Shipwrecks, Collisions and Accidents in St. Lawrence/Great Lakes Waterway, 1848-1900

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There is quite a literature about shipwrecks at sea or in the confined waters of gulfs, deltas or rivers. Indeed, wrecks have long exerted a fascination because of their spectacular results, often involving losses of vessels and lives and leaving as mute testimony smashed ships, floating debris or empty lifeboats. In many cases, shipwrecks are associated with major natural disturbances, such as gales, hurricanes, snow storms, intense fog or strong currents; sometimes, they are related to dangers inherent in particular stretches of water. But the existence of a wreck is not necessarily indicative of the hazardousness of navigation, since there are numerous other reasons for accidents, including errors of judgement, displacement of cargo and faulty equipment. Any analysis of the reason for shipwrecks must do more than simply plot and narrate the most famous.[1] In this essay I will analyze the patterns and causes of wrecks in the Canadian waters of the Great Lakes and the St. Lawrence River and Gulf.[2] A number of conclusions arise from the study, but perhaps the most important is the improved safety associated with the transition from wind to steam and wood to steel.

The basic information needed to examine the causes of shipwrecks can be obtained from official reports of departments, agencies and boards of the Canadian federal government and in published reports of boards of trade and other bodies. I have divided the years between 1848 and 1900 into two sub-periods, with the watershed at Confederation in 1867 because of significant differences in available information. Before 1867, I have compiled a list of all shipping accidents by type of vessel; this involves 4776 accidents, or an average of 367 annually. Through 1861, the database includes both deep-sea British, Canadian and foreign vessels and inland Canadian and US craft. It also includes Canadian inland vessels involved in accidents in US Great Lakes' waters. For the years 1862-1867, however, the evidence is scattered and incomplete, and includes only the deep-sea vessels entering and clearing the port of Québec.

The post-Confederation data are more substantial.[3] For each casualty we have the date, name of vessel, tonnage (sometimes), port of registry (or where it started its voyage), approximate location of the accident, causes, number of lives lost, and a dollar

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estimate of the damage or loss. But there was a problem isolating the accidents and casualties that occurred in the St. Lawrence/Great Lakes waterway because the exhaustive list is chronological and includes accidents elsewhere, such as the coastal waters off the Maritimes and British Columbia, and on some other inland waterways, such as Lake Winnipeg. It also includes accidents to Canadian vessels overseas. I eventually extracted from the longer list a total of 2561 accidents.[4] The number of accidents in this waterway represents an average of thirty percent of the larger list for the years 1870-1885. This decreased to twenty-five percent between 1886 and 1890 and to sixteen percent for the last decade of the century. The list includes the same types of vessels as for the years 1848-1861, but excludes the accidents and casualties to US-flag vessels in the American waters of the Great Lakes and Upper St. Lawrence.

Not all information in the official reports has been compiled. Material on damage was not collected, although this could be done in the future, perhaps in connection with a study of insurance rates and coverage. The location of the accident is not always precise; there are many references designated "unknown" and identified only as a "lake," "Gulf, "river" or "estuary." On the two maps later in the paper I have included all the "unknown" total losses in a box for each Great Lake and for sectors of the St. Lawrence. I also found some errors in the reporting of collisions. Despite these drawbacks, this preliminary survey reveals to some extent the difficulties and hazards of navigation on a waterway system with the reputation of being risky and difficult. The navigation season was limited to seven and one-half months, from late April until early December.

In 1874 T.E. Blackwell produced a discussion of various types of shipping accidents in the nineteenth century, in which he divided the incidents into six categories for six types of vessels (see tables 1A and IB). The number of vessels total 4476, including a large number of American inland craft. I agree with the author that "these figures are of comparatively little service without a record of the tonnage engaged in the trades, both inland and ocean, out of which disasters have arisen." It is interesting to note, however, that more than half the accidents involved schooners, the backbone of the inland fleet, followed by steamers, which have been subdivided into sidewheelers and propellers. The vessels "wrecked and sunk," as well as those destroyed by "fire," accounted for 14.6% of the total. The largest single cause (38.8%) was damage; the author specified that "many of the instances recorded are mere mishaps, perhaps only affecting the cargo, rather than the vessel, yet still placed under the head of 'disasters.'"[5] The next cause of shipping accidents was the stranding of vessels that, in many cases, were able to be freed after several attempts. The other two types of accidents (jettison and collision) were caused mostly by human error or the forces of nature. Some comparisons can be made with the statistical data compiled for the 1868-1900 period in later tables. It should not be surprising to find many vessels stranded in such a complex waterway, especially in the confined waters of the estuary, river, connecting channels and canals, and the approaches to ports and harbours.

Table 1A
Shipping Accidents in the St. Lawrence/Great Lakes System by Vessel Type, 1848-1861

Vessel Type	1848-1855	1856-1861	1848-1861	
			Total	% Total
Schooners	1161	1540	2701	56.6
Steamships	503	585	1088	22.8
- Sidewheelers	(275)	(226)	(501)	(10.5)
- Propellers	(228)	(359)	(587)	(12.3)
Barques	76	165	241	5.0
Brigs	325	219	544	11.4
Scows	51	151	202	4.2
TOTAL	2116	2660	4776	100.0

Table IB
Nature of Shipping Accidents to Vessels using the St. Lawrence/ Great Lakes System, 1848-1861

Nature of Accidents and Casualties	1848-1855	1856-1861	1848-1861	
			Total	% Total
Wrecked and sunk	280	327	607	12.8
Stranded	571	787	1358	28.4
Fire	37	47	84	1.8
Damaged	868	986	1854	38.8
Jettisoned	83	101	184	3.8
Collision	277	412	689	14.4
TOTAL	2116	2660	4776	100.0

Source: T.E. Blackwell, *Descriptive Statement of the Great Water Highways of the Domain of Canada. Hydrology of the Basin of the Gulf and River St. Lawrence, with Appendices Relating to the Commerce and Navigation of Canada by Wm. J. Patterson* (Montréal, 1874), appendix 3. This compilation is in fact an aggregate of the listings of the Board of Lake Underwriters, which published detailed tables for the period 1848-1855 and disaggregated numbers between 1856 and 1861.

Table 2
Number of Sea-going Vessels Lost, Wrecked, Stranded and Damaged Entering and Clearing the Port of Québec, 1856-1866

Year	Number of Casualties	Total Sea-going Vessels In and Out of Québec	% Vessels Involved in Accidents (1)/(2)	Number and Percent of Steamers and Out of Québec	
	(1)	(2)	(3)	Number	Percentage
1856	38	2089	1.8	36	1.82
1857	49	2638	1.8	48	1.90
1858	51	2065	2.4	56	2.86
1859	52	2021	2.5	116	6.35
1860	43	2545	1.6	122	5.12
1861	102	3105	3.2	134	5.24
1862	94	2666	3.5	156	7.40
1863	75	3446	2.1	128	4.62
1864	55	2986	1.8	122	5.25
1865	48	2913	1.6	144	6.35
1866	67	2710	2.4	146	7.00

Note: Excluding the traffic of river steamers between Québec and Montréal.

Source: J.C. Chapais, *General Report of Public Works Canada* (Ottawa, 1867), appendices 48 and 53.

Table 3A

Number of Vessels Lost, Wrecked, Stranded and Damaged in the St. Lawrence/Great Lakes System, 1868-1900

Years	Number of Casualties, Sea-going Vessels	Number of Casualties, Inland Vessels	Total Number of Casualties	Years	Number of Casualties, Sea-going Vessels	Number of Casualties, Inland Vessels	Total Number of Casualties
				1886	37	21	58
				1887	28	43	71
				1888	16	22	38
1868-69	62	13	75	1889	44	31	75
1870	42	84	126	1890	50	17	67
TOTAL 68/70	104	97	201	TOTAL 86/90	175	134	309
1871	50	58	108	1891	48	16	64
1872	54	68	122	1892	24	j *I*	1 ^ *JJ*
1873	87	28	115	1893	28	6	34
1874	97	30	127	1894	13	7	20
1875	79	24	103	1895 **	2	16	18
TOTAL 71/75	367	208	575	TOTAL 91/95	115	56	171
1876	110	11	121	1896	34	8	42
1877	99	45	144	1897	32	16	48
1878	78	33	111	1898	20	9	29
1879	90	48	138	1899	18	8	26
1880	102	70	172	1900	14	6	20
TOTAL 76/80	479	207	686	TOTAL 96/00	118	47	165

Years		Number of Casualties, Sea-going Vessels	Number of Casualties, Inland Vessels	Total Number of Casualties	Years	Number of Casualties, Sea-going Vessels	Number of Casualties, Inland Vessels	Total Number of Casualties
1881		54	45	99				
1882		62	39	101				
1883		65	48	113	GRAND TOTAL	1,623	938	2,561
1884		47	33	80				
1885		37	24	61				
TOTAL	81/85	265	189	454				

Sources: Chapais, *Report,* appendix 53; *SP,* III, No. 4 (1870), appendix N, "Annual Report of the Dept. of Marine and Fisheries;" *SP,* IV, No. 3 (1870), appendix 19; *SP,* V, No. 4 (1871), appendices 32-33; *SP,* VI, No. 4 (1872), appendices 28-29; *SP,* VII, No. 3 (1873), appendices 30-31; *SP,* VIII, No. 4 (1874), appendix 5; *SP,* IX, No. 4 (1875), appendices 3-4; *SP,* X, No. 4 (1876), appendices 3-4; *SP,* XI, No. 2 (1876), appendix 5: *SP,* XI, No. 2 (1877), appendices 3-4; *SP,* XII, No. 4 (1877), appendix 5; *SP,* XII, No. 4 (1878), appendices 3-4; *SP,* XIII, No. 6 (1878), appendix 5; *SP,* XIII, No. 6 (1879), appendices 3-4; *SP,* XIV, No. 6 (1879), appendix 5; *SP,* XIV, No. 6 (1880), appendices 3-4; *SP,* XV, No. 4 (1880), appendix 4; *SP,* XV, No. 4 (1881), appendices 2-3; *SP,* XVI, No. 5 (1881), appendix 4; *SP,* XVI, No. 5 (1882), appendices 3 and 5; *SP,* XVII, No. 9 (1882), appendix 4; *SP,* XVII, No. 5 (1883), appendices 2-4; *SP,* XVIII, No. 6 (1883), appendices 6-7; *SP,* XVIII, No. 6 (1884), appendices 4-5; *SP,* XIX, No. 9(1884), appendix 2; *SP,* XIX, No. 9 (1885), appendix 2; *SP,* XX, No. 14 (1885), appendix 2; *SP,* XIX, No. 9 (1886), appendix 2; *SP,* XX, No. 14 (1886), appendix 2; *SP,* XXI, No. 7 (1887), appendix 2; *SP,* XXII, No. 8 (1887), appendix 2; *SP,* XX, No. 7 (1887), appendix 2; *SP,* XXII, No. 8 (1888), appendix 2; *SP,* XXIII, No. 12 (1888), appendix 2; *SP,* XXIII, No. 12 (1889), appendix 2; *SP,* XXIV, No. 7 (1889), appendix 19; *SP,* XXIV, No. 7 (1890), appendix 19; SP, XXV, No. 8 (1890), appendix37; *SP,* XXV, No. 8 (1891), appendix37; *SP,* XXVI, No. 8 (1892), appendix4; *SP,* XXVII, No. 9 (1892), appendix 59; *SP,* XXVII, No. 9 (1893), appendix 59; *SP,* XXVIII, No. 8 (1893), appendix 61; *SP,* XXVIII, No. 8 (1894), appendix 61; *SP,* XXIX, No. 9 (1894), appendix62; *SP,* XXIX, No. 9 (1895), appendix62; *SP,* XXXI, No. 9 (1895), appendix 47; *SP,* XXXI, No. 9 (1896), appendix 47; *SP,* XXXII, No. 9 (1896), appendix 49; *SP,* XXXII, No. 9 (1897), appendix 49; *SP,* XXXIII, No. 10 (1897), appendix 52; *SP,* XXXIV, No. 9 (1897), appendix 49; *SP,* XXXIV, No. 9 (1898), appendix 49; *SP,* XXXIII, No. 10 (1898), appendix 52; *SP,* XXXV, No. 9 (1898), appendix 48; *SP,* XXXIV, No. 9 (1899), appendix 49; *SP,* XXXV, No. 9 (1899), appendix 48; *SP,* XXXVI, No. 9 (1899), appendix 47; *SP,* XXXV, No. 9 (1900), appendix 48; *SP,* XXXVI, No. 9 (1900), appendix 47; *SP,* XXXVII, No. 9 (1900), appendix 48; *SP,* "Tables of the Trade and Navigation of the Dominion of Canada: Shipping Statements," 1868-1902.

Table 3B
Number of Sea-going Vessels Involved in Accidents and Casualties in the St. Lawrence/Great Lakes System, Compared to the Annual Traffic of Such Vessels lo the Ports of Québec, 1868-1900

Years	Number of Casualties, Sea-going Vessels	Total Number of Sea-going Vessels In and Out of the Ports of Québec	Percentage of Sea-goirig Vessels Involved in Accidents	Years	Niitnber of Casualties, Sea-going Vessels	Total Number of Sea-going Vessels In and Out of the Ports of Québec	Percentage of Sca-going Vessels Involved in Accidents
				1886	37	2070	1.7
				1887	28	2675	1.0
				1888	16	2000	0.8
1868-69	62	2655	2.3	1889	44	1731	2.5
1870	42	3223	1.3	1890	50	2060	2.4
TOTAL	104	average		TOTAL 86/90	175	average	1.7
1871	50	2925	1.7	1891	48	1892	2.5
1872	54	3268	1.6	1892	24	1952	1.2
1873	87	3123	2.7	1893	28	2011	1.3
1874	97	2994	3.2	1894	13	2046	0.6
1875	79	2895	2.7	1895 **	2	1689	0.1
TOTAL 71/75	367	average	2.4	TOTAL 91/95	115	average	1.4
1876	110	2935	3.7	1896	34	1765	1.9
1877	99	3106	3.1	1897	32	2142	1.4
1878	78	2903	2.6	1898	20	1978	1.0
1879	90	2233	4,0	1899	18	1941	0.9
1880	102	2377	4.2	1900 ***	14	1876	0.7
TOTAL 76/80	479	average	3.5	TOTAL 96/00	118	average	1.2
1881	54	2812	1.9				
1882	62	2273	2.7	GRAND TOTAL	1,623		
1883	65	2288	2.8				
1884	47	2435	1.9				
1885	37	2035	1.8				
TOTAL 81/85	265	average	2.2				

Notes: Ports of Québec are Québec, Montréal, Gaspé, Rimouski, New Carlisle, Magdalen Islands, Trois-Rivieres, PERCÉ and Sorel. Several harbours were added after 1890, such as Matane, Pasbebiac and Chicoutimi. For certain years, the table is based upon fiscal rather than calendar years. Data for 1895 are incomplete.

Source: See table 3A.

Table 4
Shipping Accidents in the St. Lawrence/Great Lakes System by Type of Vessel, 1868-1900

Type of Vessel	1868-1870	1871-1875	1876-1880	1881-1885	1886-1890	1891-1895	1896-1900	TOTAL	% of Total
Schooners	81	222	246	140	121	78	67	955	37.2
Steamships	17	122	163	141	83	44	70	640	24.9
Barques	47	132	161	89	44	28	10	511	19.9
Ships	31	61	45	21	13	5	4	180	7.0
Barges	5	7	27	29	19	–	4	90	3.5
Tugs	3		1	13	15	11	3	46	1.8
Brigantines	17	27	40	18	9	3	5	119	4.6
Dredges		—	–	1	1	—	-	2	)
Sloops	-	1	2	2	2	2	1	10	)
Scows	~	3	1	–	2	—	~	6	) 1-1
Cutters	-	—	~	–	–	–	1	1	)
Unknown	-	-	-	-	1	~	--	1	)
TOTAL	201	575	686	454	309	171	165	2,561	100.0
Powered vessels	20	122	164	154	98	55	73		
Percent Powered Vessels	–	21.2	23.9	33.9	31.7	32.1	44.2		
Non-powered Vessels	181	453	522	300	211	116	92		

Note: Powered vessels include steamships and tugs; non-powered vessels include all others.

Source: See table 3A.

Table 5
Nature of Shipping Accidents to Vessels using the St. Lawrence/Great Lakes System, 1868-1900

Nature of Accidents and Casualties	Period							TOTAL	% of Total
	1868-1870	1871-1875	1876-1880	1881-1885	1886-1890	1891-1895	1896-1900		
Damage by Ice	31	41	46	30	34	27	18	227	9.0
Stranded, Grounded	109	382	381	221	164	48	77	1,382	54.0
Collision between Vessels	22	38	58	37	32	16	13	216	8.4
Collision with Fixed Objects	18	42	107	41	24	13	11	256	10.1
Foundered	13	36	45	49	21	13	12	189	7.3
Fire	4	32	38	51	17	29	20	191	7.4
Leak, water pressure	4	4	7	15	6	15	2	53	2.1
Wrecked	-	~	4	6	8	6	8	32	1.2
Unknown	~	-	-	4	3	4	4	15	0.5
TOTAL	201	575	686	454	309	171	165	2,561	100.0

Source: See table 3A.

Table 6
Causes of Shipping Accidents to Vessels using the St Lawrence/Great Lakes System, 1868-1900

Causes	1868-1885 Number	1868-1885 Percent	1886-1900 Number	1886-1900 Percent	TOTAL
Effects of Nature					
Snow storms	40	2,6	9	1.9	
Strong currents	45	2.9	20	4.3	
Fog	160	10.4	28	6.1	
Ice (Shore, Pack or Ice Cakes)	80	5.2	17	3.7	
Stress of Weather (Gale, Hurricane, Strong Winds)	468	30.6	170	36.9	
Low water, Tides, Too Close to Shore	71	4.6	36	7.8	
SUB-TOTAL: Effects of Nature	864	56.3	280	60.7	1,144
Human Error					
Error of Judgement	196	12 8	35	7.6	
Error of Navigation	135	8.9	29	6.3	
Error of Pilot	34	2.2	23	5.1	
Neglect by Crew	13	0.8	4	0.9	
SUB-TOTAL: Human Error	378	24.7	91	19,9	469
Failure of Equipment					
Displacement of Cargo, Improper Stowage	16	1.1	2	0.5	
Damage due to Broken or Lost Equipment	132	86	49	10.7	
Water Pressure on Hull or Leakage	124	8 1	28	6.0	
Faulty equipment (Compass, Rakes. Cordage, etc.)	18	1 2	10	2.2	
SUB-TOTAL: Failure of Equipment	290	19.0	89	19,4	379
GRAND TOTAL	1,532	100%	460	100%	1,992

Source: See table 3A

Table 7
Results of Shipping Accidents to Vessels using the St. Lawrence/Great Lakes System, 1868-1900

	1868-70	1871-75	1876-80	1881-85	1886-90	1891-95	1896-00	Total	% of Total
Total Losses	32	145	210	167	99	81	73	807	31.5
Partial Losses	165	406	460	280	194	88	91	1684	65.8
Unknown	4	24	16	7	16	2	1	70	2.7
TOTAL NUMBER	201	575	686	454	309	171	165	2,561	100.0
Lives Lost	14	81	75	355	59	32	74		
TONNAGE OF TOTAL LOSSES	~	57,197	51,803	51,623	29,015	20,517	19,996		

Notes: "Lives Lost" for 1881-1885 include two major disasters: *Victoria* (182 lives) and *Asia* (92 lives). Tonnage is expressed in long tons. Tonnages may not be strictly comparable between sail and steam vessels since over the period many changes in measurement were introduced (see figure 4).

Source: See table 3A.

It is impossible to provide comparable data for the years 1861-1868. Table 2 therefore stands on its own, but at least gives an idea of the number of accidents to sea-going vessels (mostly sail) and steamers in and out of the port of Québec. The number of casualties varied from a low of thirty-eight in 1856 to a high of 102 in 1861, for a total of 674 accidents over eleven years, or about sixty casualties per annum. Are these high or low numbers compared to the total traffic in and out of Québec? This represented an average of 2.2% of entrances and clearances over these eleven years, with a high of 3.2% in 1861 and a low of 1.6% in 1860 and 1865. Although the traffic of sea-going steamers relative to the total number of vessels was still limited, it reached seven percent in 1866.

Tables 3 A and 3B are based upon a total of 2561 shipping accidents over a thirty-two-year period. While total accidents increased by 111 between 1871/1875 and 1876/1880, it diminished gradually thereafter. From a peak of 686 casualties in 1876-1880, it fell to 165 in the last quinquennia of the century. Accidents involving sea-going vessels accounted for between fifty-five and seventy percent of the total over the period. The worst years were 1877 and 1880 with, respectively, 144 and 172 casualties. But I suspect that many minor accidents to inland vessels were not reported. After all, the schooners were everywhere, night and day, linking the small ports and harbours with the major ones and providing the riparian regions with essential trade and commercial relations. Almost two-thirds of vessels plying between Montréal and the Maritimes were schooners. While it is true that their captains knew the waterway system better than anyone else, they were not immune to accidents. Indeed, 1 would assume that they freed or salvaged their vessels without reporting the fact so as not to affect their insurance premiums.

These raw data convey a broader meaning if we compare them with the traffic in the system, as we did in table 2. This was done by comparing the number of accidents to sea-going vessels in the St. Lawrence bound for Québec and Montréal. Hence, I have calculated in table 3B the percentage of these vessels involved in accidents. The results should be treated as indicative rather than precise, since to make an exact comparison would require adding the traffic of sea-going vessels bound for the ports of the Miramichi, Prince Edward Island and Pictou, NS.

An even better method would have been to divide the waterway into six sectors, as I do later in the analysis, and to compare the number of accidents with estimated regional traffic, but this is a task for the future. The noticeable trend here is the decrease in accidents to sea-going vessels from 3.5% of the total (1876-1880) to 1.2% twenty years later. This propensity towards a safer waterway was even stronger than it appears. Although the number of vessels decreased slightly, the registered tonnage of sea-going vessels tripled over the period, which means that a higher proportion were larger, steam-powered and steel-hulled.[6]

It is possible to divide vessels involved in accidents into eleven types after 1868 (see table 4). The three most common — schooners, steamers and barques — accounted for eighty-two percent of accidents. Schooners, which were used almost exclusively in the coastal trade, alone represented 37.2%. If we combine steamships and tugs to form a new

category of "powered vessels," they represented 26.7% of casualties. There was a steady decline in accidents to non-powered vessels after 1880 due to the decrease in the number of sailing vessels using the system. Accidents to powered vessels increased from 21.2% in 1871-1875 to one-third by 1890, before soaring to 44.2% in the last period (figure 1).

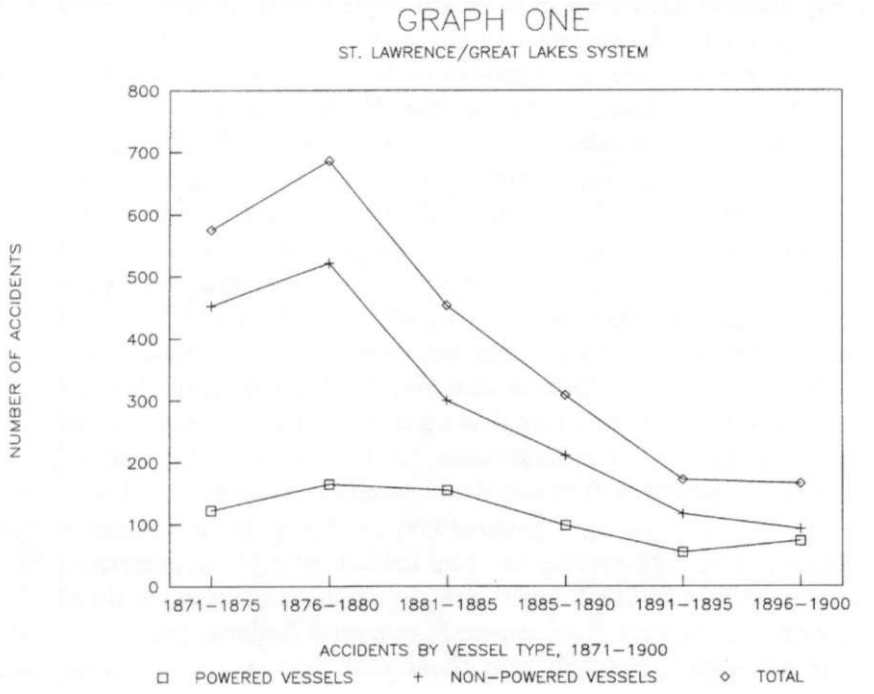

Figure 1: St. Lawrence/Great Lakes System

Source: Courtesy of the author.

The nature of shipping accidents is seldom analyzed, except by insurance companies, and their results usually remain confidential. In table 5 I have grouped the accidents into eight categories. Although each is clearly identified by one or two words, some further explanation may be needed. Under "damage by ice" I have included both damage caused by faulty equipment — broken masts, torn sails or lost anchors — or by forces of nature. Many "stranded" vessels became wrecks because they could not be freed at high tide by the crew or another vessel, such as a tug. Ships stranded on a rocky bottom often ended up as total wrecks. "Collisions with fixed objects" are those with piers, lock walls, approach walls, jetties and docks. Most "fires" happened in steam engines or other equipment on steam vessels. A ship that "foundered" disappeared completely, sometimes without a trace, but in the confined waters of the St. Lawrence it was usually possible to recover some identifiable objects. Many vessels developed "leaks" in their hulls which let water infiltrate, causing them to sink. The category "wrecked" relates to vessels abandoned due to irreparable damage.

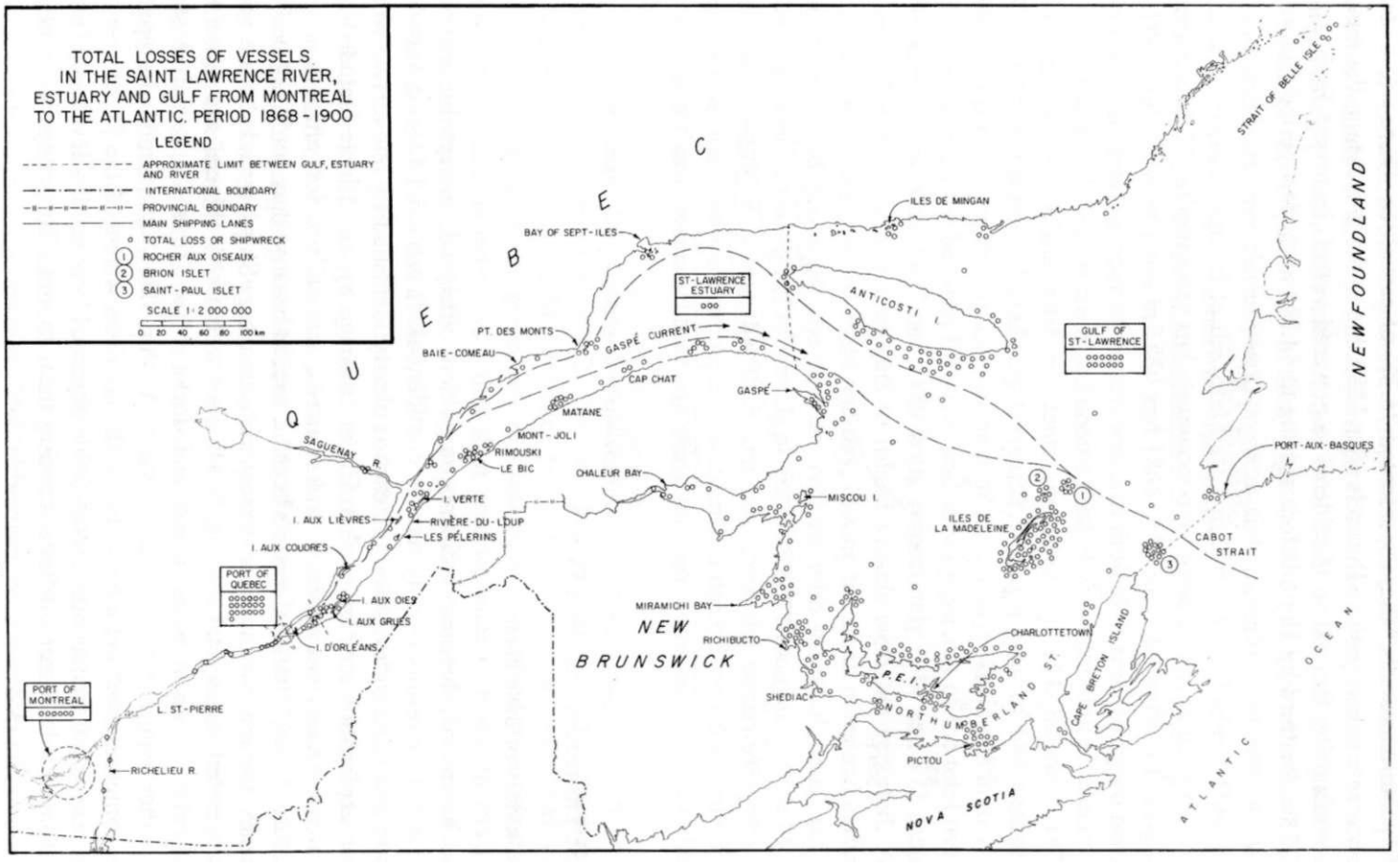

Figure 2: Total Losses in the St. Lawrence River and Gulf, 1868-1900.

Source: Courtesy of the author.

More than half the accidents were caused by stranding. The vessels affected were predominantly sailing craft that became uncontrollable when caught in a gale, snow storm or heavy seas and ran aground, in many cases becoming a total loss. The 472 casualties resulting from collisions between vessels or with fixed objects may surprise some readers. Since they were caused by human error, many could have been avoided. Of course, this is also true of stranding. Misjudgments of distance and speed, combined with the effects of currents, tides and winds, often led to disasters. Accidents are accidents; admiralty courts, among other institutions, decide who is to be blamed.

I have introduced fourteen categories subdivided into three broader groupings — effects of nature, human error and faulty equipment — to examine the cause of accidents in a slightly different way (see table 6).[7] More than half of all accidents were caused by the effects of nature, a proportion that increased to sixty percent after 1885. The other two categories contributed approximately one-fifth each. The number caused by human error decreased from 24.7% to 19.9% over the period. The single largest cause was the stress of weather in the Gulf, the Great Lakes and some sections of the river, confirming the reputation the waterway earned over centuries as difficult, hazardous and dangerous. Lloyd's and other insurance companies were well aware of these conditions in the second half of the nineteenth century and set their premiums accordingly.[8] Taking extra precautions could prevent many of the accidents due to faulty equipment or human error; the forces of nature were always more problematic.

The accidents can also be divided into two groups: total losses, which accounted for 31.5% of all accidents, and partial losses, which totalled 65.8% (see table 7). We could have evaluated damage estimates, because such data exist, although they are incomplete. But this would have introduced new problems, since the price of many commodities, such as iron and steel, fell over time. Without access to shipowners' accounts or insurers' books, it is impossible to calculate the real cost of vessel losses. In dividing the incidents into these two categories, however, I was able to plot the total losses on maps and to outline the areas that were most dangerous. The locations of the 807 total losses appear in figures 2 and 3. I have also compiled the tonnage of total losses, which averaged over 50,000 long tons per quinquennium between 1870 and 1885, decreasing to below 20,000 tons between 1896 and 1900. In 1872 alone, more than 18,000 tons were lost in these waters (see figure 4).

My compilation of the 1684 vessels with partial losses due to accidents is based on the same geographic sectors, and the findings complement those for total losses. The details, from the Gulf to the Lakes (the limits for each geographic sector are shown on the maps), of the number of vessels that suffered partial losses are as follows:

		Number of Partial Losses of Vessels
a)	Gulf of St. Lawrence	446
b)	St. Lawrence Estuary	320
c)	St. Lawrence River (Québec to Kingston)	492

Total for the St. Lawrence			1258
d)	Lake Ontario	174	
e)	Lake Erie	116	
0	Other Great Lakes	135	
Total for the Lakes			425
g)	Undetermined		
TOTAL			1684

The most difficult sectors were the Gulf and the River, where more than half the accidents happened. If we add total losses, it confirms that the Gulf was prone to more accidents than any other sector of the waterway.

Many wrecks and losses took place on the shores of islands near the shipping lanes in the Gulf. In the age of sail, vessels entering the Gulf passed near Saint-Paul Islet, Brion Islet, Bird's Rock *(Rocher aux oiseauxs)* and the Magdalen Islands. From the middle of the Gulf they then steered toward the south coast of Anticosti, followed that coast to its western end, and thus avoided the Gaspé current, which flowed in an easterly direction. At that point, they steered toward Sept-Iles and sailed along the north shore until Pointe des Monts, using the prevailing winds. Thereafter they criss-crossed the estuary until they reached Québec. In the estuary, many accidents occurred near ports or bays where vessels anchored at night, sometimes in precarious positions. Again, islands, reefs and sand bars were obstacles to avoid.

Since steamers did not have to worry as much about prevailing winds, currents or tides, they navigated closer to the Gaspé coast. The heavy local and regional traffic in Northumberland Strait led to many total losses near entrances to ports or bays, such as Chaleur and Miramichi bays, or the ports of Richibucto, Charlottetown and Pictou. The greatest number of losses was near the Magdalen Islands, along the south coast of Anticosti, and at Saint-Paul Islet. In the river, the greatest number of total losses was in the ports of Québec and Montréal, despite the proximity of shores and the presence of tugs and other vessels to assist. Several losses were caused by fires. Fifteen accidents were recorded simply as losses in the gulf or estuary with no precise locations noted. In most losses, the site was described as near some place; in a few instances, we are given the coordinates or the distance in miles and the direction from a port, bay, cape or island.

Again, the largest numbers of losses were directly related to the frequency of traffic in major shipping lanes on the lakes or at the entrance to ports and harbours. In Lake Ontario, the entrances to Oswego and Kingston, along with the Bay of Quinte area, Long Point, and the approaches to Toronto, Port Credit and Hamilton, were prone to mishaps. This was also true of Long Point in Lake Erie, the channels near Pélee Island and Point, and the entrances to the small ports. In Lake Huron, the most dangerous areas were the south shore of Manitoulin Island and the Georgian Bay ports. In canals and

rivers, total losses were infrequent. Still, several total losses occurred over the period. West of Sault Ste. Marie, the information is sketchy and incomplete.

Knowing that it is impossible to contain the forces of nature, sensitive to the bad reputation of the St. Lawrence/Great Lakes waterway, and responding to public pressure, it seems that the authorities had no choice but to improve navigational aids, to enforce stricter regulations and to better inform users about dangers. The Canadian federal government, through the departments of Marine and Fisheries and Public Works, increased the number of navigational aids exponentially.

Number of Navigational Aids	1850	1875	1900
St. Lawrence (Québec district from Belle-Isle to Montréal)	116	243	408
Great Lakes (From Montréal to Lakehead)	48	197	270
TOTAL	**164**	**440**	**678**

Along the Gulf coast of New Brunswick, and around the Magdalen Islands and PEI, the authorities proceeded the same way. Around PEI, for instance, the number of lighthouses increased from eighteen in 1875 to sixty-seven lights at thirty-nine stations in 1900.[9]

Dredging the St. Lawrence ship channel (which extends from sixty-four kilometres below Québec to Montréal) became a permanent project between 1850 and the 1890s. The major concern was a deeper, wider and safer channel, and decisions to enlarge and deepen it were often made before the preceding target had been reached. In 1853 the channel was dredged to 16.5 feet (five metres), with a width of 150 feet (45.8 m). In 1867, the channel had a depth of twenty feet (six metres) and a width of 300 feet (91.4 m). It was deepened to 22.5 feet (6.85 m) in 1878, and to 27.5 feet (8.4 m) in 1888, with a width of 500 feet (152.4 m) in some sections. In the St. Clair flats, jointly with the US Corps of Engineers, a channel 200 feet (60.9 m) wide with a depth of twelve feet (3.6 m) was provided in 1858. Dredging continued annually until 1892, when an eighteen-foot (5.4 m) channel was finally attained over a significant distance. It was costly, but this was a very busy stretch of water, with thousands of propellers moving the sand, earth and alluvials. Some 22,274 vessels and ninety timber rafts passed through the St. Clair flats during 1865, an average of eighty-six vessels per day during the season.[10]

Major improvements also took place on the US side of the Soo, with the opening in 1855 of a canal with locks and a channel 150 feet wide and fourteen feet deep (46.8 and 4.2 m). These facilities were enlarged between 1870 and 1881 and again in 1896. In 1895, a new lock and canal on the Canadian side was opened, with a channel 150 feet wide and twenty-two feet deep (45.8 and 6.7 m). The Canadian government opened the Soulanges Canal in 1899, replacing the Beauharnois Canal around the rapids in the St. Lawrence between Lakes Saint-François and Saint-Louis. Other major improvements took

place in the 1870s and 1880s, such as deepening all the St. Lawrence canals and the Welland Canal to fourteen feet (4.2 m), but these works were not completed until the late 1890s and thus had a limited effect on navigation before 1900.

A number of accidents occurred at the entrance to ports and harbours. It was urgent to improve access channels and to build piers and wharves accessible to the largest number of vessels. There were many wooden piers built and maintained by private interests in addition to the public works. In the 1850s and 1860s, governments initiated major pier construction programmes, which became the core of future ports and harbours. Fifteen such facilities were opened in the St. Lawrence sector and more than thirty along the Canadian shore of the Lakes between 1850 and 1875." The locations of these small ports and harbours are shown on figures 2 and 3.

Government also started a steam tug service in 1849 to ease navigation in the canals between Montréal and Kingston. This service, using nine tugs, was subsidized until 1875, improving considerably navigation in the upper St. Lawrence. As well, between Montréal and Pointe-aux-Pères (Father's Point), pilots were available.[12] The number of such men did not vary much, fluctuating around 200 for most of the period. Several legislative changes were made to increase the professionalism of the pilots, as well as to improve navigation rules and specific conditions. The best example was the adoption in 1873 of a new comprehensive Pilotage Act.

A new Board of Steamboat Inspection was created in 1857 and charged with regulating and inspecting steam vessels, especially for safety.[13] In 1868, the first Steamboat Act was passed by the new Canadian Parliament. Despite such efforts, shipping accidents not only continued but also increased. Two calamities — the sinking of the inland passenger vessels *Victoria* and *Asia* involving the loss of hundreds of lives — forced the government to do something. An example of public pressure was the publication in the *Globe and Mail* in 1881 of an article entitled "Our Inland Waters — Unsafe Conditions for Steamers." While the inspection of hulls and equipment became mandatory for steamships, much remained to be done for sailing and deep-sea vessels, especially regarding deckloads, freeboards and loadlines.

Better communications and information were essential. Following the sinking of *Asia,* a hydrographie survey of Georgian Bay was begun in 1883. This was also the year the Canadian Hydrographie Service was formed to assume the responsibilities of the British Admiralty as well as the tidal and current survey branch.[14] A signal service to report on vessel movements was modernized in the 1870s. Meteorological data had been collected since the 1840s, but the transmission of information for forecasting purposes was impossible until the inauguration of a coast-to-coast telegraphic service in 1887.[15]

On the US side of the waterway, in addition to the dredging programme on the St.-Clair flats and the Detroit River, and the construction of the Soo locks and canals, major improvements were made to ports and harbours, lighthouses and buoys. Hydrographie surveys, started in 1840, were completed in 1882. Indeed, most such developments occurred after the Civil War.

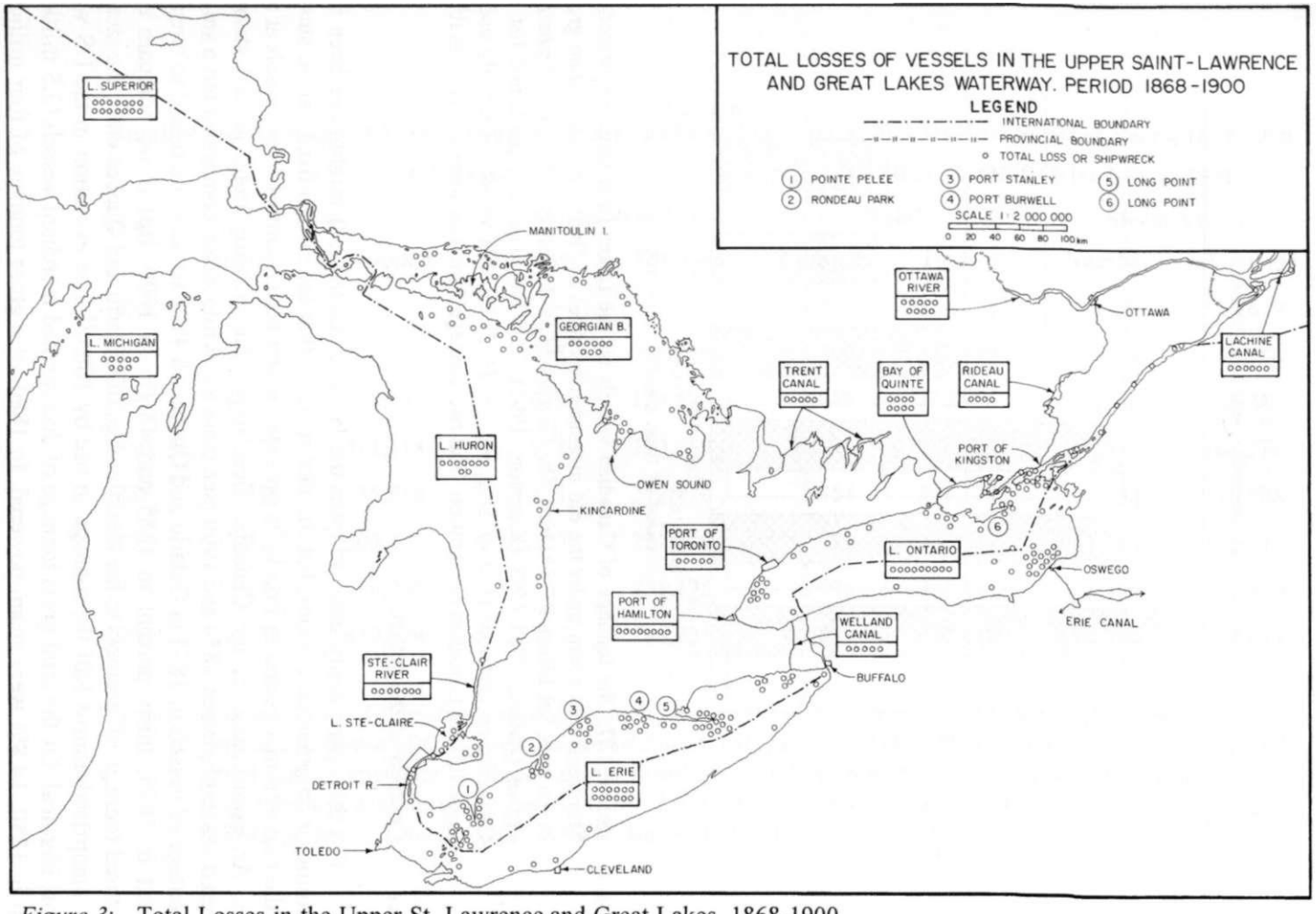

Figure 3: Total Losses in the Upper St. Lawrence and Great Lakes, 1868-1900.

Source: Courtesy of the author.

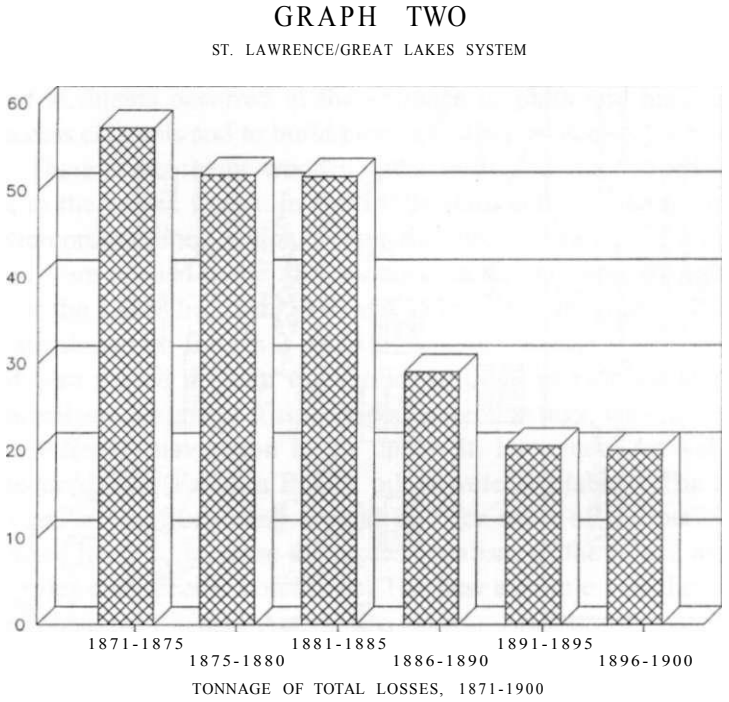

Figure 4: Before 1873 the tonnage of Canadian vessels on the Lakes (and some registered at Montréal) was given under the old measurement rules as "burthen" rather than gross or net tons. See Eileen Reid Marcil, *The Charley-Man: A History of Wooden Shipbuilding at Québec, 1763-1893* (Kingston, 1995), 364-366. The first published list of Canadian registrations *(List of Shipping for 1873)* records vessels separately under Imperial and Canadian registration. The two tonnage formulas were not comparable.

Source: Courtesy of the author.

For their part, many users adopted the latest technology. It might have been for economic or commercial reasons, but the fact remains that the switch from sail to steam and the move from wooden to iron hulls provided much better control over vessels at all times. An examination of the Canadian fleet shows the growing trend toward steam-powered vessels between 1854 and 1900 (see table 8). While steam comprised but a small percentage of vessels in 1854 in Ontario and Québec (8.4%), its share increased to twenty percent in 1875, thirty percent in 1885 and 48.7% in 1900. But if we compare the registered tonnage of steamers to the total tonnage of Ontario and Québec craft, the steam fleet comprised almost half the tonnage in use by 1885.[16] The evolution in the US was almost identical. Of the total gross tonnage of documented merchant vessels (3.5 million tons) in 1850, 14.8% were steam-powered. In 1880, of a gross tonnage of four million, 29.7% were steam-powered. In 1900, the percentage rose to 51.4%.[17]

Table 8
Number and Tonnage of Vessels Registered in Canada and in Ontario and Québec, Selected Years, 1854-1900

Year	CANADA				QUEBEC & ONTARIO REGISTER			
	Total		Steam Vessels		Total		Steam Vessels	
	Number	Tonnage	Number	Tonnage	Number	Tonnage	Number	Tonnage
1854	~	-	~	~	1,503	134,202	129	13,679
1867	3,822	777,343	335	45,766	1,909	222,699	294	46,256
1875	6,952	1,205,565	679	124,576	2,656	337,955	555	106,481
1880	7,377	1,311,218	918	190,159	2,931	370,822	737	161,271
1885	7,315	1,231,856	1,131	212,570	2,854	348,122	854	170,908
1891	7,015	1,005,475	1,433	221,679	2,799	301,244	1,008	166,917
1896	7,279	789,299	1,762	251,176	2,994	305,171	1,196	175,570
1900	6,735	659,534	2,177	298,421	2,857	279,248	1,394	194,613

Sources: *Journals of the Legislative Assembly of the Canada* (1854-1855), appendix 12, XIII, ZZ; Canada, Parliament, House of Commons, *Sessional Papers (SP),* I, No. 9 (1867-1868), Paper No. 73, 1-21; *SP,* IX, No. 4 (1876), appendix 1, "Report of the Board of Steamboat Inspection," 3-5; Annual Report of the Department of Marine and Fisheries (1876), LXII/LXV; *SP,* XXXI, No. 8 (1897), 47-49; *SP,* XI, No. 2 (1878), appendix 1, table C; *SP,* XXXV, No. 9 (1902), Paper 21B, IX-X.

Table 9
Number, Tonnage and Percentage of Types of Vessels in Use in the Leading Ports of the St. Lawrence, 1860, 1880 and 1900

NUMBER OF VESSELS

Year	Steam		Sail		Total	
1860	2,280	(17.8%)	10,484	(82.2%)	12,764	(100%)
1880	10,678	(30.3%)	29,534	(69.7%)	35,212	(100%)
1900	16,772	(51.6%)	15,712	(48.4%)	32,484	(100%)

TONNAGE OF VESSELS

	Steam		Sail		Total	
1860	433,591	(18.9%)	1,857,114	(81.1%)	2,290,705	(100%)
1880	5,287,490	(58.2%)	3,796,758	(41.8%)	9,084,298	(100%)
1900	11,160,252	(81.8%)	2,480,440	(18.2%)	13,640,692	(100%)

Note: 1860 includes only Montréal and Québec. 1880 and 1900 include the ports specified in note 18. All years include sea-going, inland and river vessels.

Source: Province of Canada, "Tables of the Trade and Navigation of the Province of Canada for the Year 1860," *SP,* XIX, No. 1 (1861), No. 29, appendix 2; Chapais, *Report,* appendix 48, tables 1-7; *SP,* XIV, No. 2 (1880/1881), tables 22-26; *SP,* XXXV, No. 5 (1901), tables 40-55.

An examination of the number of sail and steam vessels using the Welland and St. Lawrence canals and the major ports of the St. Lawrence river, estuary and gulf demonstrates the trend toward steam, especially after 1875.[18] In 1860, 19.7% of Welland Canallers were steam vessels. Twenty years later the share had hardly changed (20.4%), but by 1900 it had reversed, with steam accounting for 77.1% of users. In the St. Lawrence canals the process started earlier but was less pronounced. In 1860, 24.5% of users were steamers, rising to 32.8% in 1880 and 40.1% in 1900.[19] Below Montreal, the proportion of steamers increased gradually from 17.8% in 1860 to 51.6% in 1900. But the registered tonnage of steam vessels increased more rapidly, reaching 58.2% of total tonnage in the St. Lawrence in 1880 (see table 9). The transition to steam started in the 1880s. Such changes over a fifty-year period must have had a certain effect in reducing the number of accidents on the waterway.

NOTES

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1. There is a published guide available for those interested in individual wrecks; see Richard Brown and G.T. Wright, "In Search of Shipwrecks: Canadian Archives Sources Relating to Marine Casualties in Canada," *FreshWaterJV* (1989), 14-20. Some of the more important literature on wrecks includes Charles Hocking, *Dictionary of Disasters at Sea during the Age of Steam, Including Sailing Ships and Ships of War Lost in Action, 1824-1962* (Rev. ed., 2 vols., London, 1990); Karl E. Heden, *Directory of Shipwrecks of the Great Lakes* (Boston, 1966); David D. Swayze, *Shipwrecks! A Comprehensive Directory of Over 3700 Shipwrecks on the Great Lakes* (Boyne City, MI, 1992); Jean-Pierre Andrieux, *Shipwreck. Marine Misadventure in Story and Pictures from the Treacherous Shores Beyond* (3rd ed., Beamsville, ON, 1975); and Frederic Landry, *Pièges de Sable* (2nd rev. ed., Montréal, 1988).

2. The eastern limit of the Gulf is a line between Cape North on Cape Breton Island and Port-aux-Basques, Newfoundland, and the entrance of the Strait of Belle-Isle.

3. The basic data were gathered from the appendices to the annual report of the Steamship Inspection Board in Canada, *Sessional Papers (SP),* 1867-1903. The full list appears in table 3A.

4. I would estimate that the database has an error rate of perhaps 1-1.5%.

5. T.E. Blackwell, *Descriptive Statement of the Great Water Highways of the Domain of Canada. Hydrology of the Basin of the Gulf and River St. Lawrence. With Appendices Relating to the Commerce and Navigation of Canada by Wm. J. Patterson* (Montréal, 1874), 52.

6. Registered tonnage of sea-going vessels entering and clearing Québec and Montréal in 1855 was one million tons, reaching 1.5 million tons in 1865, 2.1 million in 1885 and 3.2 million in 1900. J.C. Chapais, *General Report of Public Works Canada* (Ottawa, 1867), appendix 48; *SP,* XIX, No. 1 (1886), table 49; *SP,* XXXV, No. 5 (1901), table 48.

7. In determining the causes of accidents I analyzed 1992 cases. This is a smaller number than the 2561 vessels inventoried in tables 3-7 because it was impossible to determine a specific cause for 569 accidents. I believe, however, that 1992 cases is sufficiently high to be useful.

8. Although principally a classification society, Lloyd's also wrote insurance. The firm opened an office in Québec in 1852. Other bureaus were established in Saint John, NB (1853), PEI (1856), Halifax and Montréal (1886), Toronto (1887), Vancouver (1888), St. John's, NF (1891), Port Arthur (1912) and St. Catharines (1963).

9. *SP,* IX, No. 4 (1876), 11; *SP,* XXXV, No. 9 (1901), 39.

10. John W. Larson, *History of Great Lakes Navigation* (Washington, 1893), 17.

11. John Page, "Report of the Chief Engineer of Public Works on the Navigation of the River St. Lawrence between Lake Ontario and Montreal," *SP,* IX, No. 6 (1876), appendix 21.

12. See J. Leclerc *Le Saint-Laurent et ses pilotes, 1805-1860* (Montréal, 1990), 85-120.

13. The first inspectors had been appointed under a previous act in 1852. The certification of engineers by the Board started in 1859. New Brunswick introduced a Steam Boat Act in 1843, and Nova Scotia passed an Act to regulate steamboats in 1864. T.E. Appleton, *Usque ad Mare. A History of the Canadian Coast Guard* (Ottawa, 1969), 197-201.

14. S. Fillmore and R.W. Sandilands, *The Chart-makers* (Toronto, 1983), 254.

15. Appleton, *Usque ad Mare,* 87-89.

16. The registered tonnage of steam-powered vessels in Ontario and Québec comprised ten percent in 1854, thirty-one percent in 1875, forty-nine percent for 1885, and almost seventy percent by 1900.

17. B.J. Wattenberg (comp.), *The Statistical History of the U.S. From Colonial Times to the Present (Hew* York, 1976), 749-751.

18. The ports retained for the St. Lawrence sector were the seven major ports of Québec — Gaspé, New Carlisle, Québec, Rimouski, Sorel, Trois-Rivières and Montréal — the ports of the New Brunswick Gulf coast; the port of Pictou, NS; and the ports of Prince Edward Island.

19. Chapais, *Report,* appendix 48. See also the sources for table 9.