DOMINION OF CANADA

SIXTY-SEVENTH

ANNUAL REPORT

OF THE

DEPARTMENT OF MARINE

FISCAL YEAR

1933-34

OTTAWA
J. O. PATENAUDE
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1934

Price, 25 cents

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To His Excellency Captain the Right Honourable the Earl of Bessborough, P.C., G.C.M.G., Governor General and Commander-in-Chief of the Dominion of Canada.

MAY IT PLEASE YOUR EXCELLENCY:

I have the honour to submit herewith for the information of Your Excellency and the Parliament of Canada, the Sixty-seventh Annual Report of the Department of Marine.

I have the honour to be,

Your Excellency's most obedient servant,

ALFRED DURANLEAU,
Minister of Marine.

DEPARTMENT OF MARINE,
OTTAWA, April 6, 1934.

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REPORT OF THE ASSISTANT DEPUTY MINISTER OF MARINE

To the Hon. ALFRED DURANLEAU,
Minister of Marine.

SIR,—I have the honour to submit the report of the Department of Marine for the fiscal year ended March 31, 1934. The report, as usual, contains a record of the major branches of the department.

Conditions in the shipping and shipbuilding industries, according to Lloyds, show some improvements in Great Britain in 1933 over the preceding year. The tonnage commenced during 1933 is nearly three-and-a-half times the record low figures for 1932, and present indications are that the quarterly totals of tonnage commenced will continue to show an upward tendency.

A considerable amount of work has been done during the past fiscal year in connection with the revision of the Canada Shipping Act. Bill J was introduced in the Senate last year being a complete revision of the Canada Shipping Act. It was reintroduced this year as Bill E, and it is probable that it will be finally dealt with by both Houses of Parliament this year.

Drafts have also been prepared of regulations for the protection of persons employed in loading or unloading ships and for the safety of life at sea as provided for in the International Convention of May, 1929.

The north channel of the St. Lawrence river (from the foot of the Island of Orleans to Ile-aux-Coudres is used extensively by deep draft ocean liners and is becoming more and more popular with masters of vessels and pilots.

Respectfully submitted,

E. HAWKEN,
Assistant Deputy Minister.

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OPERATIONS OF CHIEF CANADIAN SHIPBUILDING PLANTS FOR THE FISCAL YEAR ENDED MARCH 31, 1934

DAVIE SHIPBUILDING AND REPAIRING CO., LIMITED, LAUZON, LEVIS, P.Q.

There was no ship construction done during the above period. Fifty-eight ships received repairs to hull, machinery, boilers, joiner work, painting, tanks, and other minor repairs.

MIDLAND SHIPBUILDING COMPANY, LIMITED, MIDLAND, ONT.

Minor engine and boiler repairs in fitting out six upper lake vessels.

HALIFAX SHIPYARDS LIMITED, HALIFAK, N.S.

The value of ship repair work carried out at Halifax Shipyards Limited for fiscal year ending March 31, 1934, amounted to $618,917.98. No shipbuilding was carried on during this period.

CANADIAN VICKERS, LIMITED, MONTREAL, P.Q.

Shipbuilding:

Yard No.	Vessel	Built for:	Dimensions
121	Warping tug.....	Shawinigan Engineering Co.....	55′ 0″ x 12′ 0″ x 7′ 0″
122	Logging tug.....	" "	65′ 0″ x 17′ 0″ x 9′ 0″
123	Logging tug.....	" "	65′ 0″ x 17′ 0″ x 9′ 0″

Repair Work.—Thirty-five vessels were docked during season 1933, including all types of ocean and lake steamers and miscellaneous smaller craft.

Repairs covered from extensive bottom damage to minor jobs. In addition to vessels dry docked, a number of vessels were repaired afloat.

BURRARD DRY DOCK COMPANY, LIMITED, NORTH VANCOUVER, B.C.

There were repaired 248 vessels, totalling 939,913 tons, the largest of which were: ss. *Empress of Asia,* 16,909 tons; ss. *Nariva,* 8,714 tons; M.S. *Loch Goil,* 9,462 tons; ss. *Protesilaus,* 9,547 tons; ss. *Nebraska,* 8,263 tons; M.S. *Dinteldyk,* 9,399 tons; M.S. *Loch Katrine,* 9,409 tons; M.S. *Loch Monar,* 9,412 tons; M.S. *Winnipeg,* 8,379 tons; M.S. *India,* 9,549 tons; and M.S. *Tacoma,* 8,268 tons.

PORT ARTHUR SHIPBUILDING CO., LTD., PORT ARTHUR, ONT.

Fifty-one ships were repaired during the fiscal year ending March 31, 1934. The repairs were as follows: to hulls, 34; engines, 21; boilers, 8, and miscellaneous, 17. Thirteen ships were dry-docked, of a gross tonnage, 53,303.

PRINCE RUPERT DRY DOCK AND SHIPYARD, PRINCE RUPERT, B.C.

Repairs carried out at this plant during the fiscal year, are as follows: 55 vessels, docked, cleaned, painted and miscellaneous hull and engine repairs, and 236 vessels miscellaneous hull and engine repairs not requiring docking.

ST. JOHN DRY DOCK AND SHIPBUILDING CO., LTD., ST. JOHN, N.B.

Twenty-five ships were dry docked for repairs, of 113,341 tons, the principal ones being H.M.S. *Norfolk,* 12,000 tons; M.V. *Vancolite,* 11,404 tons; R.M.S. *Lady Nelson,* 7,970 tons; R.M.S. *Lady Hawkins,* 7,988 tons; R.M.S. *Lady Drake,* 7,985 tons; and M.V. *Trontolite,* 7,115 tons.

Twenty-seven other vessels were docked on the marine railway for repairs, of 12,635 tons.

STATISTICS OF CANADIAN SHIPPING

STATEMENT of vessels built in Canada and registered during the year 1933

Province	Wood									Metal									Totals		
	Sailing			Steam			Motor			Sailing			Steam			Motor					
	No.	Tonnage		No.	Tonnage		No.	Tonnage		No.	Tonnage		No.	Tonnage		No.	Tonnage		No.	Tonnage	
		Gross	Net		Gross	Net		Gross	Net		Gross	Net		Gross	Net		Gross	Net		Gross	Net
New Brunswick	4	88	88	....	.....	.....	28	722	603	....	.....	.....	....	.....	.....	....	.....	.....	32	810	691
Nova Scotia	2	38	36	1	143	73	40	536	450	....	.....	.....	....	.....	.....	....	.....	.....	43	717	559
Quebec	2	252	227	....	.....	.....	32	802	568	1	233	233	....	.....	.....	....	.....	.....	35	1,287	1,028
Ontario	2	497	415	3	203	114	14	200	159	....	.....	.....	....	.....	.....	2	86	78	21	986	766
Prince Edward Island	....	.....	.....	....	.....	.....	2	20	16	....	.....	.....	....	.....	.....	....	.....	.....	2	20	16
British Columbia	12	986	986	16	271	175	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....	28	1,257	1,161
Manitoba	....	.....	.....	....	.....	.....	2	33	28	....	.....	.....	....	.....	.....	....	.....	.....	2	33	28
Yukon Territory	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....	.....	.....	.....
Saskatchewan	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....	.....	.....	.....
Totals	22	1,861	1,752	20	617	362	118	2,313	1,824	1	233	233	....	.....	.....	2	86	78	163	5,110	4,249

STATEMENT showing the number of vessels and number of tons on the Registry Books of the Dominion of Canada on December 31, 1933

Province	Sailing Vessels			Steam Vessels		
	No.	Gross Tons	Net Tons	No.	Gross Tons	Net Tons
New Brunswick	462	23,863	23,245	548	28,578	18,002
Nova Scotia	489	47,783	42,821	890	99,623	62,916
Ontario	522	100,819	93,577	1,335	518,885	326,251
Quebec	476	128,934	123,471	844	607,468	359,108
British Columbia	1,031	196,535	193,787	2,053	285,895	158,400
Prince Edward Island	80	4,706	4,397	55	12,571	6,670
Saskatchewan	1	145	145	4	447	252
Manitoba	27	5,841	5,841	86	8,793	5,664
Yukon Territory	11	2,502	2,502	6	3,496	2,529
	3,099	511,128	489,547	5,822	1,565,756	939,792

COMPARATIVE STATEMENT showing the number of vessels and number of net tons on the Registry Books of the Dominion of Canada, on December 31, in each year from 1929 to 1933, both inclusive

Province	1929		1930		1931		1932		1933	
	Vessels	Tons	Vessels	Tons	Vessels	Tons	Vessels	Tons	Vessels	Tons
New Brunswick	885	34,031	919	38,350	983	39,766	983	39,293	1,010	41,247
Nova Scotia	1,471	127,077	1,478	119,055	1,434	112,891	1,400	113,352	1,379	105,737
Quebec	1,265	506,594	1,262	495,017	1,277	506,787	1,321	509,634	1,320	482,579
Ontario	1,759	365,531	1,775	392,708	1,771	378,925	1,761	422,336	1,857	419,828
Prince Edward Island	134	8,370	130	8,351	129	10,996	134	11,124	135	11,067
British Columbia	3,257	335,810	3,203	361,328	3,178	361,305	3,161	362,407	3,084	352,187
Manitoba	103	11,051	105	11,185	110	11,461	112	11,485	113	11,505
Yukon District	19	4,543	20	5,584	17	5,031	17	5,031	17	5,031
Saskatchewan	6	486	6	486	6	486	6	486	5	397
	8,899	1,393,493	8,898	1,432,064	8,905	1,437,648	8,895	1,475,148	8,920	1,429,578

COMPARATIVE STATEMENT of vessels built and registered in the Dominion of Canada and their net tonnage during the year ended December 31, in each year from 1929 to 1933, both inclusive

Province	1929		1930		1931		1932		1933	
	Vessels	Tons	Vessels	Tons	Vessels	Tons	Vessels	Tons	Vessels	Tons
New Brunswick	86	1,142	44	1,582	67	902	42	627	32	691
Nova Scotia	70	2,591	94	4,393	52	2,008	14	2,045	43	559
Quebec	29	13,271	53	13,791	49	4,595	64	4,219	35	1,028
Ontario	39	611	52	4,503	25	3,240	20	1,126	21	766
Prince Edward Island	3	90	.....	.....	2	3,438	5	98	2	16
British Columbia	184	10,478	90	4,979	38	1,975	57	1,810	28	1,161
Manitoba	5	367	2	134	5	276	5	81	2	28
Yukon District	3	316	1	1,041	.....	.....	.....	.....	.....	.....
Saskatchewan	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	419	28,866	336	30,423	238	16,434	207	10,006	163	4,249

STATEMENT showing number of vessels removed from the Registry Books of the Dominion of Canada during the year ended December 31, 1933.

Sold to foreigners	12
Wrecked	23
Stranded	8
Lost	10
Broken up	103
Burnt	14
Transferred to St. John's, Newfoundland	9
Transferred to British West Indies	16
Transferred to London, England	3
Supposed to be out of existence	28
Registry no longer required	16
Abandoned	3
Seized by Order of Court	4
	249

Estimated number of men and boys, etc., inclusive of Masters, employed on ships registered in Canada during the year 1933, 45,870.

It is figured approximately that there were 10,000 in Ontario and about 8,000 in the three western provinces of Manitoba, Alberta and Saskatchewan.

REPORT OF THE MASTERS AND SEAMEN BRANCH

Navigation schools were in operation at Saint John, N.B., at Halifax and Yarmouth, N.S., at Quebec, P.Q., at Prince Rupert, B.C., and at Kingston, Ont.

Examinations for masters' and mates' certificates were held at Halifax and Yarmouth, N.S., at Saint John, N.B., at Quebec and Montreal, P.Q., at Ottawa, Kingston, Midland, Toronto, Owen Sound, Collingwood and Port Arthur, Ont., and at Vancouver and Victoria, B.C.

Issued during the year 8 masters', 13 mates', and 19 second mates' sea-going certificates of competency; 58 masters' and 76 mates' coasting certificates of competency; one master's coasting certificate of service; 15 masters' and 30 mates' inland waters certificates of competency; 17 masters' and 13 mates' minor inland waters certificates of competency, and 34 masters' temporary certificates; 27,038 seamen were shipped and 23,148 seamen were discharged at sea-ports.

RETURNS of Shipping Masters for the year ending December 31, 1933.

Province	Seamen shipped	Seamen discharged	Amount
			$ cts.
Quebec	9,674	8,148	7,411 90
New Brunswick	970	713	698 90
Nova Scotia	9,110	7,794	7,077 80
Prince Edward Island	38	41	32 70
British Columbia	7,246	6,452	5,425 30
	27,038	23,148	20,646 60

CHIEF ENGINEER'S BRANCH

REPORT OF H. DE MIFFONIS, B.Sc., B.A., I.C.

This branch has charge of the construction of lighthouses, fog alarms and other aids to navigation; of the design and manufacture of lighthouse and fog signal apparatus, and research work in connection with the improvement of same; of the administration of shops and Dominion Lighthouse Depot at Prescott, Ont.; of the construction and repairs of piers, wharves, and buildings owned by the department.

Examinations and reports are made on all projects in connection with the development and improvement of harbours operated under Harbour Commissions. This branch also has charge of all surveys and transfers of land owned by the department, and water lots; of the publication of "List of Lights" and "Notice to Mariners;" of the removal of wrecks, icebreaking, and other works in connection with aids to navigation.

CHANGES AND IMPROVEMENTS

Nova Scotia.—Dartmouth, Lightships Nos. 15 and 24, Ciboux island, Flint island, Hobson island, Egg island, Jeddore rock, Larrys river, Little Hope, Mary Joseph, Maugers beach, Petitdegrat, Sambro, Scatari, South Ingonish, and Wedge island.

New Brunswick.—Saint John, Lightship No. 14.

Prince Edward Island.—Bird Rocks and Escuminac point.

Quebec.—Cap de Rosiers, Quebec. Lightships Nos. 3, 5, 7, 20 and 25.

Montreal.—Champlain, Montreal and Sorel.

Ontario.—Brighton, Burlington, Great Duck island, Leamington, Northwest Territories. Parry Sound—Lightships Nos. 21 and 22, Port Burwell and Prescott.

British Columbia.—Ballenas island, Chatham channel, Discovery rock, Fiddle reef, Fraser river, rearrangement of lighting system, North reef, Ogden, point, Point Atkinson, Point Upwood, Sisters, Trial island, Victoria and Yellow island.

PUBLICATIONS

Eighty notices to mariners comprising 197 subjects, have been issued during the past year.

The annual edition of the "List of Lights, Fog Signals and Radio Aids to Navigation" has been published.

DOMINION LIGHTHOUSE DEPOT, PRESCOTT, ONTARIO

As in previous years, the work performed at the depot has been principally in connection with the manufacture of lighthouse apparatus and equipment, fog signalling machinery, etc., for this district, also for the agencies in various provinces of the Dominion.

EXPERIMENTAL WORK AND TESTS

The following problems have been investigated at the Dominion Lighthouse Depot during the year: Inconel tubing in connection with oil vapour burners; a new form of flame spreader and the value of protecting sleeves over the vapourizing tubes for same; oil mantle lamps; coloured glass more particularly green glass for aids to navigation.

ICEBREAKING

The contract with the Sin-Mac Lines, Limited, to keep the harbours at the head of lake Superior open for navigation until December 17, and open them in the spring as soon as the canal at Sault Ste. Marie is open for navigation, is still in force.

REMOVAL OF OBSTRUCTIONS IN NAVIGABLE WATERS

This branch has attended to the removal of various minor wrecks and other obstructions to navigation.

COMMISSIONER OF LIGHTS' BRANCH

REPORT OF J. G. MACPHAIL, B.A., B.Sc., M.E.I.C., COMMISSIONER OF LIGHTS

The principal work performed during the fiscal year ending March 31, 1934, has been an extension of the buoy and beacon services, together with the maintenance of lights and other aids to navigation throughout the Dominion, and the maintenance and inspection of some 798 public wharves. These operations are set forth in tabular form in statement attached.

It will be observed that the total aids to navigation are shown, as follows:—

Lights	1,924
Lightships	11
Fog signals	381
Gas and signal buoys	601
All other aids to navigation	9,226
Grand total	12,243

STATEMENTS, by Districts, showing the number of lights of the several orders, lightships, lightkeepers, fog signals, buoys, submarine bells, etc., for the fiscal year ending March 31, 1934

Districts	1st order lights	2nd order lights	3rd order lights	4th order lights	5th order lights	6th order lights	7th order lights	Gas beacons	Pressed lens lights and other minor lights	Catoptric lights	Electric lights	Total lights	Lightships	Lightkeepers	Diaphones	Explosive signals	Fog whistles
New Brunswick	.....	4	3	23	22	31	62	4	10	11	7	177	1	169	28	1	.....
Nova Scotia	3	3	8	33	15	19	34	8	26	50	9	208	1	178	21	1	1
Prince Edward Island	2	7	8	32	6	11	39	9	32	119	4	269	.....	183	13	1	.....
Quebec	3	1	10	27	11	18	48	12	65	117	28	340	6	244	30	2	5
Montreal	.....	.....	.....	7	7	6	19	7	30	164	9	249	.....	167	.....	.....	.....
Prescott	.....	.....	3	15	2	6	15	36	7	15	10	109	.....	41	11	.....	.....
Parry Sound	.....	4	10	21	16	11	40	60	43	67	27	299	2	150	31	.....	2
Kenora	.....	.....	.....	.....	.....	.....	3	2	2	2	2	11	.....	5	.....	.....	.....
Manitoba	.....	.....	.....	.....	3	.....	4	.....	7	9	1	24	.....	12	.....	.....	.....
Victoria	3	.....	3	8	7	1	5	96	10	7	24	164	1	60	27	.....	.....
Prince Rupert	1	.....	3	4	.....	1	2	48	4	4	.....	66	.....	17	10	.....	.....
Hudson Strait and Bay	.....	.....	.....	.....	.....	.....	.....	6	.....	.....	2	8	.....	.....	.....	.....	.....
Total	12	19	48	170	89	104	271	288	236	565	123	1,924	11	1,226	171	5	8

STATEMENTS, by Districts, showing the number of lights of the several orders, lightships, lightkeepers, fog signals, buoys, submarine bells, etc., for the fiscal year ending March 31, 1934

Districts	Sirens	Fog bells	Hand fog horns	Hand fog bells	Total fog signals	Fog signal stations only	Gas buoys	Gas and whistling buoys	Gas and bell buoys	Whistling buoys	Bell buoys	Total gas and Signal buoys	Lightship submarine bells	Lighted spar buoys, floats and dolphins	Unlighted buoys	Stakes, bushes and balises	Unlighted dolphins, spindles, and beacons
New Brunswick	.....	11	23	.....	63	6	5	15	8	8	36	72	.....	.....	601	528	65
Nova Scotia	.....	2	46	1	72	3	9	21	18	25	63	134	.....	.....	1,154	29	9
Prince Edward Island	1	.....	10	.....	25	.....	3	4	6	5	11	29	.....	.....	961	1,797	6
Quebec	.....	.....	24	3	64	1	78	1	11	.....	1	91	2	1	302	100	96
Montreal	.....	.....	.....	.....	.....	.....	110	.....	.....	.....	.....	110	.....	3	649	170	424
Prescott	.....	4	6	.....	20	.....	52	.....	4	.....	.....	56	.....	1	578	.....	6
Parry Sound	.....	7	33	.....	73	.....	45	4	11	.....	5	65	.....	29	667	64	72
Kenora	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	439	.....	.....
Manitoba	.....	.....	5	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Victoria	1	11	4	.....	43	1	13	6	5	3	6	33	.....	15	70	.....	11
Prince Rupert	.....	3	3	.....	16	2	1	8	2	.....	.....	11	.....	.....	187	.....	115
Hudson Strait and Bay	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	34	.....	41
Total	2	38	154	4	381	13	316	59	65	41	122	601	2	49	5,642	2,688	845

RIVER ST. LAWRENCE SHIP CHANNEL

REPORT OF N. B. McLEAN, M.E.I.C., CHIEF ENGINEER

DREDGING OPERATIONS, SEASON 1933

During the season of 1933 the following dredging work was carried out in the River St. Lawrence Ship channel.

The department operated four dredges, working 10 hours per day, throughout the season of 1933, except for 29 working days, during the months of June and July, when these dredges were operated for 24 hours per day. The average date for all the departmental dredges being in commission was April 30, and they were all brought into winter quarters in the middle of November.

These dredges moved 549,962 cubic yards place measurement of original dredging and 323,643 cubic yards place measurement of cleaning up in the North channel below Quebec, totalling 873,605 cubic yards place measurement. Considering the curtailment of the season due to ice conditions and the large quantity of cleaning up, the progress was very satisfactory.

The first of the contract dredges began work May 20 and the last of these dredges was taken in on November 25. Eight dredges were operated by the contractors, together with one clam dredge, two rock drills and 3 drags. Very satisfactory progress was made, 93·6 per cent of the excavation having been completed at the close of the season.

The quantities moved by the contractors amounted to 759,628 cubic yards place measurement.

River St. Lawrence Ship Channel—Progress of dredging operations at end of season 1933

WORK PERFORMED BY SHIP CHANNEL PLANT

Locality	Miles dredged in 1933	Miles dredged to date	Miles yet to be dredged	Cubic yards dredged in 1933 place measurement	Total cubic yards dredged to date place measurement	Cubic yards yet to be dredged place measurement
Division No. 1—Montreal to Sorel—						
Longueuil Shoal	Contract	0·43	Contract	Contract	358,125	Contract
Longue Pointe to Lanoraie	.....	24·31	.....	.....	10,222,409	To be cleaned up
Lanoraie to Sorel	0·08	0·08	0·53	4,464	4,464	109,261
Total—Division No. 1	0·08	24·82	0·53	4,464	10,584,998	109,261
Division No. 2—Sorel to Batiscan, not including Lake St. Peter—						
Sorel to Three Rivers	0·47	10·17	0·11	103,700	4,534,020	To be cleaned up
Three Rivers to Batiscan	0·99	9·00	.....	67,834	2,780,810	To be cleaned up
Total—Division No. 2	1·46	19·17	0·11	171,534	7,314,830	
Division No. 3—Lake St. Peter—						
Lake St. Peter	0·52	18·32	.....	43,571	8,591,308	To be cleaned up
Total—Division No. 3	0·52	18·32	.....	43,571	8,591,308	
Division No. 4—Batiscan to Quebec—						
Cap Charles Channel	o ntract	0·14	Contract	Contract	62,975	Contract
Cap Charles Curve	.....	0·59	.....	.....	119,419	To be cleaned up
Grondines	.....	0·74	.....	.....	157,114	To be cleaned up
Lotbiniere	.....	0·01	0·56	.....	2,411	205,589
Ste. Croix Channel	Contract	0,10	Contract	Contract	130,286	Contract
St. Augustin	.....	0·01	1·40	.....	11,596	627,358
Total—Division No. 4	.....	1·59	1·96	.....	483,801	832,947
Division No. 5—Quebec to Goose Cape, North Channel—						
Madame Reef Shoal (1,000 ft. wide)	.....	2·27	2·27	.....	1,705,196	996,522
West Sand and East Narrows (1,000 ft. wide)	0·31	3·50	2·75	330,393	13,668,646	409,585
Total—Division No. 5	0·31	5·77	5·02	330,393	15,373,842	1,406,107
Total—Ship Channel Fleet, 35-foot Project	2·37	69·67	7·62	549,962	42,348,779	2,348,315
Cleaning up and widening (1930 estimate)	.....	.....	.....	.....	170,336	966,888
Total	.....	.....	.....	.....	170,336	966,888
Barre à Boulard	.....	.....	.....	.....	6,213	Cleaning up
Beaujeu Bank	.....	.....	.....	.....	250,054	Cleaning up
West Sand and East Narrows	.....	.....	.....	318,464	633,535	Cleaning up
Cap Brule	.....	.....	.....	3,750	3,750	Cleaning up
Cap Gribanne	.....	.....	.....	1,429	1,429	Cleaning up
Total—All work Ship Channel Fleet, season 1933	.....	.....	.....	873,605	Place Measurement	

River St. Lawrence Ship Channel—Progress of dredging operations at end of season 1933

WORK PERFORMED BY CONTRACTORS' PLANTS

Locality	Miles dredged in 1933	Miles dredged to date	Miles yet to be dredged	Cubic yards dredged in 1933 place measurement	Total cubic yards dredged to date place measurement	Cubic yards yet to be dredged place measurement
Division No. 1—Montreal to Sorel—						
Longueuil Shoal	0·22	1·60	.....	56,397	583,219	9,909 Cleaning up
Total—Division No. 1	0·22	1·60	.....	56,397	583,219	9,909
Division No. 2—Sorel to Batiscan not including Lake St. Peter—						
Batture Perron	0·32	1·59	.....	51,773	316,116	1,500 Cleaning up
Total—Division No. 2	0·32	1·59	.....	51,773	316,116	1,500
Division No. 4—Batiscan to Quebec—						
Batiscan Curve	.....	1·94	.....	.....	393,908	1,500 Cleaning up
Batiscan Traverse	.....	1·37	.....	.....	462,046	50 Cleaning up
Cap Levrard Channel	0·01	2·07	0·10	2,821	207,391	21,590
Cap a la Roche Curve	0·51	2·06	.....	287,748	965,372	2,785 Cleaning up
Cap Charles Channel	0·50	1·36	0·06	135,353	428,910	7,295
Cap Sante and Ste. Croix	0·94	1·90	2·16	200,198	873,708	347,436
Total—Division No. 4	1·96	10·70	2·32	626,120	3,331,335	380,656
Total—Contract Dredging—35-foot Project	2·50	13·89	2·32	734,290	4,230,670	392,065
Fairchild Airport	.....	.....	Completed	844	106,829	All completed
Montreal East Channel and La Salle Basin	.....	.....	Completed	24,494	862,398	All completed
Fly Bank	.....	.....	Completed	.....	555,659	All completed
Total—All Contract Dredging	2·50	13·89	2·32	759,628	5,755,556	

River St. Lawrence Ship Channel—Summary of all dredging operation at end of season 1933

Locality	Length in miles	Length of dredging miles	Miles dredged in 1933	Miles dredged to date	Miles yet to be dredged	Cubic yards dredged in 1933 place measurement	Total cubic yards dredged to date place measurement	Cubic yards yet to be dredged place measurement
Division No. 1—Montreal to Sorel—								
Ship Channel Plant	.....	25·35	0·08	24·82	0·53	4,464	10,584,998	109,261
Contractor's Plant	.....	1·60	0·22	1·60	.....	56,397	583,219	9,909
Total—Division No. 1	45	26·95	0·30	26·42	0·53	60,861	11,168,217	119,170
Division No. 2—Sorel to Batiscan, not including Lake St. Peter—								
Ship Channel Plant	.....	19·28	1·46	19·17	0·11	171,534	7,314,830	To be cleaned up
Contractor's Plant	.....	1·59	0·32	1·59	.....	51,773	316,116	1,500
Total—Division No. 2	36	20·87	1·78	20·76	0·11	223,307	7,630,946	1,500
Division No. 3—Lake St. Peter—								
Ship Channel Plant	.....	18·32	0·52	18·32	.....	43,571	8,591,308	To be cleaned up
Total—Division No. 3	20	18·32	0·52	18·32	.....	43,571	8,591,308	
Division No. 4—Batiscan to Quebec—								
Ship Channel Plant	.....	3·55	.....	1·59	1·96	.....	483,801	832,947
Contractor's Plant	.....	13·02	1·96	10·70	2·32	626,120	3,331,335	380,656
Total—Division No. 4	59	16·57	1·96	12·29	4·28	626,120	3,815,136	1,213,603
Division No. 5—Quebec to Goose Cape—North Channel—								
Ship Channel Plant	.....	10·79	0·31	5·77	5·02	330,393	15,373,842	1,406,107
Total—Division No. 5	70	10·79	0·31	5·77	5·02	330,393	15,373,842	1,406 107
Total—35-foot Project	230	93·50	4·87	83·56	9·94	1,284,252	46,579,449	2,740,380
Ship Channel Plant's Dredging—								
Cleaning up and widening 1930 estimate	.....	.....	.....	.....	.....	.....	170,336	966,888
Barre a Boulard—cleaning lumps	.....	.....	.....	.....	.....	.....	6,213	.....
Beaujeu Bank	.....	.....	.....	.....	.....	.....	250,054	.....
North Channel, East Narrows and West Sand	.....	.....	.....	.....	.....	318,464	633,535	.....
Cap Brule	.....	.....	.....	.....	.....	3,750	3,750	.....
Cap Gribanne	.....	.....	.....	.....	.....	1,429	1,429	.....
Contractors' Dredging—								
Montreal East (including LaSalle Basin and Imperial Oil Entrance)	.....	.....	.....	.....	.....	24,494	862,398	.....
Fairchild Airport	.....	.....	.....	.....	.....	844*	106,829	.....
Fly Bank	.....	.....	.....	.....	.....	.....	555,659	.....
Total—All dredging						1,633,233	49,169,562	3,707,268

* Adjustment on final estimate.

Abstract of Work of Ship Channel Dredging Fleet during Fiscal Year ending March 31, 1934

Dredges	Locality of dredging	Time of service, days	Working hours 12 per day	Hours actual dredging	Number scows filled	Cubic yards dredged (place meas.)	Depth of dredging at E.L.W.	Width in feet	Character of soil
							ft.	ft.	
Dredge No. 12....	Three Rivers	17	204	162	60	8,523	36½	300	Clay, stones and boulders.
	Cap Madeleine Course	60	972	789	204	26,455	36½	225	Clay, stones and boulders.
	Ile au Raisin Traverse	61	732	448½	244	43,571	36½	225	Clay.
	Ile aux Foins	7	84	67	25	4,464	36½	225	Sand and stones.
	Total	145	1,992	1,466½	533	83,013			
Dredge No. 14....	Becancour Upper Traverse	40	669	511¾	146	19,426	36½	225	Hardpan, stones, shale and boulders.
	Cap Madeleine	39	504	407¼	113	13,430	36½	225	Hardpan, stones and boulders.
	Sorel	56	672	446	422	101,129	36½	225	Clay.
	Total	135	1,845	1,365	681	133,985			
Dredge No. 8.....	Sorel	5	54	35¼	*18	2,571	36½	225	Clay.
	North Channel, East Narrows and West Sand (original)	80½	870	640½	*287	102,500	37	250	Clay and sand.
	North Channel, East Narrows and West Sand (cleaning)	62½	994	785	*280	100,000	37	250	Sand.
	Cap Brule (cleaning)	11	120	79	*10½	3,750	37	.....	Sand and stones.
	Cap Gribanne (cleaning)	4	48	27½	*4	1,429	37	.....	Sand and stones.
	Total	163	2,086	1,567¼	*599½	210,250			
Dredge No. 16....	North Channel, East Narrows and West Sand (original)	85	1,098	760¾	*468	227,893	37	250	Clay and sand.
	North Channel, East Narrows and West Sand (cleaning)	87	1,071	750¾	*462	218,464	37	250	Clay, sand and stones.
	Total	172	2,169	1,511½	*930	446,357			
	Cubic yards dredged	.....	.....	.....	.....	873,605			

* Hopper barges.

Classification of Disbursements for Contract Dredging, Season of 1933

Name of dredge	Number cubic yards dredged, each locality	Rate per yard	Cost of work each locality	Total amount earned by each dredge	Kind of material dredged	Locality of dredging	Remarks
		$ cts.	$ cts.	$ cts.			
Manseau No. 101	18,742	2 00			Hardpan, stones and shale rock broken by Department	Cap a la Roche Curve	Class "B".
	124,435	4 00			Shale rock	" "	Class "A", cost of breaking not included
	28,070	7 00	731,714 00		Shale rock	" "	Class "A", cost of breaking included.
	2,812	0 45			Hardpan and stones	Cap Levrard Channel	Class "B".
	9	8 00	1,337 40		Boulders	" "	Class "A".
	174,068			733,051 40			
Manseau No. 103	2,532	4 00	10,128 00		Shale rock	Cap a la Roche	Class "A", cost of breaking not included.
	36,242	2 00			Hardpan and boulders	Cap Charles Channel	Class "B".
	51,927	4 00			Shale rock	" "	Class "A", cost of breaking not included.
	18,354	7 00	408,670 00		Shale rock	" "	Class "A", cost of breaking included.
	109,055			418,798 00			
Manseau No. 105	41,945	0 90			Hardpan, gravel, clay and stones	Longueuil Shoal	Class "B".
	5,921	8 00	85,118 50		Shale rock and boulders	" "	Class "A".
	552	0 50			Hardpan, clay and stones	Montreal East, including La-Salle Basin and Imperial Oil Entrance	Class "B".
	63	8 00	780 00		Shale and boulders	" " "	Class "A".
	48,481			85,898 50			
Manseau No. 107	7,984	0 90			Hardpan, gravel, clay and stones	Longueuil Shoal	Class "B".
	83	8 00	7,849 60		Shale rock and boulders	" "	Class "A".
	18,264	0 50			Hardpan, clay and stones	Montreal East, including La-Salle Basin and Imperial Oil Entrance	Class "B".
	953	8 00	16,756 00		Shale, trap rock and boulders	" " "	Class "A".
	27,284			24,605 60			

General Brock	1,727	4 00			Shale rock	Cap a la Roche Curve	Class "A", cost of breaking not included.
	5,573	7 00	45,919 00		Shale rock	" "	Class "A", cost of breaking included.
	7,300			45,919 00			
Bruxelles XXXX	464	0 90	417 60		Hardpan, gravel, clay and stones	Longueuil Shoal	Class "B".
	4,622	0 50			Hardpan, clay and stones	Montreal East	Class "B".
	40	8 00	2,631 00		Boulders	Montreal East	Class "A".
	51,662	0 60			Sand, clay and stones	Batture Perron	Class "B".
	111	8 00	31,885 20		Boulders	" "	Class "A".
	56,899			34,933 80			
Midland	199,676	0 50			Sand, hardpan and stones	Cap Sante—St. Croix	Class "B".
	522	8 00	104,014 00		Boulders	" "	Class "A".
	200,198			104,014 00			
Delver	101,183	4 00			Shale rock	Cap a la Roche	Class "A", cost of breaking not included.
	2,123	7 00	419,593 00		Shale rock	"	Class "A", cost of breaking not included.
	103,306			419,593 00			
Halifax No. 25	23,477	2 00			Hardpan and stones	Cap Charles	Class "B".
	5,353	7 00	84,425 00		Shale rock	"	Class "A", cost of breaking included.
	28,830			84,425 00			
Adjustment final estimate (Midland).	259	2 00			Hardpan and stones	Cap a la Roche Curve	Class "B".
	730	4 00			Shale rock	" "	Class "A", cost of breaking not included.
Cap a la Roche (1931-32).	2,374	7 00	20,056 00		Shale rock	" "	Class "A", cost of breaking included.
	3,363			20,056 00			
Adjustment, final estimate, Baie St. Paul and Manseau 105 (1931-32).	749	0 90			Hardpan	Fairchild Airport	Class "B".
	95	8 00	1,434 10		Shale and trap rock	" "	Class "A", cost of breaking included.
	844			1,434 10			
General Brock and Bruxelles XXXX (1932).	263,920	0 10	26,392 00		Clay, sand and stones	Batture Perron	Class "B"—paid at 50c.—correct rate 60c. Adjusted 1933.
	263,920			26,392 00			
Total	759,628			1,999,120 40			

Details by Localities all Dredging—Season 1933

SHIP CHANNEL FLEET

Locality	Number of dredges elevator type	Days actual work	Cubic yards dredged place measurement	Material
35-foot project above Quebec—				
Montreal-Sorel	1	7	4,464	Sand and stones.
Sorel-Three Rivers (not including Lake St. Peter)	2	5 and 56	103,700	Clay.
Lake St. Peter	1	61	43,571	Clay.
Three Rivers-Batiscan	2	77 and 79	67,834	Hardpan, stones, shale and boulders.
35-foot project below Quebec—				
North Channel, East Narrows and West Sand	2	80½ and 85	330,393	Clay and sand.
Total, all 35-foot project	.....	.....	549,962	
Cleaning up—				
North Channel, East Narrows and West Sand	2	62½ and 87	318,464	Sand, clay and stones.
Cap Brule	1	11	3,750	Sand and stones.
Cap Gribanne	1	4	1,429	Sand and stones.
Total yardage dredged, Ship Channel Fleet, Season 1933.	.....	.....	873,605	

CONTRACTOR'S FLEET

On the majority of Contractor's Dredges two shifts of men were employed. The remainder of the Dredges worked 24 hours a day

Locality	Number of dredges	Type of dredges	Cubic yards dredged place measurement	Material
35-foot project above Quebec—				
Longueuil Shoal	2	Dipper	56,397	Hardpan, gravel, clay, shale, trap rock and stones.
	1	Elevator		
Batture Perron	1	Elevator	51,773	Sand, clay and stones.
Cap Levrard Channel	1	Dipper	2,821	Hardpan and stones.
	1	Drill		
Cap a la Roche Curve	3	Dipper	287,748	Shal rock and hardpan.
	1	Suction		
	1	Drill		
Cap Charles Channel	2	Dipper	135,353	Shale rock, hardpan, stones and boulders.
	1	Clam		
	2	Drills		
Cap Sante-St. Croix	1	Dipper	200,198	Sand, hardpan and boulders.
Total	.....	.....	734,290	
Montreal East, including La Salle Basin and Imperial Oil entrance	2	Dipper	24,494	Sand, clay, shale and stones.
	1	Elevator		
	1	Drill		
Fairchild Airport—Adjustment on final estimate, work of 1931 and 1932	2	Dipper	844	
Total yardage dredged, Contractor's Fleet, season 1933.	.....	.....	759,628	

COST OF SHIP CHANNEL FROM YEAR 1851 TO MARCH 31, 1934

Cost of dredging	$39,688,683 77
Expenditure for plant, shops, surveys, etc	14,613,882 11
Quantities dredged	107,920,928 cu. yards

NOTE.—Detailed statements of the above figures shall be found in the previous reports. Those for last four years follows—

NOTE:—Commencing with Year 1930-31 all quantities are calculated in Place Measurement.

—	Cost of dredging	Expenditure for plant, shops, surveys, etc.	Quantities dredged, cubic yards (place measurement)
	$ cts.	$ cts.	
Fiscal year 1930-1931	2,119,101 63	425,453 64	1,896,552
" 1931-1932	5,127,395 83	699,205 24	3,558,125
" 1932-1933	5,653,490 63	268,867 58	2,661,012
" 1933-1934	2,920,569 66	210,176 57	1,633,233

TIDAL SEMAPHORES

The tidal semaphores were put into operation on the following dates, in 1933: Crane island, April 14; St. Nicholas, May 17; Grondines, May 2; St-Jean, May 2, and Pointe Citrouille, May 2.

HEIGHT OF WATER

During the season of 1933 a new low water record was established. The extreme low water level at Montreal was 2 feet 2 inches lower than the 1897 datum. The difference in level between the 1897 datum and the 1933 datum gradually decreased downstream, and at about the lower end of Cap Charles Channel this difference ran out to nothing.

Average depth for each month in the ship channel, from Sorel gauge, from 1897 to 1930 is given in the previous reports. Figures for 1930 to 1933 follow:—

—	May	June	July	Aug.	Sept.	Oct.	Nov.	Highest	Lowest
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
1930	36 4	35 5	35 2	33 2	32 1	31 8	31 1	38 9	30 3
1931	33 2	32 5	31 5	31 4	31 6	31 5	31 8	35 3	30 9
1932	34 11	33 3	32 10	33 0	33 10	34 3	35 1	40 9	32 3
1933	37 5	33 10	32 6	32 3	31 7	31 1	30 10	40 4	30 1

The lowest reading for the season was 30 feet 1 inch on November 13, 1933.

ICE-BREAKING OPERATIONS, 1933-34

The winter of 1933-34 set in early. On October 24th there was a very heavy snowstorm, followed by steadily decreasing temperature and frequent snowfalls. On November 12 the ice was running in the St. Lawrence. On November 18 it was commencing to be a menace to shipping and rapidly developing to the worst ice condition since 1917. This situation had been anticipated and all the icebreakers were ready to take care of any crisis which might arise. The icebreakers in operation were the following: *Mikula, McLean, Montcalm, Saurel, Lady Grey* and *Bellechasse.*

The acute ice condition in the St. Lawrence of this autumn cannot be considered abnormal as conditions of a similar nature occur from time to time at infrequent intervals, the previous occasion being in 1917. The severe ice conditions of the autumn of 1933 were by no means average as this usually occurs only at the end of the first week of December. In 1926 the last ship cleared from Montreal December 5 and from Quebec December 23. Six vessels wintered in Montreal and one at Sorel. In 1929 the last ship left Montreal December 7, and Quebec December 23.

On November 20, 118 vessels had arrived at or were booked for Montreal. Of the above ships 3 were cancelled, 1 turned back below Quebec, 1 remained in Montreal, 3 remained in the Lakes, leaving 110 to go out. 14 vessels were turned at Quebec.

The final analysis gives 95 vessels cleared from Montreal and 14 from Quebec. Total 109 vessels all told cleared after November 20.

Total number of vessels assisted was 247.

The last convoy left Quebec outward bound on December 9.

In regard to the Norwegian steamer *Fjeld,* the only vessel left to winter in Montreal, it is pointed out that had instructions been followed, this vessel would have got away like the rest. .

During December of 1933, after the last vessels had cleared the river, a new record for low temperatures was established and as a result the river became blocked from Cape Sante to Three Rivers.

By January 20 the channel had been reopened to a point about one mile above Three Rivers. This channel was maintained throughout the winter though with some difficulty as a considerable number of jams had to be cut out at different points.

On February 28 the work of opening the river to Montreal began at a point about one mile above Three Rivers. Exactly one month later, on March 28, the channel had been opened to Victoria pier, Montreal. Although the ice was only of about average thickness between Three Rivers and Montreal the opening of the channel took rather longer due to the fact that on several occasions, propeller blades were lost and in one instance a complete propeller, all of which delayed the work.

It is of interest to note that, for the last five years—1930 to 1934 inclusive —since the river has been opened to Montreal, the average date for the first arrival from sea was April 18. The previous average date for the first arrival from sea, when the river was only opened up into lake St. Peter or occasionally to Sorel, was April 25, which indicates a gain in the length of a season of seven days in the spring.

The *Lady Grey* was employed cutting out a very long heavy bank of frazil in lake St. Louis below the Soulanges canal from April 24 to May 2. The *Saurel* was engaged opening the Saguenay river from April 26 to May 2. With the clearing of the entrance to the Soulanges canal and the opening of the Saguenay, the ice-breaking was brought to a close in the upper St. Lawrence for the season.

The *McLean* and *Montcalm* carried out patrol work in the gulf, where the ice conditions were exceptionally bad.

EXPENDITURE for the year 1933-34

—	Appropriation	Expenditure	Balance
	$ cts.	$ cts.	$ cts.
Ocean and River Service—			
Dominion steamers	1,460,000 00	1,311,422 77	148,577 23
Cattle inspection	4,000 00	3,485 44	514 56
Distressed seamen	1,000 00	416 10	583 90
Investigation wrecks	5,281 19	1,697 38	3,583 81
Masters and mates	15,718 81	15,718 81	.....
Registry of shipping	2,000 00	1,515 79	484 21
Removal of obstructions	1,414 00	378 78	1,035 22
Schools of navigation	5,700 00	4,860 76	839 24
Distressed seamen (special)	1,100 00	788 85	311 15
Subsidy to wrecking plants	40,000 00	40,000 00	.....
Unforeseen expenses	8,100 00	6,751 01	1,348 99
Life saving service	46,275 00	42,808 70	3,466 30
Hydrographic Survey	420,000 00	393,286 85	26,713 15
Radio Telegraph Service	590,550 00	520,218 62	70,331 38
Radio reception	259,400 00	245,429 68	13,970 32
Allowance to L. Larson	500 00	500 00	.....
Total	2,861,039 00	2,589,279 54	271,759 46
Public Works—			
Ship channel	3,430,350 00	3,421,053 72	9,296 28
St. Lawrence river dams	90,000 00	89,560 25	439 75
Total	3,520,350 00	3,510,613 97	9,736 03
Exchequer Court awards	20,543 75	20,543 75	.....
Non-Active Investments—			
St. John Harbour restoration	50,000 00	42,000 00	8,000 00
Lighthouse and Coast Service—			
Agencies, rents and contingencies	195,000 00	192,192 02	2,807 98
Construction	331,000 00	248,790 07	82,209 93
Maintenance	777,000 00	770,125 21	6,874 79
Salaries of lightkeepers	652,243 00	645,859 10	6,383 90
Allowance, J. Davidson	500 00	500 00	.....
Allowance, E. J. McCoskrie	420 00	420 00	.....
Marine Signal Service	92,917 00	92,916 57	0 43
Administration of pilotage	118,000 00	86,687 77	31,312 23
Repairs to wharves	9,250 00	7,424 91	1,825 09
Icebreaking in Thunder bay	30,000 00	19,500 00	10,500 00
Pensions to pilots	6,600 00	6,581 45	18 55
Allowance to Angelina Foisey-Cantin	1,000 00	1,000 00	.....
Total	2,213,930 00	2,071,997 10	141,932 90
Scientific Institutions—			
Meteorological Service	350,000 00	312,640 63	17,359 37
Steamboat inspection	136,800 00	121,224 17	15,583 83
Miscellaneous—			
Gratuities	6,000 00	2,576 07	3,423 93
Salary Deduction Act	18,000 00	10,665 74	7,334 26
Refund of water lot rental	1,037 09	1,037 09	.....
Revision of legislation	5,194 26	5,194 26	.....
Total	30,231 35	19,473 16	10,758 19
Civil Government—			
Minister's salary	9,000 00	9,000 00	.....
Salaries	288,882 00	281,215 77	7,666 23
Contingencies	46,630 00	33,867 25	12,762 75
Total	344,512 00	324,083 02	20,428 98
Investments—			
Montreal Harbour Commission	.....	449,000 00	.....
Quebec Harbour Commission	.....	106,914 06	.....
Vancouver Harbour Commission	.....	1,208,298 68	.....
Halifax Harbour Commission	.....	151,258 38	.....
St. John Harbour Commission	.....	829,190 56	.....
New Westminster Harbour Commission	.....	12,614 00	.....
Three Rivers Harbour Commission	.....	107,000 00	.....
Chicoutimi Harbour Commission	.....	332,100 00	.....
Total	.....	3,196,375 68	.....

Expenditure for the year 1933-34—*Concluded*

—	Appropriation	Expenditure	Balance
	$ cts.	$ cts.	$ cts.
Recapitulation of Services—			
Ocean and River Service	2,861,039 00	2,589,279 54	271,759 46
Public Works (Capital) Marine	3,520,350 00	3,510,613 97	9,736 03
Lighthouse and Coast Service	2,213,930 00	2,071,997 10	141,932 90
Scientific Institutions	330,000 00	312,640 63	17,359 37
Steamboat Inspection	136,808 00	121,224 17	15,583 83
Miscellaneous	30,231 35	19,473 16	10,758 19
Civil Government	344,512 00	324,083 02	20,428 98
Total	9,436,870 00	8,949,311 59	487,558 76
Exchequer Court Awards	20,543 75	20,543 75	.....
	9,457,414 10	8,969,855 34	487,558 76
Investments	.....	3,196,375 68	
		12,166,231 02	
Non-Active Investments	50,000 00	42,000 00	8,000 00

Revenue for fiscal year 1933-34

—	Gross Revenue	Refunds	Net Revenue
	$ cts.	$ cts.	$ cts.
Radio Revenue—			
Traffic	49,081 39	.....	49,081 39
Private Radio receiving licences	1,304,978 14	13,493 49	1,291,484 65
Private Commission and Amateur Broadcasting	3,570 00	655 00	2,915 00
W/A licence and others	9,358 90	200 15	9,158 75
W/O examination fees	620 50	1 50	619 00
	1,367,608 93	14,350 14	1,353,258 79
Piers and wharves	102.995 67	314 17	102.681 50
Harbour dues	2,179 50	7 00	2,172 50
Dominion steamers	2,529 19	.....	2,529 19
Masters and mates	3,261 50	2 00	3,259 50
Steamship Inspection—			
Engine fees	1,181 00	10 00	1,171 00
Inc. fees	8,359 95	.....	8,359 95
Plans	972 50	.....	972 50
Annual	92,537 89	362 50	92,175 39
Casual Revenue—			
Rental	9,118 02	50 00	9,068 02
Previous year expenditure	53,280 43	300 00	52,980 43
Sundries	867 64	.....	867 64
Publications	5,076 37	23 94	5,052 43
Premium, discount and exchange	29 42	0 15	29 27
Signal Station wires	1,115 00	.....	1,115 00
Marine registry	125 40	1 65	123 75
Pilots licence fees	150 00	.....	150 00
Fines and forfeitures	685 99	.....	685 99
	1,652,074 40	15,421 55	1,636,652 85
Capital Account (Previous year expenditure)—(Ship Channel)	10,688 02	2,050 00	8,638 02
	1,662,762 42	17,471 55	1,645,290 27

METEOROLOGICAL SERVICE OF CANADA

REPORT OF JOHN PATTERSON, M.A., F.R.S.C., DIRECTOR

ADMINISTRATION DIVISION

During the fiscal year the Service was continued on the same basis as the previous year, without any increase or decrease in the staff at the Head Office.

Personnel.—Mr. H. A. Small retired on superannuation after forty-five years' service, as weather observer and clerk of supplies. His place was taken by Mr. G. E. Graham.

Mr. D. C. Archibald, Superintendent of the Western Airways Weather Service, was granted one year's leave of absence, from October 12, 1933, without pay, to proceed to Europe, to study meteorology, under Prof. J. Bjerknes' of Bergen, Norway. Mr. Archibald will also visit the principal meteorological centres in Europe, to learn as much as possible of their work and organization.

Weather Broadcasts.—It is very gratifying to be able to report that arrangements were satisfactorily completed with the Canadian Radio Commission whereby beginning on November 13, 1933, forecasts for the twenty-five forecast districts in Canada, together with a brief synopsis of the weather, have been broadcast daily at 10.35 p.m., E.S.T., on the Trans-Canada chain. The forecasts for all Canada except British Columbia are prepared by the Meteorological Office, Toronto, and those for British Columbia by the Meteorological Office in Victoria. The latter are telegraphed to Toronto and reach the Broadcasting station in time to be given out with the other forecasts. These forecasts are based on observation taken at 8 p.m., E.S.T., and are thus available to all interested, two and a half hours after the observations are made.

The various Radio and Wireless stations of the Radio Branch of the Department of Marine broadcast at stated times the forecasts and storm warnings for the benefit of shipping in the Maritime Provinces and on the Great Lakes, while local broadcasts are made of the weather and forecasts for the district from numerous stations.

Lecture Courses in Meteorology.—Prof. J. Bjerknes', a leading exponent of the Norwegian methods of forecasting, was invited to Toronto to give a series of lectures and instruction in modern developments in meteorology, during the month of July. Dr. B. Haurwitz of the Geophysical Institute at Leipzig and visiting professor at the Massachusetts Institute of Technology, visited Toronto at the same time and also gave a number of lectures. These were attended by members of the Meteorological staff and also a number from the University of Toronto. It was the first time the service had the opportunity of having the outstanding meteorologists of the world lecture to them; their visit was a very great source of inspiration to the staff, and it is hoped when similar opportunities occur in the future, advantage will be taken of them. It gives members of the staff who cannot otherwise meet the leading meteorologists of the world an opportunity to discuss with them the common problems that affect the science of meteorology.

Through the efforts of Dr. E. F. Burton, Professor of Physics, University of Toronto, a graduate course in meteorology, leading to the degree of M.A., was established. The lectures given in the University in mathematics and physics were specially designed to be of the greatest assistance in the science of meteorology, while members of the technical staff gave lectures in meteorology and practical work in modern methods of forecasting. This course marks the first definite attempt in Canada to provide the necessary scientific training for the technical staff of the Service, and insures that it will be possible to obtain meteorologists who have had considerable training and the proper foundation

for the study of meteorological science before they enter. Hitherto it has been necessary to recruit the technical staff from those who have excellent training in the fundamental sciences but no experience in meteorology. Much time had therefore to be spent before they became trained meteorological officials.

Observing Stations.—Mr. F. P. Ronnan, weather observer, Grade 5, at Halifax, for over thirty years, was retired on the 1st of September, and the station moved to the Citadel, in charge of the East Coast Radio Service.

Mr. T. S. H. Shearman, weather observer, Grade 5, at the Vancouver office, was retired at the same time, and his place was taken by Mr. E. B. Shearman.

The Meteorological station at Bird Rock in the gulf of St. Lawrence, was transferred to Grindstone Island during the year. Through the co-operation of the Canadian Airways, a Telegraph Weather Reporting station was opened at their Wireless station at God's Lake, Man. This adds one more to the list of stations extending the line northward to meet those along the fringe of the Arctic. In order to give the Air Service from Montreal to Albany more detailed information, a weather reporting station was opened at LaColle Junction, P.Q. This station gives the weather at definite times to our office at the St. Hubert Airport for use on the air routes.

Through the energy of Mr. F. M. Barnes, in charge of the Saint John Observatory, and the active co-operation of the Lumber and Power Corporations of New Brunswick, some 38 additional Rainfall stations have been opened up in that province. This is most gratifying, and is the beginning of a movement to have, by voluntary observations, a very much more detailed report of the rainfall throughout Canada. At the present time we have less than 900 stations reporting rainfall. When it is remembered that there are something like 4,000 Rainfall Reporting stations in Great Britain alone, the need of a very great increase in the Rainfall stations is apparent if an accurate record of rainfall is to be obtained. This is becoming increasingly important for all industries, especially those dealing with power, and for the grain growing regions of the west.

Ten voluntary climatological stations were established in regions where observations are urgently required, two of these being in Northern Canada, where observations are very scanty, and in a region that is rapidly being opened up through prospecting.

On March 31, 1934, there are in addition to Headquarters at Toronto, 5 Branch offices, 12 Chief, 1 Airport, 59 Telegraph, 40 Bulletin, 67 Climatological, and 729 Rainfall stations. Of these, 524 are voluntary and it is a great pleasure to record the appreciation of the service to those who voluntarily give their time to taking these important observations in connection with the climatology of the country. There are 115 storm signal stations distributed as follows: 3 in British Columbia; 63 on the Great Lakes and Lower St. Lawrence, and 49 in the Maritime Provinces.

Inspection.—During the year 20 Telegraph and 45 Climatological stations were inspected.

At the request of the Director of the North West Territories Branch, Department of the Interior, Mr. Middleton accompanied the ss. *Nascopie* on its voyage to the Eastern Arctic. He inspected all the stations where the boat called, instructed the observers and as far as circumstances permitted studied the topographical features of the country as they affect the climate. On his return he prepared a brief summary of the climatology of the Eastern arctic, based on his experience, and an analysis of many of the records from the far northern stations for the Department of the Interior.

The inspection of these stations emphasized once more the absolute necessity of having all our climatological and other stations inspected as soon as possible if the accuracy of the observations is to be maintained. It is found that in

many cases the observers are not taking the observations in the way that they should, and that the exposures are frequently bad. The observers are anxious to do what is right, but never having been visited by an inspector, they are working under a great handicap and it speaks very much for their faithfulness and loyalty in carrying on year after year, especially those who are doing the work voluntarily.

Conferences.—During the year the director attended the meeting of the Fifth Pacific Science Congress in Victoria and Vancouver, from June 2 to June 15, 1933, and was chairman of the section on Meteorology and Terrestrial Magnetism. He gave several papers before this congress, prepared by members of the staff.

At the request of the Director of the Experimental Farm, the Hon. Mr. Bryant, Chairman of the Conservation Commission for the Prairie Provinces, and others, a conference was held in Regina during the World's Grain Exhibit, to give further consideration to the recommendations made at the Winnipeg Conference held in November, 1931. This conference was very largely attended and emphasized especially the necessity of putting into effect the recommendations of the Winnipeg Conference as soon as possible, and that our observing stations not only in the West but throughout Canada should be inspected even if other work could not be undertaken. It was also specially urged that the Experimental Farms across Canada should be fully equipped with meteorological instruments. It has been decided by the department to undertake the equipping of these stations and the necessary instruments are now being obtained for that purpose. At this conference the director gave an address on "Weather Forecasting."

In co-operation with the Grain Exchange at Winnipeg, a weather service similar in all respects to that in Winnipeg, was set up in Regina during the World's Grain Exhibit and Conference. Daily maps were prepared and distributed in the city and to the various parts of the fair. The exhibit attracted very considerable attention and co-operation was received from the Canadian Pacific Telegraph Company, the Gestetner Company, and the United Typewriter Company, in furnishing the machines necessary to undertake this work free of charge.

New equipment.—Since the present working chart for use in the Forecast division was prepared the area from which meteorological data is obtained has been extended very materially to the east, west and north, and in order to take in this enlarged area, a new map is in the course of preparation. On this map it is proposed to show by means of light tints the different levels of the topography in order to more clearly show the movements of the air masses and their relation to the topography of the country. The map is being prepared by the Topographical Surveys Branch of the Department of the Interior, in accordance with the recommendations of the International Meteorological Organization.

The small press on which the daily map has been printed for many years has been replaced by a larger and more modern press. This will materially speed up the time of printing the weather map and thus insure earlier delivery. It fulfills a long-felt want.

In order to expedite the statistical work in the Climatological Division, a new tabulating machine has been installed. This machine will greatly assist in the compilation of the climatological data, and in the preparation of the Monthly Record of Observations.

Library.—During the year 136 volumes, 209 periodicals, and numerous pamphlets, were received. There were distributed each day 590 copies of the Daily Weather map and each month 577 copies of the Monthly Weather map and 617 Records of Meteorological Observations; 125 copies of the Magnetic

Year Book for 1927 were sent to the various Observatories throughout the world with which exchanges are made.

The growth of the library in recent years and the accumulation of meteorological publications of the department, had used up practically all the available space for storage. Much, however, of this was obsolete and during the past year an unemployed veteran was engaged to go over all the material and set aside a sufficient stock for all purposes. The Salvage department disposed of the remainder. In this way the accommodation in the library has been materially increased and at the same time the records stored so as to be easily accessible.

Publications.—Articles were published by various members of the staff as follows:—

The Director—

"A New Method of Barometric Reductions"—American Meteorological Society Bulletin.

"The Development of Meteorological Science"—Journal of The Royal Astronomical Society.

"Water Temperatures in the Pacific and Their Relation to the Weather of Canada"—Proceedings of The Fifth Pacific Science Congress.

"Weather Forecasting"—Proceedings of the World's Grain Exhibit and Conference.

The Assistant Director—

"Progress Report on the work of the Canadian Magnetic Observatories"—Transactions of The American Geophysical Union, 1933.

"Solar Activity and Terrestrial Magnetism"—The Fifth Pacific Science Congress.

"Report on Meanook Observatory"—The Fifth Pacific Science Congress.

Andrew Thomson, M.A.—

"Intertropical Circulation of the Atmosphere over the South Pacific Ocean"—Fifth Pacific Science Congress, Vancouver.

"Dynamics of Extra tropical Cyclones"—American Meteorological Society, Chicago.

"Some characteristics of Polar fronts"—Royal Society of Canada.

A. J. Connor, M.A.—

"Droughts in Western Canada"—Canada Year Book.

W. E. K. Middleton, M.Sc.—

"An Instrument to facilitate the Drawing of Wind Roses"—Meteorological Magazine.

In Course of Publication; "Une méthode de présenter les données de la fréquence des vents."

A number of popular lectures on meteorological subjects were given by various members of the staff in addition to some special lectures by Mr. Andrew Thomson to university students on "Modern Developments in Meteorology."

THE SECOND INTERNATIONAL POLAR YEAR 1932-33

The second International Polar Year for 1932-33 closed officially on August 31, 1933, and the various members of the Canadian parties returned from their field of operation in September and October. During the rest of the year they have been employed in reducing the observations and preparing them for publication.

Each of the polar year stations carried out its full program of work in so far as they were equipped for the various major investigations undertaken during the International Polar Year. The following gives a brief summary of the accomplishments at each of the stations:—

Chesterfield Inlet.—The party was in charge of Mr. F. T. Davies, M.Sc., assisted by Dr. B. W. Currie, S. McVeigh, B.Sc., and J. P. Rea.

At this station continuous records of atmospheric pressure, temperature, humidity, sunshine, solar radiation, wind direction and velocity, were obtained throughout the year. In addition the self-recording rain gauge was in operation and a continuous record of the difference in temperature between the top and bottom of the 120-foot radio mast was obtained by means of thermocouples. These records were supplemented at four observation periods daily, by eye readings of the barometer, air temperature, maximum and minimum temperatures, and humidity. Earth temperatures at 1′ and 4′ depths were read twice daily and hourly records of clouds and weather made. Pilot balloon ascents to determine wind direction and velocity in the upper air were made daily, the total for the year amounting to 496, one being a record for the length of time observed. Kites carrying meteorographs for determining the pressure, temperature, humidity and velocity of the air at different levels within a mile of the ground were flown on 87 occasions and many very important results were obtained.

Continuous records of declination, horizontal and vertical intensity, were obtained with two sets of LaCour magnetographs at different sensitivities. These were standardized by eye readings with a CIW magnetometer and an inductor and galvanometer. Electrical methods of measuring horizontal intensity by the Smith portable magnetometer were found impractical due to the very low value of the horizontal component, but especially to the rapid fluctuations in declination. Extreme disturbance characterized the records obtained.

Continuous records of earth currents in the EW. and NS. directions were obtained with apparatus loaned by the Department of Terrestrial Magnetism of the Carnegie Institute, Washington. Extremely rapid variation was characteristic of these records, also, and a close relationship was found between magnetic and earth current storms.

The gradient of electrical potential in the air was continuously recorded over a period comprising winter, spring and summer conditions. A report on this data by Dr. B. W. Currie appears in the March number of "Terrestrial Magnetism."

For the auroral program visual observations were supplemented by photographs of auroral forms and spectrographic photography was carried out throughout the months September, 1932, to April, 1933, when daylight prevented observations. The work was recommenced in August and continued until the date of departure. Most of the auroral displays occurred to the south of the station, the region of maximum auroral frequency lying between Churchill and Chesterfield. Two thousand photographs of aurora were taken and developed at the station. The spectrographic results show that aurora was present even on nights overcast with cloud. One thousand pair of photographs of aurora were taken simultaneously at the base station and at a subsidiary station twenty miles to the south. A small hut was built in September, 1932, for the subsidiary station and occupied for periods totalling six weeks by Dr. Currie. During the darkest months these photographs show aurora at heights of about 100 km., with a range of 80 to 400 km. A survey of the exact distance between the stations was made by Dr. Currie and Mr. McVeigh during the spring.

Mr. Davies and Dr. Currie published in "Nature" 1933, an account of aurora in regard to the question of low height and audibility.

During the summer of 1933, magnetic observations were made at Baker Lake, 180 miles northwest of Chesterfield, by Mr. Davies, and also at Marble Island, 45 miles south, where he was assisted by Mr. J. P. Rea. In addition to the regular program which they carried out, a collection of flowering plants was made during the summer of 1933, for the Botany Department, University of Toronto.

The party left Chesterfield on the return journey on September 13, 1933. During the stay in Chesterfield the party was much indebted to Sergeant J. E. F. Wight, R.C.M.P., and the various members of the Police detachment; to Father Ducharme, and other members of the R.C. Mission; and to the Hudson's Bay Company, for unfailing courtesy and assistance.

Coppermine.—The station at Coppermine, N.W.T., on Coronation gulf, established in August, 1932, for the International Polar Year was maintained in operation until August 26, 1933, when the equipment was quickly packed and the return trip started to Toronto on the 30th. Mr. R. C. Jacobsen was in charge, assisted by Mr. D. R. Kinnear.

Continuous autographic records were obtained of barometric pressure, temperature, humidity, surface wind velocity and direction, and of temperature gradient, checked by control instruments every six hours. The instruments were of the standard type used by the Service plus a microbarograph of greater sensitivity. The temperature gradient was measured as the difference in temperature between thermocouples placed one in a regular Stevenson screen beside the thermograph, the other in a smaller Stevenson screen at the top of one of the radio masts, 30 metres above the first. A similar set of thermocouples measured the temperature difference between the thermograph-screen and the grass or snow surface, both sets recording on a thread recorder beside the indications of an electrical resistance thermometer also placed in the screen as a check on the thermograph. With the exception of a couple of weeks in midwinter, a continuous record of solar radiation was obtained from a Robitzsch radiometer. Subsoil temperatures at depths of one and two feet and grass-minimum readings were also noted at the synoptic hours. A record was kept of cloud data and sky-state according to the International recommendations and panoramic and serial photographs taken, both at the 4 synoptic hours and as often in between as developments warranted. Sunshine was recorded with the usual Campbell-Stokes recorder, a special one being used for the night-sunshine in the summer. A 24-hour watch was maintained in general, and note made of types of snow crystals, frost and rime, visibility and incidental atmospheric phenomena (halos, etc.). Rain and snowfall were measured by eye readings at synoptic hours, a 4-inch standard raingauge being used for rainfall.

Pilot balloon ascents to determine upper air velocity and direction were made, normally twice daily, 610 flights in all. One of the daily ascents was made in daylight throughout the year, but the other had to be made with a candle lantern attached to the balloon, during several months of the winter. The longest ascent was followed for 87 minutes.

Kites carrying meteorographs to record temperature and humidity aloft were flown whenever the wind was suitable. Of the 74 flights made, some 60 per cent show more or less marked temperature inversions. The surface wind was also found to be quite shallow on many occasions during the winter. The highest flight reached 1,135 metres. Several Moltchanoff radiosondes were dispatched attached to large balloons. These signalled back the air temperature and pressure by radio. One of them ascended into the stratosphere (base 8·5 km., minimum temperature —38° C) before the batteries failed.

Five Patterson lamp-signalling meteorographs were sent up, yielding temperature records up to 2 Km.

A continuous watch on auroral phenomena (written notes from eye observations) was maintained, while single-station photographs with a special Stormer camera were taken according to the international time schedule whenever photographs were possible, some 700 in all being obtained.

A determination of the station latitude and longitude was also made for the Topographical Survey.

Cape Hope's Advance.—Mr. J. E. Lilly, M.A., assisted by members of the Radio staff, commenced Polar Year records on August 1, 1932, and continued till September 30, 1933. (Partial records were kept for a few days in October, 1933.) Thermometers, barometer, rainguage, thermograph, barographs, and hygrograph, were read three times daily (at 8 a.m., 2 p.m., and 8 p.m., E.S.T.), and continuous records (with only a few breaks) of temperature, pressure, relative humidity, sunshine, and wind, were obtained by means of the recording instruments. A thermograph, hygrograph, and two barographs were in use, one having a scale value of 100 millibars=7·5 cm. (approximately 1 inch pressure=1 linear inch) and the other 1 inch pressure=2·5 linear inches. The wind records were kept, as they had been previously, by the staff of the Radio station. The visibility and the amount and type of cloud were recorded at the regular hours of observation. Cloud observations were also made, rather irregularly, at intermediate hours, and a weather diary was kept. The latter included a general record of cloud changes, approximate times of precipitation and fog, and a brief account of optical phenomena. Snowflakes were examined and classified at some time during nearly every snowfall.

Pilot balloon ascents were made, in general, twice daily. Altogether 675 ascents were made, with a mean duration of 15 minutes, the longest being 182 minutes. Theoretically this balloon was more than 18 miles above the earth's surface, and more than 60 miles away, when it faded out in the distance. It appears probable, however, that the balloon started leaking at about 170 minutes (at a height of about 17 miles).

Visual records of practically all aurora occurring previous to midnight (and some occurring later in the night) were kept, and over 1,200 photographs were taken, mostly at five-minute intervals.

Meanook.—The Polar Year program at the Observatory was carried out by Mr. E. H. Vestine, M.A., assisted by H. E. Cook, the resident observer, and reached a successful completion by the beginning of October.

The work consisted mainly in the securing of very complete measurements and records in terrestrial magnetism, but in addition an ambitious and successful auroral and meteorological program was carried out. The photographically recording magnetic equipment including a high-speed recorder timing magnetic changes within two seconds was operated without loss in trace throughout the year. Auroral observations were carried on up to midnight. In meteorology continuous records were obtained of the meteorological elements and about 180 pilot balloon flights made, a number of which succeeded in penetrating the stratosphere. Occasion was also taken of the opportunity to investigate the air movements in Chinook winds by means of pilot ballons.

Of especial scientific interest in the magnetic work is the frequent recurrence of peculiar pulsating magnetic changes which have rarely been measured elsewhere during the past fifty years.

On July 20 the very rare and beautiful phenomenon resembling aurora called noctilucent clouds was observed, the observation being the only one ever recorded in North America. Since the nature and origin of these so-called clouds is unknown the measurement and photographs taken are of high interest and give data on the upper atmosphere at a height fifty miles above the earth.

Incidentally it was found that radio reception was seriously affected during the period of time the phenomenon was observed.

In addition to the program carried out at the four main stations, balloons carrying self-recording instruments were sent up twice a month at Goderich, and Calgary, on the international days, and visual auroral observations were made at Cochrane, Ottawa, Prince George, Ft. George, Aroostook, Ft. Simpson, Ft. Smith, Aklavik, Pt. Burwell, and Winnipeg, and special cloud observations at Saint John, N.B., Toronto, Winnipeg, Victoria, and St. Hubert. Canada has thus taken her share of the International Polar Year program and while it is yet too early to say definitely what the results will be, it is known from the observations obtained that they will be of very great scientific value.

FORECAST DIVISION

Weather charts were prepared and forecasts issued twice daily, including all Sundays and holidays, throughout the year. To this end reports of barometric pressure, temperature, state of weather, wind direction and force, precipitation, humidity, barometric tendency, visibility, etc., were received by telegraph from 69 stations in Canada, 147 in the United States, 5 from Mexico, 4 from Greenland and one from Bermuda. In addition to these North American reports, some 20 European reports and a variable number from ships on the Atlantic and Pacific were received through the medium of the United States Weather Bureau. The European and Atlantic reports were copied at Bar Harbour from the Rugby, England, broadcast, and the Pacific reports were copied at San Francisco. Representative stations were selected from these broadcasts and forwarded immediately by telegraph to Toronto and the complete lists including a number of Asiatic reports were received later by mail.

It is regretted that for economic reasons the United States Upper Air reports were not received by telegraph but came in later by mail.

The teletype communications with the telegraph companies have functioned most efficiently and without interruption throughout the year. The reception of the Canadian and United States reports was usually complete by 8.45 a.m. and p.m. daily.

The working and auxiliary charts were completed almost simultaneously with the receipt of the last reports. The forecaster's analysis and deductions were made as quickly as consistent with all possible care and the regular forecasting was usually completed about 9.45 o'clock, E.S.T.

During the year, approximately 86,000 forecasts were issued in the regular way and distributed to 20 forecast regions extending from the Rocky Mountains to Belle Isle. These forecasts were 86·6 per cent, verified.

The storm warning service was in operation on the Great Lakes and in the gulf of St. Lawrence during the season of navigation, and throughout the year on the Nova Scotian coast and in the bay of Fundy. The storm signals were displayed at 28 stations on the Great Lakes and at 82 stations in Quebec and the Maritime Provinces. The warnings were also forwarded to the Wireless stations on the Atlantic coast. Of the warnings issued, 94·8 per cent were verified.

The Canadian and United States reports were transmitted every week-day morning to St. Hubert, where a weather map was made up, chiefly for aviation interests. The only regular forecast issued for aviation was that for the Montreal to Albany flight, but numerous forecasts were issued for individual flights.

Very considerable work was involved in supplying weather reports, synopsis of conditions and forecasts to the Italian Air Squadron previous to and during their flights from Italy to Chicago. It was the duty of this service not only to supply all possible information for the North Atlantic west of the 35th meridian and over Canada but to issue forecasts with regard to weather, wind and visibility for the point of landing on the Labrador coast and through to Chicago.

Special reports were obtained on several days at 2 o'clock a.m. and p.m., from a number of stations in addition to the regular observations. Upon their successful landing at Cartwright, Labrador, the forecasting for that area was discontinued and attention centred on the next succeeding leg of the flight, and so on until they had left Montreal and arrived in Chicago.

The proposed Mollison long distance flight from Georgian bay to Bagdad involved much work and occasioned considerable concern. Weather even approximating the ideal for such a flight is of rather rare occurrence over such a vast distance even in mid-summer. In late September and early October it seldom occurs. As in the case of the Italian flight, it was necessary to obtain special midnight reports from several stations in Central and Eastern Canada. Special services were also requested and received from the British Meteorological office and from certain Canadian Pacific Railway steamships on the North Atlantic previous to the time it was proposed to take off.

Detailed weather report from 21 stations, chiefly in Ontario and surrounding territory, as well as the regular forecasts were telephoned each morning (Sunday excepted) to the R.C.C.S. at Toronto for transmission to Camp Borden.

Fire-weather forecasts were issued during the summer, chiefly for the Quebec area. Although scarcely any duff-moisture measurements were received in the reports from the stations, the quality of the forecasts was favourably commented upon by those directly interested.

Special forecasts with regard to fruit spraying were telegraphed to Nova Scotia during the spring and early summer, and were also broadcast from Hamilton for the Niagara-Grimsby area.

The special reports of snowfall in Ontario were not only of great interest to the forecast division, but were exceedingly popular and useful to the Ontario Motor League and the general motoring public.

Bulletins containing weather reports were compiled daily, except Sundays and holidays, and telegraphed to the chief shipping centres of the Dominion, along with forecasts for the region.

The increase in the number of telephone calls with regard to shipment of perishable goods has been most remarkable. This may have been due in part to the severity of the winter.

The morning weather chart was reproduced by the chalk plate process, daily, throughout the year. Some 590 copies were printed each day, of which 103 copies were delivered within the city and 440 copies were mailed.

CLIMATOLOGICAL DIVISION

During the year daily figures of rainfall or snowfall were received for 890 stations in Canada, 6 in Newfoundland and 1 in Bermuda; daily highest and lowest temperatures for 577 points in Canada, 6 in Newfoundland and 1 in Bermuda. Monthly averages of pressure and humidity at 8 a.m. and 8 p.m.; E.S.T., for 96 stations and monthly totals and average values of sunshine for each hour of the day for 73 stations.

At 55 stations observations of wind velocity for every hour were summarized while at about 300 additional points wind data for fixed hours were analysed. Differences from normal values were computed each month and published graphically on maps.

The bulk of the data appears in the Monthly Record of Meterological Observations, 52 pages. Formerly, the hourly or bi-hourly values of temperature, pressure and humidity were included to a total of 80 pages. Manuscript copies of these hourly data are now supplied upon request only.

The Monthly Record is several months behind the date of issue but the Monthly Weather Map which gives graphical and tabular summaries of telegraphic observations of the weather of each month for a limited number of

stations has been issued regularly about the close of the first week of each following month.

About 1,000 special requests for information regarding the climate of Canada or of other countries or of the weather conditions at given periods have been answered during the year. Computations of absolute humidity, diurnal variability of temperature, monthly and annual variability of rainfall, etc. have been frequently made for engineers and manufacturers. Weekly summaries and differences from normal have been issued to other departments, federal or provincial, during the crop season. Special articles and tables have been contributed to federal and provincial Year Books or other publications.

Work has continued on the preparation of a volume on the climate of Canada.

PHYSICS DIVISION

This division has devoted much of its time to developing methods of air mass analysis which would apply directly to the atmospheric conditions occurring at various seasons in Canada. Experimental forecasts based on these methods have been prepared daily. In order to check the accuracy of the forecasts, the numerical values of the temperature, wind velocity and precipitation, have been estimated for observation times 12 hours and 24 hours in advance of the time for which data was available at Toronto. Temperature forecasts were considered verified if correct to within 4° F., wind velocities to within 5 miles per hour and precipitation to within 0.1 inch.

Forecasts were regularly made for Calgary, Winnipeg, Toronto, and Halifax, and consistently during the year out of 100 forecasts made, between 75 and 85 were verified. The forecasts for Winnipeg and the Western provinces were found to be the most frequently in error, partly due to lack of stations to the north and partly to our present ignorance of the properties of the airmasses occurring in Northwestern Canada.

Every week day there has been a seminar of members of the division on the daily weather situation and a detailed discussion of the progressive weather changes occurring on the synoptic map.

The reduction of the meteorological observations obtained at the four polar year stations from August, 1932, to August, 1933, has been supervised, and the manuscript of the volume of meteorological data is now well advanced towards publication. The actual reduction work and especially the elimination or correction of observations where the recording instrument appeared to be defective has been carried out by an observer who took the observations.

The Toronto Flying Club has during the winter of 1933 made gratuitously one flight daily to a height of 7,000 feet for Meteorological Office purposes. These observations have been carefully studied and methods developed for their rapid reduction and application in the daily forecast.

The Physics Division has devoted considerable time to answering questions involving physical principles arising both inside and outside the service. This work has been facilitated during the year by the purchase of a considerable number of standard reference works and the binding of the leading Meteorological periodicals from 1914 to 1931. In addition there has been considerable correspondence on technical subjects to weather observers and others.

Air Mail Service.—During the year St. Hubert was the only Airport station in operation while the office at Winnipeg furnished weather reports to the planes operating from Winnipeg to St. Paul, Minnesota. The operation of the station at St. Hubert is given in the appendix by Mr. Carmichael, in charge.

The investigation of the direction and velocity of the wind by means of pilot balloons has been very much curtailed, and is now only carried on at the principal stations, Victoria, Winnipeg, Toronto, St. Hubert, Lac du Bonnet, and

Cormorant Lake. The number of ascents at each place month by month throughout the year was as follows:—

—	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Total
Toronto	23	26	25	25	26	25	25	25	21	23	20	23	287
St. Hubert	39	49	47	53	39	44	46	44	44	47	44	51	543
Victoria	20	25	25	24	16	22	18	14	13	14	20	22	228
Winnipeg	22	25	24	24	15	19	21	15	17	18	22	26	248
Cormorant Lake	21	26	23	18	26	19	15	15	13	16	2	15	210
Lac du Bonnet	12	8	22	20	17	10	18	9	15	8	6	14	159
Grand total													1,675

In connection with the investigation on visibility which has been carried on for some time a telephotometer was completed and carefully calibrated in the office. The experiments in connection with the investigation have been made at the David Dunlap Observatory by the courtesy of its director. The telephotometer is used in connection with the transmission meter and low intensity photometer which was previously developed. The results of the investigation indicate that it is possible to measure visibility by day and by night with sufficient accuracy for practical purposes. The theory involved in visibility has also been investigated and is now in the process of being tested experimentally.

A considerable mass of data has been compiled recording the weather conditions as they affect aviation in Canada and Newfoundland, east of Montreal. Maps have been prepared showing upper wind roses, mean insobars and isotherms, thunderstorm frequency, and fog frequency. At present the diurnal and seasonal variation of fog is being tabulated from the fog alarm data supplied by the Lighthouse Branch of the department, the resulting isopleths showing remarkable consistency and some surprising features.

In this connection a simple instrument for the rapid drawing of wind roses has been designed and made in the office. It has been of very great assistance in the preparation of the data on aviation and climatology.

Experiments on small hydrogen generating sets that will supply hydrogen locally to each of the pilot balloon and balloonsonde stations, have been carried out with a view to saving the heavy expense in freight and the cost of the gas. It is gratifying to report that experiments indicate that it is quite possible to purchase these sets at a reasonable cost and it is hoped to install the equipment in the not distant future thereby affecting a considerable saving in the cost of hydrogen.

A thermoelectric pyranometer was made in the office and tested out for some considerable time together with a Robitzsch radiometer.

Upper Air Investigation.—Investigation of the upper air by means of balloons carrying instruments was continued during the year, especially in connection with the International Polar Year program; on the principal International days (the second Wednesday and Thursday of each month) balloons carrying instruments were sent up from Goderich and Ca'gary. The recoveries have been remarkably good. For the International Polar Year August, 1932, to January, 1934, 29 out of 35 balloons sent up from Goderich have been found and 25 out of the 34 released at Calgary. The greatest height reached was 24,500 metres (15.22 miles), on June 15, 1933, at Calgary. The lowest temperature recorded was 102·5° F., below zero above Calgary on April 13, 1933.

The reduction of the upper air observations for previous years was continued and altogether 153 records were completed during the year.

Earth Temperatures—Daily readings to ·01° F., of platinum thermometers at different depths were continued throughout the year. The maximum and minimum temperatures with the days on which they occur and the range for each depth for the calender year 1933 are as follows:—

—	Highest	Date	Lowest	Date	Amplitude
	°		°		°
Surface	91	July 31	6	Feb. 3	85
4″	76	Aug. 1	13	Feb. 3	63
10″	76	Aug. 1	26	Feb. 3	50
20″	71	Aug. 3	34	Mar. 1	37
40″	65	Aug. 30	36	Mar. 7	29
66″	59	Sept. 11	37	Mar. 26	22
9′	57	Sept. 25	43	April 10	14
15′	50	Nov. 6	44	May 29	6

Evaporation.—Measurement of evaporation has been taken at Toronto throughout the season from April to November by means of an evaporation tank 6 feet square and 4 feet deep sunk into the ground. The evaporation is measured by observing the height of the water surface once a day. During the year experiments have also been made with a Piche evaporimeter. This is an inexpensive instrument and one that can easily be used at many of our stations. The results obtained from it were very encouraging and it is proposed to greatly extend its use. The following table gives the amount of evaporation during the period the tank was in operation.

EVAPORATION (TANK) TORONTO

April	May	June	July	August	September	October	Total
″	″	″	″	″	″	″	″
1·56	2·75	3·95	4·16	3·70	2·14	1·16	19·42
(27 days)							

Sea-water Temperatures.—Thermographs have been maintained throughout the year on the routes from Vancouver to Hongkong; Vancouver to Australia; Vancouver to Yokohama, via Honolulu.

Observations of sea-water temperatures since the installation of the thermographs on the ships on the Pacific were tabulated and the means and departures from normal obtained, and presented to the Fifth Pacific Science Congress, which was held in Victoria and Vancouver from June 1 to 14, 1933.

MAGNETIC DIVISION

Terrestrial Magnetism.—During the fiscal year 1933-34, the two regular Magnetic observatories at Agincourt, Ont., and Meanook, Alta., were kept in operation and complete photographic records were obtained of the declination, horizontal force and vertical force.

In order to check the values of the magnetic elements absolute observations were made twice a week for each element and simultaneous readings made on the variometers. This required at Agincourt some 4,000 settings and readings of the absolute instruments and a similar number of readings of the variometers.

Some 28,470 measurements are made from the records of each observatory each year in order to prepare the annual report, which gives in detail the

story of the variations of the magnetic forces in both direction and intensity at each observatory.

The annual reports for 1926 and 1927 appeared during this fiscal year, the report for 1928 is in the printer's hands and that for 1929 is nearing completion.

Magnetic character tables for 1933 were prepared and forwarded to the International Commission on Terrestrial Magnetism at DeBilt, and a special report was prepared for the meeting of the International Geodetic and Geophysical Union at Lisbon.

The LaCour instruments have been found exceedingly satisfactory and as we had the two sets at the observatory at Meanook it was considered more economical to operate the ordinary sensitivity set at Meanook after the close of the polar year instead of the older instruments that had been previously employed.

Assistance was given to various observers in standardizing their equipment for geophysical investigations and magnetic survey work and many special reports were furnished to assist in reducing field observations and in making correlation studies with other phenomena. In December, Mr. Green of the Department of Terrestrial Magnetism, Carnegie Institution, Washington, D.C., U.S.A., visited the Agincourt observatory for the purpose of making comparisons between their standard instruments and the Canadian standards.

Seismology.—The Milne-Shaw seismographs have been maintained in good working order throughout the fiscal year.

It was necessary to overhaul the EW component on January 23, as cable and solenoid trouble occurred. At this time the constants were again evaluated; the previous determination having been made in June when both instruments were up to standard. The trouble given by the EW driving-clock last year, continued until September 6 when it was completely overhauled, and has been working well since. The Becker clock installed last year for giving time marks is giving satisfactory service.

Two hundred and sixty-six earthquakes were recorded, this being about the average. The months of June and April showed the greatest frequency with 34 and 33 shocks respectively. December was comparatively immune from disturbances, only 12 being recorded.

The most interesting record was that of November 20 with an epicentre in Baffin's bay. This is a most unusual location; the record at Toronto was well defined and was followed for several days by after-shocks of lesser intensity.

Three well-marked shocks originating in the United States were recorded, viz.: January 30 in Western Nevada; and two on March 12 in the state of Utah. The latter gave a much larger record than the shock at Lond Beach, California, of March, 1933, but very little damage resulted.

On January 15, 1934, there occurred one of the most destructive earthquakes of modern times. It centred in the Ganges River valley in Northern India. There was great loss of life and property. It is interesting to note that the Catalogue of Destructive Earthquakes by Milne shows that a shock of similar intensity occurred in this region 100 years ago, in 1833.

Other major disturbances recorded at Toronto with the locations were shown on April 27 from Alaska; June 24, destructive along the southwest of Sumatra; July 22—Aleutians; August 25—China; August 28—Burma; October 25—Chile; March 24—Solomon Islands.

The work involved in analyzing the shocks was kept up to date, and the results are forwarded monthly to 45 seismological stations throughout the world who return similar service. Loan of 10 of our original records was made for research and investigational purposes.

Photographic barograph, and dry and wet thermographs, were kept in operation and the measuring and abstracting of hourly curves were brought up to date. The development of these curves is now being done as soon as the record is completed, in place of once a week as before. This eliminates much delay and seems necessary as the public demand for the results is increasing in volume and importance.

Appendix A

Report of Maurice Royer, C.E., in charge of Quebec Observatory

The meteorological observations were taken regularly and the results promptly reported by telegraph to the Central office. The monthly summaries of these observations and also abstracts of the corrected readings of the recording instruments were forwarded to the Head office at the close of each month.

The correct time to the minute was given to the general public, and the correct time to the second was given to watchmakers and the gunner at the city hall. These telephone inquiries for time and also for weather forecasts were quite numerous this year and showed a tendency to increase in number. This was probably due to the unusual weather conditions experienced during the past winter and also to the fact that the service of the observatory is becoming better known to the public.

Numerous abstracts of the records were prepared for engineers, lawyers, insurance companies, and other interested persons.

Barometers, hygrometers, chronometers, and other instruments were compared and reset to the correct readings for their owners.

M. Royer was also required to appear in court several times in order to testify regarding the weather conditions on specified dates.

The station was inspected by Mr. Andrew Thomson on July 26, 1933.

The instruments have been kept in working order, cleaned and oiled whenever deemed necessary.

Appendix B

Report of Francis M. Barnes, in charge of Saint John Observatory

During the past year from April 1 to December 31 meteorological observations were taken at 8.30 a.m., 3 p.m., and 8.30 p.m., and from January 1 to March 31 at 8.30 a.m. and 8.30 p.m. The 3 p.m. reading was discontinued on account of the change in the Meteorological Register.

The observations were coded and telegraphed to the Head office. Hourly abstracts from the recording instruments, anemograph, barograph, hygrograph and thermograph have been made, means computed and copies forwarded to the Head office.

At the beginning of each month a summary and report on the weather for the Maritime Provinces was made and reported.

Co-operation with the New Brunswick Forest Service and the New Brunswick Electric Power Commission resulted in the placing of thirty-one volunteer rainfall observers in scattered districts of New Brunswick.

WEATHER BULLETIN

The weather bulletin with tabulated readings and weather forecasts have been issued daily, prominently displayed for public use, mailed to those interested and also published in the daily press.

Storm warnings have been displayed at all stations in the Maritime Provinces on receipt of telegrams from the Head office.

BROADCASTING

The noon and midnight forecasts are broadcast for the benefit of shipping by the Red Head Wireless Station and by the Chebucto Head Wireless Station at 12.40 p.m. and 12.40 a.m.

The radio broadcasting stations throughout the Maritime Provinces broadcast the weather at different times throughout the day.

INTERNATIONAL POLAR YEAR

Cloud observations for identifying air masses were carried on throughout the year until August 31, 1933. These observations were taken daily at the usual time of observation and on Wednesdays and Thursdays every three hours from 8.30 a.m. to 11 p.m. During the month of July cloud observations were taken daily every three hours.

Aurora observations were carried on at the same time.

TIME SERVICE

Transmit observations with the three inch meridian telescope for the determination of time have been made as usual and comparisons made with the Riefler and Kullberg Sidereal Clocks.

During the year the Mean Time Transmitting Clock, Riefler Sidereal Clock, the Impulse Clock for the Tower and the Tower Clock were overhauled, repaired and cleaned. The steel clutch which engages the escape wheel on the Tower Clock was very much worn and had to be renewed. The pallet jewel on the Mean Time Transmitting Clock was taken out and replaced. While there is evidence of wear on certain parts of the Riefler Sidereal Clock provision should be made in case of an emergency.

The time has been transmitted throughout the Maritime Provinces and broadcast as mentioned in previous annual reports.

GENERAL

The severe winter 1933-34 has demonstrated the value of the service to the community. During the extreme cold periods as many as 300 telephone calls per day were received and the public have been interested more than usual in the weather reports and forecasts.

During the year information has been supplied daily to the contractors on the work of the Saint John Harbour development and inquiries from shipping interests have been frequent during the winter months.

The usual calls for time, weather and other information have been received and the press have been furnished records and statistics.

During the year several junior clubs and other organizations visited the observatory and were conducted through the building.

In August, Mr. Andrew Thomson, M.A., of the Headquarters staff, made an inspection visit of several stations in New Brunswick and Nova Scotia. Mr. Thomson made a thorough inspection of the equipment and work performed at Saint John.

APPENDIX C

Report of F. Napier Denison, in charge of Gonzales Heights Observatory, Victoria, B.C.

During the past year the regular meteorological and seismological observations have been taken, and the daily weather forecasts issued for the following districts: South Vancouver Island, the Lower Mainland, Kamloops, Okanagan

and Kootenay. Special frost warnings have been broadcast on the Kelowna Radio Station during the spring and early summer for the benefit of the Okanagan fruit growers.

Beginning on December 1, 1933, the daily weather forecasts and brief weather summary have been wired to the Head office, Toronto, and at 7.35 p.m. Pacific standard time; these are received by thousands of British Columbia radio listeners from C.R.C.T., who greatly appreciate this information.

During the past year, though the winter was exceptionally wet and cloudy, 239 pilot balloons were sent up from this site and their courses duly plotted. There were 18 flights lasting for one hour or more, and 77 were observed from 30 to 60 minutes. The longest flight lasted for 95 minutes and when lost to sight, it had reached a height of 56,000 feet.

These balloon observations are of value here in connection with our weather forecasts in this province, and also they form part of a chain of similar observations being taken throughout Canada.

The Time Service has been very satisfactory and the radio time signals have been broadcast twice daily through our Automatic Time Sender and the Dominion Gonzales Radio Station.

The noon and 9.30 p.m. time guns are fired at our military headquarters here by phone signals from this observatory. One of our chronometers has held a steady rate of ·07 second per day for over a month.

Special weather reports giving "ceiling," wind, visibility, etc., are wired three times daily to the Seattle Airport, and similar weather reports are received from certain United States stations also three times daily.

The three seismographs installed here are giving perfect satisfaction, and records from these have assisted in locating some of the world's great earthquakes.

Our correspondence is growing rapidly largely due to the great number of inquiries received regarding the climate of this province, and particularly from intending settlers here.

I am pleased to report that the new form of electric contact which I have been working on for several years in connection with our anemometer has proved a complete success as a means of saving considerable battery cost where it is used.

Appendix D

Report of A. R. McCauley, in charge of Winnipeg Meteorological Office

A Daily Weather Map was issued from the Winnipeg Office at 10 a.m., except sundays and holidays. This reduced map was reproduced by a mimeograph process from a large scale map which was plotted from the data of weather messages received, via Toronto, from 155 first class stations, and in summer from an additional 45 supplementary prairie stations. About 164 of these mimeographed maps were distributed locally by messenger and 65 by mail to outside points.

The Weather Bulletin which was telegraphed each morning to the cities of Western Canada was revised in order to give a maximum of information at a minimum cost. Mimeograph copies of this revision were distributed in Winnipeg.

For the grain trade weather data including temperature, wind, state of weather, precipitation, isobars and forecasts were entered daily on a large glass wall map located on the trading floor. This year the week end precipitation for the United States winter wheat belt was forwarded from Toronto each Monday morning and entered on this map. During the crop season, April 1

to October 31, the weather conditions of 45 supplementary prairie stations were entered on a glass map of the Prairie Provinces. A telegraph code was introduced for these supplementary reports.

Regular observations were made three times daily at the Manitoba Agricultural College. Pilot balloon observations were taken from the roof of the Grain Exchange at 11.30 a.m. During the balance of the polar year special cloud and aurora observations were made.

A system of keeping the records of the weather during the crop season was introduced which has proven satisfactory and from these each Monday morning a summary of the precipitation data is telegraphed to the Head office.

The forecasts were distributed as widely as possible by means of the daily maps, the press, broadcasting stations and by phone. During the year upper air observations and forecasts were issued daily to the regular passenger and airmail service to the United States, the Royal Canadian Air Force, and on request for individual flights. Meteorological information and forecasts were given in answer to an ever increasing number of inquiries.

Appendix *E*

Report of J. F. Carmichael, in charge of St. Hubert Meteorological Office

Continuous records of pressure, temperature, humidity and wind, were obtained by means of self-recording instruments, and the hourly values worked out. The forms and records for the daily, weekly and monthly reports for Airport stations were compiled.

The Head office in Toronto supplied the necessary data once each day for the preparation of a daily weather map to be used in connection with the air Service from the Airport.

Weather reports by radio were sent to planes of the Canadian Colonial Airways during the flight on the Montreal to Newark route.

Hourly reports by radio to WWAH Albany were sent ten times daily, making a total of 3,200 for the year.

Pilot balloon reports were sent twice daily to Albany, or a total of 547.

In addition during the season of navigation weather reports were sent from Montreal to Rimouski, making a total of 264.

During the Italian flight the following observations were made; special pilot balloon observations, 14; 4-hourly signals to Toronto, 62; St. Hubert WXS to Montreal base, 61; St. Hubert WXS hourly July 14-15 to New York base, 13.

Weather clearances for mail trips giving the weather at St. Hubert at 1 p.m. and 2 p.m. daily, Sundays included, to the despatcher of the Boston Maine and Central Vermont Airways, were given from March 23, 1934.

During the year the Cloud Journal for the polar year was maintained up to August 31.

REPORT OF WRECK COMMISSIONER'S BRANCH

STATEMENT OF FORMAL INVESTIGATIONS AND PRELIMINARY INQUIRIES HELD DURING THE FISCAL YEAR 1933-34

Name of ship and official number	Port of registry	Remarks
Beaverdale, 149987	London, Eng	On November 25, 1933, stranded at Traverse Spit, North Channel, below Quebec. Preliminary Inquiry was held at Quebec, on November 29, by Captain G. E. L. Robertson.
Citadelle, 157010, and *Empress of Britain*, 162582	Ottawa, Ontario, and London, Eng	On October 27, 1933, collided at Wolfe Cove, P.Q. Preliminary Inquiry was held at Quebec, on November 2 and 3, by Mr. B. J. Kaine.
Canby, 131402	West Hartlepool	On February 19, 1934, stranded on Guion Island, N.S. Preliminary Inquiry was held at Louisburg, on March 6 and 7, by Captain W. F. Mitchell.
Levnet, 136689	London, Eng	On June 9, 1933, stranded at or near Matane, River St. Lawrence. Formal investigation was held at Montreal on June 27, before Captain L. A. Demers, F.R.A.S., Dominion Wreck Commissioner, assisted by Captain N. Martorell and Captain J. F. Smeltzer, acting as Nautical Assessors. Finding: The Court severely reprimands Captain Albert Cyril Lloyd, B. of T. certificate No. 0016454, who is held solely to blame for this uncalled for casualty. The Court counsels First Mate, Percy Bedford, to be more thorough in issuing instructions when being relieved.
Lincoln II, 156807, and *O.K. Service*, 151154	Liverpool, N.S. and La Have, N.S.	On August 31, 1933, collided off Egg Island, N.S. Preliminary inquiry was held at Halifax on October 24, by Captain W. F. Mitchell.
Mary, 216739	New York, N.Y.	On June 12, 1933, stranded near Curve No. 1, Lake St. Peter. Formal investigation was held at Montreal on June 29, by Captain Demers, assisted by Captain Charles Lapierre and Captain A. LeBrun, acting as Nautical Assessors. Finding: The Court finds Pilot Jean Naud, in default, without an iota of extenuating reasons for so forgetting his responsibilities. In view of what is considered gross indifference his licence is suspended for a period of 2 months.
Mont Louis, 147791	Montreal, P.Q.	On September 1, 1933, stranded at Pointe-aux-Trembles River St. Lawrence. Preliminary inquiry was held at Montreal on September 14 by Mr. R. A. Wiallard.
Pennyworth, 137828	Newcastle	On November 18, 1933, stranded about 2 miles west of St. Jean Light, Island of Orleans, St. Lawrence River. Preliminary inquiry was held at Quebec on November 27 and 28, by Captain G. E. L. Robertson.
Susaa, N.G.J.K.	Copenhagen	On November 12, 1933, stranded near Heath Point, Anticosti Island. Preliminary inquiry was held at Montreal on November 25, by Mr. R. A. Wiallard.

PILOTAGE REPORT

CAPTAIN G. E. L. ROBERTSON, DIRECTOR IN CHARGE

The Honourable the Minister of Marine is the Pilotage Authority for the Pilotage Districts of Sydney, Halifax, Saint John, Quebec, Montreal, Churchill, and British Columbia, the latter district including all the coastal waters of British Columbia, with the exception of the Pilotage District of New Westminster. The Pilotage District of Churchill, Manitoba, was established by Order in Council, dated July 13, 1933 (P.C. 1416). All matters relating to pilotage in these districts are dealt with through the local Superintendents of Pilots at the above-mentioned places.

There are in addition thirty-six Pilotage Districts, which are established in pursuance of the provisions of the Canada Shipping Act:—

Quebec.—Bonaventure.

Nova Scotia.—Bras d'Or; Digby; Annapolis and Bear River; Economy; Glace Bay; Inverness Southern; Louisburg; Minas; Parrsboro; Pictou; Port

Medway; Pugwash; Richmond County; St. Anne; St. Mary's Bay; St. Mary's and Liscombe; Tatamagouche and Brulé; Tidnish and Northport; Wallace.

New Brunswick.—Baie Verte and Cape Tormentine; Bathurst; Buctouche; Caraquet; Charlotte County; Chignecto; Cocagne; Miramachi; Restigouche; Richibucto; Shediac.

Prince Edward Island.—Prince Edward island.

British Columbia.—New Westminster.

DISTRICT OF SYDNEY

At the commencement of the year there were 15 pilots in this district. One pilot retired at the end of the season, leaving 14 pilots on March 31, 1934.

The season of navigation opened on April 17, 1933, and closed, owing to the abnormal weather conditions on January 4, 1934.

The gross revenue of the district amounted to $31,439.12, an increase of $6,166.02 over the year 1932-33. The total expenses including the amount paid into the superannuation fund, general maintenance and up-keep of pilot boat and stations was $5,793.04, leaving a balance to be divided among the pilots of $25,646.08.

The total number of ships piloted was 599 inwards and 599 outwards, making a total of 1,198 ships, with a total net tonnage of 1,303,131, as compared with a total of 1,012 ships, with a total net tonnage of 910,611, for the year 1932-33 an increase of 186 ships and 392,520 net tons.

In addition the ss. *Caribou,* whose net tonnage is 1,362, and which is subject to pilotage but by special arrangements with the owners, pay a lump sum in lieu of pilotage per trip, made 117 voyages in and out of Sydney during the year 1933-34.

In this district 10 per cent of the gross revenue is deducted for the Pilots' Pension Fund, which is administered without charge by the Department of Finance. On March 31, 1934, this fund amounted to $63,723.96.

DISTRICT OF SAINT JOHN

There were 11 pilots and two apprentice pilots at the beginning of the year. One apprentice pilot was appointed a probationary pilot during the season.

The gross revenue of the district was $45,517.44, an increase of $4,103.50 over 1932-33. During the year the pilotage dues in this district were subject to a reduction of five per centum. The total expenses, including the up-keep of the pilot boat, repayment of loans, and the amount paid into the pension fund, amounted to $13,393.61, leaving a balance to be divided among the pilots of $32,123.84.

The total number of ships piloted inward was 436 and outward 418, a total of 854 ships, with a total net tonnage of 2,459,829, being an increase of 88 ships, and an increase in the net tonnage of 105,158 from the year 1932-33.

On March 31, 1934, the Saint John Pilots' Pension Fund amounted to $51,865.91. It is administered for the Saint John pilots by the Department of Finance without charge. Ten per centum (10%) of the gross revenue is deducted for this fund.

The *Alex Johnston* is the pilot tender at this port. This vessel is equipped with full Diesel engines.

Mr. J. C. Chesley, Agent of the department, is the Acting Superintendent of Pilots.

The expenses incurred by the department for the up-keep of the office and the salaries of the staff was $2,029.45.

DISTRICT OF HALIFAX

There were 23 pilots in this district all year, no new pilots or apprentice pilots having been appointed.

The gross revenue for the year 1933-34 amounted to $96,849.87, an increase from the previous year of $12,914.19. The total expenses including repayment of loans, maintenance of the two pilot tenders, and the amount paid into the Pension Fund was $21,816.39, leaving a balance of $75,033.48 to be divided among the pilots.

The number of ships paying pilotage inward was 1,203 and 1,180 outward, a total of 2,383 ships with a total net tonnage of 8,731,346, as compared with 2,037 ships with a total net tonnage of 8,421,164, an increase of 346 ships and 310,182 net tons from 1932-33.

The pilot tenders *Hebridean* and *Nauphila* were maintained in first-class condition. Both tenders are equipped with short-wave radio telephones, and are in constant communication with the Signal Station at the Halifax Citadel.

On March 31, 1934, the Halifax Pilots' Pension Fund amounted to $112,174.28. It is administered without charge by the Department of Finance. Five per centum (5%) of the gross revenue is deducted in this district for the Pension Fund.

Captain W. F. Mitchell, Supervising Examiner of Masters and Mates, is the Acting Superintendent of Pilots.

The expenses incurred by the department for the up-keep of the office and salaries of staff for the fiscal year 1933-34 was $3,065.71.

DISTRICT OF QUEBEC

There were 53 pilots and 19 apprentice pilots at the beginning of the year. Two pilots died during the year, thus reducing the number to 51 pilots on March 31, 1934.

The pilotage station at Father Point was opened on April 1, 1933, and closed on December 31.

The first ship passed Father Point on April 8, and the last ships left Quebec on December 13.

The gross earnings of the pilots were $232,617.27 for the season as compared with $222,502.45, an increase of $10,114.82, and this notwithstanding that all pilotage dues (with the exception of movage charges and minimum tariff) were subject to a reduction of seven (7%) per centum from April 11, 1933.

The total number of ships piloted inward and outward was 3,270 of a total net tonnage of 11,279,683, as compared with 2,977 ships of 10,485,933 net tons in 1932. This is an increase of 293 ships and 783,750 net tons.

The pilot tender *Jalobert* arrived at Father Point on April 16, 1933, and returned to Quebec owing to the very bad ice conditions on November 29, 1933.

The launch *Abraham Martin* was in service throughout the season and was then hauled out on the slips at Father Point as formerly.

The Quebec Pilots' Pension Fund amounted to $134,596.49 on December 31, 1933. This is an increase of $6,581.48 over 1932. This fund is administered by the Quebec Pilots' Corporation.

In addition to the pension received from the corporation, certain retired pilots (22 in number) received under the provisions of an Order in Council, dated December 6, 1906, an annual allowance of $300 each from the Government. One of these retired pilots died during the year, leaving 21 on the list at March 31, 1934.

DISTRICT OF MONTREAL

On April 1, 1933, there were 55 pilots and 28 apprentice pilots on the role. Before the season of navigation opened 7 apprentice pilots were examined and given licences as pilots. During the season owing to a great increase in traffic 3 more apprentice pilots were examined and given licences as pilots. One pilot died at the close of the season. No new apprentice pilots were appointed. There were, therefor, 64 pilots and 18 apprentice pilots on March 31, 1934.

The first sea-going ship to arrive at Montreal was the ss. *Boston City* on April 14, and the first coasting ship was the ss. *Belle Isle* on the same date.

The last departures were the sea-going ships *Exelsund* and *Trajan* on December 6.

The gross earnings of the pilots were $272,583.74 for the season as compared with $255,291.67 for the 1932 season, an increase of $16,292.07, and this notwithstanding the fact that all pilotage dues (with the exception of movages and minimum tariff) were subject to a reduction of ten per cent (10%) from April 11, 1933.

There were 2,275 ships piloted inward and 2,403 outward, a total of 4,708, having a total net tonnage of 11,676,126, as compared with 4,056 ships of a total net tonnage of 10,650,513 in 1932. This is an increase of 652 ships; 1,025,613 net tons over 1932.

Seven per cent (7%) of the gross earnings of the pilots is deducted for the Montreal Decayed Pilots' Pension Fund. This fund, which is administered without charge by the Department of Finance, amounted to $145,151.11 on March 31, 1934.

GENERAL—MONTREAL AND QUEBEC

Mr. R. A. Wiallard, Agent of the department, is the Acting Superintendent of Pilots. Mr. F. J. Boulay, Quebec, is the Assistant Superintendent of Pilots. Mr. Raoul Lachance is the officer in charge at Father Point.

All expenses for the pilotage services at Montreal, Quebec and Father Point are paid out of public funds. These amounted to $12,177.69 for the District of Montreal, and $56,102.99, the latter including the cost of the maintenance of the pilotage offices at Montreal, Quebec and Father Point, and the cost of the maintenance of the pilot tenders *Jalobert* and *Abraham Martin*.

The Pilot tenders *Jalobert* and *Abraham Martin* in addition to embarking and disembarking the pilots also attend to the Quarantine Service for the Department of National Health, medical doctors being attached to the *Jalobert* allowing of pratique being given to ships, provided, there is no contagious disease on board. This does away with ships having to stop at Grosse Isle.

The *Jalobert* lands the mails for all eastern points, and also handles mails between ships and aeroplanes, and vice versa, for the aerial mail service, which was started during the season of 1927. There was a total of 8,598 bags of mail and 1,602 bags of parcel post handled during the year. This was made up of 6,176 bags of letter mail, 534 bags of letter mail for the Maritime Provinces, and 1,888 bags of letter air-mail. This is a decrease of 1,544 bags of letter mail and 178 bags of parcel post from the year 1932.

The customs officers of the Department of National Revenue are put on and taken off the ships. There are now six services centralized at Father Point; Pilotage, Quarantine, Customs, Two Mail Services for the Post Office Department, Immigration and Agriculture.

Considerable economy to the federal government and great satisfaction has been given to the shipping interests by the centralization of these services at Father Point.

The embarking and disembarking of pilots at Quebec both for the Montreal and Quebec Districts is done at the King's wharf, immediately adjacent to the Pilotage building.

The Pilotage building at Quebec houses the Examiner of Masters and Mates, the Nautical School, the Inspector of Radio for Quebec, as well as the Pilotage Services.

DISTRICT OF CHURCHILL

By Order in Council, dated July 13, 1933, this district was established, the payment of pilotage dues being made compulsory. By-laws under which the district is now being governed were approved by Order in Council of August 1, 1933.

This port is under the immediate control of the Department of Railways and Canals. All pilotage dues collected are used by this department to maintain the pilot boats.

Two pilots were appointed during the season for this district.

Twelve ships were piloted inward and twelve outward. The net tonnage of these ships was 36,176 inward and the same outward.

The first ship to arrive at Churchill was the ss. *Pennyworth* on August 13, and the last ship to leave was the ss. *Brandon* on October 2, 1934.

DISTRICT OF BRITISH COLUMBIA

On April 1, 1933, there were 32 pilots on the role. During the year two probationary pilots were granted licences. Three pilots died and one pilot retired. There were, therefore, 30 pilots on the role on March 31, 1934.

The pilot launches *B.C. Pilot No. 1, B.C. Pilot No. 2, B.C. Pilot No. 3* and *B.C. Pilot No. 4* have been kept in first-class condition. Nos. 1, 2 and 4 and the pilots' office at Victoria were equipped with shortwave radio telephones, thereby eliminating delays in supplying ships with pilots.

From April 1 to July 31, 1933, the pilotage rates in this district were subject to a reduction of five per cent. By Order in Council, dated August 26, 1933, by-laws Nos. 1, 2, 3, 4, 5, 6, 7 and 43 were rescinded and new by-laws approved in lieu thereof. New pilotage rates were made and reduced the existing rates by approximately six per cent. The system of pensions to pilots was also changed and the British Columbia Pilots' Pension Fund established. All pensions to pilots will hereafter be paid out of this fund.

In this district 7 per cent of the gross revenue of the pilots is deducted for the above mentioned fund. This fund is administered, without charge, by the Department of Finance and amounted on March 31, 1934, to $56,653.08.

The total gross earnings of the pilots for the year ending March 31, 1934, was $230,847.92, which is an increase of $26,382.13 over the year 1932-33. The total expenses, including the up-keep of the four pilot launches, repayment on loans, travelling expenses, etc., amounted to $45,587.45. The total amount paid into the pension fund was $15,705.40. The total amount divided among the pilots was $185,260.47 (which included the amount of $15,705.40 paid into the Pension Fund).

The total number of ships piloted was 3,230, of a total net tonnage of 13,478,502. This is an increase of 467 ships and 1,553,256 net tons over the year 1932-33.

The pilots maintain a lookout at Victoria, B.C. Captain F. T. Saunders is the Superintendent of Pilots.

The expenses incurred by the department for the up-keep of the office and the salaries of the staff were $7,453.88.

The following is a comparison between the year 1928-29 (considered to be the peak year in shipping) and the year 1933-34 of ships paying pilotage in the districts named, and also giving the total net tonnage of such ships:—

District	1928–29		1933–34	
	Ships	Tonnage	Ships	Tonnage
Sydney	2,352	2,257,544	1,198	1,303,131
Saint John	957	2,701,004	854	2,459,829
Halifax	2,859	9,132,930	2,383	8,731,346
Quebec	4,045	15,640,646	3,270	11,279,683
Montreal	4,540	12,982,710	4,708	11,676,126
Churchill	(Not established)		24	72,352
British Columbia	*3,221	13,597,143	3,230	13,748,508

* For the year 1930-31—first full year in operation.

While 1928-29 was the peak year this comparison will show that conditions in 1933-34 are above normal, in fact almost as good as in 1928-29.

During the year assistance was given to the pilotage districts established under the provisions of the Canada Shipping Act in the preparation of by-laws, and in the interpretation of the law and their by-laws.

CANADIAN HYDROGRAPHIC SERVICE

Report of Capt. F. Anderson, M.E.I.C., Chief Hydrographer

The thirty-first consecutive season of modern charting of Canadian coasts and waterways under centralized administration, was carried out during the fiscal year ending March 31, 1934. This was also the fifty-first consecutive year since hydrographic charting operations were undertaken by the Canadian Government. Satisfactory progress characterized the work of all divisions, at sea, in the field, and at headquarters.

VESSELS AND EQUIPMENT

As in 1932 two of the hydrographic steamers were not commissioned, but remained laid up in their berths during the season. These were C.G.S. *Bayfield* at Charlottetown, and the C.G.S. *Lillooet* at Victoria.

The motor launch *Boulton,* which had been laid up at the Marine Depot at Prescott, was overhauled and again put into commission and used on the St. Lawrence river, below Quebec, in triangulation work, re-location of survey monuments, and in testing certain channels there, and in taking echo sounding depth measurements in the Saguenay river.

In addition to the past year's operations, a party went into the Western Arctic, fitting out the motor schooner *Pilot* at Fort Smith on the Slave river, and proceeding down the Mackenzie waterways to its eastern outlet into Beaufort sea where an examination of entrance channels and the charting of Tuktoyaktuk harbour was carried out, in co-operation with the Hudson's Bay Transportation Company in an endeavour to locate routes for the transport of supplies by way of the Mackenzie to the Arctic coast stations, east of the Mackenzie delta.

The full-powered hydrographic steamers *Acadia* and *Cartier* on the Atlantic coast, and the *Wm. J. Stewart* on the Pacific coast, were commissioned and operated throughout the full season. With the *Wm. J. Stewart* there was also used the Houseboat *Pender* in the sheltered inlets of the West coast of Vancouver island, continuing the charting of that region where left off the previous year.

It was not necessary this season to add but very little in the nature of instrumental equipment, with the exception of the latest model Admiralty Recording Echo Sounding apparatus to the *Acadia* and the *Wm. J. Stewart.*

HEADQUARTERS DIVISION

As in past years the work carried out by this division of the service, in addition to administration, comprised the planning of new and special surveys, investigation and research relating to chart revision and hydrographic publications, preparation, compiling, writing and editing of Coast Pilots and Sailing Directions, research on hydrographic and navigational subjects, reports and personnel, and the collecting and dissemination of general and special marine information for the benefit of Canadian shipping and mercantile and transportation concerns.

Considerable data was collected, compiled and checked for insertion in a new edition of Canadian Ports and Shipping Directory, which became available to the public at the end of the fiscal year.

AERIAL PHOTOGRAPHY

Photographic surveys were carried out by the Royal Canadian Air Force detachments in co-operation with hydrographic parties on both coasts. On the Pacific, the greater portion of the Queen Charlotte islands was photographed from the air, in order that the results might be available at any such time as an hydrographic vessel could be released for the coast charting of that region; and on the Atlantic coast, the North shore of the gulf of St. Lawrence was similarly photographed from the Mingan islands eastward to Natashquan, and also the remaining unsurveyed portions of the coastline of Anticosti.

INTERNATIONAL EXCHANGE OF HYDROGRAPHIC DATA

As in previous years many new charts and hydrographic publications were received and examined and filed for research and library purposes, principally from the British Admiralty Hydrographic Department, U.S. Hydrographic Office at Washington, U.S. Coast and Geodetic Survey, at Washington, U.S. Lake Survey office at Detroit, the International Hydrographic Bureau at Monaco, and also certain related publications from the Hydrographic Services of France, Germany, Japan, Italy, and other countries. On a co-operative basis the Canadian service furnishes these foreign Government services with copies of new or revised charts and hydrographic publications of interest to each, prepared and issued here and relating to Canadian coasts and waters.

COAST PILOTS AND SAILING DIRECTIONS

Much progress was made towards the compiling, editing and publishing of a complete series of Coast Pilots and Sailing Directions of Canadian waters, there being now catalogued thirteen volumes and supplements. During the fiscal year there were completed and issued to the public the following new or revised editions:—

"Great Lakes Pilot, Volume 1"—1st edition, from Kingston to Sarnia.
Supplement No. 1 to the "St. Lawrence River Pilot (Quebec to Montreal)."
A Supplement to the "Sailing Directions for the Hudson Bay Route."
"Great Lakes Pilot, Volume 2, Lake Huron and Georgian Bay."
A Supplement to the "St. Lawrence Pilot (below Quebec)."
"British Columbia Pilot, Volume 1."

Compilation work was also carried out on a first edition of "Gulf of St. Lawrence Pilot," which is proposed to contain descriptions and sailing directions for the gulf coasts of New Brunswick, Nova Scotia and Prince Edward Island, and the transatlantic steamship routes of strait of Belle Isle and Cabot strait. There were also under preparation a description and sailing directions

for the Saint John river, from the bay of Fundy to Fredericton, to contain information for mariners, supplementary to that shown on the series of new charts of that waterway.

DIVISION OF HYDROGRAPHY

The principal activities for the past season of 1933, in this, the major division of the Hydrographic Service, were as follows: The charting of a portion of the Baffin island shore of Hudson strait, and the examination of harbours of refuge in connection with the general scheme of providing aids to navigation for the Hudson bay route and its improvement, through the gathering of data and the advancement of the charting of that waterway; in the gulf of St. Lawrence the charting of the north shore of the gulf, between Natashquan and the Mingan islands, was continued by a steamer and large party, and a second steamer carried out surveys of the Magdalen islands and several New Brunswick and Nova Scotia harbours. This latter ship also conducted special tidal and current investigations in the Lower St. Lawrence. On the St. Lawrence river, examination and testing work was done in some of the channels below Quebec and in the Saguenay river; on the Saint John river, New Brunswick, the last section of the river leading to Fredericton was charted; in lake Winnipeg, work was continued by a small party in the southern portion, in connection with transportation routes to the mining districts; in the Western Arctic, the east entrance to the Mackenzie delta was surveyed; on the Pacific coast, the continuation of the general scheme of charting the west coast of Vancouver island northward was carried out, and the Canadian portion of Juan de Fuca strait was also charted and a commencement made of the waters of the straits of Georgia, leading to Vancouver and the Fraser river.

The distribution of the various hydrographic surveys by districts and establishments, was as follows:—

Hudson Strait.—Motor launches and shore party, under the command of Mr. F. C. G. Smith, with the assistance of the patrol ship *N. B. McLean.*

Gulf of St. Lawrence, North Shore.—C.G.S. *Acadia,* under the command of Mr. J. U. Beauchemin.

Magdalen Islands and Tidal Investigation.—C.G.S. *Cartier,* under the command of Mr. H. L. Leadman; tidal work in charge of Mr. H. W. Jones.

Saint John River.—Motor launch and shore party, under the command of Mr. M. A. MacKinnon.

St. Lawrence.—C.G. Launch *Boulton,* under the command of Mr. E. Ghysens.

Lake Winnipeg.—Motor launch and shore party, under the command of Mr. J. L. Foreman.

Mackenzie River Delta.—C.G. Motor Schooner *Pilot,* under the command of Mr. Norman Wilson.

Pacific Coast.—C.G.S. *Wm. J. Stewart,* under the command of Mr. H. D. Parizeau, and the C.G. Houseboat *Pender,* under the command of Mr. J. H. Knight.

HUDSON STRAIT

The hydrographic survey of Hudson strait was continued this year, charting operations being conducted along a 75-mile stretch of the southeastern coast of Baffin island. The personnel of the expedition consisted of Mr. F. C. G. Smith in charge, assistants Messrs. T. M. Tardif and O. M. Meehan, and a crew of eleven men.