CHAPTER I

The Georgian Bay and Great Lakes Survey, 1883-1903

THE GEORGIAN BAY SURVEY UNDER STAFF COMMANDER J.G. BOULTON, RN, 1883-1893

CANADA'S FIRST HYDROGRAPHIC SURVEYOR

John George Boulton, was in his forty-first year, and had served in the Royal Navy some twenty-six years before coming to Canada in 1883 to commence the resurvey of Georgian Bay. Born in England 29 November 1842, he was in the RN before his fifteenth birthday. In December 1857, he was a master assistant to Capt. H.C. Otter, RN, HMS *Porcupine,* Survey of the West Coast of Scotland. In 1858 Capt. Otter was sent to Newfoundland where he took part in survey operations in connection with the laying of the first Atlantic cable in Bull's Arm, Trinity Bay.

When the Australian Colonial Survey was formed in 1860, it was placed under Commander H.L. Cox, RN, HM Steam Frigate *Curacoa,* with headquarters at Victoria. Master Assistant Boulton was then posted to this station where he remained until 1867. On 6 December 1863 he was successful in "Passing in Seamanship" and was then reappointed second master HMS *Eclipse* on this station. Before the month of December ended, he held this rank in HMS *Curacoa,* with the proviso "additional for Surveying Duties." During the Maori War in the Pacific Ocean, Second Master Boulton was detached from the Australian Survey for special work in New England. When the Admiralty oceanographic vessel HMS *Challenger* was in Australia during her world cruise, Second Master Boulton had the honour of being enlisted as one of her officers, from 1 October 1866 to June 1867 and as usual, additional for surveying duties.

Just prior to Canada's confederation, on 3 June 1867 Second Master Boulton was posted to the South African Station at the Cape of Good Hope, and was re-appointed navigating sub-lieutenant, HMS *Seringapatam,* the receiving ship at this station.[1] His appointment to *Seringapatam* was labelled "for Surveying Service," and he was paid as a second class assistant from 9 December 1867. On 1 January 1870, Navigating Sub-Lieutenant Boulton was advanced to the grade of assistant surveyor, first class. Then on

[1] In 1867 the ranks of master and second master were abolished, and renamed navigating lieutenant and navigating sub-lieutenant.

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account of illness contracted on the South African Survey, he sought permission to return to England, and this was approved by the Admiralty 12 July 1871.

The next tour of duty by this Admiralty surveyor was in what was now known as Canadian waters. On 10 April 1872, his name appeared among the list of officers of HMS *Royal Alfred,* the flagship of North American and West Indies Squadron, and as usual "additional for Surveying Service." He was then posted to the Newfoundland Survey, at that time in charge of Navigating Lieutenant Wm F. Maxwell, RN, in the hired steamer *Gulnare,* and with headquarters at Charlotte Town [sic], PEL Here Boulton was to remain until 1881. In the ensuing years, besides charting the sea-coasts of Newfoundland and Labrador, he assisted with the recharting of Port Hood Harbour, NS, in 1873, and Beaujeu Bank and Channel in the St Lawrence River below Quebec, in 1874. In 1875, Navigating Lieutenant Maxwell was promoted to the rank of Staff Commander, RN, (and to Staff Captain in 1893). It was not, however, until 7 June 1879 that Lieutenant Boulton attained this rank, still attached to the Newfoundland Survey under Staff Commander Maxwell.

In March 1880, the Newfoundland government requested the Admiralty's assistance for the fisheries investigation along the coast of Labrador, and Staff Commander Boulton was detached from the Newfoundland Survey and sent north to report "on the feasibility of surveying the coast from Nain to Chidley." As instructed, he embarked from Rigolet in Hamilton Inlet early in August on the Hudson's Bay [Company] northern supply steam-vessel, and made a return voyage to Fort Chimo in Ungava Bay. Davis Inlet was visited twice, and Nachvak Bay once. Many prominent headlands and uncharted islands along this coast, including Cape "Chudleigh" (Chidley), were positioned. Plans for several small harbours and fishing anchorages were made, and the coast pilots amended. In a letter to Staff Commander Maxwell dated 26 April 1881, the Hydrographer stated, "the labours of Staff Commander Boulton on the coast of Labrador in 1880 are being embodied in charts and a hydrographic notice, and I hope these will be ready before the fishery season on that coast next season." Upon receipt of instructions from the Hydrographer, Staff Commander Boulton and his family returned to England 28 July 1881, so that he might take his examination in pilotage for first-class ships.[2]

Following this examination and a brief period of leave, Staff Commander Boulton

[2] For the reader unfamiliar with the rank structure of the 19th century Royal Navy, an explanation may he helpful. The responsibility for the safe navigation of warships in the age of sail had always rested with the master, who was appointed by a warrant from the Navy Board. These officers were always subordinate to lieutenants, the most junior of the "sea officers," who held commissions from the Admiralty. Although the Navy Board was abolished in 1832, the rank structure and standing of those responsible for navigation remained. As noted above, the rank of master was abolished in 1867 and a category of navigation officers (similar to the distinction made for engineering and other branches) was created. The ranks were designated navigating sub-lieutenant, navigating lieutenant, staff commander (the creation of a separate rank of lieutenant commander for lieutenants over eight years seniority was not formalized until the First World War) and staff captain. Navigating lieutenants were expected to qualify for "ships of the first class," which meant large warships drawing 26 feet or more. Promotion to staff commander and staff captain was by selection. A further change in 1879 gave navigating duties to officers of the executive branch who had been specially trained.(Such officers were designated (N) as a gunnery specialist was designated (G).) The navigating branch was not disbanded however until 1893. [Ed.]

was posted to the Survey of the West Coast of England in the hired vessel *Knight Errant.* Not too happy with this assignment, he petitioned the Admiralty on 24 October 1881 to be returned to North America and sent to Hudson Bay the following year in the Hudson's Bay steamer. To this request he was informed, "nothing can be said decisively, but your wishes for employment in this direction will certainly be kept in view." Again, on 7 June 1882 Boulton requested that he be appointed a "naval assistant" to the Hydrographer, but not having passed his pilotage examination sooner, the Hydrographer wrote him as follows on 3 October 1882, "without therefore intending to imply the slightest disparagement to your long service as an Assistant Surveyor - I am constrained to appoint an officer who has this service in having had charge of a Ship of War on active foreign service."

Probably aware of the Dominion government's request of the Admiralty for a surveyor to undertake the recharting of Georgian Bay, Staff Commander [Boulton] offered his service if such a Canadian survey should be undertaken. Then on 11 July 1883, he was recommended by the Admiralty to the Dominion government to commence the Georgian Bay Survey, with full pay and allowances as in the Royal Navy. He then left England early in August and arrived in Ottawa the 13th, where he reported to the deputy minister of Marine and Fisheries, Mr Wm Smith. Then, having discussed with departmental officials the conduct of this resurvey, he left the capital and arrived at Collingwood on 15 August. On 12 April 1893, Staff Commander Boulton severed his connections with the Department of Marine and Fisheries, but to 24 April his name was still being carried on flagships of the North American and West Indies Squadron, and as usual "for additional surveying service." The names of these flagships while he was in Canada were HMS *Northampton, 2* August 1883 to 1 March 1886; HMS *Bellerophon, 2* March 1886 to 23 March 1892, and HMS *Blake,* 24 March 1892 to 24 April 1893.

Upon his return to the Admiralty Hydrographical Office, Staff Commander Boulton served as a naval assistant to the hydrographer from 25 April 1893 to 11 February 1898. On 28 December 1896, he was promoted to the rank of staff captain, and at his own request he retired from active duty on 12 February 1898. He continued, however, with his work for an additional six months, and on 8 August 1898 left the Royal Navy with the rank of captain, RN, (Retired).

Following his retirement, Captain Boulton returned to Canada and took up residence in Quebec City. Here he resided until January 1909 when at the request of his former first assistant, Mr Wm J. Stewart, now chief hydrographer, he returned to Ottawa to write the first Canadian volume of sailing directions for the St Lawrence River from Quebec to Kingston. This work was written from surveys by the Public Works department 1896-1904, and the hydrographic survey 1904-1906. In January 1914 he again returned to Ottawa to rewrite a new volume of his original sailing directions for Georgian Bay and the North Channel, together with descriptions for the Canadian shores of Lake Huron. This was to be Captain Boulton's last official connection with the Canadian Hydrographic Survey (Hydrographic Service 1928), and on 24 May 1929 he died at Quebec City in his eighty-seventh year.

In 1884 when Boulton was in charge of the Georgian Bay Survey, the Dominion government decided to send its first expedition to Hudson Bay. A committee of the House of Commons sought his advice and recommendations on this matter, and it was to his credit

that most of his proposals were adopted by the government in detail. His suggestion that "there should be six or seven small parties taken out in the vessel, to be landed in the Straits, left all winter and picked up in the spring" was a major adoption. In later years, Dominion Hydrographer Mr R.J. Fraser wrote "it is notable that the Canadian Hydrographic Service's expeditions and exploratory surveys, 1910 to 1914, and others after the war [were] along the lines of Boulton's recommendations, and Gordon's *Neptune* expedition."

A writer of numerous technical and historical articles, Staff Commander Boulton also prepared two papers in the early 1890s which he read before the annual meeting of the Dominion Land Surveyors Association,[3] one of which was on the "British Government Surveys" and the other "Water Levels in the Great Lakes." But of all his writings, none was of more personal concern to him than the paper he read before the Historical Society of Quebec Sessions 1909-1910 on the "Life of Admiral Henry Wolsey Bayfield, RN, FRS." When, with Staff Commander Maxwell on the Newfoundland survey, he was stationed during the winter months at Charlottetown, PEI, he got to know "the Admiral" quite well before his death in 1885. In their frequent conversations, Boulton probably learned from Admiral Bayfield many first-hand accounts of hydrography about the waters of the Great Lakes - years prior to his own appointment as Canada's first hydrographic surveyor for these inland waters.

PRELIMINARY INVESTIGATIONS AND SURVEYS IN GEORGIAN BAY, 1883

When in Ottawa, Boulton was instructed to adopt Admiral Bayfield's shorelines in his charts, and to confine his surveys to the main steamer routes between Owen Sound in Georgian Bay, and Sault Ste Marie in the North Channels. After serious consideration of using Bayfield's shorelines, Commander Boulton strongly urged the Dominion government to undertake new surveys of the coasts, to which it reluctantly "acceded to." Upon his arrival at Collingwood on 15 August a week or so was spent in making numerous enquiries of sailing masters, pilots, and shipping authorities concerning unreported shoals, rocks and reefs, and the amount of lake traffic in these waters. This Commander Boulton later wrote, "to guide myself in selecting the area to commence the Georgian Bay survey, taking in all factors from the viewpoints of general navigation, shelter from autumnal westerly winds, and the United States Geodetic Survey position of Cove Island Lighthouse in the entrance of the Bay. It was therefore decided, to commence the survey on that portion of the bay which includes the entrance from Lake Huron and the North Channel."

With a few hired hands, he then left Collingwood for Killarney, Ontario (in the southern entrance of the North Channel), and while here awaiting the arrival of a departmental vessel a baseline was laid for a triangulation network - the first actual survey in the hydrographic service. Then with the aid of a few daily hired fishing-tugs, this network was extended some distance southwestwards towards Cove Island lighthouse. This central baseline at Killarney also served as a control for extending the Georgian Bay survey into the

[1] See *Canadian Surveyor*.

North Channel a few years later.

With no department steamer in sight by the end of August, and the season well advanced, Commander Boulton took it upon himself to charter from Noble Brothers of Killarney, for a period of forty-five days at $30 per day rental, the recently built fishing tug *Ann Long* - the first vessel to be used by the service for hydrographic work. The *Ann Long* was not a large vessel being only 45 tons gross (30 tons net) with dimensions of 72 feet in length, 16 feet in width, and a draught of about 6 feet. Her registry number in the Shipping Register was 78026, and she was listed as being a motor-screw vessel, built in Collingwood, Ontario in 1882. Of this vessel Commander Boulton later wrote that, "with sacrifice to his comfort, he was able to do as much work as with a larger and a more expensive vessel."

When the navigation season of 1883 ended, the following dangers had been accurately positioned in Georgian Bay: Dawson, Bernard, and Pulkey Rocks, and Bear's Rump. Harbours investigated were Tobermory (Collin's), Club Island, Squaw Island, Rattlesnake and Killarney. Shoreline examined included Wall Island; Wekemikong Bay and Cape Smith to Little Current on Manitoulin Island in the North Channel.

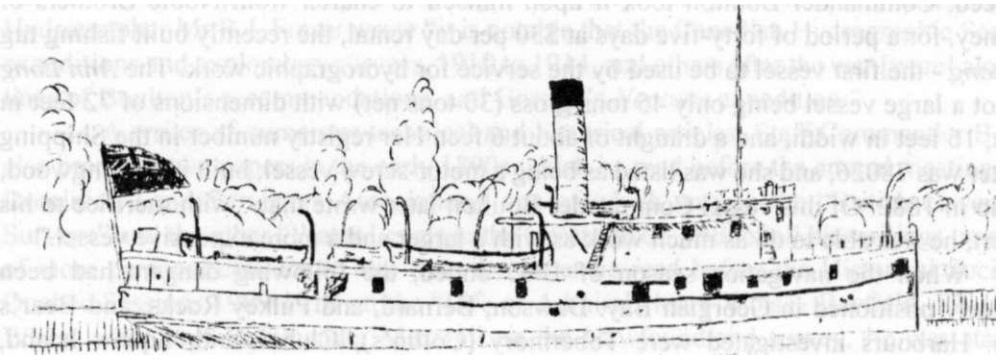
On 31 October Commander Boulton returned to Ottawa where he took up his first winter-quarters in the offices of the Marine and Fisheries on Parliament Hill (West Block). Here he began the writing of the first chapter of *The Georgian Bay and North Channel Pilot;* prepared field sheets and layouts for future surveys; submitted specifications to the government for a department survey steamer and recommended the appointment of an assistant surveyor. To commence the surveys of Lakes Superior and Huron the munificent sum of $5,000 was requested in the House of Commons,[4] but to the end of the fiscal year, 30 June 1884, this expenditure was increased to $6,000, with a large portion of it being spent on the purchase of new survey instruments.

CHARTING GEORGIAN BAY 1884-THE COMMENCEMENT OF ACTUAL HYDROGRAPHIC SURVEYING

Early in the spring of 1884, the Dominion government purchased for the sum of $15,000 its first hydrographic steamer, from Wm J. Murray of St. Catharine's, Ontario - the former American built tug *Edsall.* An amount of $4,000 was then spent on remodelling and refitting the *Edsall* for survey work, and when this was finished, by order-in-council dated 7 May 1884, her name was changed to *Bayfield* commemoration of the admiral who contributed so much to Canada's early hydrography in the Great Lakes and St Lawrence River from 1815 to 1856. On 22 March, Mr William James Stewart, lieutenant Canadian Militia, a "First Graduate" and gold medallist of the Royal Military College in Kingston, was appointed first assistant to Commander Boulton, with a salary of $550 per annum.[5] The first ship's officers

[4] *Debates,* 7 May 1883.

[5] The term "First Graduate," retained in the text with Median's initial capital letters, is redundant. As the gold medalist, he was the top graduating student of his year. The Royal Military College had been established on 1 June 1876; any suggestion that Stewart was a member of the first graduating class, the "Old Eighteen" as they are known, is therefore incorrect. It is interesting to note however that Stewart used all their names while



Bayfield 1
picture courtesy David Gray

appointed to the *Bayfield* were Captain Alexander M. McGregor, sailing master and pilot, and Mr Charles Linter, chief engineer. Captain McGregor was an experienced sailing master on the lakes, and was one of the first to sight wreckage of the ill-fated steamer *Asia* off the Limestone Islands in Georgian Bay. He is also believed to have lost a son in this tragic disaster, and spent considerable time in searching Georgian Bay for survivors. Such an experienced Captain was a most valuable asset to Commander Boulton this season. The *Bayfield's* ship's company comprised "thirteen working hands," and when survey and ship officers were added the total complement was about seventeen personnel. At the end of his first full season, Commander Boulton was able to write, "in the whole five months not the slightest suspicion of insobriety or disobedience occurred" - and this in the days of the lumber shanties and demon rum.

Surveys

On 25 April Commander Boulton left Ottawa with his newly acquired survey instruments from England, and first stopped at St Catharine's in Lake Ontario to supervise the necessary alterations of the *Bayfield.* He later wrote, "in order to get on my ground at as early a date as possible (the spring being now well advanced), exceptional means had to be adopted in the fitting out of HM Dominion Surveying Steamer *Bayfield.*" En route to Georgian Bay, posts were established at Port Dalhousie, to enable masters of vessels to adjust their ship's

engaged on the Georgian Bay survey. [Ed.]

compasses - the earliest account of hydrographic work in Lake Ontario.

On 26 May the *Bayfield* reached the entrance of Georgian Bay from Lake Huron, where with the aid of a "boat's crew" actual survey work was conducted in close detail to a scale of one nautical mile to the inch. The general limits of the first area charted was "bounded in the west by and including the southeast coast of Manitoulin Island, and on the east by the meridian running through Cabot's Head, as far north as the parallel of Cape Smith." Several channels between Lake Huron and Georgian Bay were well-surveyed, and plans made on a larger scale for Tobermory and Club Harbours. In his first annual report on the season's activities in Georgian Bay, Commander Boulton wrote, "the peculiarly irregular character of the bottom necessitated very close sounding, the number of miles being 4,120, and square miles 790. The number of miles of coastline charted was 150." On 28 October the *Bayfield* reached Owen Sound for her first wintering for hydrographic ships in the Great Lakes, because in the early years of the survey it was "the nearest harbour containing a dry-dock and other facilities for docking." In his annual report for 1884, Commander Boulton remarked "in these waters a steam launch would be of service," but no such mode of conveyance was used in the Hydrographic service until about the year 1907 when the survey of the St Lawrence River above Montreal was fast coming to a close.

Bayfield I sounding crew, 1884
photo courtesy CHS

Oceanography, 1884

During the course of his survey duties, Commander Boulton frequently found time to make oceanographical observations by the Hydrographic service in Georgian Bay[6] and reported "specimens of the bottom were brought up in 1884, containing some very interesting diatoms of siliceous casts of minute plants." These specimens and other observed data such as air and sea temperatures were sent to the Acting Director of the Geological Survey for study and analysis.

In the winter 1884-85, of Commander Boulton and his first assistant, Mr Stewart, were fully occupied in preparing for the engraver in London (under the auspices of the Hydrographer of the Admiralty) the first coast chart from resurveys to this time. For the fiscal year ending 30 June 1885, the munificent sum of $27,000 had been voted for the Georgian Bay Survey, and $26,745.54 was spent of the first full season of actual hydrographic charting, including the purchase of the steamer *Bayfield.*

FIRST PUBLICATION FROM CANADIAN RESURVEYS, AND CHARTING THE NORTH CHANNEL, 1885

Before the 1885 season of navigation opened on the Great Lakes, Chapter One of *The Georgian Bay and North Channel Pilot* was written by Commander Boulton, and published by the Department of Marine and Fisheries in Ottawa. This was the first official publication from Canadian resurveys, and it was issued to sailing masters on the lakes, free of charge. On 1 May before leaving Owen Sound, a second assistant, Mr D.C. Campbell, also a graduate from Royal Military College in Kingston, was appointed to Commander Boulton's field staff.[7] With a second assistant, Commander Boulton could now detach Mr Stewart and his boat's crew for inshore surveying and sounding - the first shore-party in the Hydrographic service.

Field work in 1885 was centred in the northwest area of Georgian Bay, to complete the unfinished work in that region. When this was completed, the survey was then extended westwards into the North Channel as far as Clapperton Island - the first actual recharting in the North Channel by the Hydrographic service. As to this work, Commander Boulton wrote, "the principle I have adopted is to confine myself to the present trade route, not feeling justified in putting the country to the expense of surveying water which, at present, a vessel has no inducement to pass. Should minerals be discovered, or other industries spring up, it will be an easy matter to extend the survey over the particular locality, and with the contingency in view, the centres of the main triangulation stations have been marked by broad arrows into the rocks or iron bars driven into the soil." This was the first reference to survey markers by Commander Boulton in any of his annual reports to this time.

On 31 October the *Bayfield* returned to Owen Sound. Much of the season's success was attributed by Commander Boulton to the chief engineer, Mr Charles Linter, who "has

[6] M&F. 1886.

[7] Three hydrographic officers were to be regular field staff of the Hydrographic service until 1904.

paid the same unremitting attention to his engines, and deserved great credit for the comparatively small consumption of coal (200 tons), considering that there was scarcely a day on which the steamer was not under weigh."[8]

That fall the *Bayfield* was visited by the deputy minister of Marine, Mr Wm Smith, and during his visit Commander Boulton took the opportunity to point out to him certain essential repairs that were necessary if the recharting of the exposed north coasts of Georgian Bay were to be undertaken. Also alterations were needed to give a cabin to the second assistant, and to make the ship generally more comfortable.

FIRST CHART FROM CANADIAN RESURVEYS, AND REMODELLING THE STEAMER *BAYFIELD,* 1886

Early in the spring of 1886, the *Bayfield* was "housed-in" to give her more freeboard and additional accommodation. A portion of her hull was also removed, and when remodelled the outlay amounted to $5,1 17.36. She could now accommodate two boats, crews, and a total ship complement of about twenty-three personnel.

Before the opening of navigation Chapter Two of *The Georgian Bay and North Channel Pilot* was in the hands of chart agents on the Great Lakes. What was more significant, sailing masters also had their first coast chart of the lakes from Canadian resurveys No. 906 "Cabot Head to Cape Smith and Entrance to Georgian Bay," published at the Admiralty 15 February 1886 under the Superintendence of Captain W.J.L. Wharton, RN, Hydrographer. This was an engraved chart drawn on a scale of 1*'A* nautical miles to the inch approximately, with insets on a larger scale for Tobermory, Rattlesnake and Club Harbours. Concerning this chart, Commander Boulton commented, "the Admiralty published these charts at their own expense, the price was fixed at two shillings, which is very reasonable, if bought in London, but when purchased in Western Ontario the price rises to $ 1.25, causing considerable dissatisfaction to purchasers, especially when accustomed to free distribution of the United States charts of American Waters. I mentioned this fact to the principal if not the only importer in Toronto, and he informed me that it would not be worth his while to handle them [if] did he sell them at a lower figure, mentioning the fact that he had to pay a duty of twenty percent."

In the summer of 1886, the *Bayfield* began recharting the exposed north shore of Georgian Bay from Collins Inlet to Byng Inlet (off which the steamer *Asia* foundered 14 September 1882). That season the *Bayfield* encountered her first grounding, and of this sector of the coast Commander Boulton wrote,

> this shore possesses all the characteristics unfavourable to the hydrographical surveyor. In the first place, the coast has by some mighty agency been broken into countless low islets and rocks. The back country is thickly wooded and perfectly flat, a combination which rendered a

* In March 1886 Mr Finlerdied suddenly, and he was replaced by Mr John Nisbet. who remained chief engineer of the *Bayfield,* and her replacement, until the resurvey of the Great Lakes ended in 1920.

> regular triangulation over some portions impracticable. Harbours, to serve as bases of operation, were few in number and difficult to approach. The shore being likewise studded with sunken rocks rising from the bottom very abruptly, made navigation in the vessel while attending on the boats very precarious, but by steaming slowly, keeping a good lookout and continual use of the lead, the vessel only struck one and without any serious result. The broken up character of the shore renders it impossible to measure the number of miles of coastline surveyed.

A special plan was made of French River this season on a scale 3 inches to the mile, and about it Commander Boulton remarked, "the survey of this portion of the northeast shore of Georgian Bay will principally benefit vessels trading to Collins Inlet, French River, and Byng Inlet for lumber and logs."

When the weather in Georgian Bay became too inclement in the fall, the *Bayfield* proceeded to the more sheltered waters of the North Channel. This year [1886] Commander Boulton was instrumental in having the Department of Public Works install a monumental block of stone near Little Current on Manitoulin Island, for the resurvey of this channel. Concerning this first record of a benchmark Commander Boulton wrote, "the leveled top of this being 6 feet 9 inches above mean summer surface level of the water, these figures have been engraved up on the top of the stone to serve as a permanent benchmark for future references and comparison".

HYDROGRAPHIC SURVEYING IN THE GREAT LAKES, 1883-1903

Before continuing with this story, it might be well to outline some of the methods and practices of surveying introduced to the Hydrographic service by Commander Boulton in its formative years. These practices pertain particularly to land or coast surveying, inshore and offshore sounding, the graduation of the finished chart, and difference between the Admiralty and United States methods of hydrographic surveying.

> Having determined upon the scale, the next thing is to find a place suitable for measuring a small base, and a good opportunity is afforded for this while traversing the coast in connection with the main triangulation. Having measured our small base, we proceed to throw as good a triangulation over the projected season's work as the natural features of the coast will permit. During the season, the latitudes and longitudes of two extreme points are obtained, and by means of these the chart is measured in the winter in the office. The astronomical distance calculated between these two extreme points determines the scale, and should agree closely with the assumed scale from the small base.
>
> While the triangulation is being carried out, principally by the chief, his assistants are sketching in the coastline in the boats. This consists in pulling from point to point with a patent log astern, the index being on the

rail of the boat, and offsetting by estimation when they do not exceed a distance of 100 yards. Over that amount a patent log distance is run from the original line.

The boats are run about 200 yards apart and at right angles to the general trend of the coast, unless the shore runs nearly east and west, north and south, when the lines are run in these directions for appearance sake. The boat soundings are run out to a depth of seven fathoms, or if the shore is very steep, to a distance of 400 yards. This gives the ship safe room to turn in changing her lines. He also takes sextant, station-pointer, protractor, tracing paper, dividers and pencils.

For the sectional soundings of a large shallow bank a long way offshore, we make use of two or three flag buoys. In Georgian Bay, where there is very little current, with the error of the compass ascertained, a tolerably calm day and good helmsman, keeping on line is not a difficult matter. Where the depth does not exceed 24 fathoms the ship steams steadily on, at about 5**'/2** nautical miles per hour. The sounding machine with a lead from 25 to 40 lbs. attached to it, is hauled out by a traveller, on a wire rope, to the bow of the vessel. It is detached from the traveller by a tripping line when a cast is wanted. The line travels through the hand of a man aft and at a depth of over twenty fathoms, the lead would be fifty or sixty feet astern of the vessel before striking the bottom. An experienced and attentive sounder easily notices the slacking up of the line, which is then brought up to the steam winch and hove up. The bottom of the lead being armed with clean tallow before the cast, the sounder's opinion of the lead being down is corroborated by the nature of the bottom brought up. The interval between the sounding is regulated by an ordinary time-piece, with a second hand. With a level bottom of twenty fathoms, an interval of three minutes gives a distance of about a quarter of a mile. The soundings are carried offshore as far as the landmarks are visible.

As far as I know, the boat sounding of a piece of coast by American surveyors would entail the services of three officers, perhaps four, two in the boat and two with theodolites at the shore beacons to fix the boat by intersecting lines at preconcerted signals. With us the one officer steers his boat, fixes his position, records his sounding unassisted. We usually alternate times in the boats keeping abreast of each other as well as we can.'

The last seasons when sailing gigs, or whalers, were used for inshore coast charting in the hydrographic Service were as follows: Pacific coast, 1907, and Atlantic coast (Gulf of St. Lawrence) about 1935.

' Boulton, *Canadian Surveyor.* 1890.

FIRST CANADIAN CHART FOR THE NORTH CHANNEL, 1887

Before leaving Owen Sound to commence the field season of 1887, the *Bayfield* established beacons in the entrance of this harbour to enable masters of vessels to adjust their magnetic ship's compasses. She then proceeded to the North Channel with a party of twenty-nine officers and men, and arrived at Spanish River on 12 May. The vessel being too small to accommodate the whole party, Mr Stewart and his boat's crew went ashore and remained under canvas until the end of September, surveying the north shore of the Channel from Clapperton Island to Mildrum Point, and tied in the work in the western part of the Channel with the "accurately determined position of Point Detour Lighthouse by the United States Government."

This year the Admiralty published the first chart for the North Channel, a companion chart to No. 906 for the entrance of Georgian Bay - No. 907 "Georgian Bay to Clapperton Island," with insets for Little Current and Killarney Harbours, dated 20 May 1887. This edition was also an engraved coast chart drawn to the same approximate scale, 1 *'A* nautical miles to the inch.

ICE CONDITIONS AND OCEANOGRAPHY IN GEORGIAN BAY, 1888

The field season of 1888 was spent on the southwest shore of Georgian Bay between Cabot's Head and Point Rich, and included surveys of McGregor, Lion's Head and Owen Sound Harbours. Before taking up this work, the *Bayfield* left Owen Sound on 7 May to complete a few weeks of unfinished work in the North Channel. En route, Mr Stewart and his boat's crew disembarked at McGregor Harbour. On passage to Killarney, Ontario, to pick up a few workmen the *Bayfield* was continually "beset with ice for 96 miles of our passage to Gore Bay, some of which I estimated to have been 20 feet thick caused by one floe being hoved [heaved] on top of another by the sea, and welded together." Killarney was reached on 10 May and here two men "walked off the ship on the ice, a usual phenomenon at that date."

Commander Boulton further reported "on my way to Cape Croker, Bruce County, to take up the new work, I took a line of soundings across Georgian Bay, which shows a gradual and regular down-grade in the floor of the bay, until the coast of the Saugeen Peninsula is reached. The bottom is principally composed of a very fine pink or drab coloured ooze."

SHIPPING IN GEORGIAN BAY, 1888

An indication in the growth of shipping on the upper Great Lakes to 1 888 is contained in Commander Boulton's further remarks, "the volume of the grain trade between Chicago and the ports of Collingwood and Owen Sound, in sailing vessels and steam barges, seems to be steadily increasing, and two additional passenger steamers were put on last summer between the last mentioned port and the North Channel of Lake Huron. A shipyard for the building of first class iron steamers has been established at Owen Sound, which together with the impending enlargement of its harbour, and the gradual improvement of the harbour of

Collingwood will, I think by and expansion of trade consequent thereon, prove that the survey of this season was not undertaken too soon." During the season of 1888, 100 miles of shoreline were surveyed; 1360 miles of ship sounding, and 784 miles of sounding by the boats, were completed.

In 1889 the *Bayfield* was back on the northeast coast of Georgian Bay working between Byng Inlet and the Limestone Islands, and that summer Mr Stewart and his boat's crew reached the western end of the North Channel where they charted certain areas of St Joseph Channel. This was an exceptionally rough year for the *Bayfield,* and about this sector of the Georgian Bay coast Commander Boulton remarked, "several new dangers were discovered, notably a bank with only 9 feet of water over it [presumably Kennedy Bank], lying in the track of ships, and four miles distant from the nearest island, showing the necessity of these waters being sounded without delay." Commander Boulton continued,

> work on this portion of Georgian Bay must necessarily be slow, for a more broken-up coastline it is impossible to conceive, and the same up-and-down character of the bottom is extended to sea for two or three miles in the shape of many dangers very hard to find by the ordinary methods of hydrographical surveying ... the only way to navigate a coast of this exceptional character is to adhere exactly to the leading marks given on the charts and sailing directions, and not to make too free with this uneven bottom, though the chart may show more than sufficient water. Sounding in the dark waters of the northeast coast of Georgian Bay where a rock with only 6 feet on it cannot, at time, be seen, is only groping about in the dark at the best, and although our lines are sometimes only 100 yards apart - not a great distance, when the enormous expanse of the lakes yet unexamined is considered it sometimes happens that no indication of a rock is given with the lead. I mention this fact to show that hydrographical work cannot be hurried excepting at the risk of leaving out dangers, entailing the loss of the reputation of the officer in charge, and perhaps of valuable lives.

During this season, some 580 nautical miles of sounding were made by the boats, and 520 by the steamer, but "the broken-up character of shore prevents any estimate being formed of the coastline sketched." At the end of the season of 1889, Commander Boulton estimated that it would take three more years to complete the survey of Georgian Bay and the North Channel, and in his annual report wrote "the United States government completed the survey of their shores in 1881, taking forty years, with a staff three times as large as mine, and spending $2,977,000 over it."

CLOSE OF THE NORTH CHANNEL RESURVEY, 1890

In the first week of May 1890, the *Bayfield* built a series of beacons along the northeast shore of Georgian Bay to assist navigation of the inside channel from Parry Sound to Pointe au Baril (where the survivors of *the Asia* landed 15 September 1882). This enabled steamers to

avoid fifteen miles of rough water outside. Buoys were then placed for the first time on Black Hills Rock [Black Bills Rock], and another near the entrance of Byng Inlet. The ship then proceeded to the North Channel where she worked until 8 August between Mildrum Point and Bruce Mines. Later Commander Boulton reported this season "the finest yet experienced," and in his annual report dated 20 October 1890 wrote, "a vessel can now proceed from Owen Sound to Sault Ste Marie a distance of 200 miles over recently surveyed waters."[''] When the North Channel survey ended, the *Bayfield* returned to Georgian Bay and called at Owen Sound to refuel. She then returned to Parry Sound for the remainder of the season where the whole party worked between the Limestone Islands and Moose Point, including channels leading to the town to Parry Sound. Commenting on this coast, Commander Boulton remarked, "the general outside traffic along this coast, the numerous islands and occasional inside channels are inducing tourists to make it a summer resort.""

In 1890, the number of nautical miles charted was 480; lineal miles of sounding by the vessel 1,240, and by boats 850.

FIRST SURVEY BEYOND THE GREAT LAKES, AND WATER LEVELS IN THE GREAT LAKES, 1891

In the first week of May 1891, the *Bayfield* returned to the northeast shore of Georgian Bay to resume the survey between the McCoy Islands and Moose Point, including several channels in Parry Sound. This work consisted in sounding the shallow waters in two open boats, while the deeper water was done from the vessel. The number of nautical miles sounded by the two boats was 1,320 and the vessel, 860. Commander Boulton later wrote, "this section is the most broken-up portion of the whole north-east coast of Georgian Bay, there being upwards of 4,000 islands and dry rocks on the coast surveyed last season. Numerous sunken rocks were found, several lying at a considerable distance off the outer islands, and in the track of general navigation. Many of the dangers of this Laurentian shore, rise abruptly from the bottom, necessitating very close sounding to make sure of not missing them. The light draught mail steamer from Midland and Penetanguishene, uses the passage southeastward of Parry Sound, known as the South Channel."

RESURVEY OF BURRARD INLET, BC, THE FIRST CANADIAN SURVEY ON THE SEA-COASTS

In June 1890, while outbound for the Orient from Burrard Inlet, BC the Canadian Pacific Railway steamer *Parthia* touched a shoal without incurring serious damage. This was later reported by the Pilot Authority in September. An investigation of this area was then

''' With the completion of the North Channel survey, official instruction given to Commander Boulton six years previously, had now been duly carried out.

" In 1961 and 1962, CHS published Canadian charts 2203 and 2204 that were specially designed for use by small-boat operators, and covered the inner passage of Georgian Bay, from Parry Sound to Killarney, with insets of harbours and intricate passages at a larger scale.

conducted by Lieut. Barrett, RN, in the steam cutter HMS *Amphion,* and from it a resurvey of this inlet was recommended "in view of the fact that large vessels with heavy draft of water are now entering Burrard Inlet."[12] By an order in council dated 4 November 1890, this survey was recommended to Her Majesty's Government by the Dominion government, and a favourable reply was received 5 March 1891 "agreeing with the proposal of the Dominion Government." Mr Wm J. Stewart, first assistant of the Georgian Bay Survey under Staff Commander Boulton, was then sent to the Pacific coast to carry out this resurvey.

As instructed, Mr Stewart left Ottawa 2 April for Owen Sound to pick up a few experienced workmen, and then continued his journey to British Columbia arriving at Vancouver on the 21 April. Here he was loaned a gig or whaleboat by the naval authorities at Esquimalt, and until 25 September made good use of it in resurveying Burrard Inlet and Vancouver harbour - the first salt-water survey in the hydrographic survey. Later he reported to Commander Boulton that he "traversed principally on foot, 75 nautical miles of shoreline, and sounded 450 miles." Mr Stewart also installed the first tide-gauge in the Service this season.[11] This gauge was placed on the west end of the Canadian Pacific Railway wharf, where from 21 April to 2 July continuous day and night observations were made and from which a datum was determined for sounding reduction purposes. This datum was "the same as the Railway Company Engineers have used for their improvements around the wharves." Tidal comparisons were observed at Point Atkinson, Vancouver and Port Moody, and the current was found to be "very strong all over the inlet, often too much for boat work even in a large bay like English Bay, where its direction was very uncertain." Magnetic observations were also taken for variation of the compass needle at Point Atkinson, English Bay, Port Moody and Seymour Narrows.[14] In later years referring to his work in Burrard Inlet, Mr Stewart wrote, "I lived in hotels and had five men and a tide-watcher." The sum voted for the Burrard Inlet Survey was $2,500, but to the end of the fiscal year ending 30 June 1 892, $2,580.45 had been spent on this first coast survey.[15]

UNUSUAL WATER LEVELS IN THE GREAT LAKES, 1891

In his annual report dated 10 November 1891, Commander Boulton wrote,

> the absence of the usual summer rise of water was an unusual phenomenon, and whatever the cause, was attended with serious consequences to shipping, not merely in the vicinity of my work but in the shallow channels of the lakes generally. I think myself that the low water which has existed

[11] M & F Report 1890. 75.

[12] This was two years prior to the appointment of Mr Wm Bell Dawson as Canada's First tidal surveyor in the Marine Department.

[14] Second Narrows? [Ed.]

[8] In March 1893. the Admiralty published chart No. 922 " Burrard Inlet," from a resurvey by Mr Stewart in 1891. Since it also embodied hydrography from previous Admiralty surveys, particularly that of Capt. G.E. Richards. RN, in 1859, it cannot be considered to be the first chart from a complete Canadian resurvey.

for the past four years, culminating in the low dip of the past summer is only temporary. From records kept by the Public Works Department at Little Current, Algoma, and at Milwaukee by United States engineers, it would appear that the water was, between 1881 and 1887, as much above the average level as it is now below it. I think therefore, that during the next few years the water will be up again.

However, as long as we have to rely only upon the fickle memory of the oldest inhabitant there will always be an element of uncertainty as whether the waters of the lakes are subject to temporary fluctuations, or are steadily lowering their level. I would, therefore respectfully suggest that datum stones be erected, say at Collingwood, Sarnia, Port Colborne and Kingston, similar to that placed at my suggestion in the interest of the survey, by the Department of Public Works, at Little Current, Manitoulin Island. That your agents at the ports mentioned, be instructed to note the height of the water at least once a day during the season of navigation.

AN ACT RESPECTING TECHNICAL WORK IN THE DEPARTMENT OF MARINE AND FISHERIES, 1892

With the publication of the first volume of sailing directions in 1892, *The Georgian Bay and North Channel Pilot,* the formative years of the hydrographic service were just about over. On 12 April 1892, an *Act (55-56 Vict. Chap. 77) Respecting Technical Work in the Department of Marine and Fisheries* was assented to, and assigned to this department all such work as tidal observations on the coasts of Canada, and hydrographic surveys. Officially, this meant that the Georgian Bay Survey under Commander Boulton was placed under the immediate direction and supervision of the chief engineer, Mr Wm P. Anderson, who also was named general superintendent lighthouses and hydrographic service. Other relevant duties now under the Chief Engineer's Branch were the examination of water-lot applications in the interests of navigation, and the preparation and publication of Notices to Mariners and hydrographic notes acquired from sailing masters on inland and coastal waters. With this departmental reorganization, Commander Boulton's employment with the Dominion government was fast drawing to a close, but his two assistants who had been on the Outside Service of the department to this time were now eligible for appointment to the Inside Service of the department's civil government list - the first progressive move of the hydrographic service since it began in 1883.

LAST FIELD SEASON, COMMANDER BOULTON, 1892

Aware of the new departmental changes before leaving Owen Sound in the last week of April, Commander Boulton's first activity this season was to lay out a measured mile at this lake port to test the speed of government police vessels being built at the Poison Works. On 4 May the *Bayfield* departed for Penetanguishene to disembark Mr Stewart and his shore party. For the remainder of the season, surveying was centred in the southeastern area of

Georgian Bay between Moose Point and Waubaushene, including Christian Islands. Later Commander Boulton wrote, "it will take the middle of next summer to complete this chart." He further stated, "sufficient of the above-mentioned section has been done to show that the head waters of Georgian Bay contain several excellent havens, such as Victoria Harbour, Midland and Penetanguishene, the approaches to which are comparatively free from outlying dangers. Although not so favourably situated as Parry Sound, with regard to shortness of distance, 1 am of the opinion, all things considered, that this locality is the best suited for a transcontinental port in connection with a line from Montreal, and I think it quite likely that the favourite Georgian Bay route will finally settle down into this locality."

On 28 October the *Bayfield* returned to her winter port of Owen Sound to bring to a close nine full seasons of active charting under the command of Staff Commander Boulton. This was also to be the last field season for his second assistant since 1885, Mr D.C. Campbell, who upon his return to Ottawa was transferred from the Outside Service of the Georgian Bay Survey to the Inside Service of the Chief Engineer's Branch. This was the first occasion when a field officer in the hydrographic service was transferred from field to permanent office duties in Ottawa.

In his last annual report dated 24 October 1892, Commander Boulton remarked that there still remained to be surveyed the east shore of Nottawasaga Bay, about thirty miles, and again about twenty miles of shore between Collingwood and Owen Sound. "Two more seasons should complete the survey of Georgian Bay and North Channel of Lake Huron. The total number of nautical miles of coastline surveyed has been about 2,560; the boat sounding amounts to 8,224, while 9,203 miles have been sounded in the ship. The cost of this has been approximately $ 188,000 giving an average value of $73 for each mile of coast surveyed. The United States have about the same quantity of lake coast as Canada, their survey was commenced in 1841 and finished in 1881, the total cost being ... (2% million dollars)."

THE GEORGIAN BAY SURVEY UNDER MR WM J. STEWART, 1893-1894

On 12 April 1893, Staff Commander Boulton officially relinquished his command of the Georgian Bay Survey to his first assistant since 1884, Mr Wm J. Stewart, and returned to the Admiralty Hydrographical Office in London. Before the *Bayfield* left Owen Sound for the season's work, Messrs F. Anderson and J.F. Fraser were transferred from the Chief Engineer's Branch as first and second assistant to Mr Stewart respectively.[16]

As instructed by the chief engineer, Mr Stewart proceeded to the southeast coast of Georgian Bay to continue the survey "on the same general lines" as adopted by Commander Boulton. With a party of twenty-two officers and crew, the *Bayfield* worked in 1893 between Hope Island and Moose Point, to a line four miles west of the Christian and Western Islands. In his first annual report to the chief engineer dated October 1893, Mr Stewart wrote "as a result of careful examination of the various channels, it may be said that did business warrant

"' Both Mr Anderson and Mr Fraser had been appointed clerks in the Department of Marine and Fisheries in September 1892. and replaced Mr Stewart and Mr Campbell.

the expenditure, channels could be buoyed into various harbours as we found necessary for the economical prosecution of the work. The *Bayfield* drawing lOVi feet water, used the inside channel continually showing that by the aid of a few buoys, the local boats trading between Collingwood, Midland and Killarney could use this channel and avoid the heavy seas that often roll in between Hope Island and the 'umbrella.'" During this season Mr Stewart made two trips to Parry Sound to point out to the contractor the position for the new lighthouses. For the remainder of the season of 1893, work was centred on the south coast of Nottawasaga Bay to extend the triangulation of Collingwood and approaches to Point Cockburn, and then to Cape Rich, thus completing the main triangulation of this Bay.

THE SURVEY OF BAY OF QUINTE, LAKE ONTARIO, BY THE CHIEF ENGINEER, DEPARTMENT OF MARINE AND FISHERIES, 1893 AND 1897

With the completion of the Murray Canal at the head of the Bay of Quinte in 1889, the volume of steam traffic in this region of Lake Ontario increased greatly. With Mr Stewart fully occupied with the Georgian Bay Survey in 1893, and the demand for a good chart for these waters imperative, the chief engineer, Mr Wm P. Anderson, undertook this hydrographic survey on his own - the most significant resurvey of the Great Lakes to this time, other than by Commander Boulton and Mr Stewart. During the months of February and March Mr Thomas Drummond, D.L.S. was engaged as a temporary assistant with the triangulation survey. In the summer months the Bay was sounded-out with the aid of a hired steam-yacht ($10 per day rental, including two men), and Mr F.A. Wilken as sextant observer. The total cost of this survey was $4,271.67, and his annual report to the deputy minister of Marine, the chief engineer stated, "the whole of the Bay of Quinte has been surveyed from the Murray Canal to Centre Brother Island, and the charts to be published will include work done by the American Government between Kingston and Centre Brother Island, in connection with the Murray Canal. It is proposed to publish the charts on two sheets of double elephant paper, on a scale of about 2,000 feet to an inch. These charts are now being prepared by the permanent staff of the department, and it is hoped they will be ready by the opening of navigation."

It was not until the spring of 1898 that the first of these sheets was published by the Admiralty - the eastern portion from Kingston to Desoronto. So as to expedite the publication of the second sheet to the westward, Mr J.F. Fraser was transferred from the steamer *Bayfield* to Mr Anderson's permanent staff in Ottawa. During the summer of 1898, Mr Fraser worked on this sheet, as far west as Presqu'ile Bay and Weller's Bay, and in October assisted Mr Anderson with further survey work in this region. This second sheet was then published by the Admiralty in March 1900. Its long delay Mr Anderson reported to be due to "pressure of work in the draughting room here, when the fair sheet was sent to England it was lost in the wreck of the *Labrador,* and lastly the cartographers of Admiralty are always crowded with work."

CANADA'S FIRST TIDAL AND CURRENT SURVEYOR - MR WM BELL DAWSON, C.E., 1893

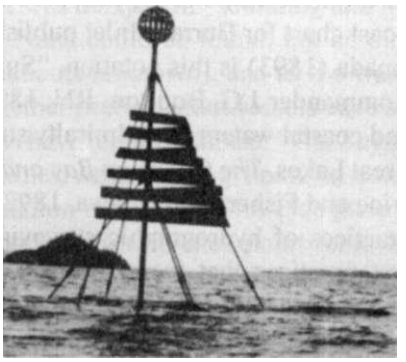
Before the calendar year 1893 ended, another important appointment of hydrographic significance was made in the Chief Engineer's Branch, when on 1 December 1 Mr Wm Bell Dawson, C.E., was named engineer-in-charge, tidal survey, and placed in charge of all tidal and current surveys on the sea-coasts. For some years that followed, the tidal service under Mr Dawson was listed in annual reports of Marine and Fisheries under the sub-heading "Ocean and River Service," whilst hydrographic surveys under Mr Stewart were sub-listed under "Scientific Institutions."[17]

CLOSE OF GEORGIAN BAY SURVEY AND FIRST SURVEY OF LAKE HURON, 1894

In the months of May and June, the steamer *Bayfield* and her two boats' crews were engaged in sounding Nottawasaga Bay on the south coast of Georgian Bay. Then according to instructions, Mr Stewart proceeded to the entrance of the bay from Lake Huron, to extend its survey westwards along the south coasts of Manitoulin and Cockburn islands "to meet the United States Survey at Drummond Island." This was the first actual Canadian survey of Canadian waters in Lake Huron.

Triangulation Surveys in Lake Huron, 1894

The triangulation survey of Manitoulin Island in the summer of 1894 presented quite a problem to Mr Stewart, and obliged him to make use of platform buoys to extend his network to the westwards. This was the technique adopted and in his annual report he wrote, "the south shore of Grand Manitoulin was found to be very low, much broken up, and densely wooded almost to the water's edge, trending so nearly in a straight line that an ordinary triangulation was out of the question. I therefore constructed a number of three-cornered platform buoys to support small and light tripods. These were moored offshore as far as could be conveniently seen from the low shore, and in this way a very satisfactory series of triangles were carried on, connecting Cove Island Lighthouse to the Duck Islands, a distance of fifty-four miles." In



A platform buoy
photo courtesy CHS

[17] Up to the year 1924 when the Tidal and Current Survey Division was integrated into the Canadian Hydrographic Survey, on each occasion the hydrographic survey was transferred to another department of the government, the Tidal and Current Survey Division was also moved to the same department.

addition to this important work, a large portion of the distance was coast-lined, and the necessary beacons erected for boat sounding. Mr Stewart further stated, "the survey of this part of the lake will be rather troublesome, as good shelter from prevailing westerly winds for a small vessel cannot be had between South Bay and Duck Islands. Such long runs in doubtful weather absorb a lot of valuable time."

CLOSE OF GEORGIAN BAY RESURVEY, 1894

When work in Lake Huron ended, the *Bayfield* returned to Nottawasaga Bay in Georgian Bay to complete the unfinished work in this area, and to bring the Georgian Bay Survey to a temporary ending. This season, in addition to the commencement of the Lake Huron survey, 1,210 miles of ship sounding and 670 miles of boat sounding were recorded. In his annual report dated 13 November 1894, Mr Stewart wrote, "the survey of Georgian Bay is now practically finished, there is only an area of 1,300 square miles, in the middle of the Bay, that has not been systematically sounded. In crossing and recrossing the Bay a few lines have been run and as no shoals have ever been reported within this area, it may be left till more important work is done in other lakes."[18]

With the survey of Georgian Bay now ended, Mr Stewart further wrote, "eleven seasons have been taken up in the survey of Georgian Bay and the North Channel, at a cost of about $215,000 (Report of Chief Engineer $215,389.21 and including cost of steamer *Bayfield),* but with the possible exception of Lake Superior, none of the other lakes will take anything like that amount of time or money." The expenditure of the final year of this survey amounted to $16,292.48.

From eleven seasons of hydrographic surveying to 1894, the Admiralty published thirteen general, coast and harbour charts for the Great Lakes, eight for the waters of Georgian Bay, and five for the North Channel. On all these editions appears the name of Staff Commander J.G. Boulton, RN. On the first coast chart for Burrard Inlet published by the Admiralty in the year of his departure from Canada (I 893) is this notation, "Surveyed by Mr W.J. Stewart, under the direction of Staff Commander J.G. Boulton, RN, 1891." In addition to navigation charts for Canada's inland and coastal waters this admiralty surveyor wrote the first volume of sailing directions for the Great Lakes, *The Georgian Bay and North Channel Pilot,* published by the Department of Marine and Fisheries in Ottawa, 1892. What was more significant were the techniques and practices of hydrographic surveying that Commander Boulton passed on to his successors, practices that were 'norms' for the Hydrographic service until the gasoline launch was introduced in 1924, and the gyroscope compass and echo-sounder since 1928.

[18] It was not until seventy years later, in the summer of 1964, that the centre of Georgian Bay was finally sounded. This was done by the survey vessel *Cartier.* which used, for the first time in the Great Lakes, the electronic distance-measuring instrument HI-FIX.

THE GREAT LAKES SURVEY UNDER MR WM J. STEWART, 1895-1903

In his annual report to the acting deputy minister dated 25 January 1895, the chief engineer made certain remarks concerning the "Hydrographic Survey of the Great Lakes," and stated, "the hydrographic survey of the Georgian Bay and North Channel, which was most urgently required, having been completed, it was decided to continue the work on the remaining Canadian waters of the Great Lakes. The use of deeper draught vessels and the increasing speed of steamers make the demand for reliable charts very urgent."[19]

LAKE ERIE, 1895-97

The survey of Lake Huron, begun in 1894, was temporarily discontinued, and consideration given to "take up the survey of the north shore of Lake Erie ... both because the quantity of traffic in the lake is important and the coast dangerous, and because the completion of this survey is a preliminary necessity to a correct definition of the international boundary line."[20]

As instructed, Mr Stewart left Owen Sound in the *Bayfield* on 1 May 1895, with a party of twenty-four officers and crew, and proceeded to Lake Erie. On passage, a call was made at South Bay, Manitoulin Island, to pick up some of the large platform-buoys used in Lake Huron the previous season. A line of soundings was then carried down Lake Huron to Nine-Fathom Bank, and while in Lake St Clair, half a day was spent in sounding around the "dump" from the dredging for the new United States government channel. This was the first Canadian hydrographic survey in Lake St Clair and it was made to locate a channel to assist local vessels trading between Chatham, Ontario and Windsor. A good channel with eleven feet of water was found by the *Bayfield* just south of the dump.

Point Pelee in Lake Erie was reached at noon on 4 May and until the 7 May Mr Stewart was delayed in "sounding and making enquiries about new shoals reported to exist there." None could be found, but he did learn that "several wrecks existed in the locality (whereabouts unknown), and as the water is not very deep for many miles off the point, it is altogether probable that vessels have at times bumped against these sunken hulls, and the captains have reported shoals." The *Bayfield* on 8 May anchored off an unnamed point, about thirty miles west of Long Point, to commence the season's work. Here one of the main triangulation stations [USLS Houghton] of the US Coast and Geodetic Survey placed in 1876 had every reference point removed; however, Mr Stewart was able to erect a new station within a few feet of the older one. Other USC&GS stations at that time were located at Long Point [USLS Long Point], near the mouth of the Grand River [USLS Grand River], and at Sugar Loaf Hill [USLS Sugar Loaf] (Port Colborne) and were found without

[19] M&F 1894, 83.

[20] This is believed to be the earliest hydrographic survey in connection with the international boundary between Canada and the United States. In 1907 Mr Stewart was appointed a Canadian representative to the International Waterways Commission which, in April 1903, began the compilation of a series of thirty boundary charts for the St Lawrence River and the Great Lakes. Up to the year 1925, monuments delineating this boundary were maintained by the Canadian Hydrographic Survey.

difficulty. The use of these stations, Mr Stewart remarked, caused "a large saving of time and money, and making our work more accurate than otherwise could be with a small staff and inferior instruments. In no case can a purely hydrographic survey hope to be as accurate as a special geodetic survey."

With the north shore of Lake Erie now triangulated and surveyed to thirty miles west and outside Long Point, the remainder of the 1895 season was centred between the inner bay of Long Point and Port Colborne. Boat work was extended from the shoreline "to a safe distance outside shoal water, that is an average distance of 214 miles." Ship sounding outside was carried to a distance of about eleven nautical miles from shore, "or as far as objects could be distinguished on the shore." The area sounded was 430 square miles, including 955 nautical miles in boats, and 290 by vessel. In addition, some 85 nautical miles of shoreline were traversed. The *Bayfield* passed through the Welland Canal on 23 October to winter at Port Dalhousie in Lake Ontario - the first wintering beyond Owen Sound.

In his annual report dated 5 November 1895, Mr Stewart stated[21]: "The shore of Lake Erie is unlike that of Georgian Bay in that there are no islands, and only small indentations but I found the portion examined this season fringed with dangerous reefs, often a long distance, 4 miles off shore. Whilst known reefs have been accurately charted, one very dangerous new reef has been discovered lying about 4 miles south of Nanticoke, and covered with only 7¼ feet of water."

WATER LEVELS LAKE ERIE, 1895

While the level of the water in Lake Erie has been very low, and a serious matter for the large craft using the lakes, records show it has been as low as previous years, in the winters of 1868, 1872, and 1873. However, at that time the low water was not a serious trouble, both because it occurred in the winter months, and because the vessels in use then were of shallow draught. Most of the large vessels in use now were built during a long period of high water, when, also, the canals and harbours were improved. On these accounts, we hear many complaints about the very low water, and the chances are that it will be lower than ever this coming winter. Various causes have been assigned for it, the clearing of the lands and the unusually small rainfalls of late years, no doubt, being the principal causes. There is a theory advanced that the deepening of the outlets to the Lakes have contributed to a serious loss of water, but while the inlets to Lake Erie have been deepened in late years, no outlets have been altered. On the above theory, the water of Lake Erie should have fallen less than of any of the other Lakes.

INAUGURATION OF UNITED STATES-CANADA CAR FERRY, 1895

At Port Dover this season, a line of ferry boats "to run the year round" was inaugurated,

[21] The typescript manuscript from which this has been transcribed does not have complete sets of quotation marks to mark both the start and finish of much of the material quoted here. Partial quotation marks and the verb tense combine to suggest that all the material indented was from the report of 5 November 1895.

connecting the Grand Trunk System here with the Pittsburgh and Shenango Railway, at Conneaut (Ohio), and in this way deliver coal into Canada.

HISTORICAL MAPS AND CHARTS, LAKE ERIE

This summer, Mr Stewart was fortunate enough to see a chart of Lake Erie by Admiral Bayfield dated 1818, on which the "present Long Point Island is shown as joined to the mainland." He also saw a map of a large portion of North America compiled by Joseph Bouchette (1815) where the present "gap" is marked "portage." A chart by Mr John Harris, R.A., (1839) shows a gap from the main part of Lake Erie to Inner Bay of Long Point. This gap was filled up in 1862, but afterwards dredged, and in 1895 was practically closed again.[22]

In the spring of 1896, the first chart of the Canadian shore of Lake Erie was prepared for the hydrographer of the Admiralty, and embraced that portion of the north shore from Port Colborne to Port Rowan, including Long Point, to be published on a scale of one-tenth of an inch to one mile. Before the *Bayfield* left Port Dalhousie to return to Lake Erie, she underwent extensive repairs. She then proceeded up the Wei land Canal to Lake Erie, and for the remainder of the season worked between Port Dover and Rhondeau Harbour. This season, no important shoals were discovered. However, owing to the character of the shore, a regular triangulation of the sector from Houghton Sand Hills to Rhondeau about sixty buoys for the apexes of triangles [were laid]. A great deal of inconvenience was encountered from the lack of harbours, "there being no good harbours between Long and Pelee Points." Headquarters this year were at Port Stanley. Heavy gales were experienced in May, July and September.

Water Levels, 1896

"The water on the Lakes has at least not shown any inclination, during the past season to drop lower than during its predecessor, but has rather improved, owing probably to the fact that we had far more rain in the summer of 1896 than 1895. It is sincerely to be hoped that the improvement will continue."

On 16 October the *Bayfield* returned to the North Channel of Lake Huron to examine a few reported dangers. When positioned, the results were published in a Notice to Mariners. On 24 October the *Bayfield* went into dry-dock at Collingwood for minor repairs and then returned to Owen Sound for the winter.

In his annual report of 1896, Mr Stewart stated, "with fairly good weather the survey of the Canadian shore of Lake Erie, from Port Colborne to Pelee Point should be completed by the first of September (1897). The balance of the Canadian shore was surveyed by the United States government about twenty years ago, and as no complaints have been made

[22] Mr Joseph Bouchette was surveyor general of Lower Canada (Quebec) at that time, and Mr John Harris, RN, had assisted Capt. W.F.W. Owen and Lt. H.W. Bayfield with the original Admiralty survey of Lakes Ontario and Erie in 1815 and 1816.

about shoals left out, there seems no necessity for a resurvey."

FIRE, WEST BLOCK, PARLIAMENT HILL, 1897

On 11 February 1897, a large portion of the roof of the West Block on Parliament Hill was burnt and destroyed many valuable documents and early records of the Department of Marine and Fisheries. At that time, the offices of this department were located in this building, with many of its early documents stored in a large room on the upper floor. This fact is herewith mentioned for its historical value, and probably accounts for many original hydrographic reports and documents [being] unobtainable today.

FIRST BRITISH COLUMBIA TIDAL RECORDS

In the West Block fire blueprints from the first tidal records by the Department of Public Works on the Pacific coast were destroyed. These records were for Sand Heads, at the mouth of the Fraser River, and Victoria and dated back to February 1895. Copies from the originals were then requested by the Tidal Survey, and these were supplied by the chief engineer of the Public Works. In September 1898 during a fire at New Westminster, BC, the original series was lost, and reprints from the copies sent to the Tidal Survey were then sent to Public Works. With the exception of one month, this series covered the period from February 1895 to July 1898."

CLOSE OF LAKE ERIE SURVEY, AND CHARTING LAKES HURON AND ERIE, 1897

In April 1897, the Admiralty published the first chart embodying Canadian resurveys for Lake Erie, an engraved edition No. 336 "River Niagara and Welland Canal" from latest United States and Canadian government surveys. That spring, two copies of the fair sheet "Port Colborne to Long Point" were drawn in Ottawa. One was sent to the Admiralty for engraving, the other to the United States Hydrographer in Washington. This was one of the earliest records of international cooperation between Canadian and United States hydrographic offices. Another sheet for the north shore of Lake Erie was only partially finished that winter from Long Point to Pointe aux Pins.

Before leaving Owen Sound to return to Lake Erie on 26 April 1897, Mr G.W. Hyndman was added to Mr Stewart's field staff. This date was the earliest start yet to be made by the *Bayfield.* On Lake Erie, the work of the previous autumn was resumed west to Point Pelee during the months of May, June and July that brought the first resurvey of Lake Erie to a close. In these months, 50 nautical miles of shoreline were traversed, 500 miles carefully sounded from the boats over shallow water, and 1,200 miles of ship sounding completed to an average distance of 12 miles from the shore. A careful survey of Rondeau Harbour was made, it being "the only harbour or refuge between Point Pelee and Long

[23] M & F. 27, 80. [n.d., t:d.**j**

Point." Very few shoals off this shore were found between Pointe aux Pins and Point Pelee, and only half a dozen within a mile of the shore between Morpeth Pier and the village of Clearville.

Mr Stewart later wrote, "it is intended to publish this survey in two coast sheets, the eastern one to embrace the east end of the Lake as far as the west end of Long Point, and the other taking the remainder. The first sheet should be on sale before the opening of navigation in 1898. The hydrographic survey of the Canadian shore of Lake Erie has taken two and a half seasons to complete, and has cost $38,608.95."

Lake Huron Survey, 1897

In the first week of August 1897, the *Bayfield* was back on the south shores of Cockburn and Grand Manitoulin Islands in Lake Huron, and a recharting survey of the north coast of this lake, from Drummond to Duck Islands and False Detour Channel, was actually started. On this sector Mr Stewart wrote, "in this area are many dangerous and little known reefs ... there are also many dangers in the channel through the Duck Islands that have never been charted ... it is intended to carry out the soundings to a distance of ten miles from shore." Careful observations for the declination of the magnetic needle were obtained at False Detour Channel, Burat, Great Duck and Outer Duck Islands, Cove Island, and at Owen Sound "with a new field unifilar magnetometer," and these declinations "will no doubt prove of great value in the preparation of future isogonic charts of the locality." The steamer *Bayfield* returned to Owen Sound on 25 October, making the longest season in the history of the survey and before returning to Ottawa, Mr Stewart made a careful resurvey of this harbour "as many changes had been made there since the last survey." During the winter of 1897-98 the preparation of the second edition of *The Georgian Bay and North Channel Pilot* was taken in hand.

A PACIFIC COAST HYDROGRAPHIC NOTE, 1897

In the annual report of the chief engineer of the Department of Marine and Fisheries dated 31 October 1897, is this interesting hydrographic note: "the master of the Dominion steamer *Quadra* has this year forwarded several hydrographic notes concerning British Columbia waters, including the location of several rocks and corrections of existing charts. The results of his work (Capt. J.T. Walbran) have from time to time been communicated to the Hydrographer of Great Britain and the United States, and embodied in our Notices to Mariners."[24]

[24] The steamer *Quadra* was employed in the general lighthouse and buoy service in British Columbia. She had previously made a special trip to the west coast of Vancouver Island for the purpose of collecting evidence in the Bering Sea arbitration. Early in 1893, she assisted the International Boundary Commissioner in distributing survey parties along the coast of Alaska. While in the command of the *Quadra,* Captain John T. Walbran made many valuable contributions to Canadian hydrography for the waters of British Columbia, but is best remembered today as the author *of British Columbia Coast Names 1592-1906,* published in 1909.

GEORGIAN BAY AND LAKE HURON, 1898

Before the 1898 field season began, a few changes were made in the field staff of the *Bayfield.* Assistant G. W. Hyndman resigned, and Mr J.F. Fraser, second assistant since 1893, was transferred to the draughting office of the Chief Engineer's Branch to complete the fair sheet for the Bay of Quinte, surveyed by the chief engineer in 1893. Mr Fraser was replaced by Mr R.E. Tyrwhitt of the draughting office, where he had been employed since 1895.[25] *Parry Sound Investigations 1898.* The opening of the Ottawa, Arnprior and Parry Sound Railway to Depot Harbour in Parry Sound, and the establishment of a line of large freight steamers in connection with this railway, made a survey of this area necessary to improve the aids to navigation for entering Parry Sound. On 25 April 1898 therefore, the *Bayfield* left Owen Sound and first proceeded to Parry Sound where she carefully examined the main steamer channel. She then established some temporary range lights, and rearranged the spar buoys. From investigations made, Mr Stewart reported in favour of the Carling Rock Channel (since adopted) in preference to the Gordon Rock Channel.

Lake Huron, 1898

On 4 May, the *Bayfield* reached the Duck Islands in Lake Huron and resumed the surveys of the south shores of Grand Manitoulin and Cockburn Islands. Until 10 July, the time was occupied in finishing the work west of the Duck Islands, and then to the eastward as far as Providence Bay, with "the triangulation and traverse of the shoreline completed to Cove Island lighthouse, or to connect with Captain Boulton's work of 1883-84." Soundings were taken in the boats "for an average distance of one nautical mile from shore, or to cover all the dangerously shoal water. Those in deeper water were taken from the vessel's deck and extend out an average distance of ten miles, or to a depth of 40 to 60 fathoms." This season, 110 miles of traversing, 1,035 miles of ship sounding, and 830 miles of boat sounding were completed. In his annual report dated 17 November 1898, Mr Stewart stated, "no important discoveries have been made but several known banks (such as that from the south end of Duck Islands) and shoals have been carefully examined and will be properly charted. Owing to the nearly straight trend of the south shore of Grand Manitoulin Island and its very low character, no regular triangulation has been possible." A baseline was also measured on the

[25] In October. Mr Fraser, in company with the chief engineer. Mr Wm P. Anderson, completed an inspection tour of the St Lawrence River ship channel between Montreal and Quebec, and then assisted him with further hydrographic survey work to complete the Bay of Quinte sheet. In 1899, Mr Fraser was put in charge of all navigation plans for the ship channel on file in the Chief Engineer's Branch. Three years later (1902), he was promoted assistant engineer in charge of aids to navigation between Kingston and Montreal. During that summer, he completed a detailed triangulation survey of Lake St Louis to connect the detached dredging-surveys of the Department of Railways and Canals since_____. This also gave him an opportunity to extend his triangulation network westward between Cornwall and Ogdensburg. to tie-in with the United States triangulation network of 1870-73. In November 1903, Mr Fraser was named commissioner of lighthouses, and took over from Mr Anderson the work under his control as general superintendent of lighthouses.

east shore of Green Island harbour, and a fair set of triangles extended west to Melville Point (ten miles west of Providence Bay). An observation post was established on the highest part of Outer Duck Island, and its latitude observed upon "eight nights with sextant and artificial horizon." The longitude of this observation was obtained by running a meridian distance between it and Cove Island lighthouse.

During the winter of 1898-99, the first fair sheet for Lake Huron was forwarded to the Hydrographer of the Admiralty for engraving and publication - from Drummond Island (State of Michigan, USA) to Duck Islands, and including False Detour Channel and Mississaugi Strait.

Lake Huron, 1899

The season of 1899 was late in opening, it being May before a start could be made. The survey of the south shore of Manitoulin Island from Providence Bay to the entrance of Georgian Bay was finished by 1 July, and the resurvey of the south and west shores of the Saugeen Peninsula then begun. While the *Bayfield* underwent repairs for a main shaft, Messrs Anderson and Tyrwhitt with a boat's crew worked near South Baymouth, Manitoulin Island. The work this season was an extension of Commander Boulton's in 1884, from Cape Hurd to Lyal Island, in the entrance of Stokes Bay. Area of water surveyed was 525 square miles, and included 1,150 lineal miles of ship sounding and over 800 miles in the boats. Some 75 miles of shoreline were traversed.

In his annual report dated 30 December 1899, Mr Stewart wrote, "Stokes Bay is really the only safe harbour on the Canadian shore of Lake Huron from St Clair River to Tobermory, a distance of 160 miles. It is quite large, the anchorage is both good and safe." He also remarked, "the demand for the last edition (300 copies) of the *Georgian Bay and North Channel Pilot* has been so great that it has been cleared out. A new one is in course of preparation. With the close of the next season, the survey of Lake Huron should be completed. There will then remain only Lake Ontario and Superior of the Great Lakes to be surveyed. The former has very little unsurveyed dangerous water in the line of through traffic and its survey is therefore not pressing."[26]

The *Bayfield,* 1899

Almost two seasons had now been occupied in recharting Lake Huron when the South African War broke out in 1899, and in anticipation of the resurvey of Lake Superior, Mr Stewart strongly recommended this year a replacement for the older steamer *Bayfield* stating she was "totally unfit" for this purpose.

> She cost $15,000 in 1884 and about the same amount has been spent, at various times, upon repairs to her. She is a wooden screw tug of about 100

[26] Charting resurveys of Lake Superior began in 1902, and Lake Ontario in 1909.

> tons, built in 1863, and had very hard service before we acquired her. The original high-pressure engine, very much worn out, is still in her, and her boiler, 17 years old is weakening. In 1893 she was condemned, but has been pressed into service each year since for the summer weather only. Lake Superior is much larger than any waters we have yet surveyed, the seas are heavier, and there is no doubt a vessel of the *Bayfield's* age and conditions should not be placed in such dangerous work. The distances, too, are much greater and much valuable time would be lost in a boat that cannot make better than seven knots per hour [sic]. I would therefore recommend that the survey be provided with a more suitable, larger, stronger, faster and more economical vessel. If this be not done the work of the survey will have to be abandoned as the *Bayfield* is no longer fit for work on exposed shores, similar to the Canadian shores of the Great Lakes upon which the prevailing winds beat so much.[27]

In his annual report for 1889, Mr Stewart stated, "the shore of the Lake from Clark Point to Cape lpperwash (the termination of the survey by the U.S. Corps of Engineers) is nearly straight and free from dangers. Its survey could be left for more pressing work."

Lake Huron, 1900

In the past winter, a fair copy of the work done between Duck Islands and Cove Island, including Manitoulin gulf, had been forwarded in two sheets to the Hydrographer of the Admiralty for engraving and publication. As to sheets already sent to the Admiralty, Mr Stewart wrote, "owing to a great pressure of work at the Admiralty Office, London, no sheets have yet been issued for Lake Huron, but 1 understand the western one should be ready for distribution before the opening of navigation, 1901." A new edition of the *Georgian Bay and North Channel Pilot* was issued in April this year.

The *Bayfield* that spring arrived off Lyal Island on 2 May but soon after had to return to Georgian Bay for repairs to her main steam pipe. A fresh start was made on 8 May, and at the close of the season Clark Point was reached, 60 miles from the starting point. Shore soundings were carried out to a distance of 12 miles to deep water. The area surveyed was 750 square miles, with 1,100 miles of ship sounding and 1,100 miles of boat sounding over the shallow areas. There were 110 miles of traversing of shoreline. Harbour surveys were made of Saugeen River, Port Elgin, Kincardine and Southampton. Mr Stewart wrote, "large vessels seeking shelter near this shore must proceed to Stokes Bay. Southampton is a harbour of refuge but the anchorage space is very limited. Outside the dangerous reefs, that front most of the shore for often more than a mile, no outlying dangers were discovered. The water gradually deepens, sometimes to 80 fathoms at the outer ends of the sounding lines off

[27] For some years after its purchase, the steamer ***Bayfield*** was used in Georgian Bay by both the Marine and Fisheries Branches of the department - hydrographic work in the summer months, and fishery-patrol work in the late fall. At that time, both Marine and Fisheries were under the same minister.

Chantry Island and sometimes to only 20 fathoms, north of Clark Point. During the coming winter fair copies of the work from Cove Island to Clark Point will be prepared ... and sailing directions for the Canadian Shore of Lake Huron written."

The *Bayfield,* 1900

Once again Mr Stewart strongly recommended that the older steamer *Bayfield* be replaced with a more modern vessel, before commencing the survey of Lake Superior. He further remarked, "in 1883 a new boiler was placed in her and it is still doing service ... in 1893 the Steamboat Inspector condemned her, but as no one made an offer to buy her, when advertised for sale, she was put in service with orders to use only in fine weather. Where harbours were plentiful and easy of access as in Georgian Bay this was all right, but on the east shores of Lake Huron it is difficult to keep out of the way of storms. For work upon the shores of the lakes now unsurveyed, principally Lake Superior, a larger, stronger, and faster vessel is urgently required, or the important work will have to be abandoned."

CLOSE OF LAKE HURON SURVEY 1901

Lake Huron, 1901

Before navigation opened on the Upper Great Lakes early in 1901, the first two charts from Canadian resurveys for Lake Huron were published in April by the Admiralty. One of these coast charts was No. 1701 "Cove Island to Great Duck Island, and Entrance to Georgian Bay," and the other No. 3014 "Great Duck Island to Detour Passage." Both were engraved editions, and drawn to approximately the same scale as the first chart for the entrance of Georgian Bay, i.e., I % nautical miles to the inch. When published, sailing masters on the Great Lakes now had good chart coverage for two direct routes from Owen Sound in Georgian Bay, to the industrial shipping centre of Sault Ste Marie. One route was through the North Channel, surveyed by 1890, and the other, by Lake Huron to Detour Passage, that leads to the American waters of the St Mary River.

Up to the middle of June 1901, the survey of the east coast of Lake Huron from Clark Point to Cape Ipperwash was conducted by Mr Stewart. From then until the end of the season, the *Bayfield was,* in charge of Mr F. Anderson, first assistant. In his annual report for 1901, the chief engineer remarked, "there yet remains to be surveyed the north and south wider portions of the lake. The north portion embraces an area of 5,000 and the south an area of 1,100 square miles. Two good seasons should suffice to make a very fair survey of these two parts." When work ended in 1901, the *Bayfield* proceeded to Georgian Bay, and before returning to Owen Sound she visited Parry Sound, where she positioned and buoyed a "small uncharted pinnacle" near Jones Island range, which the steamer *Arthur Orr* struck in May.

Steamer *Bayfield,* 1901

In his annual report dated 1 January 1902, the chief engineer noted, "the boiler and hull now

require attention, but for survey work she has been superseded by the twin-screw schooner-tug *Lord Stanley,* of Quebec, purchased from Messrs Davie & Co., which will be fitted out during the coming season."

THE SURVEY OF LAKE WINNIPEG, 1901-03

The First Inland Water Survey Beyond the Great Lakes

Back in 1898, two lighthouses were constructed on Lake Winnipeg by the Department of Marine and Fisheries: one at Gull Harbour on Big Island, and the other some thirty-four miles to the northward on the eastern extremity of Black Bear Island. These lights were built, according to the chief engineer, "to accommodate the increasing steamboat traffic on Lake Winnipeg." The steamer channels between these lighthouses were located in the narrowest sector of Lake Winnipeg, an area where lake traffic was most concentrated and the waters uncharted. On 7 June therefore, Mr Stewart having placed Mr Anderson in charge of the *Bayfield,* journeyed to Lake Winnipeg to undertake the first Canadian hydrographic survey of inland waters beyond the Great Lakes.

At Selkirk, Manitoba, the steam tug *Frank Burton* was chartered from the Northwest Navigation Co. Ltd for the season at a cost of $3,387.16. Sailing master was Capt. C P. Paulsen, and chief engineer, Mr C. Walderson. Assistants with Mr Stewart were Mr R.E. Tyrwhitt of the *Bayfield* for one month and seasonal employee Mr Walter Young for three-and-a-half months. Activities were centred in the southern portion of the lake between Red River and Big Island where several lines of track soundings were run, and in the narrow channels from Gull Harbour and Berens River the waters were closely sounded.

In his annual report to the deputy minister the chief engineer wrote, "to save delay and expense the map of the lake issued by the Geological Survey (1899) is being used as a basis for a new chart." This was the first official occasion when results from a Canadian survey were not forwarded to the Admiralty for engraving and publishing.

In 1902, first and second assistants Messrs F. Anderson and R.E. Tyrwhitt replaced Mr Stewart, and extended his work of the previous season northwards. Capt. Paulsen was again sailing master of the *Frank Burton,* and Mr Walderson, chief engineer. The chartered agreement with the Northwest Navigation Company extended from 20 May to 16 October at a cost of $2,451.61. This season the eastern shore of the lake was closely examined; the channels into Berens and Big Black Rivers developed, and George, Little George and Sandy islands located and investigated.

FIRST CANADIAN CHART FROM CANADIAN SURVEYS, 1903

Before the season of navigation opened on Lake Winnipeg, in February 1903, a chart for the southern portion of Lake Winnipeg was printed in Ottawa for the Department of Marine and Fisheries. It was a coloured photo-lithographic sheet, drawn by Mr F. Anderson, to a scale of 4 statute miles to the inch. This was the first Canadian chart from Canadian surveys. Later

the chief engineer reported, "the demand for this chart has been exceedingly small."[28]

In 1903, Messrs Anderson and Tyrwhitt returned to Lake Winnipeg to develop further its northern portion. This season, Capt. Paulsen of the *Frank Burton* was replaced by Capt. A. Vance, and Mr A. Vrooman of the *Bayfield* replaced Mr Walderson as chief engineer. Special investigations were carried out in several small harbours at Spider's Islands, Warren's Landing (entrance to the Nelson River) and Selkirk Island. Most of these narrow, crooked channels with none too deep entrances were carefully sounded and marked with range beacons. In his annual report, the chief engineer commented, "the open part of the Lake has now been pretty thoroughly gone over, so that there is not much necessity for continuing the work at present." Despite this statement, another full season was necessary to bring the first survey of Lake Winnipeg to a temporary close.

THE *BAYFIELD* AND THE LAKE SUPERIOR SURVEY, 1902

Back in 1899 when in Lake Huron, Mr Stewart reported the steamer *Bayfield* as being "totally unfit" to commence the recharting of Lake Superior. The Department of Marine and Fisheries then in December 1901 purchased its first hydrographic steamer replacement, the *Lord Stanley*. In May 1902 the South African War officially ended, and in this month on her way to the upper Great Lakes the *Lord Stanley* sustained serious damage to her hull while leaving a wharf in Toronto Harbour. This obliged her to return to Sorel for repairs at a cost of $15,950.77. When seaworthy again, she was chartered by the Department of Public Works for the remainder of the season, and used in connection with ship channel surveys in the St Lawrence River below Montreal.

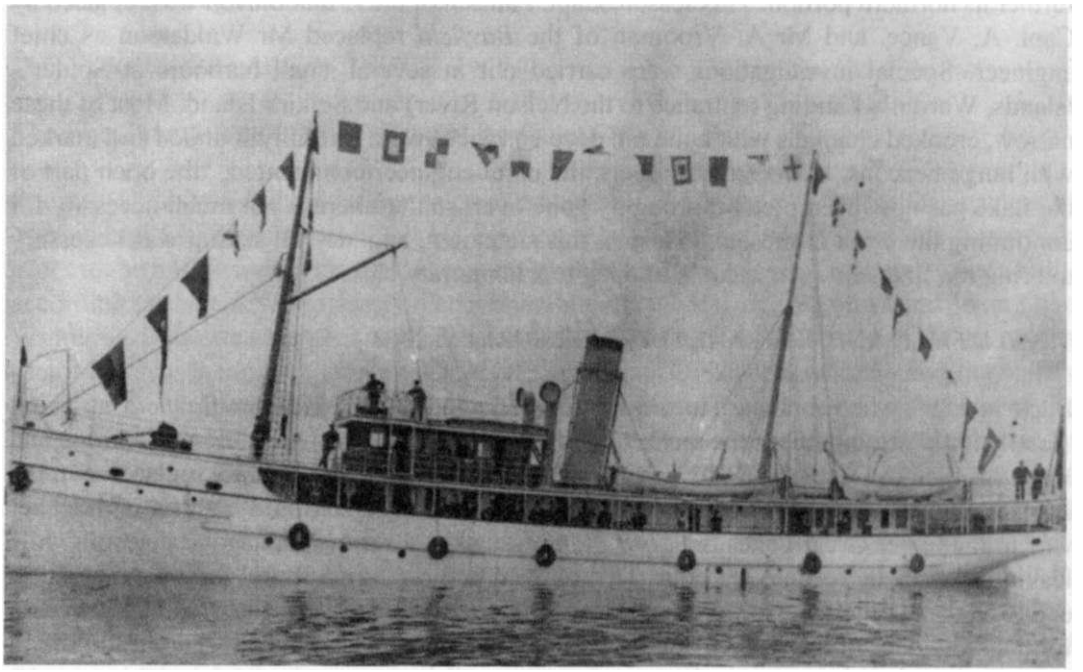
Unable to procure the more powerful *Lord Stanley,* the older vessel *Bayfield* underwent partial repairs to her boiler, and was pressed into service to commence the resurvey of Lake Superior. When the *Bayfield* returned to Owen Sound in late October, she could now lay claim to be the first Canadian hydrographic vessel to see service on all the Great Lakes. This was also to be the last season for her sailing master and pilot, Capt. A.M. McGregor.

Lake Superior, 1902

The recharting of the Canadian shores of Lake Superior was begun in 1902 on the less exposed sector of the east coast - at Coppermine Point, Ontario, the northern limit of the US Corps of Engineers survey of Whitefish Bay. From here the survey was extended northwards to Cape Gargantua. A very dangerous unknown shoal, with only 14 feet of water over it, was positioned *VA* miles west of Leach Island. Another shoal was examined off Corbay Point, and a large uncharted rock was located south of Montreal Island, and Mica Shoal. Magnetic observations were taken at Gargantua Harbour and Batchawana Bay. With both regular

[28]* An original copy of this Lake Winnipeg chart can be seen at the Map Division. Public Archives and National Library. Ottawa.

assistants in Lake Winnipeg this season, Mr Stewart was seriously handicapped, "being obliged to take all fixes alone."



Bayfield \\
photo courtesy CHS

Lake Superior, 1903

In June 1903, the steamer *Lord Stanley,* renamed *Bayfield,* arrived in Lake Superior as a replacement for the older vessel by that name. Another replacement was Capt. W.O. Zealand, as sailing master. Mr John Nisbet, chief engineer since 1886, was retained in this post. With a larger and more powerful steamer, Mr Stewart was now prepared to commence survey work on the more exposed shores of Lake Superior, and accordingly proceeded to the north shore to begin the season of 1903 in Pigeon Bay, near the International Boundary. During this season, the recharting of this north shore was extended eastwards to Thunder Bay, and including the offshore islands. A traverse of the shoreline and islands was completed as far as Thunder Bay, and about half of this area was sounded by the ship and boats. For this survey, Mr Stewart made use of the US triangulation points located on Victoria and Pic Islands, and on Thunder Cape.

In his annual report on hydrographic work in the Department of Marine and Fisheries, the chief engineer, Mr Wm P. Anderson, wrote on 10 December 1903, "no new shoals were discovered during the season, but several were found to be incorrectly placed

upon existing charts. It may safely be said, with the new chart, the inside passage between Port Arthur and Victoria Island will be much more frequently used, as the dangers in it, when properly marked are not serious. Preliminary sailing directions for this channel are being prepared."[29]

A flashback to September 1877 calls to mind a request of Capt. J.C. Parsons of the wrecked SS *Cumberland,* to the minister of Marine and Fisheries, for a resurvey of two dangers in this channel: one "five reefs off the upper end of Isle Royale, near Rock of Ages," and the other "a small shoal west of Victoria Island, in steamboat channel between Thunder Bay and Duluth."

The season of 1903 was to be the last as the Great Lakes Survey, and this year in addition to surveying on the north shore of Lake Superior, Mr Stewart "built and maintained at the mouth of the dredged channel into the Kaministiquia River, a platform-buoy supporting a Wigwam forty-one day lamp, which proved a great boon to the large steamers frequenting Fort William." During this season, two of Mr Stewart's regular assistants Messrs Anderson and Tyrwhitt were occupied in Lake Winnipeg and he had as assistants only "some transient students." The chief engineer later wrote, "it is very desirable that assistants for this class of technical work should be men of scientific attainments, permanently employed, as their value increases greatly with their experience." When the work ended in Lake Superior in 1903, it brought with it the close of the first chapter in the history of the Canadian Hydrographic Service - the era of the Georgian Bay and the Great Lakes Survey.

In 1904, the Great Lakes Survey in the Department of Marine and Fisheries became the Canadian Hydrographic Survey; and Mr Wm J. Stewart, its officer-in-charge since 1893, was named chief hydrographic surveyor, or chief hydrographer. The growth, development and expansion of the Canadian Hydrographic Service to its present status date from that year.

RECAPITULATION, FISCAL YEARS, 1883-1903

From what has now been written, it is quite apparent that the years 1883-1894 were the formative years of the hydrographic service. These were the years when the service was known as the Georgian Bay Survey. It was a period of "firsts" for many aspects of inland and coast charting, and the establishment of standard practices and procedures for future hydrographic surveys. In 1892 the service had its first official recognition when it became a technical unit in the Chief Engineer's Branch under the direction of Mr Wm P. Anderson, who was also general superintendent of the lighthouses and hydrographic service. In 1893 the Tidal and Current Survey Division had its commencement in the Chief Engineer's Branch. From then until 1924, when this division was transferred to the hydrographic survey, the recharting of Canadian waters was of more concern to the hydrographic service than other aspects of marine surveying. One must not overlook the fact that in those days hydrographic and tidal work were two separate areas of marine surveys, their only common

[29] A coloured photo-lithographic chart of this channel between Fort William and Pigeon Bay was issued to the public by the Department of Marine and Fisheries in July 1904 - the first Canadian chart from Canadian surveys for the Great Fakes.

factor being that each unit came under the direction and supervision of the same chief engineer until 1904, and from then until 1924 under the same deputy minister.

HYDROGRAPHERS

When Mr Stewart was appointed first assistant of the *Bayfield* in March 1884, he was officially a temporary "clerk" in the "Outside Service" at a salary of $550 per annum. At that time Staff Commander Boulton's salary (naval pay and allowances) was about $4,000 per annum, or about 25 per cent higher than that of Mr Wm Smith, deputy minister of Marine and Fisheries. When Mr Stewart succeeded Staff Commander Boulton as officer-in-charge, Georgian Bay Survey, in April 1893, he was listed in the Chief Engineer's Branch as a "first class clerk, salary $1,650 per annum." Mr F. Anderson, his successor as first assistant, was listed as a "third class clerk, salary $700 per annum." Before this fiscal year ended, the names of both Messrs Stewart and Anderson were changed to the civil government list of the pepartment's Inside Service. In 1895, both these hydrographic surveyors were classified as "technical officers" of the Inside Service, and despite Mr Stewart's becoming chief hydrographer in 1904, these classifications prevailed in annual government reports until positions in the hydrographic establishment were standardized by authority of the *Civil Service Amended Act, 1908.* From 1893, Messrs Stewart and Anderson were contributors to the existing superannuation plan at that time, and with the establishment of the *Retiring Act* in 1898, Mr Tyrwhitt also contributed. When the era of the Georgian Bay Survey ended in 1903, Mr Stewart's salary as officer-in-charge, CGS *Bayfield,* had reached $2,050 per annum; that of his first assistant Mr F. Anderson (then in charge of chartered tug *Frank Benton* [sic] in Lake Winnipeg), $1,200, and second assistant, Mr R.E. Tyrwhitt, $950 per annum. In comparison, the sum of $3,000 per annum was paid the chief engineer, Marine Branch (Mr Wm P. Anderson); and $2,050 (same as Mr Stewart) to the engineer-in-charge, Tidal and Current Surveys, Dr. W. Bell Dawson.

Had it not been for a period of economic recession in the 1890s, and the South African War 1899-1902, the Great Lakes Survey in all probability would have expanded beyond the establishment of one ship party and three regular hydrographers. Since the regular field staff had not increased in numbers, but when surveys of Lake Winnipeg (1901) and Lake Superior (1902) began, several temporary seasonal assistants were taken on the Outside Service. One of these assistants was a Mr G.H.G. Boulton (relative of Staff Commander Boulton?) 1899, 1900, 1901. With regular assistants Messrs Anderson and Tyrwhitt in Lake Winnipeg, in 1903 Mr Stewart had with him on the *Bayfield* the following student personnel: Mr Harris Cohen, acting first assistant; Mr Robert Rolland, acting second assistant; and other assistants Messrs A.O. Bourdonnais and H. Swan. Salaries for these temporary assistants varied from $600 to $700 per annum. Finally, there was Mr J.A. Simpson, Mr Stewart's "secretary," at a salary of $720 per annum.

SHIPS AND SHIPS' OFFICERS

Before closing out the first chapter of this story here are a few remarks on ship officers who

served in the first two *Bayfields.* Sailing master and pilot of the first ship from 1884 to 1902 was Capt. A.M. McGregor of Owen Sound, and the first chief engineers were Mr Charles Linter (1884-86) and Mr John Nisbet (1886-1902). When appointed sailing master and chief engineer in 1884, the salary of Capt. McGregor was $1,070 per annum, and of Mr Linter $800 per annum. When commissioned in 1884, the *Bayfield's* ship company was about seventeen officers and crew. That of the second *Bayfield,* the *Lord Stanley,* in 1903 was increased to about twenty-five officers and crew. At the time, hydrographic officers signed ship's articles, and the time served on the two *Bayfields* was accepted as sea-going experience when Messrs Stewart and Anderson were granted Certificates of Competency as Master, Inland Waters, in the years 1897 and 1905, respectively.

When the second *Bayfield* was commissioned in 1903, Capt. McGregor was replaced by Capt. W.O. Zealand, with a salary of $1,400 per annum. Mr John Nisbet, when he replaced Mr Chas. Linter as chief engineer in 1886, was paid $900 per annum. When he was transferred to the second *Bayfield,* his salary was increased to $1,000 per annum.

Until 1904, Mr Stewart was officer-in-charge of the second *Bayfield,* and in subsequent years was succeeded by Capt. F. Anderson (1905), H.D. Parizeau, R.J. Fraser, and H.L. Leadman. When the survey of the Great Lakes ended in 1920, she was assigned to the Gulf of St. Lawrence, and worked in this area intermittently until laid up in 1931.

Most of the survey and ship officers who served on this early training ship have now passed to the great beyond. The names of the last officers to serve in her were as follows: Mr H.L. Leadman, officer-in-charge; Capt. D.M. Snelgrove, and Mr S.A. Robson, chief engineer. One hydrographer still in our midst who began his career in the *Bayfield* in 1930, is the past Dominion Hydrographer Mr N.G. Gray. When working on the exposed coast of the Magdalen Islands in 1931, Mr Gray had the unique experience of using a boat's crew, or sailing gig, to chart these waters. A few years later, the last sailing gig was beached on the Atlantic coast, bringing to a close an era of small boat surveying introduced to the hydrographic service half a century previously by Staff Commander Boulton.

PRODUCTION

Between the years 1883-1904, the Admiralty published twenty-five engraved general, coast and harbour charts from surveys by officers in the Department of Marine and Fisheries. Two of these editions were for the Bay of Quinte, Lake Ontario, from surveys by the chief engineer and other assistants; and twenty-three editions were strictly from resurveys by the Georgian Bay and Great Lakes Survey - Great Lakes 22, British Columbia 1. Great Lakes charts were for the following regions: Georgian Bay 8, the North Channel 3, Lake Erie 3, St Clair River to Lake Huron 1, Lake Huron 4 and Lake Superior 1, and in British Columbia, Burrard Inlet 1. In addition, three photo-lithograph preliminary charts were printed in Ottawa by the Department of Marine and Fisheries: Lake Winnipeg 2, Lake Superior 1. This gives the Georgian Bay and Great Lakes Survey credit for a total of twenty-six charts (Admiralty 23, Canadian 3); and the Department of Marine and Fisheries in all twenty-eight editions (Admiralty 25, Canadian 3).

Up to the year 1904, two volumes of sailing directions had been written from

Canadian resurveys in the Great Lakes: one for Georgian Bay and the North Channel, the other for the Canadian shores of Lake Huron. Periodically, local sailing directions for harbours in the Great Lakes were printed in Notices to Mariners of the Marine and Fisheries Department.

The price of the first Canadian chart for Lake Winnipeg in 1903 was 50 cents per copy but, in the following year, the price for these photo-liths was reduced to 25 cents each. In 1906, this price was stabilized to 15 cents per copy, the same as charged a few years later for the first engraved Canadian coast charts. Up to the year 1919, sailing directions and pilots were issued to the public free of charge. In October 1919, the price of one of the earliest volumes to be written, *Sailing Directions for Lake Huron and Georgian Bay,* was changed to 25 cents per volume.

EXPENDITURE

The amount spent on the resurvey of Georgian Bay and the North Channel from 1883 to 1894 was approximately $215,400, and with the purchase and maintenance of the steamer *Bayfield,* this figure rose to $255,500. Expenditure on the resurveys of Lake Erie, Lake Huron, Lake Superior, Burrard Inlet, BC, and Lake Winnipeg came to approximately $200,000. To this must be added at least $85,000 to cover costs of chartering the steam tug *Frank Burton* in Lake Winnipeg, and the second steamer *Bayfield.* The total outlay of public funds, therefore, to the commencement of the era of the Canadian Hydrographic Survey in 1904 was slightly more than half a million dollars (almost $550,000) for twenty-one field seasons. This amounts to an average of $25,000 per annum, which is an insignificant sum when one considers the increased safety and tremendous contribution Canadian resurveys brought to Canadian shipping and navigation in those years.