CHAPTER IV

THE HYDROGRAPHIC SURVEY OF CANADA FROM 1928 TO THE COMMENCEMENT OF THE SECOND WORLD WAR

This was undoubtedly the most progressive and productive period in the history of the hydrographie service up to the Second World War, and this despite five lean years of government austerity in the 1930s, and the fact the service was in four different departments in five weeks (October-November 1936 - Marine, Transport, Interior, Mines and Resources). When the Department of Mines and Resources came into being on 1 December 1936, Capt. F. Anderson, the chief hydrographer since 1925, retired and was succeeded by Mr F.H. Peters - renamed surveyor general and chief, Hydrographie and Map Service, Surveys and Engineering Branch. Mr J.M. Wardle (the former deputy minister, Department of the Interior) became the first and only director of this new branch. Of particular concern to the conduct of the hydrographie service was the renaming of Mr R.J. Fraser, senior hydrographer, and before this fiscal year came to a close Mr F.C.G. Smith had assumed many of Mr Fraser's former duties with the title "Superintendent of Charts." To serve better navigation and shipping interests on the Pacific coast, in 1938 the Victoria office was opened all year round for the first time, with Mr H.D. Parizeau, "acting supervising hydrographer."

In the fall of 1938, the Civil Service Commission began a unit survey, or reclassification, of the Hydrographie and Map Service. Preliminary to its official approval in 1940, two major staff recommendations were carried out in 1939. One was the official transfer of copper-plate engravers from the Department of Public Printing and Stationery to the hydrographie service; the other was the transfer of all tidal and current work on the Pacific coast from the Vancouver office of the Tidal and Current Division to the Victoria office, under the charge of Mr H.D. Parizeau.

From the scientific and technical viewpoint, the years 1928-39 not only marked the commencement of the present era of the reorganized and renamed Canadian Hydrographie Service, but it also was a period of gradual transition from the older order of hydrographie surveying to present-day methods. The first major improvement was the adoption of the Sperry gyro-compass in 1928 - the first electronic navigational aid on hydrographie ships, other than wireless. In 1929 the first echo-sounding gear was installed in the *Acadia.* With added improvements, by 1932 [it] was recording on paper deep-water soundings acceptable for standard navigation charts. In 1930 aerial photography was being used for the first time by the service for surveying and cartographic purposes, and by 1935 automatic recording echo-sounding machines were in operation in ships and launches on both coasts.

In the mid-1930s the last sailing gig was beached on the Atlantic coast, and with

modern navigational aids now in use on major survey ships, there was less use for the older conventional units such as the ship's standard magnetic compass, the steam Lucas sounding machine, and the submarine, pressure, and harpoon sounders. What was once the sailing gig and "swinging the lead" method of inshore charting, now became the survey launch and echo-sounder method - a major transition and a progressive step in itself. In the early 1920s the *Acadia* experimented with radio direction finding apparatus (RDF) for ship positioning on the Atlantic coast; in the seasons of 1939 and 1940 the *Wm. J. Stewart* conducted somewhat similar experiments off the Pacific coast with radio acoustic ranging (RAR) apparatus. For the record, neither of these electronic innovations was ever adopted for charting purposes by this service.

As the renamed Canadian Hydrographic Service, in 1928 the first hydrographic party was sent to northwestern Canada to commence the charting of Great Slave Lake. This season the charting of the Hudson Bay route was resumed in Port Churchill and was continued until 1935. Other major surveys were completed during this period as follows: Lake Winnipeg, 1929-35; the upper St Lawrence ship channel (Prescott to Kingston, Ontario, now part of the present St Lawrence Seaway), 1929-31 ; Northeast Arm, Gulf of St Lawrence, including hydrographic control on the west coast of Newfoundland, 1929-39; and the Saint John River, New Brunswick, to above Fredericton, the capital, 1930-35. From 1932-33 joint hydrographic-tidal and current survey investigations were carried out in the lower St Lawrence River by the *Cartier,* below Father Point, PQ; and from 1933-37, the sector of the river from above Quebec to Father Point was investigated by the Tidal and Current Division with the aid of lightships and the former steamer *Gulnare.* To assist the Geodetic Survey of Canada with its work in Newfoundland, in 1935 two tidal stations were built on this coast by the Tidal and Current Division, and from 1934-37 the Precise Water Levels Division conducted several hydrometric investigations in the upper St Lawrence River and Great Lakes on behalf of the Interdepartmental, Montreal and Ship Channel Water Level Board. By 1939 the northernmost hydrographic surveys were the Mackenzie River delta in the western Arctic, and the south coast of Baffin Island in Hudson Strait. Only following the Second World War was hydrographic surveying extended north of these limits (1950, and still continuing).

To carry out these long-delayed surveys, a third period of staff recruitment commenced in 1931, and by 1939 the regular staff had been increased by 80 per cent of its 1927 establishment. In the first eleven fiscal years as the hydrographic service, the annual average chart production quota almost doubled that of the years as the hydrographic survey (1904-27), and the production of sailing directions and pilots about quadrupled. From a financial aspect, the average annual expenditure of the hydrographic service prior to the Second World War was approximately $430,768 with a maximum in 1930 of $565,721. This was only a 72 per cent increase from the average yearly figure of $250,000 for the 1904-27 period.

To aid the field staff better, in 1930 the new houseboat *Pender* was commissioned in British Columbia, and on both coasts several small launches and smaller craft were built. For the want of funds the *Bayfield* was laid up in Charlottetown in 1931, and the next year, 1932, the *Lillooet* at Victoria, BC. In 1933 the last-named ship was replaced by the present *Wm. J. Stewart,* and for special work in Hudson Strait the 36-foot cabin cruiser *Henry Hudson* was commissioned in 1935. With the sale of the *Bayfield* in 1937, and the *Lillooet* in 1939, there passed into the annals of the Canadian Hydrographic Service the stories of the first replaced hydrographic ship, and the first one specially designed and built for the service - both of which dated back to the years following the South African War.

When the Second World War began in September 1939, the steamer *Acadia* was

working on the west coast of Newfoundland - the first significant Canadian hydrographie work on this island. However, this assignment was to be of short duration, and before the month ended both the *Cartier* and *Acadia* were again commandeered by the Canadian navy for a second term of naval duty on the Atlantic coast. In British Columbia the *Wm. J. Stewart* was not taken over, but during the war years carried out many special and urgent investigations for the Department of National Defence. With no major ships on the Atlantic coast for the duration, smaller organized units from both the *Cartier* and *Acadia* were deployed to undertake the recharting of former Admiralty surveys along the sea coast of the maritime provinces, including certain localities in the oldest colony in the British Commonwealth at that time, and now Canada's tenth province - Newfoundland.

Since the First World War, the hydrographie survey had been occasionally referred to in Government publications under a different title, one of which was "Hydrographie Service." However, when the reclassification was approved by P.C. 54/437 of 19 March 1928, nowhere in this official document was there any mention to the title "Hydrographie Service." Furthermore, no specific order-in-council can be found authorizing any change from the old title. In fact, during the year 1927 when the survey was under review by the Civil Service Commission the title "Canadian Hydrographie Office" was used in departmental publications of tide tables, and notices to mariners (prior to 28 March 1928). It therefore seems most plausible that this change in title was a departmental ruling with the knowledge of the Civil Service Commission. It was then left to future orders-in-council for official recognition. In support of this statement are the following Government references: *Catalogue of Marine Charts corrected to April 1st, 1928; Notices to Mariners No. 14 of April 5th, 1928,* and the first annual report of the Canadian Hydrographie Service by Captain F. Anderson, M.E.I.C., chief hydrographer. It can therefore be said that the renamed "Canadian Hydrographie Service" began appearing in official correspondence and publications from 1 April 1928 - the commencement of the fiscal year 1928.

The first-known order-in-council in which this renamed title appears is mentioned in P.C. 216/661 dated 16 April 1929, that officially authorized a larger establishment, "for the Surveying Division and Charting Division of the Hydrographie Service, Department of Marine and Fisheries, effective 1 April, 1929." Special reference was made to the fact "that the present establishment of the Surveying Division is not sufficient to carry out the programme of the coming season ... the present staff of the Charting Division is fully occupied and still unable to cope with the situation."

The renamed Hydrographie Service now comprised two divisions, in addition to the staff at headquarters: Surveying Division and Charting Division. The chief hydrographer in his first annual report lists the following sub-headings: Division of Hydrography; Division of Tides and Currents; Precise Water Levels (former Automatic Gauges); Division of Chart Construction; and Division of Chart Distribution. To the end of the Second World War, the major activities of the hydrographie service were reported annually under these main divisions.

THE CANADIAN HYDROGRAPHIC SERVICE UNDER CAPT. F. ANDERSON, 1928-1936

1928-29

DIVISION OF HYDROGRAPHY

In 1928 the steamer *Bayfield* was still on loan to the Preventive Service, Department of National Revenue. The installation of the first gyroscope on a survey ship *(Acadia)* marked the commencement of a transition from the older order of surveying to one with

electronically operated units. To undertake the urgently requested surveys, experienced senior assistants with ship experience were placed in charge of minor field parties in various territories. To carry out this work efficiently, eight junior hydrographers and four other technical personnel were added to the staff. Seven separate field parties using three steamers, three motor launches, and one houseboat, with the regular auxiliary craft and equipment, were actively employed this summer. Three parties worked on the Atlantic coast, two in inland waters, and two on the Pacific coast.

Hudson Bay

The last hydrographie party in Hudson Bay was in the steamer *Acadia* in 1914; and by 1928 the Hudson Bay Railway was rapidly approaching the end of the line at Churchill Harbour. In support of the development of this northern seaport for western Canada, and to improve navigation along the Hudson Bay route from the Atlantic seaboard, it was decided to send a party to Churchill Harbour in 1928, to undertake the preparatory field work for ship surveys the next year. This party was in charge of Mr F.C.G. Smith, with assistant Mr C P. Warken. Churchill Harbour was reached from Lake Winnipeg by rail and canoes to Port Nelson, and from there by a Department of Railways and Canals tug. Work began on 19 July, but camping and surveying equipment, and a motor boat (remodelled lobster boat) did not arrive there from Halifax until the middle of August. When the season ended on 6 October, Mr Warken returned to the end of steel of the Hudson Bay Railway by aeroplane and the rest of the party departed for Halifax from Churchill on the SS *Odile.* Work completed in this short season consisted of a triangulation network of the Churchill area, four large beacons built to aid navigation, numerous observations taken for magnetic variation (first since 1912 by the hydrographie service), and a tide-gauge installed in the harbour from which forty-six days of tidal records were obtained. Mr Smith noted, "this gauge is being re-installed on a permanent basis and will be operated as a principal tidal station for the Bay."

Bay of Fundy

The *Cartier* sailed from winter quarters in Halifax Harbour for Saint John, N B, on 5 May. This party was in charge of Mr G.A. Bachand, with assistants Messrs N. Wilson, W.F. Elliott and K.V. Kierstead. Sailing master was Capt. James Roach, and chief engineer, Mr J.E. Bélanger. Survey work was centred in the main part of the Bay of Fundy between Grand Manan, N.B. and Cape Chignecto. Control for this survey was the main triangulation network established by the Geodetic Survey of Canada. Over an area of 1,750 square miles, some 2,300 miles of ship and boat soundings were logged.

Gulf of St Lawrence

In 1928 the *Acadia,* in charge of Mr J.U. Beauchemin, with assistants Messrs M.A. MacKinnon, R.W. Bent, E.D. Bent and E.F. May, left Halifax on 13 May for the Saguenay River. Here a survey of Ha Ha Bay was made and the Chicoutimi Channel swept. Sailing master was Capt. F.V. Ryan, and chief engineer, Mr J.S. Cann. First officer was Mr D.M. Snelgrove and second engineer, Mr S.A. Robson. The main survey along the north shore of the gulf was then taken in hand between Pentecôte and Sheldrake Rivers. Other special investigations were made in connection with shipwrecks off Father Point and Cape Whittle. Of 186 field days, some 25 per cent were lost on account of fog, rain, etc. Over an area of

1,560 square miles, 1,314 miles of ship and 620 miles of boat soundings were recorded, and 93 miles of coastline surveyed. Before the fiscal year, ended Messrs E.F. May and E.D. Bent resigned. These were the first Canadian hydrographie surveys with the aid of a gyroscope compass -the first electronic aid to navigation in the service.

Gyroscope Compasses, 1928-34

To expedite the recharting of the Gulf of St Lawrence and for the possible future work in Hudson Bay, a new gyroscope was installed on the *Acadia* in the spring of 1928. It was purchased from the Sperry Gyroscope Co. Ltd, England, through their Canadian representative with the Ontario Hughes Owens Co. Ltd in Ottawa, at an approximate cost of $5,752. In 1951, Sperry Rand Canada Limited purchased the Ontario Hughes Owens Ltd, and in September 1968, Mr C H . Owsten of Sperry Rand stated, in all probability this unit "would have been a Sperry MK VIII, MOD2, and the installation would have been supervised by a field engineer from the New York Office. The settling point accuracy of the MK VIII was three-quarters of a degree. This means that the compass could be calibrated to settle within 0.75 degrees of the latitude [azimuth?]." Similar units were added to the chart rooms of the *Lillooet* (1930), *Wm. J. Stewart* (1932), and *Cartier* (1934).

With the Sperry gyroscope compass, hydrographers now had for surveying purposes an accurate instrument, one that always pointed to the true north, and being non-magnetic it was not affected by its close proximity to the magnetic pole. After a season's work Mr Beauchemin reported it to be "a success... in navigating the ship... checking the ranges and clearing marks ... calibration work when fixing was impossible ... and I have given all summer my spare time this summer in studying the different parts and mechanism of the Master Compass, but I must admit that I would be at bay to make any repair in case of emergency." Later the chief hydrographer wrote, "a most satisfactory and valuable acquisition to the vessels charting and navigational equipment. The season's experience and the gratifying results obtained with this instrument will add to the usefulness in similar work, as well as for magnetic variation investigation and general survey work in Hudson Bay should this ship be detailed for work in northern waters."

Inland Waters

Lake St Clair and River (Great Lakes). The recharting of the Canadian section of Lake St Clair begun last year [sic. *Ed.]* was resumed in 1928 by Messrs E.A. Ghysens and J.L. Foreman, in the cabin cruiser *Boulton.* Over an area of 110 square miles, about 1,020 miles of boat sounding were recorded, and 75 miles of coastline surveyed. From these two seasons work, the first edition of an engraved Canadian chart for Lake St Clair was later published.
Great Slave Lake. Preparatory charting work was started this season along the south shore of Great Slave Lake "as part of a broad scheme of operation that will eventually embrace the whole of this lake, Lake Athabaska and the connecting waterways, and the Mackenzie River route to the Arctic Ocean, in the interests of increasing navigation and the development of fisheries, other natural resources and the necessary water transport connected therewith." This party was in charge of Mr H.L. Leadman, with assistant Mr W.R. Young. Unable to procure a serviceable vessel in this territory, a 40-foot vessel, the auxiliary schooner *Pilot No. 1,* was built under Mr Leadman's supervision by the Northern Boat Co. Ltd, in Edmonton, at a cost of $3,913.17. When completed, she was taken by rail to waterways, and then sailed down the Athabaska and Slave Rivers to Great Slave Lake by Mr Leadman - a distance of some 600 miles. After a brief visit at Fort Resolution, the party

moved on to Buffalo River on the south side of the lake where a summer base was established. From then until the remainder of the season, a triangulation and coast survey was carried out between these limits, and several harbour sites suitable for shallow-draft lake steamers were explored. Considerable lead-line sounding was recorded, a few water gauges installed, and bench marks established at several points on the lake. The field season was of short duration due to many delays in reaching Great Slave Lake earlier, and the work completed was more of an exploratory nature than a standard survey. When ice began to form on the lake on 26 September, the *Pilot No. 1* returned to Fort Smith for the winter, thus ending the first Canadian hydrographie season in northwestern Canada.

British Columbia

In mid-April the *Lillooet* was commissioned with Mr H.D. Parizeau in command, assisted by Commander J.H. Knight and Messrs L.R. Davies, W.K. Willis and R.H. Ettershank. Sailing master was Capt. J.J. Moore (1922-32), and chief engineer, Mr A.R. Borrowman (1911-32). *Lillooet* departed Victoria on 19 June for Millbanke Sound with the former naval launch *Thistle* in tow, and here camping parties were established. Houseboats *Somass* and *Fraser* were commissioned by Commander Knight on 24 June and for the remainder of the season worked in Nootka and Blair Inlets, Reid Passage, Port Blakeney, Matheson Channel, Percival Narrows and Moss Passage. *Lillooet* completed a small investigation in Vancouver Harbour. While working in Sooke Harbour on 17 October the 36-foot "camp launch" *Thistle* caught fire by the ignition of fumes from the gasoline tanks, causing the gasoline engineer to sustain serious but not fatal arm burns. *Fraser* also caught fire but it was controlled with extinguishers. When cut adrift from the houseboat, *Thistle* drifted outside the harbour where she sank the following morning. This season *Lillooet* surveyed 148 miles of coastline and charted an area of 147 square miles, and *Somass* surveyed 87 miles of coast and charted an area of 18 square miles. In January 1929, Mr R.B. Young, (regional hydrographer, Pacific coast, 1953-68), was appointed to the service as a hydrographer, grade I; and in March 1929 another graduate of the University of British Columbia, Mr A.E. Stewardson [was also appointed].

HEADQUARTERS

Under the supervision of Principal Assistant R.J. Fraser, several special or "emergency surveys" were carried out in 1928. Other administration duties of Mr Fraser included the writing of Canadian sailing directions and pilots, and attending to corrections and revisions of Admiralty publications.

OVERSEAS EXHIBITION OF CANADIAN CHARTS

From July to October 1928 an exhibition of imperial hydrography was held in London under the auspices of the Board of Trade, with the exhibits displayed in the new Science Museum, South Kensington. Through the courtesy of the hydrographer of the navy, several representative charts of the Canadian Hydrographie Service were placed on view. The *Canadian Surveyor,* March 1929, stated "those selected among the three hundred charts that are published by the Canadian Hydrographie Service were given mention and included several of the St Lawrence River, Gulf and Atlantic Coast, and of British Columbia coastal waters." This is the first known overseas exhibition of Canadian charts.

TIDAL AND CURRENT DIVISION

Since 1924 this division of the hydrographie service was in nominal charge of Mr H.W. Jones, senior tidal and current surveyor (Atlantic coast), assisted by Mr R.B. Lee, Misses L.R. Brown and E. Campbell in Ottawa, and Mr S.C. Hayden, senior tidal and current surveyor (Pacific coast) with his office in Vancouver. Twelve principal tidal stations were maintained in 1928, six each on the Atlantic and Pacific coasts. Four seasonal gauges were installed near the dyke-lands of Nova Scotia in the Bay of Fundy for tidal comparisons when the proposed Passamaquoddy River power project became a reality. Current instruments formerly used in the Strait of Canso were trans-shipped to the Great Bras d'Or in Cape Breton where ships now reported difficulty in making this passage in thick weather. Distribution of tide tables (always issued to the public a year ahead) tallied 90,000.

PRECISE WATER LEVELS

This division was in charge of Mr C.A. Price, assisted by Messrs Wm J. Miller, A.S. Matthewson, H.P. Williams and A.J. Tingley (five weeks). Forty-four permanent water gauges were maintained between Quebec and Port Arthur during the navigation season. In his annual report Mr Price remarked, "within the past ten years the total number of such gauging stations has increased from 32 in 1918 to 44 at the present time." In 1928 some 25,551 sheets of prepared data on water levels, an increase of2,487 over the preceding year, were issued to the public. In March 1929 Mr A.C. Turtle replaced Mr A.J. Tingley as an engineering clerk in this division.

CHART CONSTRUCTION

This division was under the direction of Mr G.L. Crichton, with Major F.J. Delaute, assistant chief, and the following cartographic staff: Messrs P.E. Parent, H. Melancon, W.L. Andrews and student M. Isabelle (appointed August 1928). The engraving section with Mr W.C. Cunningham in charge had assistants Messrs Watts, Silvers, the two Cunningham Brothers, and apprentice H. Williams (appointed January 1929). Work completed by this division in 1928 comprised 23 new editions of engraved charts, 10 new editions of photo-lithographed charts; one first edition of a photo-lithographic chart, and a new chart catalogue with 5 maps. Under Mr Cunningham's supervision, 13 new copper plates were engraved, 3,859 small corrections made to existing plates and 6 large corrections to others. In his annual report Mr Crichton remarked, "the expansion of the work of this division increased the urgent need for additional draftsmen or cartographers." The appointments of Messrs M. Isabelle and H. Williams were the first in accordance with this recommendation.

CHART DISTRIBUTION

This division was in charge of Mr Chas McGreevy, assisted by Mr A. Carbonneau and issued to the public 13,313 copies of charts, and 216 editions of Sailing Directions and Pilots. In his annual report Mr McGreevy stated, "since 1916 the number of charts distributed annually had twice doubled, and the total number issued in the past 13 years amounted to 107,993." Computed in periods of three-year intervals, the following tabulations are most interesting: Years 1917 to 1919,16,4127 copies; 1920 to 1922,21,806 copies; 1923-1925, 28,566 copies; and 1926 to 1928, 27,543 copies.

HYDROGRAPHIC EXPENDITURE, FISCAL YEAR, 1928-29

In its first fiscal year as the Canadian Hydrographie Service, expenditure amounted to $386,739.07, an approximate increase of only $70,000 more than the last year as the Hydrographie Survey of Canada. This figure also included provision for increased personnel, salary increases from the 1927 reclassification, the new auxiliary schooner *Pilot No. 1* and new hydrographie and océanographie equipment.

THE ROYAL COMMISSION ON TECHNICAL AND PROFESSIONAL SERVICE (BEATTY REPORT) AND THE CANADIAN HYDROGRAPHIC SERVICE

The small salaries of civil servants during the First World War did much to bring about the general reclassification across Canada in 1919. When the revised salary schedules of the Griffenhagen Report were implemented in 1920, they failed to take into consideration the unpredictable cost of living conditions in the years ahead. In April 1929 a royal commission was appointed to investigate and report on salaries of professional and technical officers in the Civil Service. This royal commission comprised Mr E. W. Beatty, chairman, and Sir H.J. Carneau and Dr W.C. Murray, commissioners. An interim report on the National Research Council was submitted in July 1929, and in February 1930 the actual *Report of the Royal Commission on Technical and Professional Services* was published by the King's Printer in Ottawa.

Highlights of this report of general interest to the hydrographie service were the new proposed position classifications and their salary ranges as given in Appendix A. That of the chief hydrographer was regraded to hydrographer VI, $4,800 to $5,200 (maximum of $300 over present range). Two new positions were proposed as "heads of divisions," hydrographer V, salary range $4,020 to $4,620. Officers in charge of survey ships remained hydrographer IV, with new salary scale of $3,420 to $3,900 (increase maximum of $300 per annum). Senior assistants, heads of divisions in headquarters, etc., were to be classified hydrographers III, $2,880 to $3,360. Assistants grades I and II, ranged in salary from $ 1,800 to $2,160 (no increase whatever), and $2,280 to $2,760, respectively.

In a letter to the Classification Committee, Hydrographie Group, dated 18 March 1930, the chief hydrographer stated, "it might be of interest to point out that, under the grading in the Beatty Report the average salary increase, to the positions under the Canadian Hydrographie Service for the fiscal year 1930-31, would only be 1.5 per cent over the salaries which will be accorded under existing conditions." The stock market crash of 1929 and the tight financial policy of government expenditures soon to follow, did much to forestall the actual implementation of these proposed recommendations with their increased salary ranges.

Encouraged by the Beatty recommendations, a recruitment of additional field personnel was requested, approved with P.C. 323/991 dated 13 May 1930. It read in part: "authority be granted for the creation of nine additional positions of Hydrographer Grade I, Hydrographie Service, Marine Division, effective from April 1,1930." This was to be the third and last period of active recruitment in the service until the end of the Second World War. The chief hydrographer in his annual report for 1929 remarked, "the field staff in the Division of Hydrography has been increased from time to time, as qualified applicants became available... efforts are being made to induce young graduates to enter this important branch of federal service, and it is hoped that greater success may be attained through an upward revision of salaries."

1929-30

DIVISION OF HYDROGRAPHY

With the return of the *Bayfield* from the Preventive Service, all four hydrographie ships were again in commission. This year (1929) a second electronic device was added to the *Acadia* - a sonic-sounding apparatus - one that within three years time was to record graphs of the bottom acceptable for charts. With a gyroscope compass and now an echo-sounder, two progressive advances had been made in revolutionizing the older methods of ship sounding. The fiscal year 1929 was also the first occasion when the service spent more than half a million dollars ($508,245), exceeding that of 1928 by $121,506, or by 30 per cent more. Considerable of the outlay was for recommissioning the steamer *Bayfield,* new equipment, and the outfitting the *Acadia* for Hudson Bay.

Hudson Bay

Fifteen years had now passed since the *Acadia* last visited sub-Arctic Waters, and with the Hudson Bay Railway almost completed to Port Churchill, political pressure was renewed for the immediate development of this northern shipping route. In order that "charting and océanographie research" might be more effectively conducted, the *Acadia* was outfitted with the most modern navigational and scientific instruments available and sent north. The party in charge of Mr J.U. Beauchemin was assisted by Messrs M.A. MacKinnon, K.V. Kierstead, T.M. Tardif and J.A. Deveault. Sailing master was Capt. F.V. Ryan and chief engineer, Mr J.S. Cann.

Prior to departure for Hudson Bay, a new "sonic sounding device" was added to the ship's navigational equipment and to test its efficiency, a trial run was made from Halifax to a position 55 miles southwest of Sable Island on 15 July. Here a full day was spent in checking this first echo-sounder in depths to 500 fathoms. Later when sailing along the eastern coast of Nova Scotia, contour lines and shallow spots were easily located, and experiments proved this device as an efficient "submarine sentry."

At Port Burwell the *Acadia* picked up three stranded aviators of the ill-fated trans-Atlantic airplane *Untin Bowler* and transported them to Churchill Harbour, and in August, when working off this area, rendered assistance to survivors of another air mishap - the MacAlpine party, found adrift off this harbour. When survey work on the west coast of Hudson Bay ended, and observations completed at various positions along the Hudson Bay Route, the *Acadia* cleared Hudson Strait on 1 November and tied up at Halifax for the winter on the 8 November. From the results of the two seasons' work charts of Churchill Harbour, and Cape Churchill to Churchill Harbour, were published; and before this fiscal year ended, Mr K.V. Kierstead resigned.

Scientific data gathered this season included the following: magnetic observations with the gyro-compass to check reported anomalies in certain areas along the Hudson Bay route; densities, temperature and water samples with the aid of two Negretti and Zambra reversing deep-sea thermometers and the latest pattern Nansen stopcock reversing deep-sea bottles. Routes followed and ice conditions observed were sketched, and several tables of oceanographical observations at the stations occupied were compiled.[1] Of special significance is the statement of Capt. F. Anderson, the chief hydrographer, in his annual report: "when opportunity arises, the ships are being equipped with the latest approved

[1] *Report Marine and Fisheries,* 1929.

devices for hydrographical and oceanographical research. These comprise sonic sounding apparatus, gyroscopic or mechanical compasses, and equipment for attaining deep-water samples and temperatures. This Service has been content to await the results of experimental work conducted by the Hydrographie Service of other countries and then select the types of apparatus found to be the best adapted for work in Canadian Waters, and the value of this policy is now being demonstrated in the results obtained from the instruments that have been finally selected."

First Echo-Sounding Machine in Hydrographic Ships, 1929-32

The transition from the mechanical steam-sounder to echo-sounding machines in ships of the Royal Navy dated back to 1924. The following year (1925), under licence of the British Admiralty and with the approval of its Research Department, the first commercial Admiralty pattern, non-registering, sonic-sounding machine was manufactured by Henry Hughes & Son, Ltd. of England (Trademark HUSUN). In 1928 eight Admiralty survey ships were equipped with shallow water models (130 fathoms), and soundings obtained were found acceptable for insertion on Admiralty charts. In far eastern waters another Admiralty ship was experimenting with a deep water model (designed for 4,500 fathoms). Until official interest in the development of the Hudson Bay route was renewed, the hydrographie service had to be content with a "wait and see" attitude, in the meantime keeping itself informed of the latest developments of these and similar sonic sounders in Europe and the United States. When it was decided to install sonic sounders in Canadian hydrographie ships, the units selected were Admiralty pattern machines, manufactured by Henry Hughes & Son.

The first sonic sounder in the service was a deep water type installed in the *Acadia* at the Halifax Shipyard in June 1929. It was purchased from the Ontario Hughes Owens Co. Ltd, Ottawa (Canadian representative, Henry Hughes Ltd.) at a cost of $3,377.75, a further billing of $575.00 was charged for cutting the ship's bottom and attaching the "transmitter" and "hydrophone," bringing the overall cost to $3,952.55. It was a non-recording sounding, and operated on the "hammer-compression" principle, which was characteristic of the first sonic sounders. Former Dominion Hydrographer R.J. Fraser had much to do with these first units, and wrote in the *Canadian Surveyor,* October 1949: "This machine was the hammer type, a compressor operating a hammer against the bottom shell of the ship. Down in the engine room and aft in the hydrographers' quarters you could always tell if the machine was operating by listening to the hammer blows. There was no automatic paper recorder and the operator had to wear earphones, tune in the echoes, and read off the depths as they flashed on a recording dial. This machine had two receiving hydrophones, one for shallow water, 6 to 100 fathoms, the other for deeper water 100 to 800 fathoms."

To obtain a sounding, the hydrographer in the chartroom operated a switch device in the "receiving gear" that set the "transmitter" in motion. A hard pneumatic blow from the hammer on the ship's hull propagated a high frequency sound-wave that was directed to the sea bottom. From here, it was re-echoed back to the hydrophone and transmitted to the receiver gear. Earphones plugged into this circuit could detect the true and false echoes, and the correct depth then read off the graduated fathom scale of the rotating indicator. With a rapidly changing bottom, the true echo was frequently lost. When this happened the recording gear was useless until reset with a check depth by the steam Lucas sounding machine (kept always in readiness). This model of sounder was a four-phase unit of 200 fathoms each, and was operated by the ship's regular electrical system of 110 volts. At the end of the first field season the chief hydrographer stated, "this sonic device proved efficient as a depth measuring machine to a degree of precision of 98'/2 per cent."

Satisfied with the performance of the *Acadia's* sonic sounder, there began a close association between senior officers of this service and the principals of the Ottawa and London firms of Henry Hughes and Sons and the Ontario Hughes Owens Co., such men as Mr Arthur Hughes, managing director of the parent company in London, Mr P. White, president of the Ottawa firm; and Capt. C.B. Potts, former chief officer, Canadian National Steamship Co. and now manager, Marine Department Ontario Hughes Owens Co. Ltd. In 1928 this latter company was also the Canadian representative for the Sperry Gyroscope Company, Limited, in Middlesex, England, with a branch office in Brooklyn, N.Y. In 1951 the Ontario Hughes firm in Ottawa was purchased by Sperry Rand Canada Limited, and the echo-sounding division of the business was taken over by Kelvin Hughes, Montreal - a division of Smiths Industries North America Limited. Although results from the *Acadia's* sounder were in many respects experimental, they were most encouraging, and in 1930 similar types of Admiralty pattern, non-recording, sonic sounders of different ranges were added to the survey steamers *Bayfield* and the *Lillooet.*

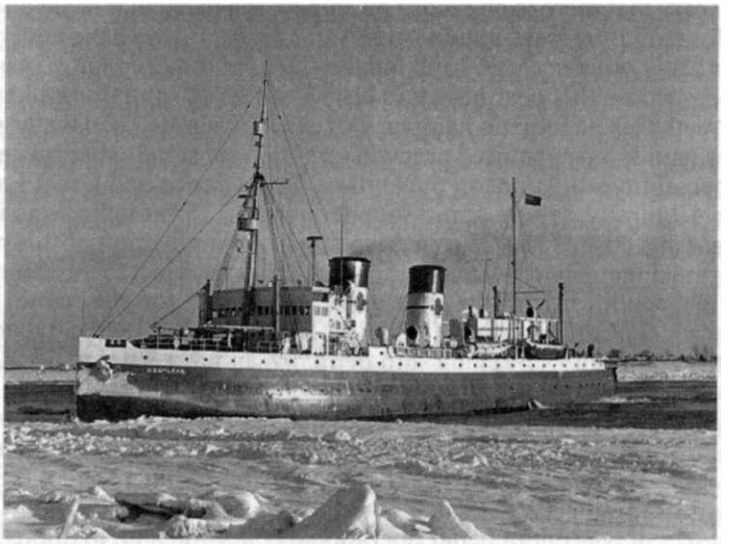
The *Lillooet's* unit was a deep water oceanic type, with a specially designed receiving gear of 2,000 fathoms. It was installed at a total cost of $6,325, and like the *Acadia's* sounder the pneumatic hammer of the transmitter required 100 lbs of air pressure from the compressor for efficient operation. The hydrophone of this machine was regulated by a sluice valve for raising and lowering the same, above and below the ship's hull. From hearsay reports, this machine seldom gave satisfactory results and was unsuitable for shallow waters. Writing to Engineer Robson, April 1932, Mr A.J. Hughes commented, "I am extremely sorry that there is no record on ship on the particular scale and system which was designed for the *Lillooet* at Captain Anderson's request... we have never yet made Deep Water Gear with any other scale of 4500 fathoms, except the *Lillooet...* in every country in the world almost where this gear has been tested, which is something like 15, they found they could get with this pneumatic hammer extremely accurate deep water soundings even on steep slopes, and it only required practice to obtain most valuable surveys."

For special investigations in the Gulf of St Lawrence and Great Lakes, a Mark II, shallow water Admiralty pattern sonic sounder, range 135 fathoms, was installed on the steamer *Bayfield* at a cost of $3,025 (machine only). An innovation of this machine was its improved electromagnetic type of transmitter, but it was "subject to the same switch contact and coil service conditions as the pneumatic type, and for the same reasons" (H.L. Leadman). Since 1927 Capt. A.G.N. Wyatt, RN (Hydrographer 1945-50) had used the Mark II sounder on the Admiralty surveying ship *Beaufort,* and in a letter to Mr R.J. Fraser dated 11 April 1929, he wrote, "Personally I would always use the Echo Gear in depths over 15 fathoms as being a great saver of time but under that depth one is rather apt to miss a sudden and brief change in the depth because when the echo is lost one has to hunt up and down the scale again ... it has been found consistently accurate to within one foot." Following trials in Lake Ontario in June 1930, the same could not be said of the *Bayfield's* machine. The next year, however, it was put in better operational condition and, to quote Mr Leadman, it "gave excellent results when the progress of the art at that time is considered."

In September 1930 the chief hydrographer was informed by the Ontario Hughes Owens Company of a new "echo-sounder with recorder" manufactured this year by Henry Hughes Ltd. The new design Mark IIA had, attached to its receiving gear, a recording gear or box in which a pen recorded the sounding on a suitable chart. With the aid of a specially prepared paper every sounding taken could be automatically recorded on the chart, and when the pen records were connected by a line, an "oceanograph," or chart of the contour of the seabed, was obtainable. This chart paper was graduated with its ordinates in equal divisions of soundings, and its abscissa, as plain horizontal lines. One improved feature of this new

machine was its adaptability to change over the recording chart from deep-water depth of 400 fathoms to ordinary navigation depths of 130 fathoms, and to shallower depths of 45 fathoms. "A handbook on this new gear is now in the course of preparation ... development work is also proceeding on a recording gear with a range of 2,000 fathoms."

For greater efficiency and reliability of soundings in northern waters, one of these new automatic recording gears was added to the *Acadia's* sonic sounder - thus marking the first progressive step in the actual transition from sonic-sounding recording to automatic recording in Canadian hydrographie ships. Results from this season's work when passed on to the Ontario Hughes Owens Co., were carefully studied by scientists and technicians in the Admiralty and Hughes Owens Limited, and the following year (1932) a greatly improved automatic receiving gear was marketed by this firm, named *Acadia-Challenger.* It was so named in appreciation of the experimental contributions by the Canadian Hydrographie Service and the Admiralty survey ship, HMS *Challenger.* This new improvement registered on paper ocean depths at the rate of sixty per minute, but was more efficient in deep water than shallow water. At the end of the 1932 field season in the Gulf of St Lawrence, the depths registered on paper "prove most satisfactory ... accepted for insertion on standard charts." Reporting on the season's activities in 1932, the chief hydrographer remarked, "the adoption of the echo-sounding method of obtaining depth measurements, which is perhaps the principal and important function of the Hydrographie Service in connection with its production of the standard navigational charts of Canadian coasts and waters, has increased the sounding of the deep water areas offshore not less than thirty percent."



The *N.B. McLean* as she appeared later in life, in Coast Guard colours, with a hanger and helicopter deck. She was completed in 1930 and named for Nathan B. McLean, of the St Lawrence ship channel authority. McLean himself led an expedition to Hudson Bay when the terminus of the railway was being decided.
Photo courtesy CHS.

In 1932 an Admiralty Pattern, "hammer-hydrophone" sonic sounder was placed in the icebreaker *N.B. McLean* for patrol and hydrographie duty in Hudson Strait. It too was

non-recording, and was used sparingly by the Hudson Strait party. The following year, 1933, it was replaced with a new magneto-striction, automatic recording echo-sounder, and its profiles of the sea bottom were used to great advantage for charting purposes by the Hudson Strait party. In 1932 the last sonic sounder was requisitioned by the hydrographie service and installed in the new survey ship *Wm. J. Stewart.* During the season of 1933 it was reported by the second engineer, Mr S.A. Robson, as "recording 1300 fathoms with ease, when the ship was steaming at 9 knots, giving a very clear graph, but had difficulty to echo steaming between 10 and 11 knots in a head sea ... the machine operated continuously for 54 hours giving no trouble whatever ... I am quite certain that this machine would perform at 2,000 fathoms, just as well, if speed of ship was reduced accordingly... in shallow water, such as connecting up boat lines, around 20 fathoms, I would say a shallow water machine would be more suitable and would give better results."

Addressing the Fifth Pacific Science Congress early in 1933, Mr H.D. Parizeau, officer-in-charge, Victoria office, remarked, "the most important development in hydrographie surveying is sounding by echo, which although not perfect in every respect is making very rapid progress .. in 1846, it was noted that Captain Kellett in the Atlantic, in obtaining a sounding of 2,905 fathoms with the method then employed took four hours for this single operation. At the present time a surveying vessel at full speed would obtain the same depth in seven and one half seconds."

Since 1929 Capt. Potts of the Ontario Hughes Owens had worked very closely with the Canadian Hydrographie Service in the development of the echo-sounder, and recalling to mind many of these early problems, he wrote in the *Canadian Surveyor,* October 1949, "it is a very good source of satisfaction to know that the pioneers of echo-sounding technique are Canadian in our Government Service. Men like H.L. Leadman and his staff, who persevered in the early days of imperfect machines, experimenting and offering constructive criticism, which enabled manufacturers to improve and design new models ... the transition from 'listening in' to automatic recording of depth in 1931 and 1932, was in no small measure to suggestions from Canada. The advent of the recording echo-sounder in 1932 accelerated the science of Hydrography and produced a volume of accurate depth knowledge of exceeding expectations."

To acquaint himself better with the latest Admiralty pattern of sounders, Mr S.A. Robson, the former chief engineer of the *Bayfield* and now second engineer, *Wm. J. Stewart,* was sent to England in the fall of 1932. Early in January 1933 he wrote Capt. Anderson, the chief hydrographer, "experiments with a new system of transmission and reception, have been successfully introduced, entirely dispensing with hammer-transmission and hydrophone reception for soundings up to 400 fathoms ... I understand however that this new system is not likely to replace the pneumatic transmitter and hydrophone reception in deep water gear, above 500 fathoms. In conclusion, I would state that Mr Hughes is doing his best, to see that I am getting the best instructions required, to carry on this echo-sounding on our ships." The advent of these automatic echo-sounders in 1933 marked the final transition in the development of this important navigational instrument - from sonic to electronic ship sounding (see Fiscal Year 1933-34).

Gulf of St Lawrence

North Shore. In mid-May the *Cartier,* in command of Mr G.A. Bachand, with assistants Messrs N. Wilson, W.F. Elliott and H. Brewer, sailed from Halifax Harbour for the North Shore. Preliminary to ship sounding, a triangulation network was extended eastward from Ste Genevieve Island to St Mary's Island, a distance of 160 miles. With the main

triangulation completed early in September, the *Cartier* moved headquarters from Natashquan to Harrington Harbour, from where the charting of Cape Whittle and its surroundings was started - the actual commencement of the recharting of the Northeast Arm of the Gulf of St Lawrence. In mid-October a resurvey of the approaches to St Peter's Bay, Cape Breton, was made, and a revised plan of this area later drawn. When the season ended the *Cartier* was laid up in Charlottetown, PEI, (not Halifax as in former years), and Mr Brewer resigned from the service.

Magdalen Islands. After five seasons' absence, two of which were with the Preventive Service, the rapidly aging *Bayfield* was again recommissioned, and outfitted at Charlottetown for work in the Magdalen Islands. This survey was in command of Mr H.L. Leadman, with assistants R.W. Bent and R.E. Hanson. Sailing master was Capt. D.M. Snelgrove (1929-65), former chief officer, CGS *Acadia,* and chief engineer Mr S.A. Robson (1929-31), former second engineer, CGS *Acadia.* The *Bayfield* left Charlottetown on 21 May and en route to Pictou examined Jourmain Shoal (near Cape Tormentine). When in Pictou drydock, a resurvey of this harbour began. Work in Magdalen Islands commenced on 28 June and ended 27 September. During this time, an area of about 400 square miles northeast of Entry Islands was sounded to the limits of Brion Island and Bird Rocks. To quote Mr Leadman, "nine uncharted shoal patches were discovered, and, as over this area the depths seldom exceed 20 fathoms and there are numerous rock outcrops, considerable time was spent on close and careful sounding." The ship then proceeded to the more sheltered waters of Northumberland Strait to survey the entrance to Richibucto River, Shippegan, "where a long contemplated and necessary resurvey" was commenced, and to Caraquet and Miscou harbours for channel investigations. Before laying up at Charlottetown for the winter, new aids to navigation were positioned at Pinette River and Orwell Bay, PEI. This season the *Bayfield* completed 1,230 miles of ship sounding with 313 miles in the boats. During the winter two new charts were drawn for the engravers - Richibucto River, and Pictou Harbour, respectively.

Upper St Lawrence River. During the months of November and December, a joint survey with the aid of a tug and a sweeping apparatus sounded and closely examined several critical sections "of a proposed new ship channel of the upper St Lawrence River" between Brockville, Ontario and Clayton, N.Y. This party consisted of hydrographers R.J. Fraser, F.C.G. Smith and W.R. Young, working in the close cooperation with engineers of the Department of Public Works. As a result of these investigations, plans were formulated "for the commencing of a resurvey of the channels, in the interests of the deep-draft traffic, from the Upper Lakes to the new government grain terminus at Prescott." Early in 1930, Mr W.R. Young resigned from the Service.

Lake Winnipeg

With the aid of a hired launch, Messrs E.A. Ghysens and J.L. Foreman began a survey of the Nelson River at the head of Lake Winnipeg. This work was carried out in the channel and approaches to Playgreen Lake between 21 June and 13 September, and as a result of these investigations it was found "that the water in the channel leading to Playgreen Lake was very shallow and obstructed by numerous boulders and submerged reefs, offering a serious problem to ships making Warrens Landing in daytime and practically impossible after dark." Over an area of 33 square miles, 262 linear miles were sounded, 60 miles of shoreline surveyed and 520 rocks and reefs located and examined. A chart from Lake Winnipeg to Goose Island was later drawn on a scale of 2,000 feet to the inch.

Great Slave Lake

In 1929 *Pilot No. 1* returned to the south coast of Great Slave Lake, in charge of Mr F.C.G. Smith and assistant Mr W.R. Young. The schooner left Fort Smith 19 June and returned to the Slave delta two days later. Fort Resolution and Hay River were selected as base quarters. The coast was then surveyed for a distance of 65 miles between these points, and soundings carried offshore "to the limit of visibility." Several dangerous shoal areas were positioned, and large-scale plans made for shallow- draft river boats in the following harbours and anchorages: Dawson Landing, Ile du Mort, Presqu'ile Cove, Sulphur Cove, Breynat Bight, Buffalo River and Hay River. A set of systematic water levels was obtained at Fort Resolution "for charting purposes, and also for the study of lake level fluctuations." When navigation closed on the lake in late September, the *Pilot No. 1* returned to Fort Smith, and the party left for Ottawa. Later Messrs Smith and Young assisted Mr Fraser with investigations in the ship channel of the upper St Lawrence River. During the season, about 965 miles of pole and lead-line soundings were taken in Great Slave Lake and the Slave River.

As a result of these two seasons' work, the first two Canadian charts for northwest Canada (District of Mackenzie) were published in 1930 and 1932, respectively. The first sheet was coast chart P 2170 (now 6370), "Slave River to Mackenzie River," first edition, March 1930, scale 1:219,356.The second sheet was P 2171 (now 6371), "Plans of Harbours in Great Slave Lake," first edition, November 1932, scale 1:6,000 - Hay River, Presqu'ile Cove, Ile du Mort, Breynat Bight, Dawson Bay and Buffalo River.

British Columbia

This district under the supervision of Mr H.D. Parizeau was assisted by Commander J.H. Knight, Messrs L.R. Davies, W.K. Willis, R.H. Ettershank and new appointees R.B. Young and A.E. Stewardson. As usual the *Lillooet* was in command of Mr H.D. Parizeau, and the houseboat *Somass,* Commander Knight. Both ships were commissioned on 15 April and laid up at Victoria in the first week in November. *Somass* was used in the resurvey of Victoria Harbour, and areas in Vancouver Harbour and the Fraser River. *Lillooet* carried out sweeping operations in Victoria Harbour, and twelve other channels, inlets and harbours in southern British Columbia. This year seven fair sheets were compiled and sent to Ottawa for the engravers; also about a dozen white prints of certain areas were prepared and issued to the public. Mr Parizeau reported "a great deal; of lost time was experienced through forest fires and city smoke."

HEADQUARTERS

This Division under the supervision of Principal Assistant Mr R.J. Fraser included several new special (emergency) surveys, problems relating to chart revision in both field and office, the preparation and editing of pilots and sailing directions, the supervision of instruments and equipment and general administration duties. One special survey was the preliminary investigation in connection with a proposed survey of the ship channel in the upper St Lawrence River. Other areas visited were the Bay of Quinte and other ports in Lake Ontario (including Port Weller, the terminus of the Welland Canal, where control surveys were made). Hamilton Harbour and Burlington Bay were examined for a revision survey next season, and to print a new edition of the chart for this locality. To assist with routine clerical and typing duties, Miss R. Gould was appointed a typist in the fall of 1929.

TIDAL AND CURRENT SURVEY

Working in cooperation with the St Lawrence Ship Channel Branch, the times of slack water of the tidal streams along the North Channel of the Lower St Lawrence River were obtained. Observations near the lower end of Orleans Island were recorded by Capt. Haufman of *Dredge No. 16,* and those of the Coudres Island Lightship (now a lighthouse) were recorded by Capt. A. Boudreault of the Marine Agency, Department of Transport at Quebec, (sailing master, tidal steamer *Gulnare,* 1934-36). On the Atlantic coast, an automatic recorder registered slack water observations in the entrance to Great Bras d'Or, Cape Breton, to improve local tidal predictions. In British Columbia the turns of the current were observed by the lightkeeper at Race Rocks, Vancouver Island, in Juan de Fuca Strait. In connection with studies being made for proposed dams in the upper St Lawrence River above Quebec, a special report was prepared by Mr H. W. Jones. It was anticipated that these proposed dams would increase the depths in the ship channel, especially in the sector from Lake St Peter to Montreal Harbour. In the fiscal year 1929 some 90,000 tide tables were distributed to the public, and twelve permanent stations were maintained on the sea coasts. In the fall of 1929 Miss M. Cumbers was appointed a typist, vice Miss E. Campbell, to assist with clerical and typing duties.

PRECISE WATER LEVELS

In 1929 there were forty-five gauges in operation on inland waters (Great Lakes - 20, St Lawrence River above Quebec - 25). The usual cooperation was maintained with the US Lake Survey, the United States Engineers' Offices, the Geodetic Survey of Canada, Department of Marine and Fisheries, Department of Railways and Canals, and the levelling work being conducted by the Department of the Interior. Some 778,000 precise deductions were computed from record hydrographs, an increase of 200,000 over the previous year.

CHART CONSTRUCTION

This division, responsible for chart production, comprises chart compilation, drafting, engraving and filing sections. In 1929 some 40 new editions of engraved charts, 4 new and original engraved charts, 8 new editions of photo-lithographic charts, and 2 new and original photo-lithographic charts were completed - a total of 54 editions. Early in 1930 Mr C. Weese was appointed a student draftsman under Mr Crichton.

CHART DISTRIBUTION

Under Mr McGreevy's supervision 14,405 copies of charts and 191 editions of pilots and sailing directions were issued to the public in 1929. In his annual report to the chief hydrographer, he wrote, "more and more this service is becoming the central Canadian repository for publications of a hydrographie nature, relating to coasts and waters all over the world. In addition to the regular navigational charts, the office is in receipt of pilot and weather charts, foreign notices to mariners, hydrographie bulletins, aerial charts, magnetic charts, current charts, and other published data of a related nature, that are now internationally exchanged." There were approximately 4,700 British and foreign navigational charts in this section in 1926. In 1929 this number had increased to approximately 5,400, or by 15 per cent in three years.

THE DEPARTMENT OF MARINE AND THE HYDROGRAPHIC SERVICE, 1930-36

The Department of Marine and Fisheries had its commencement with the *British North America Act, 1867,* with one minister and one deputy minister. In 1884 it became two separate departments, with one minister and two deputy ministers. With the departmental reorganization of 1892, it reverted to its first status of one minister and one deputy minister. No further changes were then made until 1927 when the department was divided into two separate branches - Marine and Fisheries - but still with one minister and one deputy minister.

On 30 May 1930, by an act of Parliament, *Statutes of Canada, 20 21 George V, Chapter 31,* the Marine Branch of the former Department of Marine and Fisheries was constituted as the Department of Marine; and by *Statutes of Canada 20-21, George V, Chapter 21,* the Fisheries Branch was constituted the Department of Fisheries. By Order-in-Council P.C. 1721 dated 26 July 1930, hydrographie and tidal current surveys were assigned to the minister of marine, the Honourable P.J.A. Cardin, with Mr Alex Johnston, Esq., deputy minister. From then until November 1936 this Service continued to serve the public in the Department of Marine, and its successor the Department of Transport.

1930-31

DIVISION OF HYDROGRAPHY

The year 1930 was the most active season in the history of the hydrographie service since the years preceding the First World War. Authority was approved for eighteen junior hydrographers to the staff, (Ottawa 13, Victoria 5), and, to quote the chief hydrographer, "ten fully staffed field parties, three more than the previous year conducted operations with a fleet of four hydrographie steamers, two self-propelled surveying houseboats, one cruiser-type motor launch, one auxiliary schooner and two motor boats were used in the Atlantic and Inland Waters district, and one steamer and two houseboats in the Pacific Coast district. In addition there were in service with the various surveys 15 sounding boats and 6 outboard engine craft." Yet to be finalized were plans for a new hydrographie steamer on the Pacific coast *(Wm. J. Stewart,* built 1932), and a suitable vessel for tidal and current investigations in the lower St Lawrence River, below Quebec. This year a new sonic sounder was installed in the *Bayfield* for use in Lake Superior and the Gulf of St Lawrence, and a gyro-compass was added to the *Lillooet* equipment for surveys in British Columbia. The first exploratory investigations in the channels of the Mackenzie River delta marked the northwestern limits of Canadian charting in the western Arctic until the years following the Second World War.

Sable Island and Newfoundland

About the middle of June 1930 the *Acadia* in command of Mr J.U. Beauchemin, assisted by Messrs F.C.G. Smith, T.M. Tardif, J.A. Deveault, A.K. Laing, L. Jehu and Ship Clerk J.R. Dupuis, sailed from Halifax to conduct a general hydrographie investigation of the Atlantic seabed between Sable Island and Newfoundland. This cruise was authorized to determine the extent of change (if any) to the sea bottom, as a result of the earthquake in the fall of 1929 along the Nova Scotian coast. Five océanographie stations were also occupied to observe sea temperatures and densities, and all ocean depths records were by the new sonic sounder aboard ship.

Hudson Bay and Strait

On 25 July, the *Acadia* departed Halifax to resume its previous surveys along the Hudson Bay route, and in the vicinity of Port Churchill. On the outbound and homeward voyages, scientific data such as ocean depths, meteorology, ice movements, temperatures and sea densities were observed. About the middle of August the charting of the west coast of Hudson Bay was resumed between Churchill Harbour and Hubbard Point. Homebound to Halifax, Port Burwell was visited on 23 October [1930] for inspection and investigation preparation to survey work in 1931. Hudson Strait was cleared on 29 October and the ship tied up at Halifax for the winter on 15 November. In addition to regular survey work and océanographie observations, attention was given to the calibration of the radio-telegraph stations on St Paul Island and Belle Isle, and to similar stations along the Hudson Bay route - Resolution Island, Cape Hopes Advance and Nottingham Island. When the season ended, Mr Jehu resigned and in the spring of 1931 Mr J.R. Dupuis (a clerical assistant since about 1907) was transferred to another department.

Saint John, NB

In the interests of shipping and transportation along the inland waterway, and in response for adequate charts for the guidance of the yachting and tourist trade, Mr M. A. MacKinnon with assistant Mr G.E. Lowe (reassigned from the *Bayfield)* began this survey in Kennebecasis Arm. From 23 May to 24 November, Kennebecasis Bay, between Perry's Point and Sand Point, was surveyed with the aid of a motor launch and the sounding lead. A sector of the river between the Reversing Falls and Lands End was also surveyed. This season some 317 linear miles of boat sounding and 84 miles of coastline were charted.

Gulf of St Lawrence

North Shore. The resurvey of the north shore begun near Cape Whittle in 1929, was resumed in 1930 by Mr G. A. Bachand and assistants Messrs R. W. Bent, W.F. Elliott, S.R. Titus, and E.F. Creelman. The *Cartier* sailed from Charlottetown 20 May and en route to the north shore stopped at Georgetown, PEI, to take delivery of a new survey launch, and at Natashquan, PQ, for the remainder of the ship's crew. The ship arrived off Harrington Harbour (summer base of operations) on 24 May, but was unable to enter until 5 June on account of ice conditions.

Ice Patrol, Strait of Belle Isle. The *Cartier* then proceeded to the Strait of Belle Isle where she carried out an ice patrol between 20 and 23 June along the main steamer route, and in the Atlantic approaches between Hare Bay, Newfoundland, and St Michael Bay, Labrador. No extensive field ice was observed, but fifty icebergs were sighted and positioned in the strait, and the same number in the approaches.

The regular survey was then resumed for the remainder of the season, the ship working westward from St Mary's Island light to Wolf Island and, to quote Mr Bachand, "with special attention being given to the offshore shoals and waters passed through by the transatlantic vessels which follow the route from Belle Isle to Montreal." One major discovery was "an extensive bank with several shoal water heads upon it, lying approximately 6 miles to seaward beyond these islands, and visible rocks which from the offing appear to be the mainland shore. This bank lies not far inside of the track followed by some of the larger steamships." One such large vessel using this route in 1930 was the Canadian Pacific passenger liner *Empress of Britain* of42,348 tons, drawing 32.7 feet when

loaded. Two of these reported dangerous shoals in this area have since been properly positioned and sounded for least depth. One has been named Bent Rock (after Mr R. W. Bent of this Service) and the other Roach Rock (named after Capt. J. Roach, CGS *Cartier).* Least depth found on Bent Rock was 31 feet at low water, and on Roach Rock, 33 feet - insufficient for safe passage over them by the *Empress of Britain,* and other ocean-going vessels of lesser depth, in heavy weather. The discovery of Bent Rock has frequently been mentioned by senior hydrographers and other government officials as well meriting the outlay of this north shore survey. Late in the fall when the *Cartier* laid up, Mr Creelman resigned from the service.

First Aerial Photographic Survey for the Hydrographie Service, 1930

One of the earliest known air photographs of the Canadian topography was of the Citadel in Halifax, taken in August 1883 by Capt. H. Elsdale, R.E., in a balloon, elevation 1,450 feet above ground level, and with an automatic hand-operated camera. In 1921 aerial photographs of Pelican Rapids, Ontario, were flown for survey and mapping purposes (National Air Photo Library). When the Department of National Defence was created in 1922, the former functions of the Air Board were inherited by the RCAF. One of the first air maps from oblique photographs of an area traversed by a surveyor was issued in 1925 by the surveyor-general's office - the same year the Inter-Departmental Aerial Survey Committee was organized. Government land maps from vertical photographs were being drawn about 1926 (R.H. Field, *Canadian Surveyor,* January 1953).

Scenics [sic] of local areas on the north shore of the Gulf of St Lawrence were flown by aircraft in the 1920s, but only in 1930 was an official request made by the hydrographie service to the Department of the Interior for air photographic coverage between the Aguanish River and the Strait of Belle Isle. The first sector from Aguanish River to Natashquan was flown on 1 July by the RCAF using a Fairchild camera with a focal length of 8.12 inches. These photographs were flown at an approximate elevation of 10,000 feet and gave a scale of about 1,230 feet to the inch for mapping purposes. In the latter part of this month the sector from Natashquan to Harrington Harbour was flown at a higher elevation with a camera of different lens. These are the first air photographs on the Atlantic coast for this service, and were most helpful in delineating this devious coastline.

In late September or early October 1930, a few short flights were flown by the RCAF in Barkley Sound, Vancouver Island. Mr R.B. Young, the former regional hydrographer, Pacific coast in a letter dated October 1968 writes, "I was aboard one plane during one day's flying. Two planes were used and the pilots' names were Dunlap and Morfee. One of these was later head man in the RCAF, and islands were named for them in Clayoquot Sound. I think we did some experimenting with them in the office during the winter 1930-31." These are believed to be the first air photographs flown for the hydrographie service on the Pacific coast.

Magdalen Islands

The *Bayfield,* in charge of Mr H.L. Leadman, with assistants Messrs R.E. Hanson and G.E. Lowe, outfitted at Pictou early in May, and while in drydock undergoing regular repairs, an Admiralty Type echo-sounder was installed by the Ontario Hughes Owens Co. Ltd. The ship's company was then joined by Mr J.U. Beauchemin of the *Acadia,* and a series of tests was made with this machine to a depth of 213 fathoms. Not working too efficiently, the ship returned to Pictou where, to quote Mr Leadman, "the transmitter and the hydrophone tanks

were welded." This machine was purchased especially for work in Lake Superior, and when this welding was completed a trip was made to Saint John, N B, on further trials.

About 24 May the *Bayfield* left Pictou for the Great Lakes with assistant Mr L. M. Clarke, a replacement for Mr G. E. Lowe. Trials with the ship's Mark II sonic sounder (range 130 fathoms) were conducted on passage in the St Lawrence River and Lake Ontario, and found to be not sufficiently accurate for shallow depths, and "defects showed up due to faulty work at the time of installation."[2] The ship reached Sault Ste Marie on 5 June and in Lake Superior a week later, the party was joined by assistant Mr N. G. Gray (dominion hydrographer 1957-67).

The purpose of the Great Lakes cruise was an investigation "of a recently reported shoal lying in the track of the deep-draft vessels in the uncharted deep water central part of Lake Superior." From the middle of June to the first week in August the deep water between Isle Royale and Caribou Island in Canadian waters was sounded, and Superior Shoal was located and closely examined with the lead-line (the sounding machine primarily purchased for this work was not considered reliable and accurate enough for close results). Superior Shoal was found to have only 21 feet of water over its summit. This dangerous shoal, 100 feet in diameter, is situated 3814 miles from the nearest land of the Slate Islands. "On earlier foreign charts there is shown less than three miles from this position, a depth of 1,008 feet ... and hydrographers had no cause to even suspect its existence, and no doubt it has been the cause of many marine disasters." The *Bayfield* left Lake Superior for the last time on 9 August, and en route to Northumberland Strait made a revision survey of Goderich Harbour in Lake Huron, and in Lake Erie conducted magnetic investigations in the vicinity of Tecumseh Shoal where abnormal compass variations had been reported. The remainder of the season was spent in charting Caraquet, Shippegan and Miscou Harbours, with a special survey made of Dalhousie Harbour, Bay Chaleur - the site of the present International Pulp and Paper Company.

Upper St Lawrence River and Great Lakes

Following a year's lay up at Belle River, the cabin cruiser *Boulton* was fitted out and sent to Brockville, Ontario to commence the ship channel survey of the upper St Lawrence River between Prescott and Kingston (a sector of the present St Lawrence Seaway now dredged to a limiting depth of 27 feet). This party was in charge of Mr E. A. Ghysens. While on passage in Lake Ontario, revisory surveys of several local harbours were completed. One of these investigations was for the new airport site at Trenton, and another in Cataraqui Bay in connection with the new Kingston elevator terminals. The *Boulton* reached Brockville on 28 June and was joined by assistants P. Radakir and later O. M. Meehan. From then until early November, a survey of the river was made from a point six miles above Brockville to the western end of Grenadier Island. An eight-mile stretch of the Canadian and United States main deep-water channel was triangulated, sounded and swept (with a 30-foot rail, lowered under the *Boulton's* keel). Several critical shoals were closely examined for least depth "in connection with the improved steamer route to the Prescott grain terminals." Late in October the party moved headquarters from Brockville, Ont. to Chippewa Bay, N. Y. to be nearer the western limits of its work, and to finish sweeping operations in this area before the season ended. When completed, the *Boulton* proceeded to Prescott for the winter.

Report Dept. Marine, 1936.

Lake Winnipeg

The survey of Playgreen Lake was resumed in 1930 by Mr J.L. Foreman and assistant Mr A.F. Wightman. The party left Selkirk, Man. on the Fisheries vessel *Bradbury* and reached Warren's Landing in time for the departure of the first Hudson Bay barge and tug for Whiskeyjack Portage on 20 June. From then until 20 August, the west arm of this lake was surveyed for some 665 miles to its head at Warren's Landing. For transportation, sounding and sweeping purposes, an open gig powered by an outboard engine was used by this camping party. Passage was then taken to Gull Harbour in the southern part of the lake on the S S *Wolverine,* and while in camp here during the early part of September some members of the crew were stricken with a virus said to be "typhoid fever." Although none was stricken fatally, considerable sickness was endured by at least two of the party, one of which was the gasoline engineer, Mr H. Dennison. One of the member of the crew to escape this virus was the present [1965±] superintendent of charts, Mr C.H. Martin who that year had his first introduction to Canadian hydrographie surveying. Until the season ended on 22 September, a set of magnetic range beacons was built at Gull Harbour for use by lake vessels with compass adjustments. The party then left for Selkirk on the SS *Wolverine,* where the boats and equipment were stored for the winter.

Great Slave Lake and Mackenzie River

A hydrographie party was organized in 1930 for the purpose of seeking an 18-foot channel in the Mackenzie River delta, and out into the Beaufort Sea - one that "would permit sea-going Arctic vessels to enter sheltered waters, and to make contact with steamers on the Mackenzie River." This party was placed in charge of Mr N. Wilson, who with the assistance of Junior Hydrographer G.W. Baker and local river pilotage, sailed the auxiliary schooner *Pilot No. 1* from Fort Smith down the Mackenzie River a distance of 1,200 miles to Aklavik, reached on 20 June. Here another pilot was engaged to investigate the East Channel for a distance of some 125 miles to Tunanuk, and to explore other areas in this locality. The Richards Island channel was examined to its mouth, and hence by devious routes amongst the outer islands fringing the Beaufort Sea westward and southward to the mainland shore at Tent Island. Replacing the pilot at Aklavik on 16 June [16 July ?] other channels and islands were investigated to the Mackenzie River.

The return trip up the Mackenzie River in the *Pilot* took 18 *Vt* days, without incident, and on 22 September she was berthed at Fort Smith for the winter. The party reached Ottawa by plane from Fort Smith to Edmonton, and by train from there. Some 683 linear miles of soundings were run off the mainland coast and in the approaches to the various mouths of the delta; and another 150 miles of soundings were obtained in unsurveyed and unmapped channels of this area.

Three large channels through the delta were explored throughout their length, and many smaller ones in part. After careful study of these investigations, it was reported "further hydrographie charting and investigation in the delta by this Service would seem unwarranted, until such time as an aerial photographic survey of the outer delta has been completely made and reasonably accurate maps of the area are available, in order to allow the whole time of the short Arctic season to be spent entirely on sounding and delineation of channels."

British Columbia

In 1930 three units of the fleet were in operation in the Pacific Coast - the steamer *Lillooet,* the aging houseboat *Somass* and the new houseboat *Pender* (named after an Admiralty Surveyor on this coast prior to Confederation, Capt. D.R. Pender, RN). The *Pender* (160 tons) was designed as a replacement for the older houseboat *Somass* and the water tender, *Fraser,* and was built by the Vancouver Shipyards at a cost of $31,350. It had accommodation for seventeen personnel (three hydrographers, fourteen crew), and three gasoline launches. For work on the rugged west coast of Vancouver Island, the *Lillooet* underwent extensive alterations, and was equipped with a new Sperry Gyroscope Compass ($5,750), and an Admiralty pattern oceanic type deep water sonic sounding machine with a range of 2,000 fathoms. It was installed by the Ontario Hughes Owens Co. Ltd. (Vancouver Agency) at an estimated cost of $6,325 for the machine only. Field staff comprised three senior and eleven junior hydrographers working in three parties as follows: *Lillooet,* Mr H.D. Parizeau in charge, assistants Messrs W.K. Willis, R.B. Young, A.E. Stewardson, H.N. McQuarrie, J.O. Johnson and V. Wiebe; houseboat *Pender,* Commander J.H. Knight in charge, assisted by Messrs R.H. Ettershank and J. Rutley; and houseboat *Somass,* Mr L.R. Davies in charge, assisted by Mr G.W. Turner and a crew of seven men.

Somass was commissioned mid-April, and about mid-June *Pender* was taken in tow by the *Lillooet.* Prior to taking up regular work on the west coast of Vancouver Island, the *Lillooet* made sweeping surveys in Vancouver and Squamish Harbours, and in Queen Charlotte Sound. Barkley Sound was entered in mid-July with *Somass* and *Pender* in tow, but before ship operations began, tests were conducted with the new sonic sounder to a distance of one hundred and fifty miles to seaward. Further adjustments and repairs were found necessary and the ship returned to Victoria. On her return, "30 large surveying beacons were erected in connection with an aerial photographic survey of the coast" between Barkley and Clayoquot Sounds. When the field season ended, *Somass* and *Pender* laid up in Barkley Sound for the winter, and on 29 October the houseboat parties returned to Victoria in the *Lillooet.*

Concerning houseboats, Mr Parizeau had this to say: "the advantages of a self-contained and mobile form of accommodation for detached parties as provided by a houseboat, over the older arrangement of housing survey parties under canvass on shore, were well demonstrated by the results obtained by parties using the *Somass* in the last six years." Early in 1931 Mr G.W. Turner resigned and was replaced by Hydrographer Grade 1 G.W. LaCroix (first regional hydrographer, Atlantic coast, 1959-63).

In 1930 the first volume of sailing directions for British Columbia was prepared by Mr H.D. Parizeau - Volume II, "Northern Portion, Cape Caution to Portland Inlet, also the Queen Charlotte Islands." It was compiled chiefly from the British Admiralty edition of 1923 and supplements to the same, together with the latest information derived from surveys by the Canadian Hydrographie Service, and from information from other Government sources.

HEADQUARTERS

In addition to inspection visits to the *Bayfield* and *Boulton,* Mr Fraser investigated the new port of Oshawa in Lake Ontario to provide a provisional plan to the port authorities. A number of vessels in Quebec Harbour were examined during the winter of 1931 for a suitable craft to undertake tidal-current investigations in the Lower St Lawrence River. Assisting Mr Fraser with the preparation of sailing directions and other administrative matters were Messrs F.C.G. Smith and A.K. Laing of the Hudson Bay party. Early in 1931

Messrs R.L.B. Hunter and M.S. Madden were appointed junior hydrographers (grade 1), vice Messrs Jehu and Creelman, who had resigned the previous fall.

TIDAL AND CURRENT SURVEY

In addition to maintenance of twelve principal stations, an exceptional high tide that occurred at Windsor, NS, on 14 February 1930, was levelled in. It proved to be the highest tide to be recorded "excepting the one during the Saxby gale, 1869." With a view to establishing a permanent tidal station on the Atlantic coast of Newfoundland a visit was paid to Cape Race. The high expense and comparative inaccessibility of this location proved it would be more feasible to arrange its installation in St John's Harbour. It was also reported that to procure better tidal predictions for the North Shore of the Gulf, a permanent station should be built near Cape Whittle. Tide table distribution of the 1931 editions totalled 104,000 - the first to exceed the 100,000 mark.

In 1930 Mr H.W. Jones, in charge of the Tidal and Current Survey Division, wrote in his annual report:

> the currents at Pointe des Monts [lower St Lawrence] which are reported to having a tendency to set vessels over to the south shore have never been examined to determine their extent and influence on navigation. Captains of vessels grounding on the south shore of the St Lawrence estuary are being given the benefit of doubt regarding these currents by the Wreck Commissioner and for this reason first attention should be given to this area. Investigations of the Gaspé Current eastward from Cape Magdalen in 1895, 1911 and 1912, was [were] thorough but could be well continued to the westward to meet the survey in the vicinity of Pointe des Monts, and even beyond to its beginning near the mouth of the Saguenay when appropriations and limited facilities of the Tidal Division permit. Commencement of the work depends upon obtaining a steamer with deep sea anchorage equipment and additional technical staff of the Tidal and Current Division.

Two years later (1932), these current surveys began in the river estuary in the steamer *Cartier.* They were extended from 1934 to 1936 in the Department of Marine steamer *Gulnare,* and concluded with *Relief Lightship No. 25* in 1937.

PRECISE WATER LEVELS

Forty-four automatic gauges were in operation on the Great Lakes and St Lawrence River in 1930, with forty part-time attendants. In Mr Price's "Historical Outline of Systematic Recording of Water Levels of the Great Lakes and St Lawrence River,"[3] one reference was made to water levels in the Great Lakes dating back to the year 1790. Concerning the first automatic or self-registering water gauges, these were first installed on the Great Lakes by the United States Lake Survey in 1900, and by the Public Works of Canada (Georgian Bay Ship Channel Survey) in 1906. When Public Works gauges were transferred to the hydrographie survey in 1912 (Automatic Gauges Section), they numbered nine. From 1920

[3] *Marine Report 1930,* 114-116.

to 1929 this figure varied from 26 to 45. To improve the St Lawrence ship channel in Montreal Harbour and its vicinity special water level elevations were observed between June and November in 1936.

CHART CONSTRUCTION

This division was supervised by Mr G.L. Crichton, with Major J.F. Delaute, assistant chief, in charge of compilation and drafting; and Mr W.C. Cunningham, chief engraver. Map draftsmen were Messrs P.E. Parent, H. Melancon and W.L. Andrews. In February 1931, Mr A.J. Pinet (hydrographie engineer transferred from the Department of Railways and Canals in 1904, and senior map draftsman since about 1913) died. Student map draftsmen were Messrs M. Isabelle and C. Weese. Senior engravers were Messrs W. Watts, G. Silvers, J. Brown and W.A. Cunningham; Mr R.H. Cunningham was junior engraver, and Mr H. Williams, an apprentice. About fifty editions of new and old charts were printed this year, with thirty others on hand at the end of the year. The engraving section engraved nine new and revised charts, and made 7,783 corrections to copper plates.

Standardization of Canadian Charts

Navigation charts to this time, and with few exceptions were constructed mainly on a conical projection, and a scale based on the length of a nautical or geographical mile, i.e., a minute of latitude at the middle latitude of the chart. These scales varied considerably, and their selection was regulated "by the extent and nature of the area and amount of detail therein ... as well as by the numbers, size and draught of vessels that can be reasonably expected to navigate in the particular waters which each chart represents." By 1930 new charts and new editions of the existing charts were gradually being brought to a uniform basis, and constructed on the Mercator projection. Atlantic coast charts were based on a middle latitude of 48° north, with those on the Pacific coast based on a middle latitude of 52° north. The chief hydrographer in his annual report concluded, "the scales hereafter adopted for coast and general marine charts, in as far as is found to be practicable, will be standardized at 1 inch, 0.5 inches, 0.3 inches, and 0.1 inch to a nautical mile, in order to facilitate the use of a number of such consecutive charts in series."

CHART DISTRIBUTION

Distribution of charts in 1930 totalled 11,154, and sailing directions, 211. The cost per copy of Canadian charts was increased from 25 cents to 50 cents, and sailing directions from 50 cents per edition to one dollar. In comparison, the Admiralty coast pilots sold for $2.40 per edition, and the U.S. Hydrographie Office [pilots] at $1.80 per copy. A new edition of the *Catalogue of Marine Charts corrected to April 1st, 1931,* lists 278 Canadian charts and 58 other publications of the Government of Canada. Also indexed were 309 Admiralty charts for Canadian waters, and 6 other publications for Canadian coasts.

HYDROGRAPHIC EXPENDITURE, 1930

So that the reader might get an insight into the cost of operating the Hydrographie Service in 1930, here are a few pertinent statistics from the Auditor General's Report for that year: Hudson Bay $106,080; Saint John River $10,690; Gulf of St Lawrence, North Shore $77,114; Northumberland Strait and Lake Superior $65,006 (Gulf of St Lawrence $30,381, Lake Superior $34,625); upper St Lawrence River $11,163; Great Slave Lake (Mackenzie

River Delta) $13,570; British Columbia $161,627; Tidal and Current Survey $27,571; Precise Water Levels $23,503; General Account $69,395 - a grand total of $565,719. This was the largest annual expenditure in the history of the service to the end of the Second World War, when in 1946 it rose to $646,313.74. An amount of $256,090 of the 1930 figure, or 45 percent of the total outlay, was spent on wages.

1931-32

In spite of the rapidly deteriorating economic situation in Canada, and the curtailment of surveying in other departments of the government, the Canadian Hydrographie Service in 1931 fitted out eleven fully staffed field parties - one more than the previous year. A contract was also awarded to the Collingwood Shipyards Company Limited in Georgian Bay for the construction of a modern survey ship for the Pacific coast, a replacement for the aging *Lillooet.*

AERIAL PHOTOGRAPHY

At the request of the hydrographie service, considerable photographic coverage was flown by the R C A F along the North Shore, Gulf of St Lawrence (Harrington Harbour to Strait of Belle Isle); Saint John River, N. B. to above Fredericton; Lake Winnipeg (Playgreen Lake, Nelson River area); Great Slave Lake (Slave River to Mackenzie River); and Vancouver Island (Barkley Sound and Clayoquot Sound areas).

INTERNATIONAL EXCHANGE OF HYDROGRAPHIC DATA

Of particular interest is the following statement taken from the annual report of the Marine Department, 1931 : "The usual co-operation on hydrographie matters was maintained with the hydrographie bureaus of other countries, resulting in the free interchange of national charts and publications, principally with the British Admiralty, United States Hydrographie Office, United States Coast and Geodetic Survey, United States Lake Survey Office, and the International Hydrographie Bureau in Monaco."

DIVISION OF HYDROGRAPHY

Gulf of St Lawrence

For greater efficiency, a modern receiving box was fitted to the *Acadia's* sonic sounding machine this spring, and recorded on paper fairly accurate profiles of the sea bottom between Halifax and Hudson Bay, including areas in the Gulf of St Lawrence. Early in June the *Acadia,* in command of Mr J.U. Beauchemin with assistants Messrs T. M. Tardif, J.A. Deveault, R. L. B. Hunter and M. S. Madden, sailed from Halifax for the Strait of Belle Isle. Ships officers were Capt. F.V. Ryan, Mr J.S. Cann, chief engineer and Dr F.A. Joneas, physician and surgeon. From 4 to 12 June an ice patrol was carried out within the strait and its approaches. Acting on instructions from Ottawa, the ship then proceeded to Harrington Harbour to assist the *Cartier* search parties for the bodies of Mr G.A. Bachand and the two seamen drowned on 8 June. Magnetic investigations were then conducted between 17 and 19 June in the Mingan Strait area with the ship's gyro-compass, and certain depths shown on Admiralty charts between the Magdalen Islands, Anticosti Island, and the Gaspé Peninsula were closely checked with the ship's new sounding recorder. The *Acadia* then continued to Quebec Harbour, where on 15 July she sailed for Hudson Bay with a total

complement of sixty-four personnel, including the detached Wakeham Bay shore-party.

Hudson Bay and Strait

Resolution Island in the entrance of the Strait was reached on 24 July and the following day, Cape Hopes Advance. Five days were spent by the *Acadia* in Diana Bay triangulating seventeen miles of the south coast of the strait. The shore party in charge of Mr Smith was disembarked at Wakeham Bay on 2 August and the ship then proceeded to Churchill Harbour to complete its charting of the west coast of the bay between Hubbard Point and Egg River. Here weather was found unsuitable for boat work and "all soundings were taken with the ship, from the 10-fathom contour outward, it being inadvisable to approach the shore within this danger line. The ten and twenty fathom contours were determined." During charting work, many magnetic observations were recorded, and while on passage in Hudson Bay and Strait, "oceanographical observations were made when opportunity occurred, for the purpose of amplifying the data obtained in other seasons in connection with the study of the currents, temperatures and salinities and the biological contents of the water." On the inbound voyage, six oceanographical stations were occupied in the strait, and two in the bay; and on the outbound voyage, five in the bay, and two on the Strait.[4]

A four-oared gig in Hudson Straits in 1931. Mr F.C.G. Smith (dominion hydrographer 1952-57) stands in the stern.
Photo courtesy CHS.

With the official opening of Port Churchill to foreign shipping in September 1931, the long-cherished dream of a northern shipping route to western Canada became a reality. Its work completed in this area by 2 October, the *Acadia* departed Port Churchill for the last time. After picking up the Wakeham Bay party, some time was spent in this area ship-sounding the offshore waters. Hudson Strait was cleared on 22 October and Halifax Harbour entered on the 29th. When she tied up at Halifax Dockyard the *Acadia* ended her charting days in sub-Arctic waters - a task she was expressly built for back in 1913.

[4] Tables, *Marine Report 1931,* 87-100.

Hudson Strait

This detached shore party in charge of Mr F.C.G. Smith with assistant Mr A.K. Laing was housed at Wakeham Bay in the buildings erected for the Hudson Bay Expedition in 1927. For transportation and surveying purposes, use was made of an open launch, a sailing gig and a dory. A baseline was first measured near the settlement, and from here the triangulation network was extended to embrace Wakeham Bay and the outside coast from Cape Prince of Wales to beyond the west end of Wales Island. Wakeham Bay with other anchorages and harbours in this area were coastlined and sounded. Sailing directions notes were written, and tidal readings obtained. In May 1932 Canadian chart No. 501, "Wakeham and Fisher Bays and Approaches," was printed, on a Mercator projection, to a scale 1:146,220. Insets for Fisher and Wakeham Bays were drawn to scale 1:24,000 and 1:48,000, respectively. This was the first Canadian coast chart for Hudson Strait from actual field surveys. Previous Canadian editions of the strait were reconnaissances of local harbours and anchorages.

First Canadian Sailing Directions for the Hudson Bay Route, 1931-32

With the opening of Port Churchill the charting of Hudson Bay was temporarily ended, but as a further service to marine underwriters and foreign shipping, hydrographie surveys were continued in Hudson Strait. In response from the High Commissioner's Office in London and the Imperial Shipping Committee, a volume of *Sailing Directions for the Hudson Bay Route* was prepared by Mr F.C.G. Smith during the winter of 1931-32. It was issued to the public in time for the navigation season of 1932, and was the first volume of Canadian sailing directions for northern waters.

With adequate hydrographie coverage for the safe navigation of the Hudson Bay Route, coupled with the installation of aids to navigation, insurance rates for foreign cargo-carriers to Port Churchill could now be kept to a minimum. Further reductions in these rates were applicable to ships equipped with gyroscope compasses and sounding machines.

Of historic interest, there have been few major ship fatalities along the Hudson Bay route since its opening, and these were not for the want of adequate chart coverage. One of the first sailing masters to sail from Port Churchill following its opening in September was Capt. W. Mouat, SS *Farnworth,* R.S. Dalgleish Ltd. Newcastle, England. In 1932 Capt. Mouat was in command of another grain carrier of this company SS *Pennyworth,* and in September of this year reported "as this vessel was fitted out with a gyro compass and echometer we experienced no trouble whatever the courses being maintained as set... only three courses were used between Resolution and Churchill ... to a vessel fitted with a gyrocompass, navigation in these waters is far easier than navigating the St Lawrence." Paradoxical it may seem, but nevertheless true, *Pennyworth* was stranded 18 November 1933, in one of the best channelled waterways in the world - the St Lawrence River - on Orleans Island just below another ocean terminus, Quebec City.

Gulf of St Lawrence - North Shore

The *Cartier,* in command of Mr G.A. Bachand with assistants Messrs R.W. Bent, W.F. Elliott, S.R. Titus and A.F. Wightman, left Charlottetown on 24 May for the North Shore. Ship's officers were Capt. J. Roach and chief engineer, Mr J.H. Simard (1931-39). The ship called at Natashquan to complete her crew, and then proceeded to Harrington Harbour where the main triangulation network was extended along the coast, eastwards from St

Mary's Light to Great Mecatina Island. In this forty-three mile stretch of coast, eight main and fifty-four secondary stations and triangulation marks were established - all of which were observed and connected with the previous season's work. Early in June field work was brought to a sudden cessation with the accidental drowning of three members of the ship's company - the first major fatality of a hydrographie officer on duty since the service began in 1883.

On 8 June Mr G.A. Bachand, in company with three sailors Messrs Hector Charbonneau, Louis Landry and Ignace Vignault (residents of Natashquan, Que.), proceeded up the swollen waters of the Netagamu River, five miles west of Harrington, in a single canoe. The purpose of this trip was to build and observe a triangulation station (reconnaissanced by the geodetic survey previously), located some seven miles inland from the mouth of the river, near this river. While attempting to cross a small bay at the foot of the fifth falls of the river, near this location, the canoe swamped, throwing all occupants in the cold swirling freshet waters. One sailor only, I. Vignault, managed to reach shore in safety, and this on the west side of the river. After a diligent search for his shipmates and unable to locate them, cold and exhausted, he set out on foot over cliffs and dense underbrush, and by following the telegraph line reached Pointe au Maurier, sixteen miles west of Harrington, the following morning. Here he wired the ship regarding this accident.

Within a few hours the *Cartier* had reached the Netagamu River and placed a gig crew in the entrance to patrol it. Other parties were then organized and tracked the river on both sides from its mouth to the scene of the accident. These parties were in charge of hydrographie officers, W.F. Elliott, S.R. Titus and A.F. Wightman. Further assistance was rendered the search by officers and crew of the steamer *Acadia,* and by volunteer parties organized at Harrington Harbour. Articles such as the canoe, paddles, pack-sack, and an empty transit box were found during these searches. On orders from Ottawa dated 20 June, the patrol was reduced to two men, thus bringing to an end this intensive search. Three days later (23 June) the first body was found (Mr L. Landry) inside the mouth of the Netagamu River; and on 4 August that of Mr H. Charbonneau was located a mile and three-quarters west of this river, on the shore. The third and last victim of this unfortunate accident, Mr G.A. Bachand, was not discovered until the summer of 1935 when a fisherman from Harrington Harbour attending his dogs on an uninhabited Little Mecatina Island, a few miles eastward from Harrington Harbour, found it in a small cove. Identification of the remains was made possible by previous dental work, and a woman's rubber boot on one foot, said to be that of his wife.

By Order-in-Council P.C. 189/1367 dated 14 June 1932, indemnities of $1000.00 were paid to the widowed mother of Mr Landry, and to the father and dependent of Mr Charbonneau. "Compassionate allowance of Albertine Vincent Bachand, widow of Georges Alphonse Bachand, Officer in Charge of CGS *Cartier* and Gulf of St Lawrence hydrographie survey, who was drowned on duty on June 8th 1931 ... $2,500.00."[5]

For the remainder of the field season of 1931 senior assistant Mr R.W. Bent was placed in charge of the *Cartier,* and carried on ship sounding to a distance from twenty to twenty-five miles offshore or beyond the 50th parallel of latitude. In connection with Mr Bachand's drowning Capt. F. Anderson, the chief hydrographer, visited the ship in July. When the Cartier tied up at Charlottetown on 3 November, it was to be Mr Bent's last full season in the field. On his return to Ottawa he was reassigned to writing sailing directions and pilots and other related duties, and held this position at headquarters until his retirement

[5] *Auditor General's Report 1935*

in 1944.

Magdalen Islands

On 20 May *Bayfield* [II]left Pictou Harbour for her last field season. She was in command of Mr H.L. Leadman, with assistants Messrs R.E. Hanson, N.G. Gray and L.M. Clarke. Ship's officers were Capt. D.M. Snelgrove and Chief Engineer S.A. Robson. Before sailing for the Magdalen Islands visits were made to Port Hood and Cheticamp, NS. The ship proceeded to Grand Entry in the Magdalen Islands used as a summer base until 23 September. On the return to Charlottetown, minor investigations were completed in Shippegan, Caraquet and Miscou Harbours in Northumberland Strait. When the *Bayfield* tied up at the Marine Wharf on 2 November, her charting days with the hydrographie service were over - a record that had its commencement in Lake Superior following the South African War, in 1903. It also heralded the ending of an era of four-oared gig sounding on Canada's exposed sea coasts.

The *Bayfield's* decommissioning recalls reminiscences of an earlier era. From 1841 -56 Capt. H. W. Bayfield (after whom the ship was named) when charting the Gulf and St Lawrence River, and the Atlantic coast of Nova Scotia, in the hired vessel *Gulnare,* used Charlottetown, PEI, as his home port. It was in this maritime seaport seventy-five years later, that another *Bayfield* ended her charting days. In the fall of 1949, as a coastal freighter, she met a watery grave in St Mary's Bay on the south coast of Newfoundland.

Saint John River

This survey was resumed in 1931 by Mr M. A. MacKinnon and assistant Mr G.E. Lowe, with the aid of a motor launch. The sector of the river from the entrance to Kennebecasis Bay to the narrows at Oak Point was surveyed this year. Before returning to Ottawa, the party went to Saint John where the stretch from the Reversing Falls to the limits of the existing Canadian chart was surveyed. Aerial photography was used for the first time and was of great assistance in charting this meandering river.

Upper St Lawrence River

Work begun by Mr E.A. Ghysens the previous season along this ship channel was resumed in 1931 with assistant Mr P. Radikir. Most critical areas in the main channels were sounded, swept and closely examined, and the whole breadth of the river from shore to shore was resurveyed between Crossover Light to below Brockville, including Brockville Narrows. Early in September the *Boulton* moved headquarters from Brockville to Prescott, where a careful survey of the river was conducted from below Brockville to the Galop Canal (below Prescott terminals). Control points established this season were tied in with the US network of triangulation. Before returning to Ottawa, Mr Ghysens proceeded to Valleyfield to position the upper end of the new Beauharnois Canal, and aids to navigation.

Lake Winnipeg

In the interests of local steamboat traffic, the survey of Lake Winnipeg was resumed by Mr J.L. Foreman, assisted by Mr O.M. Meehan. The party left Selkirk on 6 June in the Fisheries vessel *Bradbury,* and arrived at Warren's Landing (entrance Nelson River) on the 9th. Here this shallow channel was swept and closely examined for deeper water approaches to

Warren's Landing. One new channel was found and marked with two sets of range beacons. From 16 to 31 July, the lower and middle sections of Playgreen Lake were surveyed, and during August, the upper portion. Triangulation and coastlining for the utilization of aerial photography was carried out, and the main channels sounded. Early in September the party left Warren's Landing in the SS *Kenneth* for Berens River to examine its steamer channels and to establish necessary range beacons. From 8 September to 1 October the party was again under canvas in Gull Harbour (Hecla Island). Magnetic compass range beacons were then established on Black Island, and a preliminary examination made of the Winnipegow River area. As a result in part of this season's work, a chart was compiled for Playgreen Lake - No. 145, "Nelson River, Playgreen Lake (Whitefish Island to Norway House)," scale 3 inches to a mile.

Great Slave Lake and Mackenzie River

On 10 June Messrs N. Wilson and assistant G.W. Baker left Fort Smith in *Pilot No. 1* and reached Hay River on the south coast of Great Slave Lake on the 13th. Here a campsite was established, and the previous surveys of 1928 and 1929 extended westward to the entrance of the Mackenzie River. Summer quarters were moved to Wrigley Harbour on 20 July and from here the head of the Mackenzie River was surveyed downstream for a distance of twelve miles to Range Island. Some four hundred and thirty miles of aerial photography were flown by the R C A F for this survey party, the results of which were incorporated in the charts. When the season ended *Pilot No. 1* returned to her winter-quarters in Fort Smith. In March 1932 a new edition of Chart P 170 was printed - "Slave River to Mackenzie River," with an inset for the Head of the Mackenzie River.

British Columbia

To expedite the charting of the west coast of Vancouver Island, in 1931, an improved receiving box is reported to have been added to the *Lillooet's* sonic sounder, but no evidence can be found that it proved practical or not with Mr Parizeau. Survey activities this season were centred on the Barkley Sound - Clayoquot Sound sector of this coast, and were carried out with four units of the fleet: *Lillooet,* in charge of Mr Parizeau, with assistants Messrs Willis, Young, Stewardson, Johnson, McQuarrie and Wiebe; *Pender,* in charge of Commander Knight, with assistants Messrs Ettershank and Rutley; and houseboats *Somass* and *Fraser,* in charge of Mr Davies, with assistant Mr LaCroix. From satisfactory results of aerial photographic and hydrographie surveying this past season, eight new engraved charts for the west coast of Vancouver Island were later issued to the public. Two new charts were commenced for the Strait of Georgia, and seven for the steamship route inside Vancouver Island, and northward from the Strait of Georgia. This year the manuscript for Volume I of the British Columbia pilot was prepared under Mr Parizeau's supervision. It was for the southern portion of British Columbia and included the Canadian coast of Juan de Fuca Strait to Cape Caution, Vancouver Island, Strait of Georgia, and the United States Coast from Cape Flattery. Material from the Admiralty pilots to 1923, and from Canadian surveys since 1891, were used in its preparation. It was not issued to the public, however, until 1933.

New Survey Ship for the Pacific Coast

Provision was made in the 1931 estimates for the construction of a new major survey ship

to replace the older *Lillooet.* This new modern vessel was specially designed "for charting and oceanographical purposes ... to provide a maximum of space for chart room surveying and oceanographical apparatus and navigation equipment She was named the *Wm. J. Stewart* in commemoration of Canada's first chief hydrographer (1904-25), and was expected to be in commission the following year (1932).

HEADQUARTERS

Under Mr Fraser's general supervision, the main duties of this division comprised "the planning of new and special surveys, investigation and research relating to chart revision and hydrographie publications, editing of sailing directions and coast pilots, research on hydrographie and navigational subjects; annual reports and personnel."

Field Work

During the summer, and at the request of the Ontario Department of Mines, a minor investigation of the buoys off Point Pelee, Lake Erie, were made with the aid of a buoy-laying steamer "to mark the gravel-dredging areas." Upon his return from Great Slave Lake in October, Mr N. Wilson was sent to Parry Sound in Georgian Bay to supervise "the rearrangement of floating aids" in this area. This year Mr H. Bourdon of the Department of the Interior was appointed clerical assistant at Headquarters, vice Mr J.R. Dupuis, transferred to another department.

TIDAL AND CURRENT SURVEY

A tidal station was built at Port Churchill this season by the Department of Railways and Canals resident engineer there, and at no expense to the hydrographie service. It was intended to operate this gauge throughout the year, but late in December the shelter house was burned and the recording instrument destroyed. To assist further navigation along the Hudson Bay route, arrangements were made with the Director of Radio Service, Department of Marine, to have employees of this Branch assigned to the wireless stations in Hudson Strait to report on visual ice movements and the tidal currents in their localities. Twelve permanent tidal stations were maintained all year round as usual (Atlantic Coast 6, British Columbia 6). Turns of the tidal streams in St Ann Bay, NS, and Goletas Channel, BC, were recorded this season, and once again distribution of tide tables (for 1932) surpassed the 100,000 mark. Considerable tidal information was compiled and forwarded to Sir Alexander Gibbs in England.

National Ports, Survey 1931-32

On 11 January 1932, the Department of Marine was asked by Sir Alexander Gibbs of London, England, for certain information on tidal conditions below Montreal, as a result of weirs at the head of Lake St Peter. The following extract is from the annual report of Marine Department, 1931,

> A thorough presentation of tidal conditions in the St Lawrence River below Montreal, along with a study of the bearing of the tides on the present water levels, and of the effect of that dam, if placed across near St Augustin, might have on the these levels was given Sir Alexander Gibbs, the engineer authority engaged by the Dominion Government to report on Canadian

harbours. Samples of water taken at different places in the St Lawrence were obtained for information with regard to salinity content, which was also given Sir Alexander. The tests for salinity were made at the National Research Council Laboratory, (see also Precise Water Levels below).

PRECISE WATER LEVELS

In addition to the maintenance of the regular water gauges, the usual tri-monthly reports of water level stages in Lake Superior were issued to Canadian and American member of the Lake Superior Board of Control, as required by international agreement. On behalf of the St Lawrence ship channel studies, special observations were continued in Montreal Harbour. These data were used in the study of the slopes of St Mary's current, resulting from the effects of dredging and new harbour improvements along the waterfront. In connection with the report "National Ports Survey, 1931-32," considerable hydrometric data pertaining to the Great Lakes - St Lawrence waterways was prepared and forwarded to Sir Alexander Gibbs in England. Earlier water level records of the Department of Railways and Canals (some of which dated back to 1850) were transferred to this Division. Research was also continued in connection with "the tilting of the Great Lakes Basin."

CHART CONSTRUCTION

In the first two months of the fiscal year, three experienced map draftsmen were added to Mr Crichton's staff from the Department of the Interior: Mr J. Bell, Dominion Water Power Branch; and Messrs R.S. Simpson and G.E. Leslie, National Resources Branch. Early in October 1931, Senior Map Draftsman P.E. Parent was placed in charge of chart distribution, following Mr Chas McGreevy's retirement. This year, 30 new and revised editions of charts were printed, and 34,500 hand corrections made to published charts. In the records section, 325 items were added to the files, with a total now of 8,200 items. Seven copper plates were completed by the engraving staff, and 9,892 corrections made to existing copper plates.

CHART DISTRIBUTION

In October 1931 the first officer-in-charge of this division, Mr Chas McGreevy, retired after 27 years with the hydrographie service, and was succeeded by his former chief, Mr P.E. Parent, of Chart Construction. Prior to the amalgamation in 1904, Messrs Parent and McGreevy were hydrographie engineers with the Ship Channel Survey, Public Works Department. Both were transferred to the hydrographie survey that year. That fall Mr Parent, in charge of the survey ship *Delevis,* resigned to accept a position at Quebec, but in January 1915 returned to the survey as a map draftsman. His assistant, Mr McGreevy, remained with the survey and with the reclassification of 1919 (Griffenhagen Report) became 'assistant hydrographer,' a misnomer that was abolished following his retirement.

A reflection of the world economic situation in 1931 is indicated in the decrease of 13 per cent in Canadian chart distribution (9,692) from the previous year. In comparison, the US Coast and Geodetic Survey experienced a similar 13 per cent decrease, and the US Hydrographie Office, a 19 per cent decrease. Admiralty charts this year were also affected to the same extent. The free interchange of data and publications continued, with the Canadian Hydrographie Service the beneficiary, "being supplied gratis with copies of British Admiralty charts and publications relating to Canadian Waters for the most part, and those issued by foreign hydrographie offices, covering practically all waters of the globe, which are of value for reference purposes."

1932-33

Due mainly to the rapidly deteriorating world economic situation, Canada by 1932 was passing through one of the worst periods of economic retrenchment in its history. Effective from 1 April 1932, rigid staff controls were imposed on the Public Service that regulated new appointments, "froze" statutory increases, promotions, unfilled positions, and unit surveys. A heavier imposition was a general 10 per cent salary deduction of all civil servants, one exception being those whose salary did not exceed $1,200 per annum. Their contributions to retirement and superannuation plans were paid out of unappropriated moneys of the Consolidated Revenue Fund. On 1 April 1935, salary deductions were reduced to 5 per cent, statutory increases were restored, and departmental reorganizations resumed. This five year period of freeze effectively ended 31 March 1937, and with it civil servants began to look to the future with more security and hope.

Despite government austerity, in 1932 seven parties were placed in the field (ship 3, shore-based 4) - only four less than the previous year. For the want of funds the steamer *Bayfield,* the launch *Boulton,* schooner *Pilot No. 1,* and houseboats *Somass* and *Fraser* were not commissioned. With no survey in Hudson Bay, the upper St Lawrence River, or Great Slave Lake, some savings were effected, and with less money to operate, parties in the field were of shorter duration than usual. For the record, the hydrographie vote in 1932 was $381,707 - a 23 per cent reduction below the 1931 appropriation, and 30 per cent less than that of 1930. This was the lowest hydrographie expenditure between the years 1928 and 1939, and from a financial aspect it marked the lowest ebb of the "Depression Curve" for the Service.

DIVISION OF HYDROGRAPHY

Hudson Strait

To maintain the development of the Hudson Bay route, a shore party was sent to Hudson Strait this season, where it charted the south coast of the Strait from Cape Prince of Wales to Cape Weggs. This party, in charge of Mr F.C.G. Smith with assistant Mr T.M. Tardif, was equipped with a small open cockpit launch, better known as the 'Montcalm launch,' a power dory, tents and provisions. It was transported north for the first time by the Departmental icebreaker, *N.B. McLean,* Capt. W.J. Balcom. When in Acadia Cove, Resolution Island, a minor triangulation survey was extended to the eastwards and sounded out. A call was then made to Wakeham Bay to pick up the previous season's cached supplies, and on 2 July, Douglas Harbour was entered, where a summer base was established inside the entrance. From 25 July to 14 October surveying was extended 65 miles to the west, and about 35 miles to the east from Douglas Harbour. Before proceeding to Quebec, the *McLean's* new non-recording echo-sounder was used sparingly to chart the offshore waters. Tidal records, astronomical and magnetic observations were obtained, and some 183 miles of ship and 413 miles of launch soundings were logged. The *McLean* returned to Quebec on 29 October, and the following spring, Canadian chart No. 502, Cape "Prince of Wales to Cape Weggs" was issued to the public with an inset for Douglas Harbour. As to hydrographie surveying in northern latitudes, the following statement of Mr Smith's is most interesting: "the inclement weather which prevailed for most of the time was more than offset by having two launches at work, and the advantage of the long hours of daylight at this time of the year... it was impossible to reach these objectives and return to the base the same day with small open boats, which had a speed of only 5-1/3 miles per hour, it was necessary when working far from the base to take along camping equipment and erect it

from night to night on the shore as the survey progressed .. Cape Weggs was reached 1 a.m. the morning of 7 August and two days later the party crossed to Cape Moses Oates, Charles Island, where a triangulation beacon was built on the site of the 1914 triangulation station."

Gulf of St Lawrence - North Shore

Due in part to a reduction in appropriation, *the Acadia* in 1932 was reassigned from Hudson Bay to replace the *Cartier* on the North Shore of the Gulf. This party was in charge of Mr J.U. Beauchemin, with assistants Messrs W.F. Elliott, J.A. Deveault, G.W. Baker, R.L.B. Hunter and M.S. Madden. Before sailing from Halifax Harbour for the Strait of Belle Isle, a new improved *"Acadia* type" recording gear replaced the 1931 experimental unit on the *Acadia's* echo-sounder. It was used exclusively this season in sounding the waters of the gulf from the 15-fathom contour to about Latitude 49° 55' north, and "proved most satisfactory" (Mr Beauchemin). The recorded profile, however, being on a small scale (1 inch to 5 fathoms or 30 feet) and with a minimum of 5 fathoms under the ship's keel, shallow water echoes on this profile were none too accurate.

Before resuming regular survey work on the north shore, an investigation of seasonal ice conditions in the Strait of Belle Isle was carried out, this to assist transatlantic shipping using this route in the spring. A triangulation survey between Coacoacho Bay and Washtawooka Bay was made, and connected with previous controls. Inshore sounding (with the lead-line) was carried out in the launches to the 15-fathom contour, and from there seawards by the ship. When the season ended, the sector between Natashquan and Cape Whittle to an offshore distance of 75 miles had been surveyed, and this ended the recharting of "the transatlantic steam-ship route north of Anticosti." Several magnetic disturbances were observed with the gyro-compass this season, and the DF stations at Belle Isle and Canso, NS, were calibrated. When the *Acadia* returned to Halifax for the winter on 24 November, she had acquired sufficient data when added to the *Cartier 's* (to 1931) to compile one general, two coast, and one harbour charts.

Joint Tidal-Current Investigations

As a further curtailment in expenditures, the *Cartier* was reassigned from the north shore of the gulf to continue the *Bayfield's* survey of the Magdalen Islands, and to undertake the first joint hydrographic-tidal current investigations in the Service. The *Cartier* was in command of Mr H.L. Leadman, assisted by Messrs R.E. Hanson and L.M. Clarke (all three hydrographers transferred from the *Bayfield).* Pictou Harbour was departed on 27 May and en route to the lower St Lawrence River, revisory surveys were conducted at Port Borden, PEI, and in Gaspé Harbour, PQ.

When the *Cartier* arrived at Matane, PQ, Mr H. W. Jones and assistant Mr R.B. Lee, of the Tidal and Current Survey Division, joined the ship's company. Under Mr Jones's supervision a series of tidal-current investigations began in the estuary of the lower St Lawrence River between Pointe des Monts and Cape Chat from 4 June to 3 September. During this period twenty-eight ship and eleven boat stations were occupied.

Magdalen Islands

When tidal investigations ended, the *Cartier* resumed the recharting of the Magdalen Islands on 6 September, working in Basque Harbour and connecting Deadman Island with the main body of the islands. Between 4 and 8 October the ship worked in Miramichi Bay and

Buctouche River, NB, in Northumberland Strait. A new plan of Buctouche River was printed in April 1933, and regarding the Magdalen Islands, "it is hoped that another complete season's operations in these waters, the chart can be finally completed and issued to the public."

Saint John River

In 1932 this party was in charge of Mr N. Wilson, with Messrs G.E. Lowe and A.F. Wightman, assistants. Summer headquarters were Gagetown, NB, and the charting of the river between Evandale and Swan Creek, including the entrances to Washadamoak and Grand Lakes, was completed with the aid of a motor launch and a sounding gig. Some two hundred and fifty miles of soundings were recorded, and with the aid of aerial photography one hundred and eleven miles of shoreline were surveyed. Field season began 23 May and ended 2 November, and from this work the second chart [of the] series for this river was later drawn and printed.

Lake Winnipeg

This season Mr J.L. Foreman, assisted by Mr N.G. Gray, worked from Gull Harbour to the east of Black and Punk Islands, and between Manigotogan and Rive River - a region locally known as the Winnepegow area. With the aid of the outboard gig *Ogopogo,* five hundred and seventy miles were sounded, and four hundred and eighty-three rocks and islands located. As a result of these operations, two charts were drawn: one, No. 148, "Observation Point to Grindstone Point," printed May 1934; the other, a new edition of No. 140, "Red River to Berens River" -the first Canadian chart from Canadian surveys, printed February 1903.

British Columbia

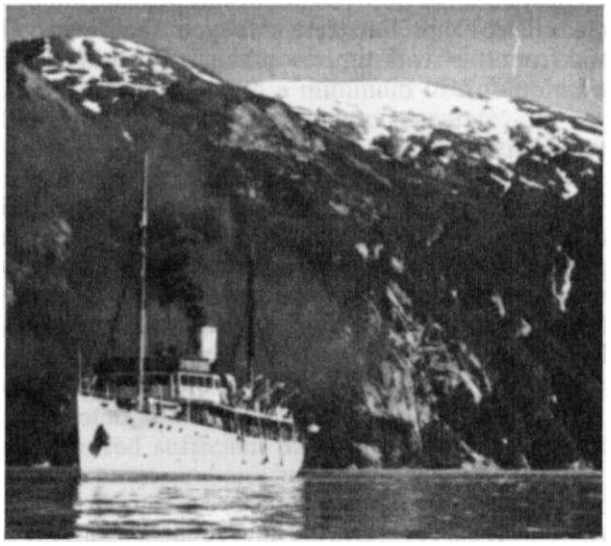
Although not commissioned for survey work, the houseboat *Somass* and water tender *Fraser* were in service. They were towed to Esperanza Inlet for use by the RCAF air photographic party. The year 1932 was the last field season for the *Lillooet,* and in the early part of the season she worked with the houseboat *Pender* on the exposed west coast of Vancouver Island, in Clayoquot Sound. Eleven assistants (see list 1931) were under the direction of Mr H.D. Parizeau. In charge *of Pender* was Commander J.H. Knight, assisted by Messrs Davies, Johnson and Rutley. From 28 June to 10 September operations were transferred from the Clayoquot Sound area southward to Juan de Fuca Strait, between Bonilla Point and Race Rocks. Before returning to Clayoquot Sound the resurvey between Discovery Island and Boundary Bay was commenced. One of the last official undertakings by the *Lillooet* from 18 to 22 November was a line of soundings in Jervis Bay, "for scientific research purposes." Most of *Pender's* season was spent in Tofino Inlet, Clayoquot Sound, extending its survey to the east shore of Hesquiat Harbour. Other areas visited by *Pender* were Herbert Arm, North Arm, Shelter Arm and Sydney Inlet. Her season began 27 April and ended 26 October.

Photo-topography in British Columbia

"Experimental work in photo-topography was conducted for the purpose of ascertaining the feasibility of combining this method with aerial photography to supplement the sketching,

observing and traversing, as conducted by regular hydrographie methods. This preliminary work has grown to be satisfactory and it is expected it will result in a saving of 30 to 40 percent of the time otherwise consumed in obtaining the necessary topographic features for incorporation in the charts."[6] Considerable of the experimental work was under the personal supervision of Commander J.H. Knight. Mr R.B. Young writes, "the method was developed by the Provincial Government Topographic Section ... a round of (horizontal) photos was taken by a camera set up on a triangulation station. The horizontal line was etched on the plate and heights and bearings scaled and calculated. Film was on glass plates about 5 inches by 7 inches."

The *Lillooet* and the New Survey Ship *Wm. J. Stewart,* 1932



The *Wm. J. Stewart* in a BC fiord.
Photo courtesy CHS.

In July 1932 the new steamer *Wm. J. Stewart* reached Victoria, BC, from her shipyards in Collingwood, Ontario, via the Panama Canal. Following the completion of this 8,000 mile voyage, she was inspected, and after docking and acceptance, was tied up for the balance of the season - it being considered uneconomical to outfit her at this late date. Certain alterations were needed, and more modern equipment had to be installed for the coming season. When the *Lillooet* tied up on 22 November, it brought to a close a quarter century of charting the coastal waters of British Columbia, a task she began in 1908 as the first specially designed survey ship in the hydrographie fleet. Capt. J.J. Moore, sailing master of the *Lillooet* since 1922, was transferred to the *Wm. J. Stewart* the following year, and Mr A. Borrowman, chief engineer since 1911, came ashore. With the lay up of the *Bayfield* and *Lillooet,* only two major hydrographie ships of the pre-war era were still in service - the *Cartier* (since 1910) and the *Acadia* (since 1913).

[6] *Marine Report, 1932,* 59.

HEADQUARTERS

Messrs E.A. Ghysens and P. Radikir of the upper St Lawrence River survey were reassigned to "emergency surveys" in headquarters because the *Boulton* was not in commission this season. Other hydrographers in this division in 1932 writing sailing directions and pilots were Messrs M.A. MacKinnon, R.W. Bent, A.K. Laing and O.M. Meehan. There were now catalogued thirteen volumes and supplements of these pilots. Field inspections reported shoals in Georgian Bay. An examination of a portion of the channel into Byng Inlet was made in the area "where vessels experience difficulty in navigating under the exceptionally low water conditions of the past season." In the lower St Lawrence River, below Quebec, a triangulation network was carried out by Mr Ghysens, work necessary for the revision of charts of this sector of the River based on older Admiralty surveys. Other supervisory matters were attended to by Mr R.J. Fraser, in charge of this division, and principal assistant' to the chief hydrographer.

TIDAL AND CURRENT SURVEY

Working in joint cooperation with hydrographie officers of the *Cartier,* a series of tidal-current investigations were undertaken this season across the entrance of the St Lawrence River, "westward where work was left off with the Gaspé Current in years before" (see Magdalen Islands and lower St Lawrence River survey). Tidal matters were in charge of Mr H.W. Jones, assisted by Mr R.B. Lee (tidal survey), R.E. Hanson and L.M. Clarke (hydrographie service). The *Carder* was in command of Mr H.L. Leadman. Observations for the turns of the tidal streams in Hudson Strait were continued by radio personnel of the department stationed in this area. On the Pacific coast, similar observations were recorded in Rocky Pass, the channel to Nitinat Lake (Vancouver Island), and in the entrance to Juan de Fuca Strait.

PRECISE WATER LEVELS

In Montreal Harbour, "the unusually high discharge of the Ottawa River held the water level well above any critical stage." A new water level gauge was installed in this harbour to assist the studies of the Ship Channel, and the St Mary's current. It was placed at the entrance to the Montreal Waterworks aqueduct. Two fewer gauging stations were in operation this season than in 1931 - forty-two in number. Hydrometric data was furnished to the Canadian Press Association and other agencies as in past years, and special attention was given to processing Department of Railways and Canals water level records taken over the previous year.

CHART CONSTRUCTION

In his annual report on this division, Mr Crichton stated, "in this division during the last year more work was performed than in any previous year, due to the relatively large number of new charts prepared, and the greater extent to which it has been possible to correct the editions of published charts, and also, the amount of assistance rendered the field parties in the completion of their fair sheets." For the most part, fifty-nine charts were taken in hand and published, with ten charts and twelve index maps printed from engraved plates. Total chart corrections amounted to 48,907, with 4,390 corrections to copper plates by the engravers.

CHART DISTRIBUTION

Under Mr Parent's supervision, assisted by Mr A. Carbonneau and at times Mr H. Bourdon, 8,955 copies of Canadian charts of all descriptions were issued to the public. This was 7.7 per cent lower than the 1931 figure; and 19.7 per cent below that for 1930. In addition 352 volumes of pilots and sailing directions, 99,000 tide tables, and 25,845 sheets, graphs, etc., of water level data were distributed.

1933-34

A slight improvement was noticeable in Canada's economic position in the fiscal year 1933 that was reflected in a 3 per cent increase above the 1932 hydrographie vote. Nine parties were outfitted and sent to the field (ships 3, shore-based 6) - two more than in 1932. With the commissioning of the new survey ship *Wm. J. Stewart,* funds were lacking to recommission the older ships *Bayfield* and *Lillooet.* Consideration, however, was given to the construction of smaller units of the fleet. Two of these units were 27-foot half-cabin survey launches built in Nova Scotia for duty on the Atlantic coast: one the *Discovery* for Hudson Strait, the other for *the Acadia.* Of special significance this year was the installation in hydrographie ships and launches of the first magneto-striction models of echo-sounders - the *Cartier* and *Boulton.* When used in conjunction aboard ship with the gyroscope compass, a new era was introduced to hydrographie charting, one that was soon to produce more detailed and accurate coast charts than any to this time.

FIRST MAGNETO-STRICTION ECHO-SOUNDERS IN HYDROGRAPHIC SHIPS AND LAUNCHES, 1933-35

Ships

Although the sonic sounder had greatly improved by 1932, it was far from an overall efficient machine. Recorded depths were fairly accurate for deep water but not always so for shallow water. There was also the wear and tear on the ship's hull from the continual operation of the pneumatic hammer, not to mention the constant noise and vibration from the blow by the hammer. The solution of these and other problems was resolved in 1933 with the advent of the first automatic magneto-striction ship and launch sounders. On the ship an electrical oscillator replaced the pneumatic hammer, and this sounder could record accurate profiles of the sea bottom adaptable to both small- and large- scale standard charts. The ship (MS 3) model was operated by an electric D.C. generator (110 volts), with both the transmitter and receiving tanks filled with water and welded to the inner surface of the ship's steel hull. It had a range of 0-250 fathoms with a 5-phase device of 50 fathoms per phase, and recorded depths on paper to a scale of 18 fathoms (108 feet) to the inch, with a minimum depth of 2 feet under the keel. It could record automatically "240 depths per minute with an accuracy of 4 inches," and sold for approximately $2,750. Following a series of trials with the *Carder's* new sounder, Mr Leadman rated its performance "greatly superior to those by the echo-sounding methods of past years."

In 1934 a new MS 3 was in operation in the *Wm. J. Stewart* on the Pacific coast, and according to Mr Parizeau, "this last summer we had no important trouble with either of our sounding machines. The new one, 250 fathoms, has worked like a charm from the 20 fathom mark to the 100 fathoms contour. Our only difficulty was beyond the 100 fathom mark. The gradient is very steep ... as for the other machine of 2,000 fathoms, with the automatic hammer, after applying the special drain in the air pipe, as suggested to me by Mr Leadman

last winter, it seems to have offset our trouble, with the automatic hammer ... made very little sounding with her last season, I would not state that all our troubles have been eliminated, but there are hopes for it. In some cases as we have been able to sound close to the 1000 fathoms line."

To complete the modernization of the ships, a new MS3 was installed in the *Acadia* in 1935. A11 ships of the fleet now had echo-sounders in them: *Lillooet, Bayfield* and *Carder,* with the *Acadia* and *Wm. J. Stewart* with two each (MS 3, and the deep water sonic sounder of the hammer-compression type).

Launches

The first magneto-striction supersonic Admiralty pattern echo-sounder in hydrographie launches was placed in the *Boulton* in June 1933. Battery-operated, this sounder designed for shallow water investigations had a range of 200 feet, and cost about $3,543. In 1936 it was reported by the chief engineer to be too light to stand the constant operation required in charting work, and was returned to Henry Hughes and Company for overhaul. With a liberal trade-in allowance on the old machine ($880), it was replaced in the cabin launch *Boulton* by a more modern MS XII model with rotating arm at a cost of $2,302 to the department. During the *Boulton* lay up in 1934, it was removed and placed in the *Carder's* starboard launch for trials under Mr Leadman's direction. At the end of the field season, Mr Leadman reported, "the machine was installed in one of a pair of exactly similar launches, both manned by experienced crews. Most of the boat sounding was done in depths such that it was not necessary to stop the boat for a cast with the hand lead. The echo-sounder easily did twice as much work as the hand held and did it much better. The former gave a profile of the bottom, the latter, only the depth at intervals. Work in deeper water would not slow down the echo-sounder but would have a tremendous effect on the other launch, especially when it became necessary to use the hand Lucas machine."

In 1934 an MS 2 supersonic echo-sounder was purchased for $3,490 and placed in the 27-foot half-cabin survey launch *Discovery.* It was an Admiralty pattern, range 100 fathoms, with 4 phases of 25 fathoms, with a scale of 7 fathoms per inch. It was operated by a current supply of 36 volts from storage batteries, and when operable, recorded automatically depths every quarter-second of time, and every three feet in distance. The following year MS 2 sounders were fitted to survey launches in the *Acadia, Carder* and *Wm. J. Stewart* (two, one of which was intended for *Lillooet).* So by 1935, not only were the major ships equipped with modern sounders, but also auxiliary launches attached to them.[7]

In summary, it can therefore be stated that the history of underwater sound transmission in the hydrographie service began with experiments in the steamer *Carder* during the summer seasons of 1915 and 1916. In 1929 the Admiralty pattern sonic sounder was installed in the steamer *Acadia,* and with the addition of improved recording gears by

[7] It was the author's privilege to work with Mr Smith in the new launch *Discovery* in 1933, and in 1934, with Mr G.E. Lowe in the *Cartier 's* starboard launch that had an MS2 echo-sounder. I can recall the many breakdowns with this machine, and the return trips to the *Cartier* for Mr Leadman's personal inspection and adjustments. Most of the trouble appeared to be with the impregnated (potassium iodide) wet paper, and the machine's stylus. I also recall the movements of local fishing schooners when the ship "dropped the hook," and sent this launch to examine in detail the myriad of shoals skirting the east coast of the Magdalen Islands. What I have yet to learn is just how the hovering fishing schooners learnt of new shoals in this area, and without ever seeing the "double-echoes" on our sounding rolls. True, it was a novelty for ship's hydrographers to see these "double-echoes" for the first time, but to fishermen about, our launch, our movements meant only one thing to them - shoals of fish, and possibly new fishing grounds.

1931, this unit was recording on paper-deep water soundings of sufficient accuracy for charting purposes. In 1933 the first magneto-striction automatic recorders were added to the steamer *Carder* and the launch *Boulton.* These were the first reliable sounders to record both shallow and deep water depths to a high degree of accuracy. The following year (1934), the first automatic recorders began operating in ships on the Pacific coast, and in 27-foot launches on the Atlantic coast. In 1935 all three major ships of the service were equipped with both ship and launch units for surveying in Hudson Strait, the Gulf and St Lawrence River, and on the Pacific coast.

In subsequent years improved MS 12 and MS 14 models of echo-sounders replaced the first MS 2 units in survey launches. Between the years 1929 and 1939, about seventeen Admiralty pattern, non-registering and registering units, had been installed in Canadian Hydrographie Service ships and launches. When the Second World War began thirteen of this number were still in operation (ships 5, launches 8). This figure included the two "hammer-compression" sonic sounders still attached to the Acadia and *Stewart,* for emergency purposes, (for further information see Appendix I).[8]

DIVISION OF HYDROGRAPHY

Hudson Strait

Partially as a result of the sinking of the SS *Brightfan* off Charles Island in October 1932, it was decided in 1933 to carry out a reconnaissance survey along the south coast of Baffin Island east of Cape Weymouth, in search of suitable harbours and anchorages in case of emergency, and to position the century-old "Griper Rock" shown on Admiralty charts and lying south of Upper Middleback Island. When in Quebec, the *N.B. McLean's* sonic sounder was changed to a modern MS 3 model and during the season it was of valuable assistance to both the hydrographie party and the ship's officers. The Hudson Strait party was again in charge of Mr F.C.G. Smith, with assistants Messrs T.M. Tardif and O.M. Meehan, and Capt. D.M. Snelgrove who looked after the boats and equipment. The *McLean,* Capt. W.J. Balcom in command, sailed from Quebec on 9July and, after a brief visit to Resolution Island, proceeded to Lake Harbour where a line of soundings with the new echo-sounder was recorded. Here, a few Eskimo pilots and their families were taken aboard for the summer months, and the ship then skirted the coast to the eastward in search of a suitable summer base. One was found in Observation Cove, Balcom Inlet (named after Capt. Balcom), and when supplies and equipment were disembarked the three sectional huts built at Quebec were erected. A tide gauge was built that registered high waters only. With a 33-foot tidal range on this flat, rocky foreshore, it was necessary to construct three wooden cribs and sink them offshore. To each crib was attached a 12-foot tide scale, and the cribs were spaced and lined up that the cook (Jack Chester) could read the water level on the staff from the dining-hut door, with the aid of a "Nelson" type telescope.

In Observation Cove a bench mark was established and its geographical coordinates determined. Subtense measurements of the initial triangle were first observed, and the triangulation network extended eastwards to Pritzler Harbour, and later westwards to Cape Weymouth. Inshore surveying and lead-line sounding were conducted in two 27-foot launches: one, the open cockpit *Montcalm* launch from the departmental icebreaker by that name; and the other, the new half-cabin 27-foot Launch *Discovery,* built this year by Kenneth MacAlpine of Shelburne, NS, at a cost of $2,940 (boat $1,775, gasoline engine

[8] This appendix does not appear to exist. [Ed.]

$1,165).

Observation Cove, Barrier Inlet, Hudson Strait. O.M.Meehan, author of this account, is identifiable by his white sock-tops. The launch from the *N.B. McLean* is on the left, a four-oared gig on the centre, and CHL *Discovery* on the right.
Photo courtesy CHS

On 25 August the *McLean* returned to Balcom Inlet from its patrol duty, and took aboard hydrographers Messrs Smith and Tardif. A close examination of the Griper Rock (reported having been touched by HMS *Griper* a century earlier) was found to be non-existent with 100 fathoms recorded by the echo-sounder. Until 31 August the *McLean* sounded some three hundred and twenty-five linear miles to the west, and when homebound in October ran another line of soundings between Balcom Inlet and Resolution Island.

The party disembarked from Balcom Inlet on 7 October and while in Acadia Cove, Resolution Island, made other surveys from the *McLean.* When weather conditions, permitted Capt. Balcom sailed from Hudson Strait and tied up at the Marine Agency wharf, Quebec, on 16 October. Over an area of 787 square miles, [figure not legible] linear miles of boat sounding (lead-line) were observed, and records for 150 tides taken. From this season's work, the first Canadian coast chart from actual surveys was made for Baffin Island - No. 1503, "Pritzler Harbour to Cape Weymouth," with insets for Balcom and Barrier Inlets, and Shaftsbury Inlet.

Neither aerial photography nor an astronomic position was available to this party. With a battery radio and time signals from Greenwich at night, the chronometer was correctly rated, and it was used for astronomical observations late in the season when the stars were brightest. Coastal topography was sketched with the theodolite and stadia, or by the 10-foot subtense staff and sextant, both methods on foot, and working from the launch or dory.

Gulf of St Lawrence - North Shore

This spring a modern receiving gear was added to the *Acadia's* improved sonic sounder, and increased the efficiency of the unit. The ship left Halifax for the north shore early in June with a new 27-foot half-cabin launch added to her equipment, and another for delivery to the Hudson Strait party. Officer-in-charge was Mr J.U. Beauchemin, assisted by Messrs W.F. Elliott, J.A. Deveault, S.R. Titus, R.L.B. Hunter and M.S. Madden. En route to the Gulf of St Lawrence, a shoal was examined in Great Bras d'Or Lake, Cape Breton. Work on the north shore was centred between Natashquan and Ste Geneviève Island (Mingan Islands), with the triangulation network extended from Ste Geneviève Island to Clearwater Point near Havre St Pierre. Aerial photography by the RCAF was of assistance with topographical details, but for a clearer photo interpretation of the more intricate areas along this coast, a hydrographie party under Mr Titus examined these areas in detail with the aid of a chartered schooner. Over 100 survey stations were built this season, and 2,100 miles of soundings taken by the ship and boats. On 5 October the *Acadia* returned to Halifax for the winter.

Magdalen Islands and Lower St Lawrence River

Early this spring the *Cartier* was equipped with the first automatic echo-sounder in Canadian hydrographie ships. It was a MS 3, British Admiralty pattern, *Challenger* type, range 1 to 250 fathoms. Early in May, the ship with Mr Leadman in charge and assistants Messrs Hanson and Clarke, sailed for the Magdalen Islands where the new sounder was tested satisfactorily in deep and shallow water in the vicinity of Brion Island and Bird Rocks. Before proceeding to the lower St Lawrence to complete the series of tidal-current investigations, the ship returned to Charlottetown where a deep sea anchoring winch was installed for tidal work. The *Carder* reached Matane, PQ, in mid-June where Messrs Jones and Lee joined the party. Current observations begun the previous year were extended in 1933 upstream to Father Point, PQ. When this work ended the last week in August, the ship returned to the Magdalen Islands, and on passage recorded a line of soundings with the new recorder from Cape Gaspé to Brion Island. From this season's activities a plan of Matane Harbour was drawn, and 1,551 miles of ship soundings obtained. Early in October the *Cartier* returned to Charlottetown for the winter.

Saint John River

The charting of this river in 1933 was resumed by Mr M.A. MacKinnon, with Messrs G.E. Lowe and G.W. Baker. The stretch of the river between Swan Point to two miles above Fredericton was surveyed, with the aid of a gasoline launch, and aerial photography. This included a close examination of Oromocto Shoals, "which governed the depth available between Saint John and Fredericton." This spring the river freshet rose to the highest level in ten years. Summer quarters were at Upper Gagetown, and then Fredericton, the capital of New Brunswick. As a result of the season's work, the third of the river chart series - from Saint John to Fredericton - was placed in the hands of the lithographers. This chart, No. 446, included large-scale plans of Sheffield Channel, Oromocto Shoals, and Fredericton.

St Lawrence River

After a lay up of one season, the cabin cruiser *Boulton* was recommissioned in 1933, with

Mr E.A. Ghysens in charge, assisted by Mr P. Radikir. Before leaving for the lower St Lawrence River a new "Super Sonic" self-registering echo-sounder was placed in this 44-foot cabin cruiser, the first automatic unit in any hydrographie launch. The party left Prescott on 26 May and on passage made several tests in Montreal Harbour with this sounder that proved highly satisfactory. The first summer base of operations was Berthier, where a triangulation network was completed between Quebec Harbour and the South Traverse - a work most necessary in the reproduction of former Admiralty charts. In July the launch entered the Saguenay River where a second base was established at Chicoutimi, PQ. Here the *Boulton* with her 30-foot sweep examined the upper channels of the river, and completed other relevant surveys until early September. About the middle of September she returned to Prescott, and was placed in the hands of a shipwright, "for overhaul and considerable repairs." In all, six hundred and fifty miles of linear soundings were logged this season, many of which were by the new echo-sounder. From the data acquired, new editions of Canadian charts for the Saguenay River region were later published.

Lake Winnipeg

This party, in charge of Mr J.L. Foreman, assisted by Mr N.G. Gray, arrived in Gull Harbour (Hecla Island) aboard the SS *Keenora* early in June. Work was centred this season in the lower part of the lake "along the routes leading to the mining district." When it ended the last week of September, sufficient information was acquired to publish the Manigotogan and Winipigow Rivers (see Canadian chart 148, printed May 1934). This particular waterway led to the central mining areas of Manitoba. Over 520 miles were sounded in the boats, 288 rocks and islets located, and 38 miles of shoreline traversed - supplemented with aerial photographic coverage.

Mackenzie River Delta

Since the turn of the present century, several small settlements had been established between Alaska and King William Island in the western Arctic, including the Mackenzie River delta. To keep these northern outposts open the year, round supply ships were obliged to navigate annually around the ice-infested waters bordering the Alaska coast. Over the years this route had claimed a toll of ice casualties and shipwrecks, frequently with the loss of valuable ship cargoes and lives. The ultimate was reached by the Hudson's Bay Company in September 1931, when its chartered supply ship, the SS *Baychimo* while homebound for Vancouver was beset in the heavy icefields off Herschel Island, and was eventually lost with its cargo of furs, oils, etc. The heavy financial burden sustained with the loss of this "ghost ship of the western Arctic" did much to influence the company in deciding to abando the Point Barrow route for the less hazardous route via the Mackenzie River. To this time, investigation in the channels of the delta had been made by their own ship captains and the hydrographie service (1930), and after considerable study it was decided that the present site of Aklavik in the western channel was not a suitable trans-shipment port terminus for vessels operating east of the Mackenzie River. Accordingly, a request was forwarded to Ottawa to have the Hydrographie Service undertake a standard survey of the proposed site of Tuktoyaktuk Harbour, and to this request the Department of Marine agreed.

Arrangements were then made for Mr N. Wilson and assistant Mr A.F. Wightman to undertake this special survey. The company agreed to supply provisions, fuel, labour for a crew, and to tow the survey schooner *Pilot No. 1* from Fort Smith to Aklavik and return. She was taken to Fort Norman on the Mackenzie River by the company's motor vessel *Pelly*

Lake and from Good Hope to Arctic Red River by the paddle steamer *Distributor.* The intervening stretches of the river navigated were under the *Pilot's* own power. A check was first made of the reconnaissances in 1930, with the Anderson Channel route being retraced by Mr Wilson in the *Pilot No. 1* and small boats. The survey of Tuktoyaktuk Harbour was carried out from 10 July to 17 August to a distance of fifteen miles towards the Beaufort Sea. Tidal observations were also noted, two pairs of range beacons were built in the eastern entrance, and the survey tied in with monuments of the topographical survey at Kittigazuit. Soundings were taken in the Aklavik Channel (by the East, and Omiak Channels) for the Company's boats using this route to Tuktoyaktuk Harbour. Over an area of 165 square miles, 385 miles of soundings were logged by the schooner and small boats. In tow of the *Distributor,* the *Pilot No. 1* left Aklavik on 2 September and reached Fort Smith at the head of navigation on 23 September, losing only seven days from bad weather. When the schooner was hauled out at the Gravel Point yards of the Hudson's Bay Company, it was to be her last field season with the hydrographie service. It also brought to a temporary close Canadian charting above the Arctic Circle until the 1950s, and in Great Slave Lake until 1944. In December 1933, Canadian chart P.2172, "Tuktoyaktuk Harbour" was printed on a scale of 1:6,103; and in March 1934 a companion chart, P.2174, "Approaches to Tuktoyaktuk Harbour," scale 1:44,102, was published. These were the first standard hydrographie harbour and coast charts for the western Arctic.

British Columbia

At a cost of $622,086, including extras, the new steamer *Wm. J. Stewart* was placed in commission for the first time on the Pacific coast. Built in Georgian Bay (1932) for "hydrographie and océanographie" work on this coast, she was equipped with the most modern instruments available at the time - including a deep sea oceanic sonic sounder of 2,000 fathoms' range (with a modern recording gear for greater efficiency) and a new gyroscope compass.

The *Stewart* was commanded by Mr H.D. Parizeau, with assistants Messrs W.K. Willis, R.H. Ettershank, A.E. Stewartson, R.B. Young, H.N. McQuarrie, V. Wiebe and G.W. LaCroix. Sailing master was Capt. J.J. Moore (1933-34), transferred from the *Lillooet.* Chief engineer was Mr J. Ascroft (1932-45); and second engineer, Mr S.A. Robson (1932-34), former chief engineer of the *Bayfield.* Houseboat *Pender,* in charge of Commander J.H. Knight, with assistants Messrs L.R. Davies, J.O. Johnson and J.A. Rutley, was taken in tow by the *Stewart* on 26 April, and both parties then proceeded to Nootka Sound on the west coast of Vancouver Island to commence the season's activities. On the return trip to Victoria, the *Stewart* carried out a few photographic surveys along the Canadian shore of Juan de Fuca Strait. Further examinations and sweeping surveys in the Clayoquot Sound area were then undertaken, and the triangulation network on this coast extended from Estevan to Nootka Sound. During August and September, the recharting of Haro and Georgian Straits were resumed in the vicinity of the international boundary. The season ended for the *Stewart* in Nootka Sound. *Pender* laid up in Esperanza Inlet on 29 September and the following day both parties returned to Victoria. Some 2,246 miles of ship and boat sounding were conducted by the *Stewart,* and 587 miles by *Pender's* two survey launches. About 220 horizontal photographs of mountain topography were taken by the *Pender's* party. In February 1934 the headquarters of the Victoria office were moved from the BC Permanent Loan Building to 319 Post Office Building on Government Street.

HEADQUARTERS

Under Mr Fraser's general supervision considerable data was collected and checked for the new edition of *Canadian Ports and Shipping Directory* that was issued to the public by the Department of Marine at the end of the fiscal year. Mr R. W. Bent gave much of his time to this request in addition to the writing of sailing directions.

TIDAL AND CURRENT SURVEY

This season two tidal-current investigations were carried out in the lower St Lawrence River. At the request of the pilotage service, a commencement was made of a general study of the current patterns of the river between Quebec and Father Point. This study was begun early in the year by Mr H.W. Jones, just above Quebec City, and with the aid of the Departmental Lightship No. 23. About the middle of June, in company with Mr R.B. Lee, he joined the *Cartier* at Matane. Here until the last week of August, joint tidal-current investigations begun in 1931 were extended and concluded at Father Point. During the winter of 1933 hydrographers A.K. Laing and O.M. Meehan were loaned to the Tidal Survey to assist Mr Jones with the preparation of the report *Currents in the St Lawrence Estuary, Ste Anne des Monts to Father Point,* published in 1934.

Working in cooperation with engineers of the Vancouver Harbour Commission, in 1933 Mr S.C. Hayden examined the tidal currents in this Pacific seaport to study their influence in berthing large steamers. Employees of the radio branch of the department stationed in Hudson Strait continued their series of visual ice and current observations at Resolution and Nottingham Islands. Tidal records were obtained this season by hydrographie parties based on Baffin Island in Hudson Strait, and in Tuktoyaktuk Harbour, western Arctic.

PRECISE WATER LEVELS

During the fiscal year 1933, continuous water level observations were maintained at forty-three locations on the Great Lakes, the upper St Lawrence, and the lower Ottawa River. Studies of the St Mary's Current in Montreal Harbour were continued. To quote from Mr Price's annual report, "the sixty curves, relative to the tilting of the Great Lakes Basin, have extended and further established the proof that this tilting will have to be given practical weight in hydraulic problems relative to this watershed." A total of 26,304 sheets of data were issued this year, an increase of 293 over 1932. To assist with the increased office work Miss F.A. Reed was transferred from the Naval Construction Division, Department of Marine, to the Precise Water Levels Division.

CHART CONSTRUCTION

A staff of thirteen cartographers, draftsmen and engravers, under the supervision of Mr G.L. Crichton, handled forty-eight charts, maps, prints and corrections - most of which were published this fiscal year. Before this year ended Mr W.L. Andrews, a senior map draftsman (with the service since 1920) retired for reasons of ill health.

CHART DISTRIBUTION

Total navigation charts distributed in the fiscal year 1933 were the lowest figure of the

depression years, a total of 8,470 editions. This figure was 5.4 per cent lower than in 1932; 12.6 percent below 1931; and 24 per cent below 1930. Ironically though the number of pilots and sailing directions distributed was 48 per cent above 1932 - 528 volumes in all. Tide table distribution showed a slight decrease in 1933, some 98,500 copies. This figure was offset by a 5.4 per cent increase in water level data - 27,251 graphs, bulletins, etc. If for no other reason, these figures do indicate the trend of Canadian shipping and other marine problems in 1933.

1934-45

For the want of sufficient funds, the *Bayfield, Lillooet* and *Boulton* were not commissioned in 1934. This year the auxiliary schooner *Pilot No. 1* was turned over to the Fort Smith Agency, Northwest Territories Branch, Department of Interior, and used to tend aids to navigation on the Slave River and Great Slave Lake. An examination of the *Bayfield* showed extensive repairs were necessary to make her seaworthy again and, "it would be more economical to dispose of this craft and replace her with a new and modern survey vessel." As to the *Lillooet,* "it is hoped that next season the appropriation for survey work on the Pacific coast will have been brought back to normal requirements, when this ship can again be put in commission." On the bright side of the 1934 picture was the installment of the first automatic echo-sounding machines in the 27-foot survey launches. With the temporary suspension of the Great Slave Lake, St Lawrence River, and Saint John River surveys most field officers of these parties were reassigned to general duties at headquarters - emergency surveys, sailing directions and pilots. As in previous years, there was a considerable international exchange of hydrographie data, and aerial photographic surveys were continued by the RCAF in connection with parties working in the Gulf of St Lawrence.

To assist with the 400th anniversary celebrations of Jacques Cartier's voyage of discovery in Canada, the survey ships *Acadia* and *Carder* were detached from field work and sent to Gaspé and Charlottetown Harbours respectively. There they rendered all possible aid to the visitors aboard the French ocean liner *Champlain.*

DIVISION OF HYDROGRAPHY

Hudson Strait

In 1934 the survey of the south coast of Baffin Island was extended eastwards by Messrs F.C.G. Smith and T.M. Tardif, between Pritzler Harbour and the Lower Savage Islands (surveyed in 1914 by Capt. F. Anderson in the *Acadia).* Equipped with two survey launches and a surf boat, the party sailed from Quebec on the *N.B. McLean* on 10 July and disembarked at its summer base in Lower Savage Harbour. In Quebec a new automatic echo-sounder (MS 2) was installed in the 27-foot launch *Discovery* - the first to be purchased expressly for this class of survey launch and the first in the service to chart northern waters. Tidal records were obtained for Lower Savage Harbour, and visual current observations recorded in Gabriel Strait. In his report on this latter area, Mr Smith wrote, "the strong tidal streams of Gabriel Strait striking heavily against the Savage Islands area sheered abruptly from their course and the accelerated, swirling currents cause a confused sea with whirlpools and remarkable tide-rips. Even on fairly calm days there occurs areas of sharp uprisings of the sea like a great boiling pot." Pritzler Harbour was reported to be "the best of the harbours in this vicinity."

When the *McLean* returned to Quebec on 20 October, it was to be the last hydrographie survey in Baffin Island until the end of the Second World War (1950, Mr

D.A.H. Charles, Frobisher Bay). From this season's activities, Canadian chart P. 1507, "Lower Savage Islands to Pritzler Harbour," with an inset of Pritzler Harbour, was published in May 1935.

Gulf of St Lawrence

The *Acadia* left Halifax Harbour on 3 May with Mr J.U. Beauchemin in command and assistants Messrs Elliott, Deveault, Titus, Baker, Hunter and Madden. The ship's company of hydrographers, officers and crew totalled forty-eight. Main charting activities in 1934 were centred on the south coast of Anticosti Island, an area covered for aerial photography this season by the RCAF. Survey launches were used for inshore sounding to a distance of two miles offshore, "whilst from the 10-fathom contour seaward the deeper measurements were taken and recorded by the echo-sounder of the ACADIA." This was a distance of 20 miles to seaward. In addition to work on Anticosti Island, the *Acadia* examined shoals near Cape Tormentine, NB, (car ferry terminal to PEI), and in Summerside Harbour, PEI, examined the channels and sounded out certain areas in the approaches to this harbour. The ship returned to Halifax for the winter on 3 October.

A highlight of the *Acadia's* season activities in 1934 was its visit to Gaspé Harbour in July, where the ship was placed at the disposal of government officials and visitors from France aboard the ocean liner *Champlain.* In commemoration of the 400th anniversary of Jacques Cartier's visit to this harbour, a cross was erected ashore, and the *Acadia's* searchlight was used to keep it illuminated. Some of the *Champlain's* visitors were also quartered on *the Acadia* during the celebrations. Those of the crew whose quarters were so occupied were accommodated overnight on the *Champlain.*

Ice-Breaking Service, Winter 1934-35

In the winter of 1922-23 the *Acadia* was engaged in winter ice-breaking operations along the Atlantic coast of Nova Scotia, until she sustained minor ice damage to her hull. During the winter of 1934-35 she was again detailed by the Marine Department to this duty, and from the middle of January to the end of March 1935 was fully occupied in freeing ice-bound vessels in Nova Scotian ports between Shelburne and Sydney Harbours. On behalf of the Marine Agency in Dartmouth, NS, she also made a return trip from Halifax to Sable Island with supplies, and tended navigational aids along this coast. Both these winter cruises had one thing in common - each were authorized at a time when the government was passing through a period of economic recession.

Magdalen Islands

The recharting of the Magdalen Islands, begun by the *Bayfield* in 1921, was brought to a close by the *Carder* in 1934. Whereas in 1921 inshore sounding of these islands was conducted in a sailing gig and the lead-line (the same as in Admiral Bayfield's time almost a century earlier), in 1934 its resurvey was concluded with a modern survey launch equipped with one of the first self-recording echo-sounders in 27-foot launches. This party, in charge of Mr H.L. Leadman, was assisted by Messrs R.E. Hanson, L.M. Clarke, G.E. Lowe and O.M. Meehan and a ship complement of forty-two. Several shoal areas were checked off the east coast of the Magdalens with the ship and launch recorders and, in several instances, less water was found on some shoals and rocks than when sounded previously with the lead-line.

In connection with the 400th anniversary of Jacques Cartier's historic voyage to the

Gulf of St Lawrence in 1534, the *Carder,* as instructed, temporarily suspended field work and early in August returned to Charlottetown Harbour. When the *Champlain* arrived at Charlottetown, she preferred to anchor outside the harbour. The *Carder* was then used to transport her personnel and visitors as requested, and when this special assignment ended she returned to the Magdalen islands for the remainder of the season. About 155 shoals were examined this season with echo-sounder and lead-line, and 2,200 miles of ship and boat soundings were logged. In March 1935 the first Canadian chart for the "Graveyard of the Gulf was published - No. 451, "Magdalen Islands."

While charting the Magdalen Islands in 1833, Capt. Bayfield's assistant Lieut. P.E. Collins, RN, was stricken with apoplexy in an open sail boat, and died before aid could be given to him. Bayfield's charts for the Magdalen Islands, with insets for Grand Entry and Amherst harbours, were the best navigation charts for this region of the Gulf until Canadian chart No. 451 was published a century later.

Lake Winnipeg

This season Messrs Foreman and Gray resumed surveys in the southern part of Lake Winnipeg along the water routes leading to the mining districts. This camping party left Selkirk on 11 June in the SS *Keenora* for Berens River, and with the aid of small boats began a triangulation survey from the river approaches to English Rapids Portage, seven miles upstream. The shores of this river were surveyed using aerial photography, and the main steamboat channels sounded out with the lead-line and sounding pole. During the season a brief visit was made to Warren's Landing in the entrance of the Nelson River to check existing range beacons. Over an area of 48 square miles, 520 miles of linear sounding and 69 miles of shoreline were surveyed. In May 1935, Canadian chart P.2160 was printed for Berens River and Approaches.

British Columbia

With the new MS 3 and older sonic sounder in operation, in 1934 the total mileage of sounding for both the *Stewart* and *Pender* was 60 per cent more than the previous year, and this in a field season shorter than usual. The *Stewart* was in commission from the end of April to early October, and *Pender* from mid-April to the third week in September. Mr Parizeau, in command of *Stewart,* was assisted by Messrs Willis, Ettershank, Stewardson, Young, McQuarrie, Wiebe and LaCroix; Commander Knight, in charge of *Pender,* had as assistants Messrs Davies, Johnson and Rutley. Charting on the west coast of Vancouver Island was extended by these parties a distance of fifty-five miles from Rafael Point, Flores Island, to Tatchu Point, Esperanza Inlet. Other important areas charted were in the lower portion of Juan de Fuca Strait between Cadboro Point and Sansuum Narrows, and a forty mile stretch between Vancouver Island and the Fraser River. About 4,648 miles of ship and boat sounding were observed by both units, and 209 shoals examined. In September 1934, Mr S.A. Robson, the second engineer of the *Stewart,* (chief engineer *Bayfield,* 1929-31), was transferred from the hydrographie service to the Aids to Navigation Branch, Department of Marine, (now Transport), where he eventually became its mechanical superintendent.

Oceanography

From 25 April to 4 August 1934, two biologists from the Fisheries Research Board biological station at Nanaimo were aboard the *Stewart,* and during this time, "when weather

conditions did not favour the conduct of hydrographie work, oceanographical investigations were made, and in all 114 ocean stations were occupied".[9]

HEADQUARTERS

Under Mr Fraser's supervision, Messrs M.A. MacKinnon and R.W. Bent were fully occupied in writing sailing directions and pilots, and performing other allied duties. In the upper St Lawrence River, Messrs E.A. Ghysens and P. Radikir examined several shoal areas. Another special investigation was conducted by Mr N. Wilson in relocating and placing a buoy on Superior Shoal in Lake Superior. This work was carried out in cooperation with contractors, concerned with experimental attempts to remove the summit of this dangerous shoal with explosives. Chart revision surveys were also made for Port Arthur and Fort William harbours in this lake. In Lake Ontario, certain channels were swept and sounded in the Bay of Quinte; in the lower St Lawrence River, near Matane, PQ, an uncharted rock was examined, and near Musquodoboit Harbour, NS, on the Atlantic coast, another uncharted shoal was investigated.

TIDAL AND CURRENT SURVEY

In 1934 the former tidal steamer *Gulnare* (1903-12), now a relief lightship at the Quebec Marine Agency, was fitted out and resumed tidal-current investigations in the lower St Lawrence River begun by Mr H.W. Jones the previous year. The *Gulnare* was commissioned for a period of three months, with Capt. A. Boudreault her navigating officer. A few stations were occupied below Quebec Harbour, with the main work centred in the North Channel between Orleans Island and Goose Cape. Assistants to Mr Jones were Mr A.K. Laing and temporary summer students, and during Mr Jones' absence on other duties, Mr R.B. Lee took temporary charge. On the Pacific coast, Mr S.C. Hayden carried out similar tidal-current work in Vancouver Harbour across the section of the proposed site of the present First Narrows Bridge. In Hudson Bay the tide-gauge in Churchill Harbour was in operation, and in James Bay seasonal gauges were functioning at Moosonee and on Charlton Island. Mr Jones, who installed both these gauges, wrote, "the Charlton Island gauge was built for a basis of tidal predictions for the whole bay, this being the only place not too remote and suitable for this purpose." In Hudson Strait a hydrographie party supplied a series of tidal records for Lower Savage Harbour, and other pertinent ice and current data were received from wireless personnel stationed in this region.

PRECISE WATER LEVELS

In 1934, fifty-three gauges were in operation - ten more than the previous year. Some of these gauges were installed on behalf of studies by the Interdepartmental, Montreal and Ship Channel Water Levels Board, constituted on 19 January 1934. With its formation Mr C.A. Price, the officer-in-charge of the Precise Water Levels Division, was named joint secretary. Working in cooperation with the meteorological service, this division prepared "a special compilation of monthly and yearly mean values of precipitation for the years between 1870 and 1933, for both the local and combined drainage areas of the Great Lakes, St Lawrence and Ottawa Rivers, taking in both Canadian and United States Territory." To assist with the

[9] *Marine Report,* 1934.

expanding duties in this division two hydrometric recorders were added to the staff - Messrs H.R. Found (temporarily) and A.W. Cole.

CHART CONSTRUCTION

Under Mr G.L. Crichton's supervision about fifty-eight charts, maps, prints and correction plates were taken in hand by the drafting and engraving sections, and for the most part these were published as new charts or new editions of existing charts. After twenty-nine years with the hydrographie service, Major F.J. Delaute, Mr Crichton's assistant chief, retired in February 1935 on account of ill health.

CHART DISTRIBUTION

A slight improvement in the distribution of Canadian charts was noted in 1934 - an increase of 10.2 per cent above that of the previous year. There was a slight fall-off however, with other publications - pilots and sailing directions 482, and tide tables 94,000. Some 28,734 graphs, bulletins, etc. of water-level data were prepared and distributed to the public - an increase of 2,430 over the year 1933.

1935-36

With a marked improvement in Canada's economic situation, by 1935 austere regulations imposed in 1932 were slackened slightly. Commencing 1 April 1935, the 10 per cent salary deduction was reduced to 5 per cent and salary increases frozen in 1932 were returned. Thought was being given to long-delayed departmental reorganizations, but no positive action was taken to finalize these considerations until 1936. Only on 1 April 1937 was the remaining 5 per cent salary reduction returned to civil servants, thus ending the five-year period of government austerity.

Only three major hydrographie ships were commissioned in 1935. *The Bayfield was* still tied up at the Marine Wharf in Charlottetown, PEI, and the *Lillooet,* at Victoria, BC. It was estimated the sum of $80,000 was necessary to recondition the *Lillooet,* and with austerity still the rule this consideration was out. Mainly for economic reasons, surveys in Hudson Strait and Lake Winnipeg were temporarily brought to a close, and this despite the commissioning of a new cabin cruiser for hydrographie work in Hudson Strait.

DIVISION OF HYDROGRAPHY

Hudson Strait

In 1935 the scene of activities was shifted from the eastern to the western entrance of Hudson Strait. The party was again in charge of Mr F.C.G. Smith, with assistants Messrs T.M. Tardif and R.L.B. Hunter. Capt. D.M. Snelgrove (former sailing master, CGS *Bayfield)* continued in charge of the boats and seamen, the same as he had since 1932. For greater mobility and efficiency, a specially designed 36-foot cabin motor launch was built - the *Henry Hudson* - and transported north with the party on the icebreaker *N.B. McLean,* Capt. W.J. Balcom. The *Hudson* was built at the Marine Agency in Quebec at an approximate cost of $6,620, including a 120 HP Kermath gasoline engine, and could accommodate a detached survey party from the summer base when necessary.

Digges Harbour was selected as the summer base, and from here the northeastern entrance to Hudson Bay was charted between Erik Cove and Nuvuk Harbour, including the

Digges Islands. As in 1932, two parties carried out the field work: one in the launch *Discovery,* the other in the new echo-sounder equipped *Henry Hudson* (MS 2). Surveying began in Erik Cove on 30 July and on 6 October the party embarked on the *N.B. McLean* to try and connect the survey limits of 1932 (Cape Weggs) with Sugluk of this year. When this became impractical on account of weather conditions, a line of soundings was run across the western entrance of Hudson Strait between Nottingham Island and the Baffin Island coast. En route to Quebec, the DF station in Belle Isle Strait was calibrated, and an uneven area examined in the Gulf of St Lawrence, eight miles off St Mary's Light. When the *N.B. McLean* docked in Quebec Harbour on 1 November it brought to a temporary close further Hydrographie surveys along the Hudson Bay route until the years of the Second World War (1942-43, Mr R.E. Hanson).

This season 1,150 miles of ship and boat soundings were recorded in Hudson Strait, and two months' continuous tidal records obtained at Digges Harbour. Reporting on the season's activities, Mr Smith wrote, "the charting of the fine deep-water channel inside of the Digges Islands and close to the continental coast... considerably shortens the distance from the sea to places on the eastern side of Hudson Bay and to Moosonee in James Bay." In March 1936, Canadian chart P. 1508 was printed - "Erik Cove to Nuvuk Harbour," including Digges Islands, with insets for Erik Cove, Port Laperriere, Nuvuk Harbour and Digges Harbour.

In August 1931 the Temiskaming and Northern Ontario Railway (begun in 1932) reached tide-water at Moosonee from North Bay and Cochrane, Ontario - a total distance of about four hundred and forty miles. This railway has since been renamed the Ontario Northland. With the opening of Port Churchill in 1931, both Ontario and Manitoba now had ocean terminals in Northern Canada, and in their development over the years the hydrographie service has played a great part. As a senior hydrographer once wrote, "the hydrographer takes on where the railroader left off; and where sail meets rail."

Gulf of St Lawrence - North Shore

The efficiency of the *Acadia* was greatly improved with the addition of an automatic echo-sounder (MS 3) to its chartroom, and a small unit (MS 2) to its 27-foot starboard launch. As in previous years, the ship was in charge of Mr J.U. Beauchemin, with assistants Messrs W.F. Elliott, J.A. Deveault, S.R. Titus, A.K. Laing and M.S. Madden. The ship left Halifax Harbour on 6 June and returned on 9 October. The unsurveyed portion of Anticosti Island between Bagot and Carleton Points was first charted. A reconnaissance survey of the inside channels along the North Shore between Harrington Harbour and Greely Island in the Strait of Belle Isle was then undertaken, for the purpose of estimating the future work to produce modern large-scale navigation charts for this region - an area infested with numerous small islets and sinuous coastline. At the end of the fiscal year, Mr A.K. Laing, who had been with the service since 1930, was promoted and transferred to the Aids to Navigation Branch in the Department.

Northumberland and Cabot Straits

While awaiting the outfitting of the *Carder* at Charlottetown, this harbour and Hillsborough Bay were examined by Messrs Leadman, Hanson, Clarke and Wightman and from the reconnaissance, a resurvey of both these areas was recommended. The *Carder* on 25 June sailed for the Magdalen Islands for an examination of Grand Entry Harbour. She then proceeded to the north coast of Cape Breton, in Cabot Strait, to commence its resurvey. Of

special significance was the ship sounding of an area of the Gulf and Cabot Strait bounded by the Magdalen Islands, the west shore of Newfoundland in the vicinity of Cape St George, St Paul Island, and the Cape Breton north coast. When the *Carder* returned to Charlottetown for the winter on 7 October she had recorded 2,200 miles of ship and boat soundings. In May 1936 Canadian chart 461 was printed - "Cabot Strait to Magdalen Islands."

Charlottetown Harbour, PEI

Back in 1841 Capt. H.W. Bayfield, RN, moved his survey headquarters from Quebec City to the colonial capital of "Charlotte Town," as it was known then. Two years later, in 1843, with assistant surveyor Commander J. Orlebar, RN, and the schooner *Gulnare,* he recharted this Atlantic seaport. Acting on Mr Leadman's recommendation in 1935, Messrs N. Wilson and N.G. Gray were sent from Ottawa to commence its resurvey. With the aid of the *Bayfield's* launch, a triangulation network around Hillsborough Bay, including Charlottetown Harbour, was first undertaken. This harbour was then sounded out from the Hillsborough River to beyond Blockhouse Point. To assist coastal delineation, aerial photography by the RCAF was used to advantage, and from the season's work the first edition of Canadian chart 460, "Charlottetown Harbour," was printed in 1936.

Saint John River

With the aid of a motor launch and seven men, the survey of the Saint John River was completed in 1935 by Mr M.A. MacKinnon, assisted by Mr G.E. Lowe. Work was centred in Grand Lake and when finished, the Salmon River had been charted to Chipman, NB. Reporting on Grand Lake, Mr MacKinnon wrote, "it is comparatively deep, possesses several bathing beaches, and offers admirable facilities for both commercial and pleasure craft cruising." The field work began on 4 June and ended on 10 October, and during this time some 400 linear miles of boat sounding were obtained, and 100 linear miles of coastline surveyed (with the aid of aerial photography). In May 1936, the last of the four charts for the Saint John River was printed, No. 462, "Grand Lake and Salmon Arm to Chipman." The Saint John River now had adequate chart coverage for local navigation from the Bay of Fundy to beyond Fredericton and Grand Lake. This season, its survey was brought to a close.

St Lawrence River

In 1935 the *Boulton* was fitted out with a new 150 HP Kermath gasoline engine that increased her speed to 12 knots, and gave her more power against the strong currents in the lower St Lawrence River. This party was again in charge of Mr E.A. Ghysens with Mr P. Radikir assistant, and left Prescott on 19 June. En route to the Saguenay River, an uncharted shoal was located above Brockville, a revision survey made for Sorel Harbour, and areas of the St Lawrence River sounded off Origeaux Point, PQ. The survey of the Saguenay River was resumed on 4 July between St Fulgence and Chicoutimi, where the channel was checked with a 30-foot sweep. Little change was noticed from a previous sweeping of this section in 1933. On the return trip to Prescott, a second visit was paid to Origeaux Point for further shoal examining. The *Boulton* laid up for the winter at Prescott on 26 September after logging 1,800 nautical miles of travelling, and recording 200 linear miles of boat sounding.

Lake Winnipeg

The survey of this lake in 1935 was resumed by Mr J.L. Foreman with Mr C H . Martin, seasonal assistant. The party left Selkirk on 10 June in the SS *Keenora* and established its first campsite on Black Island. The scene of activities was later moved to the neighbourhood of Riverton, Man. Areas surveyed this season included the main channel between Hecla Island and the east shore of the mainland, the channel between Black and Hecla Islands and northwest to Grindstone Point, and the channels east of Black and Punk Islands. Visits were paid to Clement Point and Manitogogan River to select suitable sites for proposed lights and beacons. Some 690 linear miles were sounded in the small boats, and 50 shoals and rocks located. When the party returned to Selkirk in the fall, it was to be the last hydrographie survey in Lake Winnipeg until after the Second World War (Mr P. Radikir, 1957).

During the summer seasons 1930, 1933-34 Mr Martin was employed on the Lake Winnipeg survey as "an assistant" to the hydrographers, with the classification of a naval rating. At that time this was customary practice in the hydrographie service and college students taken on for the summer months were rated as seamen, or quartermasters. With Mr Gray's transfer to the Charlottetown Harbour survey in 1935, Mr Martin was temporarily employed as Mr Foreman's assistant this season and in 1938 was taken on strength of the regular hydrographie staff as hydrographer, grade I, vice Mr W.F. Elliott's position.

British Columbia

Queen Charlotte Islands were the centre of hydrographie activities on the Pacific coast in 1935. Other areas visited were the Fraser and Powell Rivers, Vancouver Harbour, and the west coast of Vancouver Island. The *Pender,* in charge of Commander Knight with assistants Messrs Ettershank, Stewardson and McQuarrie, was towed to Clayoquot Sound by the *Stewart* on 15 April. Until 24 September, parties from *Pender* surveyed this Sound and the northwest coast of Vancouver Island, between Esperanza Inlet and Cape Cook. With no steamer to move this houseboat around, detached parties were obliged to live ashore under canvas. The *Stewart* was commissioned on 15 April at Victoria, with Mr H.D. Parizeau in command and assistants Messrs Willis, Davies, Young, Johnson, Rutley, Wiebe and LaCroix. Sailing master was Capt. J.J. Moore; and chief engineer, Mr J. Ascroft. At Departure Bay, a party of scientists attached to the biological station there "was taken on board early in June, and returned to this bay about mid-September."

With the water tender *Fraser* in tow, the *Stewart* anchored in Rose Harbour, Queen Charlotte Islands, on 2 May and here placed a camping party ashore. A second party was then landed at Lockeport to complete a triangulation network over the mountain range, to connect this locality with the former provincial government survey base in Tasu Harbour, on the west coast. A third party was placed in Tasu Harbour where the *Fraser* was moored. This year echo-sounders in the 27-foot open-type gasoline launches were used for the first time in British Columbia - in Gowgan Bay and Tasu Sound, Queen Charlotte Islands (Mr R.B. Young).

"Since 1935 the Hydrographie Service has been actively engaged in conducting special surveys when requested by the Department of National Defence. This work started with the general charting of the outside coast of the Queen Charlotte Islands."[10] When in Tasu Harbour on 7 May, the *Stewart* was joined by HMCS *Armenderes,* Lt-Cdr H. Soulsby,

[10] Mr F.C.G. Smith, *Canadian Surveyor,* January 1946

RCN, in command. Other officers aboard *Armenderes* were Cdr H.E. Reid, RCN, and Squadron Leader Shearer. The ships then inspected several harbours in the Queen Charlotte Islands suitable for defence purposes, and on 9 May the site chosen for the first survey was Big Bay. In agreement with the Department of National Defence, *Armenderes* was used as ship-base for a hydrographie party in charge of Mr L.R. Davies. When this and other local areas were surveyed by the end of June, the detached units returned to the *Stewart.* To continue experimental work with the rapidly developing method of surveying by aerial and horizontal photography, a survey officer from the Department of National Defence remained on board the *Fraser.* On 12 September the *Stewart* proceeded to Rose Spit near the northeastern limit of the Queen Charlotte Islands to examine "gravelly islets which had formed there since the British Admiralty *Egeria* survey of 1905." The *Pender* was laid up in Kyoquot Sound at the end of September and her party returned to Victoria on the *Stewart.* This season was one of the most progressive on this coast to this time. In addition to regular survey work joint operations were carried out in cooperation with naval and military officers of the Department of National Defence, and scientists of the Department of Fisheries. About 2,700 miles of ship and boat soundings were recorded by both field parties, 331 shoals examined, and 1,050 miles of coastline surveyed with aerial photography.

Emergency Surveys and Sailing Directions

Under Mr R.J. Fraser's direction, supplements for six coast pilots were prepared by Mr R.W. Bent, and data was collected for the revision of the Departmental publication *Canadian Port and Shipping Directory.* With the aid of the lighthouse tender *Murray Stewart,* Mr N. Wilson positioned Superior Shoal in Lake Superior and, assisted by a diver, the summit of this shoal was surveyed for the purpose of computing quantities, should it be necessary in the future to remove this danger. With the aid of the tender *St Heliers,* Mr Wilson, assisted by Mr N.G. Gray, carefully examined the approaches and channel in Key Harbour, Georgian Bay, from 10 to 25 June. This party then proceeded to New Brunswick where the main channel of the Restigouche River (below Campbellton, NB) was examined. When this work ended, Messrs Wilson and Gray then continued onto Charlottetown, PEI, to commence its resurvey and that of Hillsborough Bay. While here in 1935, the chartroom of the *Bayfield* was used as an office, but when Mr Gray returned to Charlottetown in 1936, the *Bayfield* was gone. At the request of the Hamilton Harbour Commissioners, buoy positions defining various dredged channels were properly located and marked on the charts.

TIDAL AND CURRENT DIVISION

Current investigations in the lower St Lawrence River were continued this season in the *Gulnare* between the North Channel and the Saguenay River. In support of this work a temporary tidal station was built at Pointe au Pic (Murray Bay), PQ. Officer-in-charge was Mr H.W. Jones, with Mr R.W. Bent replacing him for a short duration. Field assistants were Mr O.M. Meehan and summer students, and during the winter months hydrographers A.F. Wightman and R.L.B. Hunter assisted with the office computations at headquarters. A study of datum planes between Montreal and Quebec was completed to correct certain soundings shown on the older chart editions. At the request of the Newfoundland government, the Geodetic Survey of Canada began a triangulation and levelling network this season in the southern portion of this island. In support of this survey, two tidal stations were installed by Mr R.B. Lee at the termini of the Reid Newfoundland Railway (now the Canadian National Railway) - one in St John's Harbour on the east coast, and the other at Port aux Basques, on

the south coast. In connection with the proposed First Narrows bridge in Vancouver Harbour, further tidal-current measurements were obtained.

PRECISE WATER LEVELS

This year an extensive program of activities was conducted by this division on behalf of the Interdepartmental, Montreal and Ship Channel Water Levels Board. These operations extended from Port Arthur at the head of the Great Lakes shipping to within twenty miles of Quebec, "from which point seaward the rise and fall of the waters are principally of a tidal nature and so come under the study and investigation of the Tidal and Current Division of this Service." About 700,000 [?] office computations were recorded this year, and increase of 50,000 over the 1934 season. These deductions included 28 regular precise water level bulletins, 160 profiles, graphs, etc., and 27,591 sheets of water-level data. Early in August 1935, Mr W. E. Rainboth was appointed a hydrometric recorder in this division, vice H.R. Found.

CHART CONSTRUCTION

In a memorandum to the deputy minister dated 22 July 1935, the chief hydrographer, Capt. F. Anderson, wrote, "Upon the chart depends the safety of lives and incalculable valuable property. The expenditure upon single hydrographie charts, from the initial field work to the issuing of the final product amounts to over $100,000." During the fiscal year 1935, some 67 charts, maps, prints and correction patches were handled by this division. Hand corrections totalled 72,642; and of the 651 pieces of data filed, 295 were aerial photographs. The Engraving Section completed six new charts, and made 10,978 small corrections to copper plates. To assist with the increasing volume of work in this division, two student assistants were added to the staff: Mr Y. Pinard (December 1935), and Mr H. Kelson (January 1936).

On May 28, 1935 authority was granted to the Department of Marine to purchase one Mann rotary offset press for the more economical printing of hydrographie charts (P.C. 1204). In this order-in-council it was pointed out that the Topographical and Air Surveys Bureau had a plant continually in operation printing and lithographing maps, and that a saving of approximately 50 per cent had been accomplished in printing hydrographie charts that did not exceed the dimensions of the plant capacity. The purchase of this new machine "would enable the printing in the Topographical and Air Surveys Bureau plant of practically all standard marine charts and thus offset substantial savings and allow these charts to be issued without unavoidable delay and under the closer personal supervision of the officers of the Hydrographie Service." On the recommendation of the minister of Marine, one single-colour Mann press, with printing surface of 35'/2 inches by 48 inches, together with one new transfer press and one new litho-plate coating machine, were purchased at a cost of $ 16,000 "payable out of Parliamentary Appropriation Vote 135 for Hydrographie and Tidal Surveys."

CHART DISTRIBUTION

As of 1 January 1936, there were 74,667 copies of charts in stock in this section, and this fiscal year 10,228 were issued to the public. This was an increase of 10.8 per cent over the previous year and 20.7 per cent above the low figure of 1933 - an indication that the dark days of the depression were about over. In addition 590 volumes of sailing directions and

99,000 copies of tide tables were distributed. Chart agencies across Canada numbered eleven, exclusive of Ottawa. In some coast ports such as Quebec, Montreal and Victoria more than one agency was handling Canadian charts.

1936-37

The fiscal year 1936 (ending 31 March 1937) terminated the five-year imposition of the *Salary Deduction Act, 1932,* with its rigid staff and financial controls. For reasons of greater efficiency and economy, the reorganization of some of the older departments and formation of new ones became matters of government expediency. In this regard the hydrographic service found itself in four different departments in less than five weeks (28 October to 1 December 1936) - marine, transport, interior, and mines and resources. When the transfer from the Department of Marine to Mines and Resources was finalized, most personnel in the service were not happy with these moves. To some of the old-timers it meant the loss for all times the service's long-cherished identity as a nautical service, but the general attitude was well expressed philosophically by one senior hydrographer who remarked "instead of sailors, hydrographers we have now become miners." The austere years since 1932, coupled with the retirement of the chief hydrographer with this reorganization, did little to improve staff morale.

In February 1937 the *Bayfield* was sold out of the government service, and in the fall of 1936 the tidal steamer *Gulnare* tied up for the last time at Quebec (sold September 1937). Prior to the sale of the *Bayfield,* her survey launch was transferred to the *Carder's* establishment and remained in storage at Charlottetown until May 1940, when it was shipped to the inland waters of the St Lawrence River survey. The departure of these early hydrographie ships recalls to mind echoes of yesteryear when the *Bayfield* was actively engaged in charting the Great Lakes under the supervision of the first chief hydrographer, Mr W.J. Stewart, and the *Gulnare* was similarly occupied investigating the tidal streams on the Atlantic coast by the first superintendent, Tidal and Current Survey, Dr. W. Bell Dawson.

This spring, in spite of departmental transfers and government economy, the hydrographie service placed eight parties in the field: ship 4 (hydrographie 3, tidal 1), and shore-based 4.

DEPARTMENTAL REORGANIZATION AND TRANSFERS, 1936

The following changes to government organization were implemented in 1936.
- Department of Marine becomes Department of Transport, effective 29 October 1936[11]
- Creation of Department of Mines and Resources, effective 1 December 1936[12]
- Appointment of Honourable Mr T.A. Crerar, minister, 14 September 1936[13]
- Appointment of Mr Charles Camsell, deputy minister, 11 September 1936[14]
- Reclassification of Mr J.M. Wardle, director, Surveys and Engineering Branch, 14 September 1936[15]

[11] *Statutes of Canada, I Edward VIII,* Chapter 23, June 23rd, 1936 and P.C. 59/2798, 1936.
[12] *Statutes of Canada, I Edward VIII,* Chapter 23, June 23rd, 1936; and P.C. 2377 assented to September 11, 1936.
[13] P.C. 2378.
[14] P.C. 2379.
[15] P.C. 2396.

Mr J.M. Wardle had been deputy minister of the Department of the Interior since 17 August 1935. In 1936, Mr F.H. Peters, once the surveyor general and director, Topographical and Air Surveys in this Department, was titled "Director, Topographical Surveys."[16]

Since 1930 when the Department of Marine and Fisheries became two separate departments, the hydrographie service had been a branch of the Department of Marine. With the creation of the new Department of Transport in June 1936, an atmosphere of uneasiness began to prevail in the hydrographie service as to its future destiny. To some extent this doubt was dispelled with P.C. 59-2793, assented to 29 October 1936, that officially brought the Department of Transport into being, and placed the hydrographie service under the director of marine service of this new department. This action, however, was to be short-lived, and on 20 November a memorandum was sent to the deputy minister, signed by the chief hydrographer and the "assistant to the hydrographer." This memorandum was titled "Proposed Transfer of Hydrographie Service to the Department of Mines and Resources," and it was drawn to the deputy minister's attention that the hydrographie service, "is not a survey organization; it is a nautical service ... and I consider it my duty to point out at this time that this proposed measure whereby a distinctive nautical service would be pulled up by its roots from a framework in which it more or more efficiently and economically functioning and be planted within another, where operations and activities and products are vastly different, would not be in the best interests of the public it serves." However noble this last stand was, the die had been cast with the following results.

Department of Transport to Department of Interior

By P.C. 3005 dated 23 November 1936, and on the advice of the ministers of the Departments of Transport and Interior, the Canadian Hydrographie Service, and the Magnetic and Seismological Divisions of the Meteorological Service, Department of Transport were officially transferred, "to the control and supervision of the Department of the Interior." Authority for this move vested in the R.S.C., Chapter 165, 1927, *The Public Service Rearrangement and Transfer of Duties Act.* Three days later Captain Anderson was instructed by the deputy minister of Transport "to report to the Deputy Minister of the Interior, Mr J.M. Wardle," and before the month of November ended, headquarters staff of the service had moved from the Hunter Building (here since 1919) to the Confederation Building on Wellington Street. A few minor field parties were also quartered in the Confederation Building, with the remainder of the field staff quartered in the Labelle Building on George Street - once the headquarters of the Topographical Survey of Canada, and now the site of the Holiday Inn on Dalhousie St.

Department of Interior to the newly formed Department of Mines and Resources

P.C. 2/3064 assented to on 30 November 1936, approved the organization and classifications of new positions in the newly constituted Department of Mines and Resources. By this authority, the Surveys and Engineering Branch was established with the former deputy minister of the Interior department, Mr J.M. Wardle, becoming its first and only director. Under this reorganized branch was placed one amalgamated division with Mr F.H. Peters (see above) becoming surveyor general and chief, Hydrographie and Map Service - still a

[16] *Auditor General Report, 1936.*

dual responsibility for Mr Peters. Topographical surveys under him up to his change were transferred from the Department of the Interior to the Mines and Geology Branch, Department of Mine and Resources. The following day, 1 December 1936, the newly created Department of Mines and Resources came into being, and with it the Department of the Interior went out of existence (constituted 1873).

From 1936 until 1948 when the hydrographie service moved from the Confederation Building on Wellington Street to No. 8 Temporary Building on Carling Avenue, Mr Peters arranged to carry out his daily duties in two separate offices - the Confederation Building (Hydrographie); and the Labelle Building (Hydrographie and Mapping).

The Reorganized Hydrographie Service

Order-in-Council P.C. 2/3064 of 30 November also reclassified Mr R.J. Fraser's position (hydrographer grade IV) to senior hydrographer, under supervision of Mr Peters and with responsibility for the conduct of the hydrographie service. In this document the Precise Water Levels Division was listed under the reorganized Dominion Water and Power Bureau, and despite attempts to have this work transferred back to the Department of Transport, no transfer of this division was ever effected until the summer of 1967 when the renamed Water Levels Section was moved to the newly formed Inland Waters Branch of the present Department of Energy, Mines and Resources.

This Order-in-Council listed no position reclassifications for others of the regular hydrographie staff. This matter was initiated in February 1937 with a request to the director for a unit survey of the service. Salary range for the director of the new branch was $7,500 per annum; the surveyor general and chief, $4,500 to $5,400; and senior hydrographer $4,020 to $4,620.

Exclusive of ship officers and gauge attendants, the establishment of the service was not affected by these transfers, and totalled approximately 64 personnel - Atlantic coast and headquarters 50, and British Columbia 14.

In September 1936 Capt. Anderson was three years past the official age of retirement (65 years), but was granted until February 1937 an extension of time to complete the report of the Interdepartmental, Montreal and Ship Channel Water Levels Board. He separated from the government service in July 1937, and with his retirement the classification chief hydrographer was abolished. His departure marked the close of the first and only era in the service's history when its "Chiefs" were qualified to wear "two caps." One as a sailing master for inland waters and the other as a qualified hydrographie surveyor. The names of these three distinguished officers were Boulton, Stewart and Anderson (1883-1936).

THE CANADIAN HYDROGRAPHIC SERVICE UNDER MR F.H. PETERS, 1936-1948

Frederic Hathaway Peters was born in Quebec City in November 1883, and in June 1904 graduated with honours from Royal Military College of Canada. For the next four years he was employed by the Public Works Department as a first assistant engineer working on water conservation surveys in the upper Ottawa and Montreal Rivers; levelling surveys, Trent Valley Canal; in charge of the Lake Nipissing Party, Georgian Bay Ship Canal; harbour surveys at London, Ontario; and the preparation of plans, estimates and reports in Ottawa. He joined the Topographical Surveys Branch, Department of the Interior in June 1908, and until January 1909 assisted Mr J.E. Morrier, D L S, with the layout of the townsite of Fort Churchill, Manitoba. On behalf of the International Waterways Commission, he was sent to Alberta in June 1909 to take charge of a current measurement survey of the Milk

Frederic H. Peters

Photo courtesy CHS

River. In March 1910 he was successful in passing his Dominion Land Survey examinations, and this month was appointed to make special investigations of all international streams in Alberta and Saskatchewan, including St Mary's River, Ontario. He was married in Ottawa February 1911, and the following month was named commissioner of irrigation and chief engineer, Department of the Interior, Calgary, Alberta. His next promotion was in April 1919 as field superintendent of irrigation.

Mr Peters, at the request of the deputy minister, returned to Ottawa "for special work as Assistant to Dr. Deville in the reorganization of the survey work of the Department." In 1922 the several surveying branches in the Department of the Interior were amalgamated as the Surveys Bureau, and Dr. Deville was placed in charge with the title director general of surveys. Two years later (1924), Mr Peters succeeded him as surveyor general of Dominion lands. In subsequent years he became surveyor general and director, Topographical and Air Surveys Bureau. When the Department of the Interior was abolished in 1936, his position was reclassified as surveyor general and chief, Hydrographie and Map Service, Surveys and Engineering Branch, Department of Mines and Resources, Ottawa. For his outstanding contribution to map production during the Second World War, he was gazetted in July 1946 with the Order of the British Empire.

Following a departmental reorganization in February 1947, his position was renamed chief, Legal Surveys and Map Service and chief, Hydrographie Service. In October 1947 the Surveys and Engineering Branch became the Mines, Forests and Scientific Branch. The following April, Mr Peters was appointed chief, Surveys and Mapping Bureau.[17] He retired with this classification in November 1948, and has since made his home in Aylmer, PQ.

When the surveyor general of Canada, Mr Peters was chairman of the Manitoba, Saskatchewan and Alberta Boundary Commissions, and a Canadian delegate to the Map Division, International Civil Aviation Corporation. He was also a commissioned dominion, and Alberta land surveyor; a registered professional engineer, province of Ontario; a life member of the Engineering Institute of Canada; and a member of the American Society of Civil Engineers. Over the years he wrote many technical articles and papers, and was a frequent guest speaker at professional meetings.

DIVISION OF HYDROGRAPHY

Gulf of St Lawrence - North Shore

Two parties worked on this sector of the gulf in 1936 - the *Acadia,* and the cabin cruiser *Henry Hudson.* Assistants to Mr J.U. Beauchemin were Messrs Tardif, Deveault, Lowe, Titus and Hunter, with Mr W.F. Elliott in charge of the *Henry Hudson.* Triangulation was extended east of Harrington Harbour towards Blanc Sablon, and use was made of aerial photography to delineate this island-infested coastline. Three harbours were surveyed, and several dangerous shoals examined. An important phase of this season's work was the recharting of the inside steamer route for the benefit of coastal traffic. For the most part the route between Harrington Harbour and Greenly Island is sheltered from the sea by a protective barrier of islands which fringe the coast. When the season ended the *Henry Hudson* wintered at Bonne Espérance, PQ, and on 28 October the *Acadia* returned to

[17] In December 1949 the Department of Mines and Resources became Mine and Technical Surveys; and in January 1950 the classification chief, Surveys and Mapping Bureau was retitled director, Surveys and Mapping.

Halifax. Mr S.R. Titus was then sent to Yarmouth Harbour to re-examine it for necessary chart revisions. Over an area of 1,000 square miles, some 5,000 miles of ship and boat soundings were observed, and 260 shoals examined.

Gulf of St Lawrence - Cabot Strait

The *Carder,* in charge of Mr H.L. Leadman with assistants Messrs R.E. Hanson, L.M. Clarke and G.W. Baker, left Charlottetown on 6 June for the Magdalen Islands to examine a shoal off Old Harry Head. She then proceeded to the offshore area of Cape St George, Newfoundland, for further shoal examinations. The resurvey of the north coast of Cape Breton Island, begun the previous year, was extended southward this season to Cape Smokey on the northeast coast, and Cheticamp on the west coast. A detailed plan of Ingonish Harbour and approaches was made, and before returning to Charlottetown on 30 September, the ship completed considerable offshore sounding in the approaches to Hillsborough Bay, PEL Early in the spring of 1937 both Messrs G.W. Baker and L.M. Clarke resigned after almost seven years of service. As a result of the season's work two coast charts were drawn - No. 463, "Cape Smokey to St Paul Island," and No. 464, "Cheticamp to Cape St Lawrence." A harbour plan No. 465 for Ingonish Harbour and approaches was also printed in 1937.

Hillsborough Bay, PEI, Northumberland Strait

In addition to offshore sounding in this area by the *Carder,* a shore party in charge of Mr M.A. MacKinnon with assistant Mr N.G. Gray, extended the previous season's survey of Charlottetown Harbour to seaward into Hillsborough Bay and its approaches. Part of the season this work was conducted with Hudson Strait launch *Discovery* (without echo-sounder) until she sustained a gasoline explosion that injured three of the crew and caused her to sink in Charlottetown Harbour. For the remainder of the season a hired launch was used to complete this harbour survey. The *Discovery* was subsequently salvaged, reconditioned and added to the *Acadia's* complement of auxiliary craft (port launch, 1939). Over an area of 74 square miles, some 1,075 miles were boat sounded.

St Lawrence River

Before commencing the season's activities in 1936, the older and first launch echo-sounder on the *Boulton* was replaced by a new Universal Supersonic, model XII, with a rotating arm, and capable of recording depths within 2 feet of the hull on a scale of 1 inch to 2 fathoms (12 feet). It was battery operated, and cost $3,150 (less allowance $848 for old machine). An Admiralty pattern sounder, it was especially designed, and purchased for closer shoal examination in the St Lawrence River and Great Lakes. The party as in former years was in charge of Mr E.A. Ghysens with assistant Mr P. Radikir, and on 8 June left Prescott for Lake Ontario. In the Bay of Quinte a sweeping survey was made in Telegraph Narrows, and another in Lake St Louis below the Soulanges Canal. Late in July sounding and sweeping surveys were completed in the lower reaches of the Saguenay River. The launch then proceeded to Outarde Bay and Baie Laval for special investigations in connection with pulpwood shipping developments. The *Boulton* returned to Prescott at the end of September, and when she tied up at the Marine Wharf, it was to be Mr Ghysens' last field season - one that had its commencement in the houseboat *L'Arche* in Lake of Two Mountains (Ottawa River) in 1909.

Lake St Louis

With the aid of the government steamer CGS *Lady Grey,* ice conditions in a reported channel of Lake St Louis were observed the last week of April 1936 by Mr F.C.G. Smith (assigned to Headquarters this season). In the first week of November Mr Smith returned to Lake St Louis, and with the assistance of Mr N.G. Gray and the buoy tender CGS *Argenteuil* located and swept several reported shoals - shoals reported to have caused damage to shipping. Some eighty buoys and other aids to navigation were properly positioned, and a report containing recommendations submitted. These investigations were in addition to charting and sweeping by the launch *Boulton* during the field season.

Montreal Harbour

At the request of the Montreal Harbour Commissioners, and with the cooperation of the St Lawrence ship channel steamer *Bellechasse,* Mr Smith completed a study of the currents in this harbour during the high and low stages of the river, i.e., 10 to 22 June and 20 September to 2 October respectively. From these observations current charts were drawn in contrasting colours, and were a valuable supplement to the standard navigation charts for this area.

British Columbia

The principal scene of operations in the season of 1936 was on the west coast of the Queen Charlotte Islands. The *Stewart,* in command of Mr H.D. Parizeau, with assistants Messrs Willis, Ettershank, Young, Johnson, Rutley, Wiebe and LaCroix, was placed in commission in mid-April, and until the end of the month visited Lyall, Nanaimo and Vancouver harbours for minor investigations. Sweeping surveys were also made in Boundary Pass and Esquimalt Harbour. Early in May, the *Pender* was towed from Kyuoquot Sound to Nasparti Inlet (twenty miles northward), where Commander Knight and assistants Messrs Davies, Stewardson and McQuarrie charted this inlet, completed the topography of Cape Cook, and surveyed the western portion of Holberg and Rupert Inlets, Quatsino Sound. Late in June the *Pender* was towed to Rivers Inlet on the mainland where the eastern and western portions were charted until the end of September. The *Pender* then laid up in this inlet for the winter. Between 1 May and 26 June the *Stewart* was engaged in charting operations between Esperanza Inlet and Quatsino Sound on the northwest coast of Vancouver Island, and on 4 July proceeded to the west coast of the Queen Charlotte Islands where four camp parties were established between Englefield Bay and Port Louis.

In accordance with instructions, the ship returned south "to prepare for an inspection trip of British Columbia waters by the Minister of Fisheries," which terminated on 10 August at Victoria. From 28 August to 15 September the ship resumed surveying on the west coast of the Queen Charlottes, and then returned to Rivers Inlet to assist the *Pender* party until 26 September. With the water-tender *Fraser* in tow, Victoria was reached on September. A summary of the season's work by the *Stewart* included 1,239 miles of ship sounding, 1,918 miles in the boats, 167 miles of coastline surveyed, and 193 shoals located and examined. The *Pender* boat sounded 410 miles, coastlined 305 miles, completed 140 square miles of topography and examined 16 shoals. Early in 1937, hydrographer Mr V. Wiebe, who had been with the service since 1930, resigned.

HEADQUARTERS DIVISION

Until November 1936, the work of this division was in charge of Mr R.J. Fraser, assisted by

field officers Messrs F.C.G. Smith, N. Wilson and R.W. Bent (sailing directions). In addition to general administrative work, this division attended to "the planning of new and special surveys, investigations and research relating to chart revision and hydrographie publications, preparation of Coast Pilots and Sailing Directions, and various researches in hydrographical and navigational subjects ... the collecting and disseminating of general and specific marine information for the benefit of Canadian shipping and mercantile and transportation concerns." On an international exchange basis, many new charts and hydrographie publications were received from the British Admiralty Hydrographie Department, United States Hydrographie Office at Washington, United States Coast and Geodetic Survey at Washington, United States Lake Survey at Detroit, and the International Hydrographie Bureau at Monaco. Other data were received from France, Germany, Japan, Italy, and other countries. "On a co-operative basis the Hydrographie Service of Canada furnishes these foreign Government services with copies of all new or revised charts and new editions of Canadian publications dealing with the Dominion's coasts and waters."

No new pilots were written this year but supplements were revised and issued for seven of them: British Columbia, Volume 1; St Lawrence River (below Quebec); St Lawrence River (Montreal to Kingston); Canadian Shores of Lake Superior; Gulf of St Lawrence; St John River; and Hudson Bay Route. Emergency surveys were conducted by Mr Smith in Montreal Harbour and Lake St Louis.

In December 1936, Mr F.C.G. Smith was promoted to a higher classification, and many matters previously handled by Mr R.J. Fraser, such as annual reports, estimates, chart planning and production, etc., were now delegated to him. He was unable to assume these senior office duties until the fall of 1937 when he became the first superintendent of charts, a title comparable to similar duties in the Admiralty Hydrographie Office.

TIDAL AND CURRENT SURVEY

Current investigations in the lower St Lawrence River were extended in 1936 between Murray Bay and Bic Island. This work was again in charge of Mr H.W. Jones, and during his absence Mr R.B. Lee, with hydrographers A.F. Wightman and M.S. Madden assisting. This was also the last field season for the former tidal steamer *Gulnare,* that first began observing the tidal-currents in the Gulf of St Lawrence in 1903. Captain A. Boudreault was her last navigating officer. Tide gauges built in Newfoundland the previous year were maintained in 1936. With the printing of the tidal and current report "Ste Anne des Monts to Father Point, PQ," five such reports were now available to the public for Atlantic coast waters - Bay of Fundy 1, Gulf of St Lawrence 4.

PRECISE WATER LEVELS

This year Mr C.A. Price, in charge of this division, reported, "extensive research was conducted to obtain the relative values of precipitation, evaporation, and the run-off factors in the local watersheds of the Great Lakes and Ottawa River; of the full drainage area of the Great Lakes, and of the Great Lakes and Ottawa River drainage basin." The eleven self-registering gauges in use in 1934 and 1935 for water-level studies were again maintained for 1936. On 19 January 1937, the report of the Interdepartmental, Montreal and Ship Channel Water Levels Board was signed and submitted to the minister of Transport. The last board meeting was held on 18 February, and Mr Price's duties as joint secretary did not end there, but Capt. F. Anderson's did.

CHART CONSTRUCTION

During the fiscal year 1936 about 56 charts, maps, prints and correction patches were printed. Hand corrections to published charts totalled 95,709, and corrections were made to 16,831 copies of 141 different charts.

CHART DISTRIBUTION

"The great improvement during the year in maritime trade was reflected in the increased demand for charts, Pilots and Sailing Directions, and also in the large number of enquiries relating to depths, water-levels ... many Canadian coastal waters are still covered only by original Admiralty charts and, for the correction of these, information was supplied from time to time to the Admiralty."[18] This year distribution assumed more normal proportions than during the depression years of 1932-33 and included 12,883 navigation charts, 620 volumes of sailing directions and pilots, and 109,100 editions of tide tables - the greatest number to date. As of 1 January 1937, there were 79,284 copies of Canadian and foreign charts on hand, and to this time 494 editions of Canadian charts had been printed for public distribution - Atlantic coast (including St Lawrence River to Montreal, Hudson Bay and Strait) 198; Great Lakes and inland waters 141; Pacific coast (including Vancouver Island) 118; special editions 37.

1937-38

The following extract from the annual report of the Department of Mines and Resources for 1937 is a general summary of hydrographie activities for that year. "Charting, the investigation of tides and currents, the recording of fluctuations in the water-levels of the St Lawrence-Great Lakes navigation system, the preparation of Coast Pilots and Sailing Directions, special marine investigations and the supplying of diverse nautical data to the shipping trade. The development of Canadian aeronautical activities, frequently in outlying parts of the country, and the acceleration of naval defence measures, also resulted in enhanced demands for hydrographie services."

The termination of government austerity (31 March 1937), brought with it renewed requests for a general reclassification, or a unit survey, of the service. When the fiscal year ended, progress in this matter had reached the level of the director, Civil Service Commission. To undertake long-delayed field work eight parties were sent to the field: ships, 3; houseboat, 1; cabin cruisers, 2; and small launch units, 2.

DIVISION OF HYDROGRAPHY

Gulf of St Lawrence - North Shore

The charting of the northeast arm of the Gulf of St Lawrence was resumed in 1937 between Harrington Harbour and the Canadian boundary in the Strait of Belle Isle. As in previous years, this work was under the general supervision of Mr J.U. Beauchemin, with assistants Messrs Deveault, Titus, Lowe and C F. Wilkins. A detached party in charge of Mr W.F. Elliott, with assistant Mr T.M. Tardif, worked in close cooperation with the *Acadia* party in the *Henry Hudson.* Before taking up the regular work, the DF station on Belle Isle was

[18] *Annual Report,* Department of Marine, 1936.

calibrated. For inshore charting, use was made of the echo-sounder from the 27-foot launch *Discovery.* Main activities included the extension of the triangulation network, coastlining with aerial photographs, and inshore sounding of bays, harbours, anchorages, and shallow-water channels. Ship sounding was extended to seaward for a distance of 25 miles from the coast. Close examination was made "of shoals which rise abruptly from the sea, both within and without the protective chain of islands with which the coast is favoured." Early in September the *Henry Hudson* sailed for Quebec where she wintered, and in mid-October the *Acadia* tied up at H M C Dockyard in Halifax. Before returning to Ottawa, a revision survey was made of this Atlantic seaport, and another was undertaken for Yarmouth Harbour by Mr S.R. Titus. Some 2,650 miles of ship and boat soundings were recorded by the *Acadia* and *Henry Hudson,* and 960 shoals examined.

Northumberland Strait - Cape Breton

"Due to the obsolescence of many of the early Admiralty charts of the Atlantic Coast, it has been the policy of the Hydrographie Service to replace them by the production of modern scientific research as rapidly as available facilities permit." Prior to departure from Charlottetown, the *Carder,* in charge of Mr H.L. Leadman with assistants Messrs Hanson, Hunter and G.A. Surette, completed considerable ship sounding in the approaches to Hillsborough Bay, PEI. The regular survey work along the east coast of Cape Breton was resumed between Cape Smokey and Flint Island, including the entrances to Sydney Harbour, Great Bras d'Or and St Ann's Harbour. To position aids to navigation, minor investigations were made in the Magdalen Islands and Cheticamp Harbour. The *Carder* returned to Charlottetown early in October having logged 2,015 miles of ship and boat sounding, and examined 39 shoals. From this season's activities Canadian charts were later published from Flint Island to Cape Smokey, and for St Ann's Harbour.[19] Early in 1938 Mr R.L.B. Hunter, who had been with the service since 1931, resigned.

Hillsborough Bay, PEI

In addition to surveys in the approaches of this bay by the *Carder,* a shore party in charge of Mr M.A. MacKinnon with assistant Mr N.G. Gray completed the remaining work in this bay. The more exposed area of Point Prim was charted by the launch from base headquarters first established at Eldon, PEI, and then at Pinette River. The rest of the bay was surveyed from Charlottetown. Between 27 May and 4 August some 396 miles of boat sounding were recorded and 53 shoals examined. From the results of the three seasons in this area, two new charts were printed in 1938: one of Hillsborough Bay and the other, a second edition of Charlottetown Harbour.

St Lawrence River

Due to illness in 1937 Mr Ghysens was unable to resume charge of the *Boulton* and was

[19] The first Canadian hydrographie chart produced by negative engraving on plastic was printed in 1953 - No. 4368, (former 468), "St Ann's Harbour." During French rule in Canada, this harbour was known as Port Dauphin, and with the loss of Neuve Terre (Newfoundland) in 1713, it was examined and seriously considered as an alternative site for the capital of Isle Royale (Cape Breton, NS). As many school boys now know, Havre à l'Anglais (English Harbour) or Louisburg, was selected as the site of the capital for this new French colony.

temporarily replaced by Mr F.C.G. Smith of Headquarters Division. With assistant Mr P. Radikir the party sailed from Prescott early in June, and en route to the Saguenay River examined a dangerous rock shoal in Lake St Louis, lying close to the main steamer channel. The deepest sector of the Saguenay River, a stretch of fifty-five miles from its confluence to St Fulgence, was closely surveyed. In this sector of the river, "depths of over 150 fathoms were found to be general, the 100-fathom line often skirting the very foot of the precipitous cliffs. The great depths and strong tidal currents make anchorage in case of fog or emergency extremely difficult." Homebound in mid-September, the *Boulton* visited Quebec and Montreal Harbours for revision surveys. Upstream near the head of Galops Rapids, a small channel between Adams and Pier Islands was closely investigated to assist future ice-breaking operations in the spring. On 11 October the Boulton was laid up at Prescott, having logged 500 miles of sounding and surveyed 146 miles of coastline. From this season's work two new charts were later published for the Saguenay River - No. 203, "Tadoussac to Trinity Bay," and No. 202, "Trinity Bay to St Fulgence, including Ha Ha Bay."

This was Mr Smith's last field season. On his return to Ottawa he assumed his designated duties as superintendent of charts on a year-round basis. In 1952 he succeeded Mr R.J. Fraser as dominion hydrographer, and in the spring of 1957 retired from the hydrographie service.

Great Lakes (Georgian Bay and Lake Erie)

Charting surveys in Georgian Bay were resumed in 1937 by a party in charge of Mr N. Wilson, and assistant Mr J.L. Foreman - both officers-in-charge of former surveys. Equipment used by the Saint John River party was shipped to Midland, Ontario, the summer base headquarters, and for transportation a motor launch was hired. From here surveys were made in Matchedash Bay, including Ports Midland and McNicoll, Victoria Harbour, and the grain-loading terminus of Tiffin. A reported danger in the vicinity of Chicora Shoal was investigated, and an obstruction in the entrance of Collingwood Harbour reported by the Department of Transport was examined. In an attempt to locate the wrecked collier *Aycliffe Hall* a sweeping survey was made in the western end of Lake Erie. Some 420 miles of boat soundings were logged and 200 shoals examined by this party. This was to be Mr Wilson's last field season with the hydrographie service, a career dating back to 1913. Having been successful in a promotional competition early in May 1938 he returned to the Department of Transport as senior assistant, Aids to Navigation Branch.

British Columbia

The reorganization of headquarters in Ottawa just about complete, the Victoria office became the focal point of branch attention in 1937. On 15 April Mr F.H. Peters, surveyor general and chief, Hydrographie and Map Service, arrived in Victoria from Ottawa, and until 3 May carried out an inspection tour of field and office activities on this coast. With the exception of a quick trip to Victoria in 1927 by the chief hydrographer, Capt. Anderson, this was the first occasion when an extensive tour of the Pacific coast was made by any chief hydrographer since Mr Stewart's visit in 1920.

About mid-April Mr Parizeau assumed command of the *Stewart* with assistants Messrs Willis, Davies, Young, Ettershank, Johnson, Rutley and LaCroix. Commander Knight, again in charge of houseboat *Pender,* was assisted by Messrs Stewardson and McQuarrie, and resumed regular charting work in the Rivers Inlet area. During the *Stewart's* cruise, camping parties were landed at Cowichan Bay, Nanaimo and Tucker Bay, and

several uncharted rocks were sounded, swept, and properly positioned. The return trip to Victoria was by the west coast of Vancouver Island, with an inspection of the Fraser River entrance. The first-hand knowledge of staff and working conditions observed by Mr Peters greatly impressed him, and before another field season rolled around the old order of administrating affairs on this coast were to be drastically changed.

For the remainder of the 193 7 season, the *Stewart* continued charting surveys in the Strait of Georgia, and along the west coasts of Vancouver and Queen Charlotte Islands. At the request of the provincial authorities, a network of ship triangulation stations was built and observed for local topographical purposes. Early in September the ship left Prince Rupert, and while homebound visited Baker Inlet to inquire about charting requirements by local mining interests. Working in cooperation with *Pender,* sweeping operations were conducted in Rivers Inlet. The houseboat was then towed to Hakai Passage, and the ship proceeded to the Strait of Georgia. Constant winds and forest fires hindered triangulation surveys, and in the last week of September, the *Stewart* entered Victoria Harbour with *Pender* in tow. When Messrs Parizeau and Davies came ashore it would be their last full field season - service records that had their commencement in 1906 and 1907 respectively, when the resurvey of Pacific coast waters actually began.

The Reorganized Victoria Office, 1937-38

Mr Peter' s earlier visit had paved the way for administration changes of hydrographie affairs on this coast, and within a month of Mr Parizeau's return to his office in the Post Office Building, he left for Ottawa on official business - his first since assuming charge of the Victoria office in 1920. To quote from his annual report, "On October 15th I made my way to Ottawa and was away eight weeks from the office, the first opportunity that the Chief of the Pacific Coast district had ever had to go to Headquarters since 1907. It had a great deal in improving the situation of the work, and eliminated a great deal of past misunderstanding." Early in 1938 the Victoria office was kept open the year round to meet the increased demands of shipping and navigation on this coast. Mr Parizeau then assumed the duties of acting supervising hydrographer, Pacific coast (confirmed in this office April 1940), and Mr L.R. Davies was placed in charge of compiling fair sheets, drafting assignments, and keeping sailing directions up to date. Chart sales and routine office duties were handled by clerk-typist, Mr G.S. Stoney. By April 1938, Canadian navigation charts for British Columbia were being sold at the Victoria office for the first time. This was the nucleus of an organization that has grown to larger proportions over the years, and with its establishment in 193 8, gone were the days when Lieutenant-Commander P.C. Musgrave and Mr H.D. Parizeau would "lock shop" for the field season and direct hydrographie affairs from the survey ships *Lillooet* and *Wm. J. Stewart.*

Canadian Charts and the Industrial Development of British Columbia

Between the years 1906 and 1937, Mr Parizeau spent twenty-one years in charting British Columbia's rugged coastlines, and when his field days were over he could look back with much satisfaction on the part he played in the economic development of this province over the years. Here is a significant quote from his 1937 annual report. "Many years ago boats on this coast used to go into bays and inlets without a chart, but as the development of the country increased insurance companies refused to allow these ships to travel under these conditions, and it is such now that no Coastal Company will allow any of their ships to go into any new development unless the Hydrographie Service had a survey of the locality ...

the lumber industry [has] recognized the merit of the Hydrographie Service ... requested, from time to time, elaborate surveys in the vicinities of their properties, both for local improvements and for safe navigation ... the fishing industry [has] made great demands on our work, and it will be many years before we can satisfy them ... up to a point we are helping mining development along the coast .. a new industry which is developing very rapidly in British Columbia is the tourist industry .. they are the largest purchasers of our Sailing Directions, and they are beginning to get more and more interested in our chart work." Mr Parizeau concluded his remarks with this highly significant statement, "the Admiralty Court in British Columbia [has] placed the value of Canadian Charts at the same level as those of the British Admiralty, and in many cases above the Admiralty Charts themselves."

Another significant recognition of Canadian hydrographie navigation charts is contained in a letter from Mr C P . Plaxton, acting deputy minister of Justice, and dated 19 May 1938: "... in connection with the case of King vs. James Bellman, which was tried in the County Court at Saint John, NB , I beg to advise you that the ruling of the County Court judge to the extent that Admiralty and hydrographie charts were not admissible in evidence was found erroneous by an unanimous decision of the Court of Appeal for the Province of New Brunswick. The Appeal Court held that such charts were clearly admissible in evidence as public documents."

HEADQUARTERS DIVISION

This division in 1937 carried out administrative work, the planning of new and special charting, investigations relating to chart revision, the preparation of pilots and sailing directions, and various hydrographie researches for navigation purposes. With Mr Fraser's promotion to senior hydrographer, most of the former duties of this division were assigned to Mr F.C.G. Smith, who upon his return from the Saguenay River in the fall assumed new duties as superintendent of charts on a full-time basis. Mr R.B. Bent continued in charge of sailing directions and pilots, and to supervise clerical and routine office matters Mr H. Bourdon, a clerical assistant since 1931, was transferred to the Map Service, and was replaced by Mr F.R. MacMillan of the Map Service. Before the fiscal year ended, Mr W.J. Barling of the Dominion Observatory was transferred to Mr MacMillan's staff, vice Mr H. Bourdon.

TIDAL AND CURRENT SURVEY

With the aid of the reserve Lightship No. 25 of the Quebec Agency, tidal current investigations in the lower St Lawrence begun in 1932 were brought to a temporary close. This party was in charge of Mr H.W. Jones with the assistance of hydrographers Messrs Wightman and Madden, and when Mr Jones was absent on field inspection, Mr R.B. Lee replaced him in charge. Investigations were centred in the area of Father Point and in rechecking other positions already observed. During the patrol of Hudson Strait, tidal stream observations were taken by Capt. W.J. Balcom, master of the *N.B. Mclean,* and in Frobisher Bay a set of tidal observations was supplied for the head of this inlet by Mr C H . Ney of the Geodetic Survey of Canada. In October 193 7 the tidal stations in St John ' s Harbour and Port aux Basques, Newfoundland, were closed, and from the two seasons' records, values of mean sea-level were supplied to the Geodetic Survey of Canada for checking their levelling network.

PRECISE WATER LEVELS

Research and water-level studies of the upper St Lawrence River were continued this fiscal year, but to a much lesser extent with the submission of the 1937 report. According to Mr Price, "it is proposed to review the studies and write a separate memorandum for each subject." As per international agreement, water-level data was forwarded to members of the International, Lake Superior Board of Control. This season 47 gauging stations supplied records for 600,000 water-level elevations, and 24,000 sheets of data, bulletins, profiles, etc. for inland navigation of the St Lawrence River and Great Lakes.

CHART CONSTRUCTION

This year sixty charts, prints and correction patches were printed. Four charts were published from engraved plates in colour, fourteen by photography in full colour, and eleven by lithography in black only. With lithography rapidly replacing copper-plate printing in the Map Service Division, Mr H. Williams, an apprentice engraver since 1929, was transferred in May 1937 from the hydrographie service to the Labelle Building - to assist in preparing colour plates in the printing room. This memorandum of Mr Peters also included a recommendation that Mr R.S. Simpson, a senior map draftsman since 1931, be transferred to the drafting office of the Map Service.

In 1963 when Mr W.A. Cunningham (senior copper plate engraver, Canadian Hydrographie Service, 1920-39) retired, he was in charge of the Retouch and Colour Section, Map Compilation and Reproduction, Department of Mines and Technical Surveys. His position was filled by his "assistant" Mr H. Williams, who is still [in 1967±] in charge of this unit.

CHART DISTRIBUTION

In his final report on the season's activities of this section, Mr P.E. Parent stated as of 1 January 1938, there were 75,798 miscellaneous charts in stock, with 14,006 sold and issued free, and 473 volumes of sailing directions issued. Tide tables distributed free of charge numbered 103,100.

1938-39

Even though the hydrographie service was now under more central control than ever, only seven parties were placed in the field this season - the same number as in 1932 when the depression curve was at its lowest. What was quite noticeable in 1938, however, was the commencement of a new trend in chart production. For the first time *"Custom Act"* maps were compiled by the service and printed. Demands for what were called in those days "yachtsmen's charts" were many, but no action was ever taken until the post-war years to compile these tourist editions. Of special significance in 1938, and reminiscent of the year 1913 prior to the First World War, was the Admiralty's intention of not maintaining some of their charts for Canadian Atlantic coast and Newfoundland harbours. With war clouds again hovering over Europe, they found these charts most difficult to keep up to date, and as a consequence the Canadian Hydrographie Service was soon obliged to assume responsibility for them. Of more personal concern to the regular staff was the commencement in November 1938 of the long-awaited unit survey by Dr. C.H. Laberge of the Civil Service Commission.

DIVISION OF HYDROGRAPHY

Gulf of St Lawrence, North Shore to Newfoundland

To complete the recharting of the North Shore of the Gulf, two parties were organized and detached from the *Acadia.* One of these parties, in charge of Mr T.M. Tardif, with the aid of a hired launch, attended to matters pertaining to triangulation and photography. The other party, in charge of Mr S.R. Titus, surveyed Wolf Bay and its vicinity. Assistants under Mr J.U. Beauchemin on the *Acadia* were Messrs Lowe, Radikir and Wilkins. While the *Acadia* was undergoing a refit in Halifax, Mr G.E. Lowe was sent to Lockeport Harbour, NS, for a chart revision examination; and in Bedford Basin a nautical mile was measured for official test purposes by Messrs Tardif, Lowe and Radikir. The *Acadia* sailed for the Gulf of St Lawrence on 8 June and returned to Halifax on 3 November. On passage, reported shoals were examined in Beaver Harbour, NS, and between Magpie Bay and Fairway Bank on the North Shore. Combined activities of ship and launch parties brought the hydrographie triangulation network to Point Amour, PQ, and in September it was extended across the Strait of Belle Isle to Pointe Ferolle on the northwest coast of Newfoundland. This is the earliest known record of Canadian hydrographie control in Newfoundland. During the season the *Acadia* worked mostly in the area between Harrington Harbour and Middle Islands, and in addition planted several bench marks (brass bolts) marking the triangulation stations between Romaine and Blanc Sablon. She also echo-sounded offshore areas along this coast, checked local magnetic disturbances, observed water temperatures and salinities and calibrated Cape Whittle and St Paul Island radio direction beacons. From the season's activities, 1,951 miles of ship and 1,255 miles of boat soundings were recorded, and 1,003 shoals and rocks examined. As a result of surveys along this sector of the North Shore since 1929, six Canadian charts were drawn to a scale 2 inches to the mile, and required a list of 600 place names.

The compilation of the North Shore topographical work to the Strait of Belle Isle this season recalls to mind the survey of this area by Admiral H.W. Bayfield, RN, in the hired schooner *Gulnare,* a century previously. In 1834 the Admiral reached the Strait of Belle Isle with his gulf survey, and the following year, 1835, its easternmost limit - Cape St Lewis, St Lewis Inlet, on the Labrador coast. This latter season was a strenuous for him in the boats, and on 17 August, he wrote in his diary, "we are all glad to be on board again, for rougher work than the survey from this [Chateau Bay] to Cape St Lewis we have seldom experienced."

Northumberland Strait to Cape Breton

While the *Carder* was being refitted at Charlottetown, under Mr Leadman's supervision, checks were made of the buoys in Hillsborough Bay by assistants Messrs Hanson, Wightman and Surette. They made a resurvey of Pictou Bar 11-30 June, while the ship was on the Pictou slip for an overhaul. The ship then sailed for the Magdalen Islands, where soundings and examinations were conducted in Grindstone and Entry Harbours, and Meule Rock lying offshore. Regular survey work was resumed in the southeast area of Cape Breton Island, from Guyon Island to Flint Island, including large-scale plans of Main-à-Dieu Passage and Louisbourg Harbour. Early in July Hydrographer A.F. Wightman became ill and left for medical attention. He was replaced temporarily by Mr C H . Martin. Before the *Carder* laid up in Charlottetown, visits were paid to Pictou and Caribou Harbours for further hydrographie investigations. When the season ended on 13 October, some 1,130 miles of soundings had been recorded by the ship and launches and 150 shoals examined. Some 130

miles of shoreline had also been surveyed by Mr Surette using a plane-table. From this season's activities, three charts were drawn during the winter months.

Mr G.A. Surette, a certified dominion land surveyor, had used a plane-table for several years when employed by the Topographical Survey of Canada, Department of the Interior. Its use in the summers of 1937 and 1938 by Mr Surette was most helpful in surveying the rugged east coast of Cape Breton, and another first in the history of the service.

St Lawrence River and Estuary

In 1887 Quebec Harbour was surveyed by Admiralty hydrographer, Staff Commander W.F. Maxwell, RN, and in 1905 by former hydrographie engineers of the Public Works Department under Mr A. Amos. Early in June 1938, a resurvey of this inland seaport was commenced by Mr W.F. Elliott and assistant Mr J.A. Deveault. About the middle of this month the *Henry Hudson* proceeded to Baie Comeau in the lower St Lawrence River, and on passage made a close sweeping survey off Barnaby Island in search of a shoal area that a freighter reported striking. Unable to locate this marine hazard, the party continued its cruise to Baie Comeau, and began a standard survey of English Bay and its approaches - the site of a large paper mill. When ended, the *Henry Hudson* sailed for Laval Bay, where at the request of the Anglo-Canadian Pulp and Paper Company, the survey limits of Mr Ghysen's (in 1936) were widened. Work in Quebec Harbour was resumed early in September, and continued until 29 October when the *Hudson* was laid up at her winter quarters on Kings Wharf. This season 186 miles of boat soundings were recorded, and 50 permanent triangulation stations established for future references. When Mr Elliott returned to Quebec, it was to be his last field season with the hydrographie service - a career dating back to 1928. Early in December 1938 having been successful in a competition, he was transferred to the Aids to Navigation Branch, Department of Transport, as an engineer assistant.

Mr Elliott was the third experienced hydrographer within three years to be transferred to the Aids to Navigation Branch, Department of Transport, and all gave as their reasons for leaving, poor promotional prospects and small salary raises at that time. Mr Wilson had been twenty-five years with the service and had one promotion since then (1927), and Messrs Laing and Elliott, with five and ten years respectively, no promotion. It is of interest to know that when Mr Wilson retired in 1959 he was Director, Marine Service; Mr Laing when he retired in 1966 was Chief, Aids to Navigation; and Mr Elliott, still in office, is today [1967] Superintendent, Management, Aids to Navigation.

Another of the service was Mr S.A. Robson, former chief engineer of the *Bayfield* 1929-31, and second engineer of the *Wm. J. Stewart* 1932-34, who in September 1934 also transferred to the Aids to Navigation Branch. When he retired in January 1961, he was Mechanical Superintendent of this Branch, and died a short time later.

Upper St Lawrence and Great Lakes

In 1938, Mr M.A. MacKinnon was placed in charge of this survey with assistant Mr N.G. Gray. On 31 May the *Boulton* left Prescott to resurvey Toronto Harbour, and on passage positioned the newly built International Bridge between Collins Bay and Rockport. The last survey of Toronto Harbour was in 1913, and this season, working in close cooperation with the Toronto Harbour Commission, a new survey of thirty-nine control points was carried out and later a new chart of this inland lakeport was issued to the public.

On 20 July the *Boulton* departed for Heron Bay in Lake Superior - an inland trip of

800 miles - and here completed a standard survey for the Ontario Paper Company (last surveyed in 1914). The party then returned to the upper St Lawrence River, where a resurvey of Montreal Harbour was conducted until 27 October. Reporting on the season's activities, Mr MacKinnon stated, "the triangulation of this harbour was started with a view of coordinating existing geodetic control points, hydrographie points in 1896, points established more recently by engineers of the National Harbours Board, and other existing survey systems." Before laying up for the winter, the *Boulton* investigated the waterfront of Brockville and Prescott Harbours for chart revisions. This season, about 2,000 miles of inland waters were cruised, with the *Boulton* passing through "92 locks and over 2 marine railways."

Georgian Bay, Great Lakes

With Mr Wilson's transfer to the Department of Transport in May 1938, this party was placed in charge of Mr J.L. Foreman, who was assisted for most of the field season by Mr C.R. Crocker. With the aid of a hired launch, and a summer base located at Midland, Ontario, the southeast coast of the bay was recharted between Midland and Port Severn - the entrance to the Trent-Severn Waterways. It had been forty-five years since the last hydrographie survey on this coast, and in his annual report Mr Foreman wrote, "charts of the 30,000 island section of Georgian Bay are much needed ... I would strongly suggest that every consideration be given to facilitate effort and despatch in the completion of the uncharted or recharted areas between Midland and Parry Sound because of its direct or indirect national revenue producing value." As to survey conditions during the season of 193 8, Mr Foreman continued, "lake level showed an average rise of about one foot over the previous normal year.." Some 481 miles of soundings were observed, 48 miles of shoreline surveyed, and 879 shoals and rocks examined by this party.

Lake Nipigon, Ontario

In response to a request by the Abitibi Power and Paper Company, Mr Hanson was placed in charge of a survey in Lake Nipigon, and early in March 1939, by train sledge and snowshoe proceeded to the east side of this lake. On the ice in Humbolt Bay a baseline was measured, and a minor triangulation network established - all preparatory to the forthcoming season. Under agreement with the company, men, equipment and the use of their fleet of tugs were placed at the disposal of the hydrographer when actual field work began the following summer.

British Columbia

With Mr Parizeau's permanent transfer from the field, Commander J.H. Knight was placed in charge of the *Stewart* this season, his first major charge in twenty-six years of hydrographie service, and Mr W.K. Willis replaced him in charge of the *Pender,* his first major charge in twenty-five years of hydrographie service. In keeping with the time, Mr H.N. McQuarrie, who had been with the service since 1930, resigned early in the spring. His position and that of Mr Wiebe, (resigned 1937), were filled by Messrs J.W. Dolphin and T.S. Bremner respectively. Although the *Stewart* and *Pender* were in commission in mid-April, they did not sail from Victoria until the first week in June. First call was Vancouver Harbour to resound Parthia Shoal. (The grounding of the CPR Steamer *Parthia* in June 1890 had brought Mr W.J. Stewart here from Ottawa the following year). Other areas visited by

the *Stewart* were the Fraser River, northwest coast of Vancouver Island, Fern Passage, Kildala Arm, Caamano and Millbanke Sounds. *Pender's* activities were confined to the Fraser River, Howe Sound, Johnstone Strait and Clio Channel. Special investigations were also conducted on behalf of the Lands Branch, Department of Mines and Resources, and on behalf of the Department of National Defence working jointly with HMCS *Armenderes*. When the *Stewart* tied up in the fall, it was to be Commander Knight's last field season. For personal reasons, he requested duties ashore and this was granted.

In August, the Victoria office was visited by the surveyor general and chief, Mr Peters, and later by the director, Surveys and Engineering Branch, Mr J.M. Whittle. What was discussed with Mr Parizeau at that time is anybody's conjecture, but within the next three months (November 1938), Dr. C.H. LaBarge, an investigator of the Civil Service Commission, arrived in Victoria where he began interviewing field and office personnel of the service for a unit survey. In January 1939, the Victoria office took over the sale of *Pacific Coast Tide Tables,* and since April 1938 when the sale of Pacific coast charts began, about 2,632 editions were hand-corrected for a total of 50,418 hand corrections to the end of the fiscal year. For reproduction in Ottawa, six standard charts were drawn during the winter months. And in conclusion, in March 1939, the steamer *Lillooet* (commissioned in 1908, and laid up in 1932) was sold out of the government service.

TIDAL AND CURRENT SURVEY

The main functions of this division are "the investigations of both vertical and horizontal movements of tidal waters, and the publication of its results." Two complete editions of tide tables for 1939 were prepared by this division and issued to the public for the first time: one for the Atlantic coast including Labrador and Hudson Bay; and the other for the Pacific coast. They were printed expressly for the shipping industry. For the needs of fishermen, and others six abridged editions were printed: Atlantic coast (4), and Pacific coast (2). A tide gauge was installed at Louisbourg, NS, and tidal streams in Main à Dieu Passage observed by Mr O.M. Meehan. In Gaspé Harbour a current recorder was installed by Mr H. W. Jones. Mean sea levels and other tidal calculations were determined and forwarded to the Association Internationale d'Océanographie Physique, France, and the Tidal Institute in Liverpool, England. From these values, tidal analysis and predictions for reference ports and other localities were calculated. Before the fiscal year ended the publication *Atlas of Currents for the St Lawrence Estuary between Quebec and Father Point* was placed in the hands of the King's Printer. When printed in 1939, it included fifty-one chartlets showing the hourly directions and velocities of the tidal streams as observed in seventy locations in the estuary between the years 1932 and 1937.

PRECISE WATER LEVELS

For administrative purposes, activities of this division are divided into three geographic sections: Port Arthur to Kingston and Grenville; Prescott to Ste Anne de Bellevue, and Pointe Claire to Neuville (just above Quebec). Forty-seven automatic gauges were maintained this year that registered 524 months of continuous water-level records, from which 500,000 elevations were computed.

CHART CONSTRUCTION

"The work of this division covers the extent of marine cartography."[20] From field activities fourteen fair sheets were prepared, and thirty-two charts, maps, prints and correction patches were printed. A new series of semi-nautical publications was compiled this season - Custom Act Maps - and it marked a new trend in chart production. These special maps were compiled and printed by the hydrographie service "under the authority of Order-in-Council P.C. 3139 of December 19, 1937 giving effect to the recommendations of the Interdepartmental Committee appointed to consider the extent of Canadian territorial waters, and of the circumstances under which the RCMP Preventive Force, is dealing with suspected smugglers, can legally make seizures."

The first of these lithographed Custom Act Maps was for Mingan Strait in the Gulf of St Lawrence, printed in 1938. From then until 1942, ten other maps were published - a total of eleven for the series - and all for the waters of the Gulf of St Lawrence, the Bay of Fundy, and the Atlantic coast including the St Pierre and Miquelon Islands (hub of rum-running activities in the 1920s and early 1930s). In 1953 two special editions of these Custom Act maps were reproduced on a smaller scale, and embraced most of the areas in the first series: S 136 and S 137.

In March 1939 the first Canadian general chart for James Bay was published (No. P-1502, renumbered 5413). It was a preliminary lithographic process print compiled by Mr P. Jobin, and based on hydrographie surveys between the years 1912 and 1915. An interesting historical note on this chart reads as follows: "general hydrography are from Canadian chart 405,1913 edition, and from an undated chart of James Bay published by J.D. Potter and a manuscript chart by Captain Taylor of the Hudson Bay Company service."

Canadian chart No. 405, "Hudson Bay and Strait," printed January 1913, was the only general chart for northern waters by the service up to the First World War. Although surveys had been made in James Bay from 1912 to 1915, no companion chart to No. 405 was ever printed until the year of the Second World War. In subsequent years, it was found to be too inaccurate for navigation in the bay proper, and was cancelled. Since 1947 the topography of the bay has been greatly improved with geodetic controls and aerial photography. To bring the preliminary edition of the James Bay chart up to date, a new edition No. 5413 was printed in 1963.

Proposed "Yachtsmen's Charts"

By 1938 the tourist industry was rapidly coming into its own, and with it there developed a great demand for what was then termed "Yachtsmen's Charts," or small craft charts of today. A significant statement in the annual report reads, "these charts would cover the many sheltered, but often intricate, water-routes of lake and river available to yachts and motor-cruisers. On account of the vigorous steps taken to develop our tourist industry, and to the growing popularity of watercraft for holidaying and recreation purposes, the demand for this type of charts is continually growing. Unfortunately, the full use of Canadian waters for this profitable purpose has been restricted through lack of these primary navigational aids." With rumblings of a Second World War in 1938, and its outbreak the following year, nothing official was done until the end of this war to publish "tourist" charts.

One of the first set of tourist charts by the hydrographie service were for the Rideau

[20] Report Mines and Resources, 1938

Lakes System between Kingston and Ottawa. These two "map-charts" were published in the spring of 1947 from reconnaissance surveys made the previous fall by Hydrographers S.R. Titus and A.L. Mack, CGS *Boulton.* In 1964, the first folio of small craft charts were published by the service - No. 2203, "Parry Sound to Byng Inlet, Georgian Bay." Since then, other series were produced for the inland waters of Kootenay Lake and River, BC; the Athabaska and Peace River, Alberta, and District of MacKenzie, NWT; the Trent-Severn Waterway (requested in 1947); Muskoka Lakes, Ontario, and the Ottawa River.

Mobile Field Party

In his annual report for 1938, Mr Crichton recommended that a mobile field party be organized so that "more accurate data may be obtained in this office for the revision or correction of charts ... particularly as regards the coastal harbours, than is now the case." In subsequent years, no such party was ever organized in the hydrographie service. Hydrographers, however, when working in areas where certain charts required revisions, were frequently detailed to make them.

CHART DISTRIBUTION

When Mr P.E. Parent retired in September 1938, Mr E.A. Ghysens of the Hydrography Division replaced him in charge of this section. As of 1 January 1939, Mr Ghysens reported 66,632 charts in stock; and in the repository of the Chart Construction Division, 10,000 well-indexed plans. Since 1933 chart distribution had more than doubled, from 8,470 to 17,999 editions. Other relevant publications issued in 1938 were 430 volumes of sailing directions and pilots, 25,143 graphs and bulletins, etc., of water-level data, and about 32,000 tide tables - a reduction of 71,000 or 69 per cent below the 193 7 figure. This lower tide-table distribution in 1938 was mostly due to revision of the free mailing list, and the decision to make a nominal charge for all tidal publications to the public.

1939-40

Highlight of the fiscal year 1939-40 was Canada's entry into the Second World War (10 September 1939), and its influence on existing hydrographie activities. By the end of September the survey ships *Carder* and *Acadia* were again commandeered by the Canadian navy for a second term of war duty. Survey launches, power dories, gigs, dories, etc. and field equipment, having been removed from these ships, field personnel were immediately reorganized and reassigned to special emergency charting in Northumberland Strait and the Atlantic coast of Nova Scotia. These were chiefly urgent defence surveys made on behalf of the navy, army and air force. On the Pacific coast, similar defence surveys for the Department of National Defence were made by hydrographers of the *Wm. J. Stewart* and houseboat *Pender.* At the commencement of the 1939 field season, eight parties were actively employed (ship 3, houseboat 1, shore-based 4) but when it ended, and despite the loss of two ships, field parties had increased to nine (ship 1, houseboat 1, and shore-based

With the declaration of war, regulations of the *War Measures Act,* (Revised Statutes of Canada, Chapter 125, 1927) were invoked, and gave the Governor in Council authority to approve these regulations and other orders, issued from time to time, for "the security, defence, peace, order and welfare of Canada." One of the first of these wartime orders was the *Military Service Act.* Effective as of 1 September 1939, (P.C. 2514,3 September 1939),

heads of divisions were permitted to retain employees subject to active service, if in their opinion their services should be retained. Within a year, more rigid civil service and Treasury Board controls were to influence the careers and welfare of most civil servants, and as the war progressed so did staff regulations.

In the meanwhile, time was fast running out on the approval of the unit survey of the Hydrographie and Map Service, signed by the Minister of Mines and Resources and the Civil Service Commission in November 1939. Since this and similar reclassifications in other departments had been completed before the war began, this technically had yet to be ruled on by the Treasury Board. In March 1940, a general election was held, and the next month the Hydrographie and Map Service was duly reclassified and better prepared to assume its wartime duties.

In accordance with proposed recommendations in this report, two major staff changes were made in the fiscal year 1939. One was the official transfer of copper-plate engravers from the Department of Public Printing and Stationery to the Department of Mines and Resources. The other was the interim transfer of tidal and current work on the Pacific coast, from the Vancouver office of the Tidal and Current Survey Division to the hydrographie office in Victoria, BC.

Since the early 1920s, the United States Coast and Geodetic Survey on the Pacific coast had made use of radio acoustic ranging apparatus (RAR) to position offshore ship soundings better. Impressed with the results of these experiments, in 1939 the *Wm. J. Stewartbeg&n* a similar series of tests on this coast. For the want of proper equipment and time these first tests were not too successful, and were carried into the next year's activities.

DIVISION OF HYDROGRAPHY

Gulf of St Lawrence

The season of 193 9 was to be a short one for the *Acadia,* and her last with the hydrographie service until the end of the Second World War (1946). Since 1927, she had been in the charge of Mr J.U. Beauchemin, and this year he was assisted by Messrs G.E. Lowe, J.A. Deveault, S.R. Titus, C H . Martin and C F . Wilkins. Sailing master since 1927 was Capt. F.V. Ryan; and chief engineer since 1923, Mr J.S. Cann. Including the remaining officers and crew, total ship complement was forty-nine. The *Acadia* sailed from Halifax on 24 May and reached Point Rich, Newfoundland, on 5 June. This being an exceptionally bad ice year in the Strait of Belle Isle, the party was unable to commence its triangulation survey to the northward, and decided to extend the network south to Cape St George where it tied in with geodetic positions in this area. Later in the season the network was carried north to Flowers Cove Light which had been positioned the previous fall. Between Bay of Islands and Flowers Cove, hydrographie stations were "permanently marked with our brass bolts." The triangulation survey ended on 26 July. From then until 13 September the ship was fully occupied with offshore sounding in uncharted areas between Harrington and Blanc Sablon; in checking certain areas off the west coast of Newfoundland, and to quote Mr Beauchemin, "a general inspection of all the Admiralty charts covering the district." When in Corner Brook Harbour, an investigation of all the waters about Bowater and Clarke wharves was made, and the results drawn on a scale 60 feet to the inch. These are believed to be the first chart revision surveys in Newfoundland by Canadian hydrographers. Mr Beauchemin concluded that "all the most outstanding features, lighthouses and prominent hills were duly cut-in, with the result that it will be possible later on to complete the off-shore soundings from Flowers Cove to Cape St George [Cartier survey, 1936] without further triangulation or re-erecting stations."

On 13 September instructions were received to close out work in the Gulf of St Lawrence and proceed to Mahone Bay, NS, on the Atlantic coast, thus bringing to a temporary close the recharting of the Transatlantic - Belle Isle route in the northeast arm of the Gulf of St Lawrence. This year (1939) also brought to a close Admiralty surveying in Labrador (St Lewis Inlet, Admiral Bayfield's limits in 1835) by Lieutenant Commander C. W. Sabine, RN, HMS *Franklin.* Activities of the *Acadia* this season actually marked the commencement of Canadian hydrographie charting in Newfoundland - an era that became more significant after April 1949 when the island province entered Confederation.

Mahone Bay, NS

The Acadia arrived in Mahone Bay on 23 September and by the 27th hydrographers of this party had begun a survey of this bay and its approaches, with launches, gear and equipment removed from the ship. For the remainder of the season (18 December) this was the main base of operations, with Mr G.E. Lowe in temporary charge. When requested by the Department of National Defence, minor investigations were carried out by detached parties from the Mahone Bay base. On 26 September the *Acadia* sailed for Halifax and following an inventory of remaining stores and equipment, was delivered to the Dockyard authorities on 5 October. A few days later, Mr C F. Wilkins, a junior assistant, was granted leave of absence *(War Measures Act,* 1927) to accept a commission as lieutenant-commander with the Canadian navy. When discharged in 1944, he did not return to the hydrographie service.

In Halifax Harbour, shoals were examined in the Northwest Arm, new aids to navigation positioned in Bedford Basin and "soundings were taken at Eastern Passage." Another special survey was made between the northwest and southeast bars in Sydney Harbour, and at the end of November, Mr S.R. Titus was sent to Saint John, NB, where with the aid of a rented boat he made a general inspection of this harbour for chart revisions.

Gulf of St Lawrence to Cape Breton

The season of 1939 was also a short one for the *Carder,* and it was to be her last with the hydrographie service. Since 1932 she had been in the charge of Mr H.L. Leadman, who this year was assisted by Messrs N.G. Gray, A.F. Wightman, G.A. Surette and A.D. Brannon. Sailing master since 1921 was Capt. James Roach and chief engineer since 1931 Mr J.H. Simard. While the ship was being outfitted in Charlottetown, Mr G.A. Surette was sent to Amherst, NS, for a survey of the historic site of Fort Beausejour (early French military post). This work was necessary in locating the old workings used in the reduction of this early landmark. Another landmark survey was made on 22 May in Charlottetown Park near the Provincial Building. This was a check of the meridianal circle marked by three stones, with the prime vertical marked by two additional stones. Later Mr, Leadman reported, " these stones were placed, to facilitate standardization of surveying instruments, by act of the Legislative Council of Prince Edward Island which was passed in 1809. The central stone is engraved A.D. 1920 [words missing]

The *Carder* sailed from Pictou on 26 May and reached Gaburus Bay on the south coast of Cape Breton, via the Strait of Canso. Survey of this sector of coast began between Guyon and Flint Islands, and work on a companion chart, Green Island to Guyon Island, was then taken in hand. To this time, the best navigation charts for this stretch of the coast were the incomplete Admiralty editions from surveys 1847-1861. Late in June, a portion of St Patrick Channel, Bras d'Or Lake, was charted, and revisions made to the existing Admiralty charts for this area. In mid-August, the *Carder* departed for Liverpool, NS, for a resurvey

of this harbour, and then returned to Cape Breton for a resurvey of the early French military bastion - Louisbourg Harbour. The charting of this coast to the westward was resumed up to the Second World War.

On 10 September the *Carder* was instructed to proceed to Shediac Bay, NB, and await the arrival of Mr R.J. Fraser from Ottawa. When the ship reached here on the 12th, a shore party was organized, and when equipped with the necessary survey launches and gear, was placed in temporary charge of Mr N.G. Gray. With Mr Fraser aboard, the ship then left for Charlottetown to store the remaining gear and equipment, and on the 13th cleared for Halifax, NS, on her last hydrographie cruise. She arrived at the naval dockyard September 15th, and on the 20th was handed over to the Department of National Defence by Mr R.J. Fraser. This was the second occasion when the *Carder* was the first hydrographie ship to be commandeered by the Canadian navy.

When the Second World War ended, the *Carder* was declared unsuitable for surveying purposes, and was taken over by Crown Assets Disposal Corporation for disposal. She was sold out of the government service in 1947. Although she had seen service with the Canadian navy on two occasions her greatest contribution to the war effort was probably her gyro-compass - a nautical instrument that added much to Atlantic coast charting. In November 1940, it was removed from this vessel and re-installed in the armed merchantman *Jervis Bay,* Capt. Fogarty Fegan. In convoy to the British Isles that month, the *Jervis Bay* engaged the German cruiser *Admiral Scheer* in close battle, and was sunk taking to the bottom of the mid-Atlantic some two hundred officers and ratings and the *Cartier 's* gyro-compass. For his bravery, Capt. Fegan was awarded posthumously the Victoria Cross, and a short time later the *Admiral Scheer* was sunk in the Kiel Canal.

Shediac Harbour, NB

This survey party comprised nine men and four officers, including Mr N.G. Gray in charge. When Mr Leadman and Capt. Roach returned from Halifax on 20 September[?], they found the resurvey of this harbour and its approaches well in hand. The last survey of Shediac Harbour was by the Admiralty in 1885, and since then this harbour had become an important port of call for transatlantic aircraft and pulpwood carriers. Its survey completed on 30 September, the boats were then sailed to Charlottetown for the winter, and stored at the Marine Wharf. Despite the brevity of the field season, 923 miles were ship sounded, 551 additional miles in the boats, and 88 shoals closely examined. Four charts were later published from the season's activities: "Guyon Island to Flint Island, NS," "Mclvor Point to Little Narrows, NS," "Liverpool Harbour, NS" and "Shediac Harbour, NB."

Northumberland Strait

With Atlantic coast survey ships out for the duration, Mr Leadman, after consideration to future requirements in his region, wrote in his annual report:

> it is highly desirable that the coast surveys of the southeast shore of Cape Breton be continued but it should be recognized that the portion eastward of Michaud Point is exposed and difficult to access. Only the inshore work should be done, which would preclude the possibility of publishing a chart until a ship was available for the offshore work. By commencing in the vicinity of Caribou Island and working westward, it would be possible to chart Northumberland Strait, with the *Henry Hudson* and the smaller

launches. The chart would be made available to the public in due course and I have been informed verbally on several occasions by our chart agent in Charlottetown, that there is a keen demand for charts of the Strait. Carried on concurrently with this survey would be surveys of Caribou Harbour, Woods Island, Malagash, Pugwash, etc. as required.

Lower St Lawrence

The resurvey of Quebec Harbour begun by Mr W.F. Elliott the year before was resumed in 1939 by Mr T.M. Tardif and assistant Mr J.I. Thompson. Matters pertaining to the *Henry Hudson* and the crew were under Capt. D.M. Snelgrove. Early this season, the *Hudson* was equipped with a new automatic sounding machine, an Admiralty MS XIV pattern with two ranges, 0-250 feet and 0-250 fathoms. It was operated by a 36-volt battery and cost $3,330. It could record 595 soundings per minute, with a minimum depth of one foot below the keel. The field season extended from 25 May to 25 October, and in addition to the Quebec Harbour resurvey, a congested area in the St Charles River was sounded where the ship channel vessel *Detector* was unable to sweep. Another survey was made for the Department of Public Works in the approaches to the Champlain Drydock. During the period of spring tides, current measurements were observed in certain areas of the harbour with a Gurley current meter. The season's operations ended at Cap Rouge, and to quote Mr Tardif, "despite the danger from intentional or accidental shooting occasionally made by the military guard posted at the Quebec Bridge." From the two seasons' activities, a new chart for Quebec Harbour was published, and revisions made to the coast chart of the river from Grosse Isle to Quebec. (Cape Rouge was also the upstream limit of Capt. James Cook's "Plan of the St Lawrence River between Green Island and Cap Carouge" (1760?).)

St Lawrence and Richilieu Rivers

The first Canadian hydrographie survey of Montreal Harbour was in 1906, and in 1938 its resurvey was undertaken by Mr M.A. MacKinnon. This work was resumed by Mr MacKinnon in 1939 with assistant Mr A.L. Mack. On 27 June the party was joined by Mr R.J. Fraser from Ottawa. The *Boulton* then proceeded to Sorel to check its waterfront and its approaches, and while here Mr C.A. Price of the Precise Water Levels Division also joined the party. The *Boulton* then began the resounding of the Richilieu River from Sorel to the international border near Lake Champlain. This data during the winter months was processed and incorporated in two revised editions of Canadian charts for this inland waterway. When work in Montreal Harbour ended in mid-October, the launch returned to Prescott for the winter. From the two seasons survey, a new chart of Montreal Harbour was drawn.

Georgian Bay, Great Lakes

An extract from the *Annual Report of the Department of Mines and Resources, 1939,* reads: "accurate navigation charts of the Midland - 30,000 islands section of Georgian Bay are required to meet the need of shipping, which, annually, is increasing in volume." With assistant Mr P.N. Bowles-Evans, Mr J.L. Foreman worked out of Midland with a launch party until late October, and completed the charting of Wabaushene, Coldwater River, Port Severn, Little Lake, Lower Honey Harbour, and the coast from Penetang to Gin Islands. Some 392 miles of boat sounding (lead-line) were observed, 58 miles of shoreline surveyed,

and 793 rocks and shoals examined - sufficient data to publish Chart 117, "Port Severn to Present Island." This was also to be the last full season of hydrographie surveying in Georgian Bay until after the Second World War (1948, Messrs Gray and Radikir, Parry Sound).

Lake Nipigon, Ontario

Prior to the advent of the pulpwood industry, the principal navigation on Lake Nipigon was small fishing craft. With the development of this new industry, diesel tugs began appearing on the lake, and soon charts were requested by the Abitibi Power and Paper Company for certain areas. A preliminary survey on the east coast in Humboldt Bay was completed by Mr Hanson in March 1939, and in May this year, he returned with assistant Mr C.R. Crocker to complete the field work. As agreed, the company provided all necessary equipment and labour, and the use of the tugs for transportation to Orient, Humboldt and Ombabika Bays, including the Virgin Islands. One of the company's 45-foot launches, equipped with an echo-sounding machine, was used for surveying and charting purposes. When the season ended the last week of September, about 909 miles of recorded soundings, 28 miles of coastline, and 89 shoals were examined. Reporting on this season's work, Mr Hanson wrote, "Lake Nipigon is roughly thirty-five by fifty-five miles in extent, exclusive of bays, but contains so many islands that no point on the lake is more than six miles from the nearest land. Depths of seventy-five fathoms were found in the lake during the past season, but the bottom is highly irregular over the greater part of the area, and dangerous shoals rising abruptly from forty fathoms of water are not unusual. Close sounding is therefore necessary in order not to miss any of these shoals, and this fact should be taken into consideration when further charting is contemplated." in March 1940, plans were prepared for Humboldt Bay, Virgin Islands and Ombabika Bay - valuable assets to the pulpwood industry on Lake Nipigon at that time.

British Columbia

With the assignment of Commander J.H. Knight to duty in the Victoria office, in 1939 Mr W.K. Willis was placed in charge of the *Wm. J. Stewart,* and Mr R.B. Young, the houseboat *Pender*. Office assistants to the supervising hydrographer, Pacific coast, were former hydrographers Messrs L.R. Davies and Commander Knight, with Mr G.S. Stoney, clerk-stenographer in charge of routine office matters. With the outbreak of the Second World War, Commander Knight, at his own request, was granted leave of absence (29 December) to accept a commission with the Canadian navy as lieutenant-commander, and was posted to the Royal Military College, in Kingston, as an instructor. In accordance with the proposed civil service recommendations for a unit survey, in December 1939 the responsibility for field operations and the maintenance of the Tidal and Current Division on this coast were transferred by headquarters in Ottawa from Vancouver to the Victoria office. This also included the distribution of tide tables for the Pacific coast, and was the first official move that concluded with the retirement of Mr S.C. Hayden, senior tidal and current surveyor, Pacific coast, in June 1940.

Assistants under Mr Willis in the *Stewart* were Messrs Stewardson, Ettershank, Johnson, Rutley and Dolphin. Sailing master since 1933 was Capt. J.J. Moore; and chief engineer since 1933, Mr J. Ascroft. Under Mr Young in the houseboat *Pender* were Messrs LaCroix and Bremner. Both ships were in commission by mid-April and tied up at Victoria in the middle of November. Before resuming regular charting work, sweeping surveys were

made for the Department of National Defence in Victoria and Esquimalt Harbours. With *Pender* in tow, the *Stewart* then sailed for Howe Sound where until the third week in September this sound was surveyed. The houseboat was then towed to Malaspina Strait, where it remained until the end of the season. Meanwhile, the *Stewart* worked in the Strait of Georgia, the north shore of Vancouver Island, Hecate Strait and Millbanke-Hakai Passage. Campsites for tidal-current investigations were established this season in Baronet Passage, Drainey Inlet and Rivers Inlet. Homebound, a special survey was made at Lions Gate Bridge, Burrard Inlet, for the Department of National Defence; and in mid-November both ships tied up at the Department of Transport wharf for the winter. About 1,560 miles of ship sounding and 2,076 miles in the launches were recorded, and 459 shoals examined. Of 213 days in the field, 128 or 60 per cent were working days.

The gradual growth and importance of the Victoria office is reflected in these statistics for the fiscal year 1939: sold, 4,052 charts and 393 volumes of sailing directions; corrections to charts, 55,594 by hand, and to Volume I of the BC sailing directions, 2,228. Yet Mr Parizeau reported, "and I hope the Department will still endeavour to obtain for us more help, especially for clerical work and chart correction and distribution work. Unless something is done in this latter case, we will have to deliver to the public inferior quality work which is definitely against my grain."

Radio Acoustic Ranging 1939-40

In the early 1930s, the United States Coast and Geodetic Survey vessel *Guide* was using this apparatus for positioning offshore soundings. Although not as accurate as visual fixing, it was a great improvement in positioning soundings beyond the limits of the horizon. The principle of RAR was the selection of three well-defined stations along the coast and anchoring nearby each station a sensitive hydrophone. Station and hydrophone were connected by cable, and at each station a radio receiving and transmission set was in constant communication with the ship. To position the ship, a bomb dropped from the stern was exploded. This explosion was automatically recorded on board, and the instant of time when it was received by the hydrophones ashore was automatically relayed back to the ship. Knowing the velocity of sound through water, the distance from each station could be calculated. In Mr Parizeau's opinion, this was "the only satisfactory method known," and invaluable for any but small-scale surveys, especially on a coast like British Columbia "where the depth of water precludes the use of floating beacons."[21]

In the spring of 1939, Mr J.A. Nesbitt, the wireless operator on the *Wm. J. Stewart,* was sent to Seattle and Oakland, USA, to learn all he could about RAR. Due to many delays in not acquiring the proper equipment this season, the *Stewart* was unable to carry out extensive tests with this new technique. One test, however, was made by Mr Willis and the ship's company. A buoy placed fifteen miles offshore was positioned with considerable success, but unfortunately the pressure of survey work at that time did not permit further tests at greater distances this season.

In 1940, again unable to procure the needed equipment, and due to Mr Nesbitt's absence on educational leave, Mr Parizeau reported, "the RAR was not completed in time to have proper tests last season." However, when working in the Millbanke Sound area, the *Stewart* did complete tests on eight different occasions, and these were to terminate preliminary trials with this new apparatus. Due to the war, and the departure of Mr Nesbitt,

[21] Address by Mr H.D. Parizeau, Fifth Pacific Science Congress, held at Victoria and Vancouver, B.C., 1933.

this project was discontinued. The invention of Loran, Shoran, Radar and Decca during the Second World War ended for all times the adoption of R A R by the hydrographie service.

HEADQUARTERS DIVISION

The staff of this division in 1939 comprised the surveyor general and chief, Mr F.H. Peters; senior hydrographer, Mr R.J. Fraser; superintendent of charts, Mr F.C.G. Smith; Chart Construction Division, under Mr G.L. Crichton; sailing directions and pilots, under Mr R.W. Bent; Tidal and Current Survey Division, acting chief, Mr H.W. Jones; Precise Water Levels Division, Mr C.A. Price; Chart Distribution, Mr E.A. Ghysens, and office - general, Mr F.R. MacMillan. Stenographic staff were as follows: Misses C. Condon and R. Gould (Mr Peters and Mr Fraser), Miss M. Cumbers (Mr Jones), Miss F. Reed (Mr Price), and Miss A. Doherty (Mr MacMillan). Clerical assistants under Mr MacMillan were Messrs W.J. Barling, L.C. McDonald and K. Conroy.

The outbreak of the Second World War brought an immediate cessation to the regular field work on the Atlantic coast. Plans were then formulated to transfer the *Cartier* and *Acadia* to the Canadian navy; instructions were sent to field parties on both coasts to carry out urgent hydrographie investigations in certain strategic areas; and arrangements were made to increase chart production from peacetime to wartime standards to meet the anticipated requirements of both the naval service and the merchant marine.

TIDAL AND CURRENT SURVEY

Eleven principal tidal stations were maintained in 1939 (Atlantic coast 6, and Pacific coast 5). To meet the growing importance of the Belle Isle shipping route, a new principal (reference) tidal station was built at Harrington Harbour, on the north shore of the gulf, by Mr O.M. Meehan. In the western approaches to Hudson Strait (Digges Islands) tidal stream observations were taken by Capt. W.J. Balcom, master CGS *N.B. McLean.* This year, the *Atlas of Currents for the St Lawrence Estuary* was printed and issued to the public. In September 1939, following the outbreak of war, Dr. A.T. Doodson, associate director of the Liverpool Observatory and the Tidal Institute, visited the hydrographie service. In conversation with Mr H.W. Jones of this division, he remarked "that Canada had an excellent tidal service" and he also referred to "the ideal layout of tidal stations and the accuracy and character of its observations."

The staff of this division in 1939 comprised four regular personnel and two hydrographers on loan from field parties - a total of six personnel. At Headquarters, there were senior tidal and current surveyor, Atlantic coast (acting chief of this division), Mr H.W. Jones; junior tidal and current surveyor, Mr R.B. Lee; and stenographer Miss M. Cumbers (now Mrs. Soutan). On loan from the hydrographie field establishment were Messrs O.M. Meehan and M.S. Madden. On the Pacific coast, senior tidal and current surveyor Mr S.C. Hayden had his office in Vancouver. This district office of the Tidal and Current Survey had been located at Vancouver since 1924. In 1939, it was decided to transfer all tidal and current work on the Pacific coast to the re-organized hydrographie office at Victoria, and in December this transition began. With its completion in 1940, the era of tidal work on this coast by the original Tidal and Current Survey was brought to a close. In 1902, the superintendent of this survey, Dr. W. Bell Dawson, built his first tidal station on this coast, and just prior to his retirement in 1924 had established the Vancouver office with Mr Hayden in charge - better to aid shipping and navigation on this coast.

PRECISE WATER LEVELS

In 1939 forty-seven automatic water gauges were in operation on the St Lawrence River and Great Lakes. From their records, 600,000 elevations of the water level in various localities were tabulated, and issued in twelve monthly, five annual, six general, and five graphic bulletins. To quote Mr Price, "because of the importance of available depths to the loading capacity of ships on the St Lawrence - Great Lakes System, the trends of water-levels are closely watched by shipping and other interests. For this reason the Monthly Bulletins issued by this Division are published by many periodicals." The staff of this division in 1939 comprised eight personnel with the following classifications: assistant engineer, Mr C.A. Price; senior engineering clerks, Messrs A.S. Matthewman, H.P. Williams, W.J. Miller, A.C. Turtle; hydrometric recorders, Messrs A.W. Cole and W.E. Rainboth; and stenographer, Miss F. Reed.

CHART CONSTRUCTION

In 1939 the work of this division was still under the supervision of the chief, Mr G.L. Crichton, and was composed of chart compilation, drafting and copper-plate engraving. This overall staff numbered fifteen personnel, including Mr Crichton, and their classifications were as follows: drafting office - principal map draftsman (1) Mr J. Bell; senior map draftsmen (4) Messrs H. Melancon (1904-March 1940), R.S. Simpson, E. Leslie, C.W. Weese (since September 1938); map draftsmen (2) Messrs M. Isabelle and Y. Pinard (since April 1939); student map draftsmen (2) Messrs H.M. Kelson and A.M. Dunn. Copper-plate engravers: chief copper-plate engraver Mr W.C. Cunningham (since 1921); senior copper-plate engravers (4) Messrs W.J. Watts, G. Silvers, J. Brown, W.A. Cunningham (granted military leave of absence in 1940, and never returned to the hydrographie service).

During the fiscal year seventy-eight charts, maps, prints and corrected patches were completed. Hand corrections to published charts tallied 171,715 [?] ... sheets of 188 different editions. In addition, there were added to the records repository 7,778 items of hydrographie data and 990 air photographs.

Transfer of Copper-Plate Engravers, 1939

In compliance with a decision reached when the unit survey of the Hydrographie and Map Service was under review, the transfer of copper-plate engravers from the Department of Public Printing and Stationery was approved on 28 September 1939, with Order-in-Council P.C. 39-2838. Canadian government copper-plate map making had its commencement in the Printing Bureau of the Department of Public Works in 1911, with Mr W.C. Cunningham its first chief. To facilitate chart production, in 1921 a unit of these engravers under Mr W.C. Cunningham was detached from the Printing Bureau to assist the hydrographie survey - at that time located in the Hunter Building on O'Connor Street. The 1939 official transfer was the first move to centralize this work under the proposed new mapping service - a move that by 1947 brought to a close this centuries-old art of chart and map making in the government.

CHART DISTRIBUTION

As of 1 January 1940, there were 73,929 copies of charts at the hydrographie service. Distribution this fiscal year totalled 19,850 nautical charts, 953 volumes of sailing directions and pilots, and about 36,000 copies of tide tables. There were 23 dealers across Canada and in the United States handling Canadian charts: Atlantic coast (5); St Lawrence River and

Inland Waters, including the Great Lakes (14); British Columbia (2); and in the United States (2). Early in 1940 Mr E.A. Ghysens, who had been in the hydrographie service since 1909, retired. Hydrographer Mr P. Radikir was then placed in charge of Chart Distribution, with the assistance of clerks A. Carbonneau (1906-40) and L. McDonald.

RECAPITULATION, FISCAL YEARS, 1928-39

> The geographic organization of the Hydrographie Service consists of the Hydrographie Headquarters at Ottawa and a District Hydrographie Office at Victoria. The administration of the various divisions comprising the Hydrographie Service is conducted from the Hydrographie Office, Ottawa, which also serves as clearing centre for general navigational information. From here, also is carried out the planning of new and special charting, investigation, and research in hydrographie and navigation subjected, and the dissemination of special navigational information pertaining chiefly to depths, water-levels, tides, recommended navigation routes, ice data, berthing accommodation, and harbour facilities. The Victoria Office facilitates the conducting of general hydrographie operations on the Pacific Coast and acts as a main distribution centre for charts and other hydrographie publications.[22]

In 1939, headquarters and the Atlantic coast division of the hydrographie service were located in the Confederation Building, Bank and Wellington Streets, Ottawa. Field parties not accommodated here were quartered in the Labelle Building, Dalhousie and George Streets (formerly Topographical Survey Building), Ottawa. In British Columbia, the Victoria office was still located at 319 Post Office Building, Government Street (the same street in which Lieutenant-Commander P.C. Musgrave established the first office in 1907). Home ports for hydrographie ships on the Atlantic coast were Halifax and Charlottetown; Inland Waters, Quebec and Prescott, Ontario; and in British Columbia, Victoria, BC.

During this period the regular staff of the hydrographie service had increased approximately 85 per cent of its 1927 enrollment, i.e., from 41 to 76 permanent and temporary employees. Of this number 62 were employed in Ottawa, and 14 at the Victoria office. In addition to the surveyor general and chief, and the senior hydrographer, other hydrographie classifications included hydrographers 3, (Ottawa 25, Victoria 12); tidal and current surveyors 3 (Ottawa 2, Vancouver 1); precise water levels, 7, in Ottawa; chart construction, 15 (drafting 10, engravers 5) in Ottawa; clerical and stenographic, 11 (Ottawa 10, Victoria 1) - a total of 76 personnel [sic]. Ships' officers numbered 13 (Atlantic coast 9, Victoria 4); tide gauge observers, 9 (Atlantic coast 6, British Columbia 3); and river gauge observers, 39 (St Lawrence River, its tributaries, and Great Lakes). Overall personnel paid out of the hydrographie vote in the fiscal year numbered 137.

Of the 76 regular personnel, there were 62 permanent and 14 temporary employees - a ratio of 82 per cent permanent staff (slightly more that the 80 per cent permitted by civil service regulations). Ten regular staff members, and seven ships' officers in 1939, were to serve in the armed forces during the war years 1939-45. This represents about 13 per cent of the regular staff, and 54 per cent of the ship officers roster. When this war ended, three of the 1939 staff returned to the service (Messrs A.L. Mack, L. McDonald and G.B Staceyf?]); and three ship officers (Capt. D.M. Snelgrove, C. [?] and [?]).

Report Mines and Resources, 1939, 163.

When the First World War began, seven hydrographie ships were in commission (regular 6, chartered 1). When the Canadian Hydrographie Service was formed in 1928, the fleet had dwindled to three steamers, two remodelled houseboats, and one new cabin cruiser. This was technically the same number of regular units but far less gross tonnage than in 1914. During the depression years of the 1930s, ship construction was limited to one new houseboat, and one major ship replacement, and another cabin cruiser. Still the same six units as in 1939, but not with a further drop in gross tonnage.

In 1914, there were approximately one dozen open- and cabin-model survey launches in the hydrographie fleet. When the Second World War began, this figure had varied by little since then. Smaller units of the fleet now comprised the cabin cruisers *Boulton* (44 feet) and *Henry Hudson* (36 feet); and about fourteen 27-foot open and half-cabin survey launches (Atlantic coast 7, Pacific coast 7). On the Atlantic coast there was the Bayfield launch in storage at Charlottetown; the *Acadia* 3 (port, starboard and power dory); and *Carder* 3 (port, starboard and power dory). On the Pacific coast, the *Stewart* carried 4 launches (port 1, port 2, starboard 1 and starboard 2); and the houseboat *Pender,* 3. Survey launches to the end of the Second World War were better known as ship's launches, i.e., after ship establishments - *Acadia* port launch, *Carder* starboard launch, etc. Most of them, with the exception of the power dories, were equipped with the older MS 2 or modern MS 14 echo-sounding machines, and when the mother ship was absent for the duration, they continued the inshore recharting of coastal waters until its return. What the fleet lost in gross tonnage was more than compensated for by these smaller units, and with the aid of navigational and mapping improvements they were capable of a far greater charting coverage in one season than in any years prior to the 1930s.

The policy of restricted ship construction in this period was also offset with a noticeable increase in the production of charts and allied publications. As the hydrographie survey (1904-27) 164 Canadian charts and 4 volumes of sailing directions were published. Average chart production for this period was 7.1 charts per year, and one volume of sailing directions every six years. In contrast, during the period 1928-39, chart production increased from 167 to 315 editions; and sailing directions from 6 volumes to 13 *(Catalogue of Nautical Charts, 1939).* This was an average production of 12.3 charts per year, and one volume of sailing directions every one-and-a-half years. In comparison, these figures indicate an average increased chart production of 75 per cent above the years as the hydrographie survey. By 1939 many Canadian charts were being published by lithographic printing in the Department of the Interior, and since 1936 by the amalgamated Mapping Division of the Hydrographie and Map Service. In 1939, tidal and current reports numbered 11, and tide tables 9. Most of these publications over the years were prepared by the Tidal and Current Survey (even prior to its amalgamation in 1924) and were printed by the King's Printer. Publications of the Precise Water Levels Division included six new editions of water-level data for the St Lawrence River (above Quebec), its tributaries, and the Great Lakes. Finally, chart distribution in 1939 had increased 50 per cent since 1928, and was now double that of the depression years 1932,1933. Also, the distribution of Canadian pilots and sailing directions in 1939 was three-and-a-half times that of 1928.

Another yardstick of the service's growth up to the Second World War is to be found in the *Annual Reports of the Auditor General.* As the Hydrographie Survey of Canada(1904-27), the maximum yearly expenditure was $3 51,479 (1923), and the minimum was $87,608 (1918) giving an annual average outlay of $250,000. As the Canadian Hydrographie Service (1928-39), the maximum yearly expenditure was $565,721 (1930), and the minimum was $381,707 (1932), giving an average outlay of $430,768. This indicated the cost of operating the hydrographie service up to the Second World War had

increased by 72 per cent since the "golden era" as the hydrographie survey.

These comparative figures speak well for the hydrographie service in the first half-century of its history, but one wonders what its growth and potential would have been since 1883 had it not been dogged in subsequent years by two overseas wars (South African and European), the frustrating period of the 1930s and now what threatens to become a third major involvement for Canada - the Second World.