Jones, chief. Tidal and Current Survey, 1943.

THE METEOROLOGICAL SERVICE AND THE TIDAL SURVEY, 1890-1893

With an appropriation of $2,000 for tidal work in 1890, the Meteorological Service purchased three new tide gauges from J. White, in Edinburgh, Scotland, and the old Admiralty tidal records for Halifax harbour were sent to Mr Edward Roberts of the Nautical Almanac Office in London for tidal analysis and predictions. Because these new gauges could not be had before the end of the navigation season, another self-registering unit (Stierle Model) was purchased in Philadelphia, USA. It was installed on the south coast of Nova Scotia - in Liscomb Harbour (where Commander J. Orlebar, RN, once had a staff gauge when charting this coast for the British Admiralty). This was the first automatic gauge to be installed on the sea-coasts by the Meteorological Service. It was discontinued after one season's records. In 1890, another type of gauge - a staff gauge with an indicator on the face - was placed in Canso Harbour for the purpose of aiding fishermen from the Grand Banks frequenting this former French fishing station.

In the fiscal years 1891, 1892 and 1893 the sum of $10,000 was voted to the Meteorological Service for tidal work - an amount that was insufficient to undertake current investigations. In 1891 the first Canadian tide tables were printed and issued to the public-Halifax Harbour, NS. Early in October of this year Lieutenant Gordon left the Meteorological Service to accept a position as commander with the Fisheries Protection Service, Department of Marine and Fisheries. He remained with this service until ill health brought on his death in March 1893. With Lieutenant Gordon's departure, tidal field work fell on the shoulders of the director, Mr Carpmael, who on account of other duties was unable to accomplish more than a tour of eastern Canadian ports to look over suitable tide-gauge sites for future installations.

Transition

By an Act of Parliament (55-56 Vict. Chap. 77) assented to 12 April 1892, all technical work in the Department of Marine and Fisheries was placed under the direction of the chief engineer of this department, Mr Wm P. Anderson. This included hydrographic surveys and tidal observations on the coasts of Canada. Officially this meant the transfer of tidal work from the Meteorological Service of this department to the chief engineer's branch, but until such time as these proper administration changes could be effected, Mr Carpmael continued to supervise and develop this work on the east coast. By November 1893 the official transition was completed, and with the appointment of Mr W. Bell Dawson the following month as engineer in charge of Tidal Surveys, the responsibility for Canadian tidal surveys ended with the Meteorological Service of the Department of Marine and Fisheries.[17]

In July 1892, Capt. Bloomfield Douglas, RNR, was named Lieutenant Gordon's successor, and this summer in company with Mr Carpmael several potential tide-gauge sites on the east coast were visited in departmental ships. By December of this year, one tidal station had been built on Anticosti Island (Southwest Point) and another in Saint John harbour, NB - the first port of reference, or principal station, on the Atlantic coast.

The year 1893 was the last field season for tidal work under the Meteorological Service, and by November, three additional stations had been built-a total now of five. This network, covered the main shipping routes between the Atlantic coast and the St Lawrence River - the gateway to western Canada. There was now one tidal station on the Atlantic coast (Saint John, NB), three in the Gulf of St Lawrence (Southwest Point, Anticosti Island;

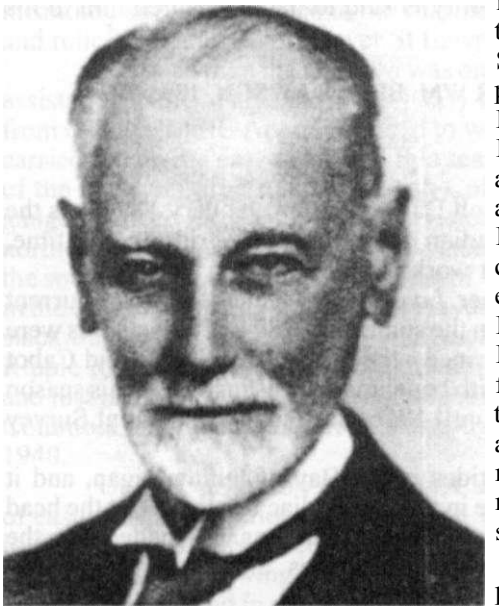
[17] Dawson Report, M&P 1893. 42

Grindstone Island, Magdalen Islands; and St. Paul Island, Cabot Strait), and one on the St Lawrence River (Quebec harbour, Lauzon Drydock at Levis). Tide tables for Halifax were in circulation, and others were being calculated. To this time, however, tidal-current surveys had yet to begin. This was the tidal heritage the Meteorological Service passed on to its successor, W. Bell Dawson, and the nucleus of an organization that by 1909 had reached the coastal waters of British Columbia, and in 1923 the waters of Labrador.

CANADA'S FIRST SUPERINTENDENT, TIDAL AND CURRENT SURVEY - DR W. BELL DAWSON, M.A., MA.B., D.SC, M.E.I.C., M.I.C.E. (ENG.), FRSC, 1854-1944

William Bell Dawson scholar, author, lecturer, civil engineer, land surveyor and international tidal authority, was born in Pictou, NS, on 2 May 1854. His father was Sir William Dawson, principal of McGill University 1853-1893, and his brother was the noted Canadian naturalist and geologist George Mercer Dawson. Dawson City in the Yukon Territory was named after this Canadian geologist. W. Bell Dawson, as he signed himself, came to Montreal at an early age and received his early education in schools there. In 1873 he graduated with a Master of Science degree from McGill University, and was a gold medallist in geology and natural science. He then left Montreal for Paris where he attended Ecole des Ponts et Chausses, and in May 1878 graduated with a diploma (equivalent to a M.Sc. degree in Montreal), coming first in his class.

Following his return to Canada, he was admitted as a registered land surveyor in the province of Quebec. In the next few years while in private engineering practice, he made a topographic survey of a gold field in Nova Scotia, and worked on preliminary surveys and plans for a proposed tunnel under the St Lawrence River between Montreal and Longueil. In 1882 he joined the Dominion Bridge Company as a designer of bridges and other steel structures, and in 1884 was employed by the Canadian Pacific Railway Company, mainly on bridge contracts in western Canada. He was appointed engineer in charge of the tidal survey in the Department of Marine and Fisheries on 1 December 1893, and in September of the following year, when permanently appointed to the Inside Service, he became Canada's first tidal and current surveyor. From then until his retirement, he was completely dedicated to national and international problems and their solutions. He had been Doctor Dawson since 1902, and in 1908 by order-in-council his position was renamed superintendent, Tidal and Current Survey. On 1 July 1924, Dr Dawson retired from the public service and returned to Montreal. Here he took up residence in Westmount where he lived until his death on 21 May 21st, 1944, aged 90.



William Bell Dawson
photo courtesy CHS

In the summer of 1884, the first systematic tidal-current investigations were inaugurated by Bell Dawson in the Gulf of St Lawrence, and with his cooperation the first

Canadian tide tables for British Columbia were printed in 1901 from Public Works records. He built his first tidal station on the Pacific coast in 1902, and in 1921 published a report on Arctic tides. While in charge of the Tidal and Current Survey, he wrote and published sixteen official publications on tides, tidal currents, tide levels and datum planes (Atlantic and Pacific coasts), and temperatures and densities of waters in eastern Canada.

Dr Dawson's reputation as an international tidal authority began following his first official visit to Great Britain and Europe in 1914. Here he met tidal experts from British, French and Netherlands offices, and personnel of the nautical almanac in London. He attended a conference of the International Research Council, in Rome, in 1922, where subjects on astronomy, geology and oceanography were discussed. Matters pertaining to tidal predictions by the Tidal Institute of Liverpool (founded 1919, and since 1923 calculated for the Canadian Government) were later discussed [sic]. In 1923 he was again a Canadian delegate to a conference of the American Geophysical Union, in Washington, USA, and in 1924 attended a meeting of the International Union of Geodesy and Geophysics in Rome.

In tribute to his many scientific works he was again awarded the Watt Gold Medal of the Institute of Civil Engineers in London, and two prizes for his research in tide levels and tidal streams by the Academy of Sciences, Paris. He was a laureate of the last-named academy, a Fellow of the Royal Society of Canada, a Member of the Engineering Institute of Canada and a Member of the Institute of Civil Engineering (London). He was a prolific writer, not only on scientific subjects but also of religious articles. Several of his religious writings were translated into Chinese, Japanese and the Korean languages. His humility was characteristic of him at all times, and his high ability is said to have endeared him to his fellow associates.

THE TIDAL AND CURRENT SURVEY UNDER DR W M BELL DAWSON, 1893-1924

1894-1914

One of the first official tasks undertaken by W. Bell Dawson before January 1894 was the preparation of a detailed report on early Canadian tidal activities prior to his time, containing recommendations for tidal and current work in the future.[18]

With the aid of the departmental steamer *Lansdowne,* systematic tidal current investigations were commenced on the east coast in the summer of 1894. These studies were conducted in the entrance to the Gulf of St Lawrence - the Strait of Belle Isle and Cabot Strait. The practice of referencing tidal stations with benchmarks was instituted this season by Bell Dawson at Forteau Bay, PQ. From then until 1956, the Tidal and Current Survey was more commonly known as the "tidal survey."

In 1899 a systematic study of the high tides in the Bay of Fundy began, and it included observations of the well-known tidal bore in the Petitcodiac River, NB, at the head of this bay. The next year, a similar study from secondary tidal stations was made along the St Lawrence River, below Quebec, and in certain localities along this waterway, measurements of the times of slack water were obtained.

With the cooperation of W. Bell Dawson the first Canadian tide tables for British Columbia were printed from Public Works tidal records in 1901. These records were for Victoria and Sands Head in the mouth of the Fraser River taken from 1895 to 1898. In 1902 Bell Dawson made his first official visit to British Columbia to inquire about the tidal

[18] Dawson Report, M & F, 1894. Appendix 4, Enclosure A.

currents on the coast from HMS *Egeria,* DGS *Quadra* and several shipping authorities. Before returning to Ottawa, he built his first two tidal stations on this coast: one at Bamfield (Barkley Sound) on Vancouver Island, and the other on the mainland at Port Simpson. This was the actual commencement of activities by the Tidal and Current Survey in British Columbia.

Tidal steamer *Gulnare,* 1902-1912

In November 1902 the Dominion government purchased the former Admiralty Newfoundland Survey Ship *Gulnare,* and when refitted she was assigned to tidal work on the Atlantic coast. With Capt. Thos.C. Taylor as sailing master, the *Gulnare* in 1903 resumed current investigations off the southeast coast of Newfoundland close to the main steamer routes. In 1904 (the year the Hydrographic Survey of Canada began), she was in the Bay of Fundy, and 1905 was loaned to the hydrographic survey (Mr Wm J. Stewart in charge) to commence Canadian recharting on the east coast (lower St Lawrence River). In 1906, in company with the chartered steamer *Laura,* she completed the unfinished investigations in the Strait of Belle Isle under Dr Dawson's supervision. She returned to the Bay of Fundy in 1907 to bring current work in this area to a temporary close, and the following year (1908) began current investigations in Northumberland Strait. Her last pre-war investigations were in the years 1910-1912 when she worked along the north shore of the Gulf of St Lawrence, the estuary of the St Lawrence River, and along the Gaspe current (begun 1895). The *Gulnare* was not used again by the tidal survey until 1931. In the meantime she was attached to the Marine Agency at Quebec where she served as a tender, and relief lightship on the lower St Lawrence.[19]

In 1905 when the *Gulnare* was on loan to the hydrographic survey, Dr Dawson with assistant Mr S.C. Hayden (since 1903) visited British Columbia, and during his absence from Ottawa, Mr R. Angus attended to work at headquarters. In 1909 no current work was carried out on the east coast, and this season the whole field staff, including some officers of the *Gulnare,* proceeded to British Columbia where they installed twenty seasonal tide gauges. Under Dr Dawson's supervision this work was divided into two portions. The northern area lying to the north of Vancouver Island was in the charge of Mr Hayden, and the southern area along the west coast of Vancouver Island and in the Strait of Georgia was in the charge of Mr H.W. Jones. Mr Hayden returned to British Columbia in 1913 to observe slack water in several northern passages, including Seymour Narrows, the site of the former Ripple Rock. In 1919 Mr Hayden became senior tidal and current surveyor, Pacific coast, and just prior to Dr Dawson's retirement in 1924, he was transferred permanently to British Columbia, taking up quarters at Vancouver. He was stationed there until his retirement in 1940.

Under Dr Dawson's direction, Capt. Bloomfield Douglas, RNR, remained in charge of east coast tidal stations from 1893 to 1904. In support of the first current investigations in the Gulf of St Lawrence, in 1894, he built new tidal stations at Forteau Bay and Father Point, PQ. The following year (1895), other gauges were installed at Bonne Bay (west coast, Newfoundland) and in the Atlantic seaport of Halifax harbour. In June 1904, Capt. Douglas left the tidal survey to accept an appointment as nautical advisor to the Board of Examiners

[19] From 1934 to 1936 she was recommissioned for tidal-current investigations in the lower St Lawrence below Quebec. Unlit for this work below Father Point, and unsuitable for other duties at the Agency, she was sold out of the government service in September 1937. She is reported to have been used by the Canadian navy on the Atlantic coast during the Second World War. In December 1949 she was dismantled for the wrecker's hammer.

for Masters and Mates, Department of Marine and Fisheries. A month previously (May 1904), Mr H.W. Jones, a graduate from McGill University, was appointed to Dr Dawson's staff as technical officer, and within a year had taken over most of Capt. Douglas' tidal stations on the east coast as far as Labrador. In 1907 he built a new tidal station on St Paul Island to replace the older one built by Capt. Douglas some years previously, and also established a new reference station at Charlottetown, PEI, the first Canadian automatic gauge in this province. The following year (1908), Dr Dawson was named superintendent of the Tidal and Current Survey, and in 1912 Mr R.B. Lee was appointed a junior assistant to the staff.

Byorder-in-council P.C. 1453,4 July 1910, both the Canadian Hydrographic Survey and the Tidal and Current Survey were duly transferred from the Department of Marine and Fisheries to the newly created Department of Naval Service. Like the chief hydrographer (Mr Wm J. Stewart), Dr Dawson now reported directly to the deputy minister, Mr G.J. Desbarats. In his first annual report to the deputy minister, Mr Dawson stated that 23,000 copies of Canadian tide tables had been distributed to the public (Atlantic coast 18,000, Pacific coast 5,000). From 1910 onwards Dr Dawson became more involved in international scientific affairs, and in 1915 made his first official visit to Great Britain and Europe.

In the fiscal year of the First World War (1914-15), the regular tidal staff, including Dr Dawson, comprised four technical officers and one clerk-stenographer, a total of five personnel. Up to this time Dr Dawson had published four volumes of tide tables for the Atlantic and Pacific coasts, six tidal current reports covering the Atlantic coast from the Bay of Fundy to the Strait of Belle Isle, and one edition of tide levels and datum planes for the waters of British Columbia - really an amazing production quota with so few assistants.

1914-1919

During the years of the First World War (1914-1918), no major tidal-current work was undertaken with departmental ships. What work was done in this regard was limited to slack water observations in strategic coastal localities. From time to time, certain data was supplied by ships' officers, while at other times actual investigations were made by tidal officers. One example was in 1915 when ship's officers of the car-ferry *Scotia* sent in slack water observations for the Strait of Canso. In 1915 Tidal officers determined the times of slack water in Northumberland Strait, the Bras d'Or Lakes and the head of the Saguenay River, and certain passages in northern British Columbia. In 1916 the tides at the head of the Bay of Fundy were investigated on behalf of the proposed Baie Verte ship canal, and in Minas Basin, where the highest tides in the world are said to exist (over fifty feet at springs). To improve the predicted tide table values above Quebec, a few investigations were conducted in 1917 forthe International Waterways Commission, and in 1919 the publication *Tide Levels and Datum Planes in Eastern Canada* was printed that gave levels in eighty-six harbours and localities in this region.

When the First World War, ended Dr Dawson had reached the ripe old retirement age of 65 years, but went on to publish in 1921 two significant publications: *Tidal Investigations and Results: Arctic Tides* and *Temperatures and Densities of the Waters in Eastern Canada.* This year he also made arrangements with the Hudson's Bay Company to install one gauge in Hudson Strait (Amadjuak Bay, Baffin Island) and another at Port Harrison (east coast, Hudson Bay). Prior to this year tide tables for Hudson Bay were printed separately. With those of the Labrador coast these were now included in a new edition of the *Atlantic Coast Tide Tables.* He also arranged with the Geodetic Survey of Canada to tie his established tidal bench marks with their levelling in the Bay of Fundy. Of

general interest is a statement by Dr Dawson in his 1921 report: "the Survey is also careful to send out promptly any new results arrived at for the benefit of navigation" (Notices to Mariners).

As a Canadian representative, Dr Dawson in May 1922 attended a conference of the International Research Council in Rome, where questions pertaining to astronomy, geodesy and oceanography were discussed. An endeavour was made for the first time to unify the whole subject of dealing with the action of tides and currents. In cooperation with the chief engineer of the Timiskaming and Northern Ontario Railway, a tidal station was built in the entrance of the Moose River, James Bay. This year 65,000 copies of Tide Tables were distributed. By order-in-council P.C. 1246, 14 June 1922, the Canadian Hydrographic Survey and the Tidal and Current Survey were transferred back to the Marine and Fisheries Department from the Naval Services, and placed under the immediate direction of the deputy minister, Mr A. Johnston.

The fiscal year 1923-1924 was to be Dr Dawson's last full season as superintendent. Two years previously the Canadian Hydrographic Survey made a survey of Lake Melville and Hamilton Inlet in connection with judicial studies to determine the Canada-Labrador boundary. On very short notice in 1923 further requests were made by the Department of Justice for detailed information concerning the water levels in Lake Melville and Hamilton Inlet, proper. This was to determine whether mean sea level was higher in Lake Melville than in Hamilton Inlet, or vice versa. For this purpose two parties in the Department of Marine and Fisheries were organized, one from the hydrographic survey, the other from the Tidal and Current Survey. In charge of the hydrographic party was Mr Chas A. Price of the automatic gauges section, with assistant Mr J.R. Dupuis of the administration staff; and in charge of the tidal party was Mr H.W. Jones with assistant Mr G.L. Crichton, chief draftsman of the hydrographic survey.

Under Mr Jones' supervision, a few tidal stations were installed in Hamilton Inlet between the sea-coast and Rigolet. With the aid of an anchored scow built by Mr Jones with local labour, and the hydrographic launch *Sea Louse,* a detailed tidal-current survey was completed by Mr Jones. Mr Price's work was centred more in the Lake Melville area. The study of these results was one of Dr Dawson's last undertakings. In 1923 he also supplied engineers with useful tidal data for two potential power schemes in New Brunswick - one at Passamaquoddy Bay, and the other in the mouth of the Petitcodiac River. He also carried on a good deal of correspondence with the International Hydrographic Bureau at Monaco, and the recently established Tidal Institute at Liverpool, England.

In his last annual report to the deputy minister, Dr Dawson wrote, " Because of the desire for economy at the present time ..." Again, in a letter by the deputy minister to Dr E. Deville, director general of survey, 27 April 1924, is this statement: "having regard to the imperative necessity for economy in all directions and the determination of this Department to discourage all unnecessary expenditures A few months later the Tidal and Current Survey was placed underthe supervision of the chief hydrographer, Canadian Hydrographic Survey.

During the thirty years he was in charge of the Tidal and Current Survey, Dr Dawson gave to the public sixteen official publications of interest to navigation and fine science - tide tables (5) and tide-current reports (11). When he began field work with this survey in 1894 he had under him two regular assistants only: Mr H.M. McKay, BSc. on current work, and Capt. Bloomfield Douglas, RNR, (from the Meteorological Service) on tidal work. When the First World War began in 1914, staff had increased by two personnel only, one junior assistant (1912) and a clerk-stenographer - a total of five. When he retired in 1924 only one clerk had been added - a total of six personnel including himself. The

names and classification of these assistants were: Mr H.W. Jones, BSc, senior tidal and current surveyor, Atlantic coast; S.C. Hayden, senior tidal and current surveyor, Pacific coast, and R.B. Lee, juniortidal and current surveyor in Ottawa. All these classifications had dated back to the year 1919, the days of the Griffmhagen Investigation.

Retirement of Dr W. Bell Dawson and the Transfer of the Tidal and Current Survey Division to the Canadian Hydrographic Survey, 1924

Treasury Board Minute No. 1 10247 25 June 1924 reads in part as follows: "The Civil Service Commission reports that, as required by the said Act *(Public Service Retirement Act, 1920,* amended) Dr Dawson has been duly notified of the intention to retire him from the Public Service: that in the event of this retirement being effected, the vacancy caused thereby will not require to be refilled." Now aged 70, Dr Dawson was granted two months gratuity of $700, and an annuity of $2,100 (salary $4,200 per annum), and officially retired from the Public Service of Canada, effective I July 1924.

So that the work in the tidal survey might continue as formerly, Mr H.W. Jones was placed in temporary charge of this division for the next sixteen years. A statement by Mr Jones in December 1938 concludes this brief outline of the tidal survey prior to its amalgamation, and it is highly significant from many aspects: "After the retirement of the former superintendent in 1924, the Tidal and Current Survey, then a branch of the Marine department reporting directly to the deputy minister, became a division of the hydrographic service. The supervision of the work of the staff, and perhaps may 1 say, the actual responsibility of carrying on, came upon me. Virtually then 1 have been in charge of the Tidal and Current Division since that date."[20]

Activities of the Tidal and Current Survey, 1924

In its first year under the chief hydrographer, the tidal survey maintained eleven principal stations on the sea-coasts - Atlantic coast (6), Pacific coast (5). A new station was built this season at Point Peter, on the Gaspe coast, in Chaleur Bay, and current observations were recorded in the Strait of Canso. On the Pacific coast, slack water observations were obtained in Queen Charlotte Sound and First Narrows (Vancouver harbour) areas. Four seasonal gauges were installed on the Saguenay River for the Public Works department, and information was supplied the ship channel branch. To improve British tide tables, new information was forwarded to the hydrographer of the Royal Navy, and tide tables were calculated for Port Nelson, Hudson Bay, and copies sent to the Hudson's Bay Company and engineers of the Department of Railways and Canals. In addition to the regular tidal staff of Messrs Jones and Lee in Ottawa, Mr L.T. Bowes, BSc. of the hydrographic survey assisted in a technical capacity during the winter months. In the fiscal year 1924, some 65,000 (regular) and 590 (abridged) editions of tide tables were distributed to the public.

J925-26

Owing to the lack of sufficient funds, the steamers *Acadia, Bayfield* and *Restless* were not commissioned in 1925. Highlights of this fiscal year were the sudden death of chief hydrographer Mr Wm J. Stewart, the appointment of Capt. F. Anderson, M.E.1.C. as his

[211] Following a reclassification of the hydrographic service in 1940, Mr Jones was named chief. Tidal and Current Survey, tie retired from this office in July 1946, and died in Ottawa December 1950, aged 70.

successor, the resignation of Mr Chas Savary, and the adoption of electrical machinery to aid ship sounding. With economy the keynote in government expenditure, it was decided to build a large survey launch so that work on the Atlantic coast could continue.

THE CANADIAN HYDROGRAPHIC SURVEY UNDER CAPT. F. ANDERSON, 1925-28

Obituaries

Following a brief illness Canada's first chief hydrographer Mr Wm J. Stewart passed away on 5 May 1925, at the Ottawa Civic Hospital. He had been with the Hydrographic Survey of Canada over forty-one years, half of which time he served in the field. He was succeeded by his first assistant since 1893, and officer-in-charge of the Atlantic coast survey since 1911, Capt. F. Anderson.

Shortly after the close of this fiscal year (in 1925), Mr Leroy T. Bowes, an assistant hydrographer since 1913, also passed away in Ottawa.

CAPTAIN FREDERICK ANDERSON, M.E.I.C. 1868-1957

Frederick Anderson was born in Charlottetown, PEI, on 23 September 1868, the son of Dr Alexander Anderson, head of Prince of Wales College. He was an honours graduate of the Royal Military College in June 1890, and in the next two years was employed on city engineering work in New York City and Norfolk, Virginia. On September 15th, 1892 he was appointed a clerk in the Chief Engineer's Branch, Department of Marine and Fisheries, Ottawa. In April 1893, when Mr Stewart was placed in charge of the Georgian Bay Survey, Mr Anderson became his first assistant on the *Bayfield.* His position was made permanent on 1 July 1894, and until 1900 he worked in Georgian Bay, Lakes Erie and Huron, including the North Channel. During Mr Stewart's absence in Lake Winnipeg in 1901, he was placed in temporary charge of the Lake Huron survey, and the following year took over Mr Stewart's work in Lake Winnipeg. This survey he completed in 1904. Successful in passing his master's examinations at Ottawa, in December 1904, he was granted Certificate No. 4608, Master Competency, Inland Waters, with the rank of captain, effective 1 January 1905. For the remainder of his hydrographic career he was familiarly known as "Captain Anderson" and to his more intimate associates as "Cap A." When Mr Stewart became chief hydrographer, in 1905 Captain Anderson took charge of the Great Lakes survey in the steamer *Bayfield.* By 1908 he had completed the first resurvey of Canadian waters in Lake Superior, and the following year began the recharting of Lake Ontario.

When it was decided to send the first hydrographic expedition to Hudson Bay in 1910, Capt. Anderson supervised the outfitting of the two survey parties and the ship details in connection with the transportation to the bay in the government icebreaker *Stanley.* The next year (1911), he succeeded Commander L B. Miles as officer-in-charge, Hudson Bay survey, CGS *Minto.* In 1913 the new Atlantic coast steamer *Acadia* completed her maiden voyage to Hudson Bay, in the charge of Capt. Anderson, and when the First World War began, he had reached the western entrance to James Bay with his northern charting. Mainly in support of the war effort, the *Acadia* began the recharting of the Atlantic coast of Nova Scotia in 1915, and for the remainder of the war, Capt. Anderson was in charge of hydrographic defence charting along the Atlantic seaboard, much of it having to do with anti-submarine installation surveys in strategic localities. He was also the first hydrographic officer to carry out joint oceanographic investigations in the *Acadia* during the season of 1915, and in the early 1920s conducted tests with RDF apparatus to improve hydrographic surveying on the Atlantic coast. He also surveyed areas of New Brunswick, Prince Edward

Island and the Magdalen Islands, and in 1924 was assigned to headquarters where he wrote sailing directions and pilots.

Following the sudden death of Mr Stewart, in June 1925 he was named chief hydrographer, and within three years of assuming this office succeeded in having the hydrographic survey reorganized and renamed the Canadian Hydrographic Service [CHS]. Under his direction the first electronic navigation aids were introduced to the service (gyro compass, echo sounding machine), and aerial photography was adopted for charting purposes. Just before his retirement he had the personal satisfaction of having a new survey ship built and named after his former chief - Wm J. Stewart. Following the transfer of the CHS from the Department of Marine to Mines and Resources (1936), he retired from active duty on 1 February 1937, and from the government service on 1 July 1937. With his separation the classification "chief hydrographer" was officially abolished.

At the time of retirement, Captain Anderson was a member of the Montreal Harbour and St Lawrence Water Levels Board; the Lighthouse Board of Canada; the Geographical Board of Canada; the Engineering Institute of Canada; and the Royal Astronomical Society of Canada. He was an original member of the Minto Skating Club in Ottawa, the Royal Ottawa Golf Club, and the Rideau Club. He died in Ottawa on 23 September 1957, aged 89, and was survived by a widow and a son. At the time of his death the *Ottawa Journal* wrote, "he was a slightly built man of exceptional physical stamina who liked nothing better than to plunge ashore and penetrate the bush country on a survey mission, often camping on the spot with more zeal than equipment."

ATLANTIC COAST SURVEY

The *Acadia* being laid up again in 1925, a shore party with the aid of a hired gasoline launch worked on the southwest coast of Nova Scotia. The survey of Lunenburg harbour begun the previous year was completed this season by Mr J.U. Beauchemin, and assistant J.L. Foreman. A new chart of Lunenburg harbour was drawn from these two seasons' work, and over one hundred shoals were carefully examined in the boats before a safe channel could be laid out for steamers entering Lunenburg harbour. The party then moved to Barrington Passage to investigate the many complaints received from captains of coasting steamers regarding uncharted rocks in Barrington Passage. A plan of this area was made to a scale 6 miles to the inch, between West Head and Clam Point. Some thirty-three uncharted rocks were located, in many cases with only 5 to 9 feet of water over them where the Admiralty charts gave 25 feet. So that future work might be more efficiently undertaken on the more exposed regions of this part of the Nova Scotia coast, and in the Bay of Fundy, it was decided to build a larger model survey launch to carry out this work *(Boulton).*

ST LAWRENCE

Lower St Lawrence

Following the death of Mr Stewart, Mr Chas Savary who had been with the hydrographic survey since 1905, and in charge of the steamer *Carder* since 1913, resigned to accept a position in the Lands and Forests Branch, Province of Quebec. Mr R.J. Fraser, formerly in charge of the *Bayfield,* and the Atlantic coast survey in 1924, was transferred to the command of the *Carder.* Assistants with Mr Fraser this season were Messrs Ghysens, Leadman and MacKinnon.

Only in recent years had transatlantic steamers and coastal shipping been using an alternate route by the Mingan Strait (now Jacques Cartier Passage) instead of the regular

route between Anticosti Island and the Gaspe coast. However, the northern route between Anticosti Island and the Mingan Islands had one advantage, it was seventeen miles shorter than the southern one, and "with the introduction of the Gyroscope Compass on some of the latter vessels navigators had more confidence in using this route." It was this uncharted route that the steamer *Cartier* surveyed this season, with soundings carried about 20 miles west of West Point, Anticosti Island, eastward to a distance of 42 miles off the north shore of the island, and extending across Mingan Strait to the Mingan Islands. In all, about 12,000 ship and boat soundings were logged.

It was intended this season to use the *Cartier* to observe the complicated tidal currents, but this work was not carried out for the want of sufficient funds. It was hoped these current surveys could be undertaken the following year.

About the middle of September the *Cartier* went to dry-dock at Pictou to repair a defective shaft, and while this work was in progress Mr H.L. Leadman completed eighty-four miles of launch soundings in the Magdalen Islands. On 16 October the *Cartier* picked up the Mingan party with their equipment, and within a few days arrived at Quebec to winter in Louise Basin. "As a result of this, and the preceding season's work ... another season's work, such as last season's should complete the area and make possible the issue of the complete chart of the whole of Mingan Strait to the public."

Improved Method of Ship Sounding, 1925

Back in 1920 Mr Chas Savary, of the steamer *Cartier,* began experimenting with fine wire as a substitute for the regular sea line for ship sounding. In 1921 excellent results were reported from these tests and, as a consequence, fine wire soon replaced the old sea line around the drum of the *Carder's* mechanical sounding machine (Walker's Harpoon Model). In 1925 another improvement was used for the first time on the *Cartier,* "an electrically driven sounding machine with wire and pressure sounding tubes attached." This made it possible to obtain depths varying from 30 to 100 fathoms at a speed from 5 to 9 knots.

Mingan Islands

With the *Bayfield* not commissioned in 1925, the survey of the Magdalen Islands could not be resumed. A shore party in the charge of Mr G. A. Bachand, with assistants Messrs Wilson and Bent, was transported from Quebec by the *Cartier* to the Mingan Islands to resurvey these waters. Havre St Pierre was base quarters for the summer. It is believed the *Bayfield* launch, built on the Atlantic coast this year, was used for transportation and survey purposes. Due to the uneven nature of the bottom, a very close examination was necessary to define the contours, and "almost invariably less water was found on the banks than shown on the existing British Admiralty chart 1834, many lying in or near the ship track." Boat soundings were extended 3 to 5 miles offshore, "taking 16,000 casts of the lead." Examination of the twenty shoals was a tedious operation "as the gigs could only be used for about two hours at slack water." Tidal records over a four month period were obtained at Havre St Pierre, and an established permanent benchmark was tied in with the tidal survey benchmark of 1910. From this season's operations, a chart of the Mingan Islands was drawn for public distribution.

South Channel, St Lawrence River

In the summer of 1925, Mr J.U. Beauchemin of the Atlantic coast survey was detailed to

locate the wreck of the *Canadian Recruit* in the South Channel below Quebec, about three miles below Stone Pillar lighthouse. He also made a large-scale plan of the locality in this area where the steamer *Montrose* grounded.

BRITISH COLUMBIA SURVEY

The resurvey of the coast in 1925 was continued in the *Lillooet* and houseboat *Somass.* In charge of this work was Mr H.D. Parizeau, who had as assistants Commander J.H. Knight, RN (Ret'd), and Messrs W.K. Willis, L.R. Davies, and Mr F.C.G. Smith (on loan from headquarters). A sweeping survey in FirstNarrows, Vancouver harbour, began the season's activities, and this was followed by a resurvey of Burrard Inlet (see Mr Wm J. Stewart, 1891). Other work was then taken up on the north coast of Vancouver Island, including Johnstone Strait, Loredo Sound and approaches, and a revision survey of Prince Rupert harbour (first chart for this coast). Tuck Harbour, Cumshewa Inlet (Queen Charlotte Islands) and Powell River were also visited. In Quatsino Narrows, tidal and current observations were logged, and in all some 685 names were submitted to the Geographic Board for approval. Twelve harbours and ship anchorages were swept this season, 640 miles of boat and 307 miles of ship sounding recorded, and 320 miles of coastline traversed. In addition eleven descriptions for sailing directions were written and issued to the public in the form of Notices to Mariners.

HEADQUARTERS STAFF, OTTAWA, 1925

Automatic Gauges

In 1925 there were thirty-nine automatic water-gauges in operation on the Great Lakes and St Lawrence River. Data between the years 1905-1925 had now been compiled by this section, and regarding the matter of seiches in the Great Lakes, it was found that "the yearly lowering of the Great Lakes leaves so small a margin of safety for the recording of seiches, a continuation of the same conditions that have held during the last seven years will necessitate the relocation of the gauges at Collingwood and Goderich." Staff of this section in 1925 were unchanged and comprised Messrs Price, Miller, Matthewman and Williams.

Tidal and Current Survey

Thirteen principal tidal stations were in continual operation in the fiscal year 1925: eastern Canada (7) and British Columbia (6). Seasonal gauges installed numbered eight: eastern Canada (4) and British Columbia (4). Current investigations in the Strait of Canso were resumed in 1925 and the data obtained here in 1922 and 1924 were sent to the Tidal Institute at Liverpool, England "for a report on the possibility of making a harmonic analysis of it and future tables of prediction." In British Columbia, slack water observations were made in First Narrows (Vancouver harbour) and in Quatsino Narrows. Data for Turn Point, Boundary Pass, observed in previous years, was sent to the Tidal Institute for analysis. Requested tidal information was supplied to the hydrographer of the Royal Navy, the United States Coast and Geodetic Survey, the Hudson's Bay Company and to engineers seeking information regarding the proposed power site in Passamaquoddy Bay, N.B. A total of 66,700 copies of the tide tables were issued to the public. Staff of this section in 1925 comprised Messrs Jones, Hayden and Lee and Miss L. Brown, clerk-stenographer.

Drafting Office

Under Mr Crichton's supervision nine new charts and eleven new editions of older charts were printed.

Chart Distribution

During the fiscal year 1925-26 some 10,000 charts were sold.

1926-27

ATLANTIC COAST SURVEY

This season the steamer *Acadia* was commissioned and assigned to the Gulf of St Lawrence survey. With the completion of the survey between LaHave and Lockeport on the southwest coast of Nova Scotia, a triangulation network now covered the Atlantic seaboard from Canso, NS, to Grand Manan, NB. This survey was in the charge of Mr G.A. Bachand with the assistance of Mr N. Wilson. For transportation, anew 44-foot cabin cruiser, the *Boulton,* was built in Mahone Bay, NS, by Mr Obed Hamm at a cost of $7,175. In the latter part of the season the *Boulton* was used for coastlining and sounding the approaches of Saint John Harbour, NB. Whether she was suitable for this task is questionable, because in his annual report Mr Anderson commented, "next season this work will be taken up from a larger vessel."[21]

ST LAWRENCE

Lower St Lawrence

En route to the Gulf of St Lawrence to complete the survey of Mingan Strait, the *Acadia* examined a few shoals in George Bay, NS, and sounded an area off North Point, PEL Sailing master of *the Acadia* was Capt. James Roach *(Cartier),* and chief engineer, Mr John S. Cann (since 1923). Mr R.J. Fraser was again in charge of this survey, with assistants Messrs Leadman, MacKinnon and Smith. A small survey of Gaspe Bay, PQ, was also made this season, and the RDF stations on Belle Isle and St Paul Island were calibrated. From work completed in these two seasons, a chart of Mingan Strait (Jacques Cartier Passage) was published, and another sheet was printed showing anchorages about Anticosti Island. Some 1,600 miles of ship sounding and 600 miles in the boats were logged this season. The year 1926 was Mr Fraser's last field season. In 1927 he was reassigned to headquarters and assumed the duties of principal assistant to the chief hydrographer.

Outardes Bay, PQ

With the aid of a small launch, a detached party of Mr E. Ghysens and assistant Mr F.C.G. Smith completed a detailed survey of Outardes Bay and River on the north shore of the St Lawrence River below Quebec. From this survey three sets of temporary beacons were built marking the channel, and the necessary buoys were placed.

[21] The obvious error in the original, of attributing this report to Stewart, has been corrected. [Ed.]

INLAND WATERS SURVEY, 1926

Georgian Bay, Great Lakes

Owing to the extreme low stage of the surface elevation of the lakes, especially Lake Huron and Georgian Bay, a resurvey of Key Harbour and its approaches was found necessary.[22] This survey was completed by Mr J.U. Beauchemin, assisted by Mr J.L. Foreman. When these waters were carefully resounded and swept, the positions of the channel buoys were accordingly adjusted.

Lake Winnipeg, Manitoba

With the Key Harbour work concluded, Messrs Beauchemin and Foreman then proceeded to Lake Winnipeg. Here they made a chart of the Winnipeg River from its entrance to the site of the Manitoba Pulp and Paper Company's plant, a distance of fifteen miles. A good entrance channel was discovered and marked with three sets of range beacons and the necessary buoys. This new survey in Lake Winnipeg was the first by the hydrographic survey since 1904, when Capt. Anderson completed his work here.

BRITISH COLUMBIA SURVEY

"This division of the Hydrographic Service"[21] was an intimation of things to come. In 1926 only the *Lillooet* and *Somass* were in service. In charge of activities was Mr Parizeau, with assistance of Commander Knight and Messrs Willis, Davies and R.W. Bent (on loan from headquarters). Areas surveyed this season were on the west coast of Vancouver Island, in the Strait of Georgia, Prince Rupert harbour, Portland Inlet, the southeast coast of Aristazabel Island and the Queen Charlotte Islands. A special plan of the new drydock at Esquimalt was begun, and which was expected to be finished in 1927. Ten harbours were carefully swept, ten sailing direction descriptions were written for Notices to Mariners, and seven blue-and-white prints were issued for small surveyed areas.

HEADQUARTERS STAFF, OTTAWA, 1926

Automatic Gauges

Forty automatic water gauges were maintained on the Great Lakes and river this year by Messrs Price, Miller, Matthewman and Williams. At Michipicoten Harbour in Lake Superior, it was necessary to deepen the gauge well and lower the intake pipe due to "the continuing lowering of the lake levels." At Goderich, in Lake Huron, for the same reason it was necessary to relocate the gauge, a work undertaken by the Public Works department. So as to adjust the values of elevation of the bench-marks throughout the Great Lakes, from Kingston to Port Arthur, a series of water transfers in connection with the precise levels run by the Geodetic Survey of Canada were carried out, and they were to continue until satisfactory results were obtained. As a start these transfers were completed for Port Stanley in Lake Erie, Thessalon in Lake Huron, and Gros Cap in Lake Superior. The first two were free from the St Mary River influence. During the fiscal year 1926-27 about 12,813 sheets

[22] Anderson, M & F Report, 1926.
[25] Report M & F 1926, 23

of prepared information were supplied the public, in comparison with 122 sheets in 1918. This was an indication of the growth of the automatic gauges section in less than a decade.

Tidal and Current Survey

In this division twelve principal tidal stations were kept in yearly operation in 1926: east coast (7) and British Columbia (5). Temporary seasonal gauges installed this year numbered six: east coast (5) and British Columbia (I). The British Columbia gauge at Squamish (Howe Sound) was installed to determine mean sea level in connection with geodetic levelling in that part of the province. Current observations were recorded for the Strait of Canso, NS, and in Boundary Pass, BC, where a camping party was placed. Some 71,300 copies of tide tables for the forthcoming year 1927 were distributed to the public. Information was also supplied to the Department of Justice, in connection with the Labrador-Canada boundary dispute, and to government engineers. The staff of the tidal survey remained unchanged in 1926 with Messrs Jones and Lee and Miss Brown in Ottawa, and Mr Hayden in Vancouver, BC, (since 1924).

Charts and Distribution

This year for the first time, the former title of "chart drafting room" or "drafting room" appears in the annual report of the chief hydrographer as the "Chart Construction Division" and chart distribution, as "Chart Distribution Division." Under Mr Crichton's supervision, five new charts and fifteen reprints were printed, and 7,380 older charts corrected. Chart distribution, in the charge of Mr Chas McGreevy with Mr A Carbonneau's assistance, accounted for 12,000 charts this year, in comparison to 10,000 the previous year (125). In 1926, there were, "161 separate sheets in circulation."

1927-28

The era of the Canadian Hydrographic Survey ended with the fiscal year 1927-28. Early this spring, the steamer *Carder,* on loan to the Preventive Service of the Department of National Revenue since 1926, was returned to the survey, for work in the Bay of Fundy. As a replacement, the steamer *Bayfield* was loaned to the Preventive Service where she remained until 1929. When hydrographic work in the Gulf of St Lawrence ended for the *Acadia* in the fall, she was handed over to the Fisheries department for a special oceanographic cruise on the east coast. To commence the resurvey of Lake St Clair, the launch *Boulton* was brought to the Great Lakes from Saint John, NB, by the Hudson River and New York State canals. In British Columbia the steam-tug *Restless* was sold out of the government service, and most significant of all, was the approval of a long-awaited reclassification of the Canadian Hydrographic Survey - the first progressive move prior to its becoming the Canadian Hydrographic Service the next year.

ATLANTIC COAST

Charting in the Bay of Fundy was resumed in 1927 by Mr Bachand with assistants Messrs Wilson and Bent. Sailing master of the *Carder* was Capt. J. Roach, and chief engineer, Mr J.E. Belanger. Some 500 square miles of surveying were completed in the approaches to Saint John harbour. From this and previous work, a coast chart was drawn from Cape Spencer to Point Lepreau, N.B., including Saint John Harbour. Early in October *Carder* returned to Halifax for the winter.

Oceanographic Cruise, 1927

Back in 1915 the first hydrographic-oceanographic cruise was completed on the Atlantic coast in the steamer *Acadia,* under the direction and supervision of Capt. F. Anderson of the Marine department and Dr Johan Bjort of the Fisheries department. When the steamer *Acadia* ended surveying in 1927, she was again used by the Fisheries department, this time without hydrographic surveyors aboard. She was handed over to the Dominion Fisheries Commission for a special oceanographic cruise on the east coast in connection with the Maritime Fisheries enquiry. When this voyage ended in the middle of November, the *Acadia* laid up with the *Cartier* in Halifax harbour for the winter.

GULF OF ST. LAWRENCE (NORTH SHORE)

Following Mr Fraser's transfer to headquarters in 1927, Mr J.U. Beauchemin was placed in charge of the *Acadia* and, with assistants Messrs H.L. Leadman, M.A. MacKinnon and F.C.G. Smith, carried on the survey of the north shore of the Gulf. Sailing master of the *Acadia* was Capt. F.V. Ryan (first officer under Capt. S.A. [sic, probably W.A.] Robson, who retired in 1924), and chief engineer, Mr J.S. Cann. Early in June, the work in the Mingan Islands area was concluded, and for the remainder of the field season the ship recharted the area of the north shore from Sheldrake River to Seven Islands. Secondary stations for coastlining and boat sounding were located by a 40-foot pole traverse, which proved to be very accurate and expedient. One must not forget that to this time, aerial photography for hydrographic surveying was three years in the offing. In late September, the *Acadia* visited Mutton Bay, in the entrance to the Gulf, to triangulate and sound out this harbour. Another visit was made to Ellis Bay, Anticosti Island, for chart revision. This season 1,145 miles of ship and 647 miles of boat soundings were recorded covering 570 square miles, and 647 miles of the coastline were traversed.

Outarde and Manicougan Bay, PQ, 1927

Early in May 1927, Messrs Ghysens and Foreman proceeded to Outarde Bay on the north shore to relocate three sets of beacons, and to place six can buoys. They then moved to Manicougan Bay where two sets of ranges were built and positioned to mark the best channel leading to the Ontario Paper Company wharf.

LAKE ST CLAIR, GREAT LAKES

While Messrs Ghysens and Foreman were occupied in the lower St Lawrence River, Mr J.U. Beauchemin of *the Acadia* sailed the launch *Boulton* from Saint John, NB, to Lake St Clair. The resurvey of this lake was then taken over by Messrs Ghysens and Foreman from a mile west of Pace River past the mouth of the Thames River. A large-scale plan of the approaches to Belle River was also made. Some 118 miles of boat, and 450 miles of launch soundings were recorded over an area of 86 square miles. This survey was tied in with the US Lake Survey (1919) and the US points; no new triangulation was necessary.

BRITISH COLUMBIA

"This division of the Hydrographic Service"[24] was under the direction of Mr H.D. Parizeau, assisted by Commander J.H. Knight, RN (Ret'd), and Messrs W.K. Willis, L.R. Davies, R.H. Ettershank and a Mr Shanks. The last two named surveyors were appointed this year, the former a junior hydrographer, the latter an instrument man, who resigned at the end of the season. In the early part of the season, the *Lillooet* surveyed False Creek, Burrard Inlet, and made sweeping surveying in Vancouver harbour. She then proceeded to Quatsino Sound to re-establish some old triangulation marks, so that the provincial government might connect them up with the geodetic survey positions in the Queen Charlotte Strait area.

Early in July the houseboat *Somass* was commissioned, with Commander Knight in charge, and assistant Mr Ettershank. Most of the season was spent in the Loredo Sound area on the mainland. From the season's activities new charts for Prince Rupert harbour (site of first Canadian charts on this coast), and Loredo Sound were printed. Before the fiscal year ended the auxiliary steam tug *Restless,* transferred to the hydrographic service from the naval service in 1920, was sold out of government service.

HEADQUARTERS STAFF, OTTAWA, 1927-28

Administration

Besides the chief hydrographer, Capt. F. Anderson, others who carried out most administrative duties in Ottawa were as follows: Mr R.J. Fraser, principal assistant; Mr Chas McGreevy, assistant hydrographer in charge of chart distribution; Mr J.R. Dupuis, clerk; Mr A. Carbonneau, clerk-messenger; and Miss C.A. Condon, clerk-stenographer.

Automatic Gauges

This section in the charge of Mr Chas A. Price (since 1913), was ably assisted by Messrs W.J. Miller, A.S. Matthewson and H.P. Williams. Forty-three automatic gauges were in operation on the Great Lakes and St Lawrence River between Quebec and Port Arthur, including those installed in Lake St Clair in support of the hydrographic survey (1927). Back in 1925, the standardization of gauge clocks began, and in 1927 there were only two gauges in operation with clocks not interchangeable. Special water surface transfers were continued this season in the Great Lakes to connect them with geodetic benchmarks, and during the year some 32,000 sheets of prepared water level data were issued to the public.

Tidal and Current Survey

Eleven tidal stations were maintained by this division all year round: Atlantic coast (6) and British Columbia (5). As a preliminary requirement to the intended hydrographic survey of the Saint John River, NB, seven tide gauges were installed along this inland waterway this season between Indiantown and Fredericton. In response to an urgent request for tidal records of this river by the Shore Line Investigation Committee of the United States Coast

[24] Capt. Anderson's Report M&F, 1927.

[25] Since 1917 the Geodetic Survey of Canada had established many positions on this coast between Washington and Alaska. USA. With the adoption of the present North American Datum 1927, wherever possible the hydrographic survey has since cooperated in connecting Canadian charts with the precise network.

and Geodetic Survey and Columbia University, a year's records for Rothesay, NB, were supplied. All gauges along the Saint John River were tied in with a level network run along the railroad near the river by the Geodetic Survey of Canada. In conjunction with the Dexter P. Cooper Company, a tide gauge was maintained at Welchpool in Passamaquoddy Bay. In 1927 two other temporary gauges were installed in British Columbia, but no new current work was undertaken on the Atlantic coast. In British Columbia, the tidal streams were observed by a camp observer in Percival Narrows, Matheson Channel. Some 85,000 tide tables for 1928 were distributed, and in the tables for 1929 it was intended to include tables for Boston and New York on the Atlantic coast, and for Seattle and Port Townsend on the Pacific coast.

Tidal staff "of the division of the Hydrographic Service" in the fiscal year 1927 were as follows: Atlantic coast and headquarters Mr H.W. Jones, M.E.I.C., acting chief; Mr R.B. Lee, junior tidal and current surveyor; Miss L. Brown, clerk-stenographer, and Miss E. Campbell a temporary office assistant; Pacific coast, Mr S.C. Hayden, senior tidal and current surveyor, with an office in Vancouver, BC.

Chart Construction Division

Technically the work of this division involved two specialized skills of map making - map draftsmen and copper-plate engravers. In charge of the engraving section was Mr W.C. Cunningham, with assistants Messrs W. Watts, G. Silvers, W.A. Cunningham, R.H. Cunningham and J. Brown. In charge of the whole division was Mr G.L. Crichton, with the drafting room assistants Messrs F.J. Delaute, P.E. Parent, H. Melancon, A.J. Pinet, and W.L. Andrews. This year, new engraved charts published numbered, 10; new editions of older existing charts, 17; charts corrected, 53; number of copies corrected, 14,380; number of corrections made, 87,700; corrections to copper plates, 420; grain statistical chart, 1; and chart of automated gauge record, 1.

Chart Distribution

Under Mr McGreevy's supervision, 11,310 charts and 241 volumes of sailing directions were issued to the public during the fiscal year 1927-28.

Hydrographic Expenditure, 1927-28

This expenditure is listed in the annual report of the Auditor-General under the subheading Vote No. 220 Hydrographic, Tidal and Current Surveys, and is as follows: Atlantic coast, $60,743.68; automatic gauges, $19,213.08; inland waters, $11,145.72; lower St Lawrence, $78,454.40; Pacific coast, $80,821.13; tidal and current surveys, $23,688.45; and general account, $36,632.55 - actual expenditure of $310,699.01. Of this figure, $164,980.59 was spent on salaries and wages.[26]

RECLASSIFICATION OF THE CANADIAN HYDROGRAPHIC SURVEY, 1927-28

The last general reclassification of the survey had been in 1919, which to many at that time was a great disappointment. The mild economic depression, and the transfer from one

[26] This was only about 20 per cent more than the years of least expenditure since the First World War (1919. 1925), and about 13 per cent less than the year of greatest expenditure, 1923.

department to another in the early 1920s, did much to curtail the survey's growth and welfare. There were a few occasions since 1924 when staff problems were officially considered, but few benefits came from them until 1927, when the Department of Marine and Fisheries was reorganized, and the Hydrographic Survey was again reclassified. Events that brought about this staff improvement were as follows.

In May 1927 the Department of Marine and Fisheries was reconstituted as two branches, with one minister, and two deputy ministers (R.S.C. 1927, Chapt. 125: assented to P.C. 802, 4 May 1927). Subsequent to this departmental reorganization, divisions of the Marine Branch were reclassified, and this included the hydrographic survey. In this regard, the chief hydrographer, Capt. F. Anderson, made his first and only official visit to the Victoria office during his term of office.

With P.C. 54-437 19 March 1928, effective 1 April 1927 [sic], the classes junior hydrographers, assistant hydrographers and hydrographers (1919) were retitled hydrographers grades I-IV, with salary ranges $1800-2160, $2400-2700, $2700-3180, and $3000-3600. No change was made to classification chief hydrographer, salary range $4,620-$5,200. The chief map draftsman was reclassified chief, charting division, salary range $3,000-$3,600; junior hydrometric engineer became assistant engineer, $2,200-$2,700; hydrometric recorders became senior engineer clerks, $l,800-$2,160; principal map draftsman to assistant chief, charting division, $2,400-2,700. No change was made to the title senior tidal and current surveyor, Atlantic coast, salary range $2,520-$3,300. One unique classification dated back to the year when the Civil Service was formed in 1908. In that year Mr Chas McGreevy (prior to 1904 a hydrographic engineer with the Public Works department) was transferred from the Outside to the Inside Service, and classified assistant hydrographer. This outmoded classification was permitted to stand until Mr McGreevy's retirement in October 1931, when it was recommended by the chief hydrographer that it be abolished and changed to the classification hydrographer grade III.

RECAPITULATION, FISCAL YEARS, 1915-1927

In 1927 staff headquarters in Ottawa were located in the Hunter Building, Queen and O'Connor Streets; and in Victoria the Pacific coast survey occupied quarters in the BC Loan Building (New Toronto-Dominion Bank Building). The regular staff of the hydrographic survey in 1927 was approximately 41 personnel. In addition to the chief hydrographer, there were 15 hydrographers, (Ottawa 10, Victoria 5); Tidal and Current Survey, 5 (Surveyors 3, clerks and stenographer 2); automatic gauges, 4; chart drafting, or "chart construction," 12 (Draftsmen 6, Engravers 6); chart distribution, 2, including a clerk; general, a clerk and stenographer. Seasonal and other employees such as those at the coast depots, shore parties, survey ships, tidal and automatic gauge attendants, etc. numbered about 162 - an overall hydrographic personnel of approximately 203 full and part time employees.

In the year 1914, the regular hydrographic fleet comprised six ships (five steamers and one schooner); by 1927 only three steamers and one cabin cruiser were in service, a total of four units. A few small survey launches, however, were added to the fleet. This diminution of ships was a major deterrent to progress of the survey in those days, but it did not prevent the adoption of new improvements when found feasible. One of these innovations was the substitution of fine wire for the centuries-old sealine; and another was the installation of an electric motor as a replacement for the steam driven sounding machine. These improvements did much to increase the overall efficiency of ship sounding, but their days were numbered. Within five years, they were replaced by self-registering echo sounding machines.

In 1914 the *Canadian Catalogue of Marine Charts* listed 65 Canadian navigation

sheets and 5 volumes of sailing directions. In its edition corrected to 1 April 1928, publications issued by the Canadian Hydrographic Service totalled 196 sheets, and 6 volumes of sailing directions. Of this total, 167 sheets were navigation charts, and 29 sheets were for non-navigation purposes. The number of navigation charts by regions were as follows: Atlantic coast (31), St Lawrence River to Lake Ontario (53), Great Lakes (55), Lake of the Woods (1), Lake Winnipeg (3), and British Columbia (24). Non-navigation charts were International Waterways Commission sheets showing the delineation of the international boundary in the St Lawrence River and Great Lakes. Also listed in this catalogue were five editions of tide tables, and eleven tidal and current reports. Distribution of navigation charts in 1915 was 3,056 - the lowest figure in any year during the First World War. In 1927, this figure increased to 11,310, almost triple that of 1915.

Prior to 1923, pilots and sailing directions were written by experienced field hydrographers, but by 1928 this had fallen behind in production. In this regard the chief hydrographer wrote in his 1928 annual report, "the survey had been obliged to practically discontinue this important phase of hydrographic work, and it has in consequence, fallen many years in arrears, and is continuing to do so."

Over a thirteen year period (1915-1927), the total hydrographic expenditure was approximately $3,315,000, or an average of $255,000 per year. This figure compared favourably with the period 1904-1914 which approximated $25,000 per year. With a drafting staff three times its 1914 figure, a tidal and current staff, an enlarged automatic gauges section, and a small fleet of ships and boats to maintain, it is a tribute to both Mr Stewart and Capt. Anderson they were able to accomplish so much with so little at hand. The solution to their hydrographic problems in that trying period of its history was production - which about trebled the pre-war figures, and this without any layoff of hydrographic field staff.