
GREAT LAKES
AND ST. LAWRENCE RIVER

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By JOSEPH D. LEWIS.

This section of the report covers the statistics of water transportation in 1906 for American vessels operating on Lakes Superior, Michigan, Huron, St. Clair, Erie, and Ontario, and on the St. Lawrence river, including all documented and undocumented craft of 5 tons net register or over except fishing vessels and vessels owned by the Federal Government.

The physical features of the lakes and the surrounding country, and the history of lake navigation and shipbuilding, have been discussed at some length in previous Census reports and in the reports of other Government offices, and will not be considered here except when necessary.

To obtain a thorough comprehension of the import of the statistics, and to avoid error in the analysis of the various statistical tables, an understanding of the schedules, instructions, and general explanations given in the general summary for the United States is needful.

It should be stated at the outset that the statistics as to the number of vessels and their gross and net tonnage do not agree with those contained in the report of the Bureau of Navigation for the year ending June 30, 1906. The total number of vessels reported by that bureau for the "Northern Lakes," excluding those on Lake Champlain, for the year indicated was 2,565, with a gross tonnage of 2,182,635, 425 vessels and 210,228 tons less than the Census figures. These differences arise partly from the fact that the reports of the two offices do not cover the same periods of time, and partly from the difference in the scope of the reports. The reports of the Bureau of Navigation take cognizance only of documented craft. Some of these were engaged in fishing, some had been destroyed, while others were idle during the entire year, and therefore not included in the Census report. Some craft, too, were operated on the Great Lakes only a small portion of the year, while others operated exclusively on other waters; these, although credited to the Great Lakes by the Bureau of Navigation, if documented there, are assigned in the Census statistics to the waters in which they operated, either exclusively or for the longest period. On the other hand, following

the navigation laws the statistics of the Bureau of Navigation do not include—

Yachts, nor boats and lighters, decked and not masted, employed within the harbor of any town or city, nor canal boats and barges without sails or internal motive power of their own, employed wholly upon canals or the internal waters of a state, nor barges and boats plying on rivers or lakes of the United States and not engaged in trade with contiguous foreign territory, and not carrying passengers, nor boats under 5 tons net.¹

All of these craft, however, except those under 5 tons net register, are included in the Census returns. In any comparisons of the statistics of the two offices, therefore, it will be necessary to bear in mind the differences that have just been indicated.

In previous Census reports and to some extent in the reports of the Bureau of Statistics it has been customary to publish statistics of vessels and water transportation by ports of registration. This method of presentation has not been followed at the present census. The ownership of vessels so frequently has no relation to their field of operations that a statistical presentation of number of vessels, tonnage, value, etc., by ports, would have little significance, and on the other hand would often prove misleading. Very many of the returns for vessels having regular routes of travel show that the home port where the document was issued differed from the terminal points of the vessel's trips. For example, a large steamer owned at Mackinac Island and registered at Marquette was leased to a company which sailed it on Lake Ontario between Lewiston and Alexandria Bay, and such cases, instead of being exceptional, are very numerous. Moreover, in the reports made for the Census, instances have been noted of vessels which were owned and registered at lake ports but which were engaged in coastwise commerce on the Atlantic ocean. The following extract from the report on the Great Lakes at the census of 1889 describes the method employed at that time:

In the case of the Great Lakes and St. Lawrence river it has been found advisable to make allotment of the statistics of equipment to what may be called the ports of frequent hail, and the statistics of traffic to the ports where records of business are kept.

¹Annual report of the Commissioner of Navigation, 1906, page 282.

The question of local taxation has a strong bearing upon this point, as there is little uniformity between the different states and cities in the taxation of floating property. In some localities vessels are wholly exempt, and in others are heavily taxed; and as a result of this inequality between ports nominal transfers of ownership frequently occur, which are in a sense fictitious, and are sometimes resorted to merely for the purpose of evading the payment of taxes.

For similar reasons the general statistics are not presented by lakes, as was done at the census of 1889. A large proportion of the shipping is engaged in inter-lake commerce, as, for example, the iron ore fleet sailing from Duluth or Superior to ports on Lake Erie, and a statistical presentation by lakes of the number of vessels, tonnage, value of vessels, employees, etc., would be utterly without meaning.

In reference to the omission of vessels of less than 5 tons, it was obviously impracticable to include them in the enumeration on account of the large number of such craft and the difficulty of reaching their owners. The waters adjacent to large cities and summer resorts fairly swarm in the season with boats of this character, and while the large majority are pleasure craft, many are engaged in transporting freight and passengers on a small scale. The following is an extract from a letter written by one of the special agents of the Office while he was engaged in the canvass:

It is estimated that there are upward of 3,000 naphtha launches under 5 tons on the St. Lawrence river. Most of them carry freight and passengers. For instance, the launch I went in from Clayton to Alexandria Bay carried six passengers beside myself, 2,000 or 3,000 feet of lumber, several bushels of coal, and quite an assortment of groceries. This is an everyday occurrence. The tonnage of these boats in the aggregate amounts to quite a large figure. People on the river are patronizing them in preference to the regulars because they will land goods and passengers at any point on the river desired. More of these boats are being built this season than last, but only a few are over 5 tons.

The canvass of this district, as in the other districts of the country, was based almost entirely upon a list of vessels prepared from the reports of the Bureau of Navigation of the Department of Commerce and Labor, supplemented by such other lists of vessels as were available. Following a canvass by mail, special agents were sent into the field, and seven of these agents were assigned to the Lake district and distributed among the most important ports. The work of collecting reports by agents was commenced about the first of February, sometime previous to the opening of interlake navigation, as it was considered of advantage to reach the owners and operators of vessels at their home ports, where they were generally to be found during the closed season. The canvass was finished by the end of April.

There were only 9 vessels, with a gross tonnage amounting to 978, for which no information of any kind could be secured. All other listed vessels were satisfactorily disposed of by the receipt either of a report or of information which made it unnecessary to report. It is believed that within the limitations above stated the results are complete, and that the statistics present an accurate showing of the operations of lake craft during the period covered by the census.

With the exception of a special report on steam navigation at the census of 1880, there had been no statistics of water transportation published by the Census Office prior to those for 1889. The greater part of the statistics for 1880 was not the result of an actual enumeration by agents of the Census but was taken from the records of the United States Steamboat Inspection Service and other offices, public and private.¹ Owing to differences in the methods of compilation it is impossible to state with exactness the extent to which the figures for 1906 are comparable with those for prior censuses. As an example of such differences between 1880 and 1906 the following statement may be cited from the report for 1880:

In the foregoing tables this steamboat property has been assigned to the states where it was owned in 1880. In cases where the ownership was obscure or divided the legal headquarters or the address of the managing owner was taken as authority for assigning the craft to a state, but very few of these perplexing cases were found. The Pacific Mail Steamship Company, owned in New York, but operating lines from San Francisco, under this ruling was assigned to the state of New York.²

The same practice appears to have been followed at the census of 1889, the statistics of equipment, income, and expenditure having been credited to the port of registration, while the freight and passenger movement was charged to the port from which the vessel was operated.

At the present census, however, all the statistics have been assigned to the waters on which the vessel was operated. These differences in method must therefore be kept in mind in all comparisons between the statistics of the present census and those for prior censuses.

Owing to the lack of Census statistics relative to water transportation prior to 1880 it will frequently be necessary in the discussion of the subject to present statistical tables from the reports of other departments of the Government.

A comparative statement of the statistics as reported at the censuses of 1889 and 1906 is presented in Table 1.

¹ Tenth Census, Transportation, page 657.

² Ibid., page 717.

TABLE 1.—ALL VESSELS AND CRAFT ON THE GREAT LAKES AND ST. LAWRENCE RIVER: 1906 AND 1889.

[In addition to the craft reported in this table there were 197 craft of 41,437 gross tons reported as idle in 1906. There is also the Bureau of Fisheries shows that in 1903 there were 206 fishing and transporting vessels, valued at \$690,450, and 3,170 boats and gasolin launches, valued at \$31790, engaged in the fishing industry on the Great Lakes. Craft of this character are not included in the table.]

	TOTAL.			STEAM.			SAIL AND UNRIGGED.		
	1906	1889	Per cent of increase.	1906	1889	Per cent of increase.	1906	1889	Per cent of increase.
Number of vessels.....	2,990	2,737	9.2	1,676	1,467	14.2	1,314	1,270	3.5
Gross tonnage.....	2,302,863	920,294	160.0	1,915,756	595,813	221.3	477,077	324,481	47.0
Value of vessels.....	\$130,805,640	\$48,580,174	169.3	\$116,833,812	\$40,888,824	188.2	\$13,821,828	\$7,711,350	79.2
Gross income.....	\$65,274,702	\$35,463,852	84.1	\$56,340,227	\$24,992,267	125.8	\$8,934,475	\$10,514,585	15.0
Number of employees.....	24,916	22,726	9.6	20,315	15,271	34.3	4,401	7,455	41.0
Wages.....	\$13,280,716	\$8,098,191	64.0	\$11,179,882	\$5,706,995	92.9	\$2,100,834	\$2,301,296	8.7
Number of passengers carried.....	14,080,146	2,235,993	529.7	14,069,146	2,235,993	529.7	(b)	(b)	
Freight shipments (net tons).....	475,009,649	25,266,974	199.2	(c)	(c)		(c)	(c)	

1 Includes all craft propelled by machinery.
 2 In a number of cases the income for unrigged craft was credited to the towing steamers.
 3 Decrease.
 4 Bureau of Statistics, Department of Commerce and Labor, Monthly Summary, Internal Commerce of the United States, December, 1906, and includes 2,003,453 net tons of bunker coal.
 5 Not reported separately.

In order that the comparison may be carried back to 1880 with respect to certain items concerning transportation by steam vessels, the following table containing statistics published at that census is introduced:

TABLE 2.—Steam navigation, Northern Lakes: 1880.¹

Number of steamers.....	947
Tonnage.....	222,290
Value of steamers.....	\$13,918,925
Capital invested.....	\$16,978,108
Gross earnings.....	\$12,136,228
Crews, persons.....	9,143
Paid for services.....	\$3,293,964
Passenger traffic, number.....	1,356,010
Freight traffic, tons.....	4,368,171

¹ Tenth Census, Transportation, page 702.

The statistics in the foregoing tables and others in this section and in the general report on water transportation in the United States indicate the extraordinary development that has taken place in the commerce of the Great Lakes. It can be stated indeed that this growth exceeds that of the water-borne commerce on any other of the great systems in the country, with the exception of the Atlantic coast. Among the causes contributing to this development are the immense increase of the population in the territory tributary to these inland seas; the resources and productiveness of the country in such great staples as iron ore, wheat, corn, etc., of which by far the major proportion must find markets elsewhere; and the generous expenditures for the improvement of harbors and canals, in deepening and widening the channels of communication, and in the construction of dock and wharf facilities.

Great Lakes compared with United States.—The statistics for the lakes are compared with those for the United States in Table 3.

The different items included in the table vary as to the accuracy with which they indicate the comparative economic importance of different transportation divisions. The number of passengers and quantity of freight carried are defective standards of comparison unless the passenger and ton mileage are also considered. To secure this information was a task that

the Bureau of the Census did not undertake, and could not have accomplished with the means at hand and the time at its disposal. Vessel tonnage is also defective as a basis of comparison, as is shown by the fact that the gross tonnage of shipping on the Mississippi river, which is made up almost entirely of coal barges of cheap construction, many of which are destroyed after the first trip, is nearly twice that on the lakes, although the earnings of lake shipping are nearly four times those on the Mississippi.

For these reasons the capital invested, the income earned, and the number of men employed and wages paid form the best basis by which to judge the comparative importance of different transportation systems. Gauged by these standards, the shipping interests on the Great Lakes represent from one-sixth to one-fourth of the totals for the United States, the percentages varying from 17.7 per cent of the total for the number of men employed to 25.8 per cent for value of vessels. The relatively high proportion, 18.6 per cent, which the gross tonnage of lake vessels represents of the total gross tonnage for the United States, as compared with the corresponding proportion, 8 per cent, for the number of craft, indicates that the average tonnage per vessel on the lakes is much greater than for the country as a whole; the average value per ton, also, is much higher.

TABLE 3.—Water transportation, United States and the Great Lakes: 1906.

	United States.	Great Lakes.	Per cent of total.
Number of vessels.....	37,321	2,990	8.0
Gross tonnage.....	12,893,429	2,302,863	18.6
Value of vessels.....	\$507,973,121	\$130,805,640	25.8
Gross income.....	\$294,894,532	\$65,274,702	22.1
From freight.....	\$175,545,361	\$52,076,533	29.7
From passengers.....	\$43,045,365	\$4,806,904	11.2
From all other sources.....	\$75,003,806	\$8,391,265	11.0
Number of employees.....	140,929	24,916	17.7
Wages.....	\$71,030,521	\$13,280,716	18.5
Number of passengers carried.....	366,825,063	14,080,146	3.8
Freight carried (net tons).....	177,519,758	475,009,649	42.6

¹ Exclusive of harbor work.
² Bureau of Statistics, Department of Commerce and Labor, Monthly Summary, Internal Commerce of the United States, December, 1906, and includes 2,003,453 net tons of bunker coal.

Undocumented craft.—It has already been pointed out that the omission of undocumented vessels from the statistics of the Bureau of Navigation impairs their value for comparison with the Census figures. The classes of vessels which are not required to be documented are described elsewhere in this report. The extent to which such vessels were reported for the Census is shown in Table 4.

TABLE 4.—Number and gross tonnage of active and idle undocumented craft: 1906.

CLASS.	Number of vessels.	Gross tonnage.
Total.....	775	150,351
Active.....	748	150,363
Steam.....	124	5,984
Sail.....	49	408
Unrigged.....	575	143,971
Idle.....	27	8,988
Steam.....	3	104
Sail.....	2	260
Unrigged.....	22	8,624

A large proportion of the undocumented steam vessels are small gasoline launches used for private purposes, and practically all the sailing vessels are operated for the same purpose. The unrigged craft are made up largely of vessels employed in harbor work, dredging, etc., such as scows, barges, lighters, derricks, pile drivers, and dredges.

CHARACTER OF SHIPPING.

The development of water transportation on the Great Lakes has naturally been attended by change and improvement in the types of vessels engaged in this commerce. The transition of lake shipping from the old to the new exhibits much the same aspects of change as in other fields of maritime commerce. The propulsive power is gradually passing from sail to steam, while the material of construction shows a steadily increasing proportion of steel. The average tonnage per vessel, except for unrigged vessels, has steadily grown larger.

Steam, sail, and unrigged craft.—In order to show the relative proportions of steam, sail, and unrigged vessels engaged in lake commerce, as reported at the censuses of 1889 and 1906, Table 5 is introduced, and following that Table 6, compiled from the reports of the Bureau of Navigation, Department of Commerce and Labor, which shows for a longer period of time the gradual evolution of this branch of American shipping. It should be stated that "steam vessels" include all classes of power craft—steam, gasoline, electric, etc.

TABLE 5.—Number, gross tonnage, and value of different classes of vessels: 1906 and 1889.

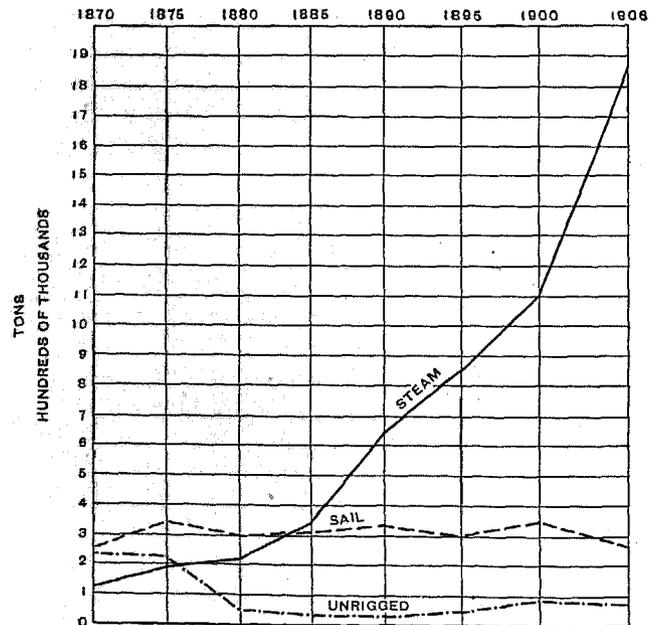
CLASS.	Cen-sus.	Number of vessels.	Gross tonnage.	Value of vessels.	Average tonnage per vessel.	Average value per ton.
Total.....	1906 1889	2,990 2,737	2,392,863 920,294	\$130,805,640 48,580,174	800 336	\$55 53
Steam.....	1906 1889	1,676 1,467	1,915,786 595,813	116,983,812 40,868,824	1,143 406	61 69
Sail.....	1906 1889	531 962	265,571 185,081	7,135,271 4,238,850	500 192	27 23
Unrigged.....	1906 1889	783 308	211,506 139,400	6,686,557 3,472,500	270 453	32 25

TABLE 6.—Number and gross tonnage of different classes of vessels, with average tonnage per vessel: 1870 to 1906.¹

YEAR.	STEAM.			SAIL.			UNRIGGED.		
	Number of ves-sels.	Gross tonnage.	Average ton-nage per vessel.	Number of ves-sels.	Gross ton-nage.	Average ton-nage per vessel.	Num-ber of ves-sels.	Gross ton-nage.	Average ton-nage per vessel.
1906..	1,824	1,838,136	1,008	511	268,585	526	230	75,914	330
1900..	1,719	1,108,842	644	813	333,906	411	233	82,109	352
1895..	1,737	854,018	492	1,066	298,297	280	157	48,649	310
1890..	1,507	648,725	430	1,236	326,077	264	174	29,301	168
1885..	1,154	332,365	288	1,282	310,383	242	198	41,876	211
1880..	912	209,465	230	1,415	302,264	214	202	45,766	227
1875..	869	197,073	227	1,645	335,822	204	2,075	238,740	115
1870..	625	136,980	219	1,545	254,819	165	2,384	237,287	100

¹Reports of the Commissioner of Navigation, 1885 and subsequent years, and "Commerce and Navigation of the United States," Treasury Department, 1880 and preceding years.

DIAGRAM I.—Relative amount of tonnage, steam, sail, and unrigged vessels: 1870 to 1906.



As shown by the above statistics the sailing vessels of the lakes are steadily diminishing in importance,

indeed to a much greater degree than is indicated in the tables. There is a class of vessels included under the classification of sailing vessels which are commonly called "schooner barges," and which in reality operate as barges; that is to say, they are towed between ports, but are equipped with masts and canvas to provide against breaking towlines or other accidents. While the returns do not make clear the exact proportion of the entire fleet which this class forms, it is certain that this proportion is considerable. A careful examination of the returns of the present census shows that there were at least 117 schooner barges on the Great Lakes, with a gross tonnage of 160,002, and a value of \$5,273,884; an average tonnage per vessel of 1,368, and an average value per gross ton of \$33.

The largest navigation company on the lakes, in reference to the vessels of this class which formed a part of its fleet, stated:

The sailing vessels are nothing more than tow barges that have masts on which sails can be rigged if necessary, although they are of the same nature as the barges called "pigs" which carry no masts, and we think the figures for sailing vessels and unrigged craft should be combined as tow barges.

The recommendation of the company was followed and its "sailing fleet" classified as unrigged craft or barges. There were, perhaps, many other craft of this class returned as sailing vessels, but there was nothing in the reports to indicate their exact character. It should be stated that "rigged barges" are classified as sailing craft by the Bureau of Navigation in its List of Merchant Vessels of the United States and by the Lake Carriers' Association in its annual reports, although in the annual report of the Commissioner of Navigation for 1905 a statement showing the number and tonnage of seagoing schooner barges is given. The following extract from that report accurately defines these vessels:¹

A seagoing schooner barge is a vessel usually towed from port to port, but rigged with masts and furnished with sails, so that if in emergency she breaks adrift from the towing steamer, she may not be helpless at sea. Nearly all of these schooner barges before 1890 were square-rigged vessels or schooners which had outlived their usefulness as such and were dismantled and converted into barges. Shortly before 1890, and to a considerable extent since, such schooner barges have been specially constructed, some of them with steel hulls. The practice of cutting down square-rigged vessels and schooners into barges still continues.

Owing to the confusion as to the classification of schooner barges it can not be stated with certainty that the statistics for this class as presented separately are complete, but the 117 schooner barges already referred to represent over one-half of the total gross tonnage and over two-thirds of the total value of sailing vessels on the Great Lakes, as reported in Table 5 for 1906. If these schooner barges are deducted, there are left 414 sailing vessels, with a total gross tonnage of 105,569.

An official of the United States Steamboat Inspection Service, whose experience in navigating the lakes extends back for nearly fifty years, in conversation with the writer, described Buffalo harbor and river as crowded with sailing vessels forty years ago, with only occasional steamers, and this at that time was the condition in all lake ports. Since that time, however, sailing ships have been gradually disappearing from the lakes, probably for the reason that they are unequal to the competition of the large modern steamers in freight traffic. Some of these sailing vessels have been reconstructed into barges, many have been wrecked, and others are laid up as useless. Many of the sailing vessels now in commission are practically "tramps," picking up occasional cargoes of posts, cord wood, stone, etc., for short voyages. Others are engaged in business of a speculative character, purchasing farm produce for sale in city markets. Taken as a whole their work is spasmodic and unreliable. By far the largest proportion of sailing vessels remaining on the Great Lakes, however, are operated in the lumber trade on Lake Michigan, although there are many in commission on the other lakes. By reference to Table 41, in which are presented the detailed statistics, it will be seen also that in the sailing fleet there are 122 pleasure craft or yachts, with a gross tonnage amounting to 1,458.

It was the original intention to ascertain in the canvass the manner in which sailing vessels were rigged, whether as schooner, brig, barkentine, etc., and the number of each type; this, however, was not attempted, but it can be stated that practically all sailing vessels on the lakes are of the schooner type or its modifications.

The decadence in the tonnage of sailing vessels has been accompanied by an enormous increase in that of steamers, and the explanation lies almost entirely in the immense development of the traffic in iron ore, coal, grain, and other important commodities. The tonnage of the iron ore carried by lake shipping in 1906 was alone over one and one-half times the total tonnage of all freight carried on these waters in 1889. From 1889 to 1906 the gross tonnage of steam vessels increased 221.5 per cent and of unrigged craft 51.7 per cent. It would appear, however, that within the last few years the use of unrigged vessels in interlake traffic has been decreasing. The following extract from a public document is of interest in this connection:²

Turning to the Great Lakes, it is found that the use of barges there also is on the decline. Of the freight which passed through the locks of the Sault Ste. Marie in the years from 1888 to 1899, inclusive, nearly one-third was carried in barges, the percentages varying in different years from 26 to 33. In the year 1904 only 18 per cent was carried in barges. * * * Very few, if any, new barges are being built for the lake trade, all new vessels, as a rule, being made self-propelling.

¹ Report of the Commissioner of Navigation, 1905, page 195.

² Report by the Mississippi River Commission, H. R. Doc. No. 263, Fifty-ninth Congress, 1st session, pages 14 and 15.

The fact that from 1901 to 1905 the reports of the Bureau of Navigation show a steady relative decline in the number and tonnage of unrigged vessels, documented, appears to support this view; some craft of this class are, however, reported as constructed every year, although these additions are not enough, evidently, to make up for the annual loss.

Table 6, covering as it does a longer period of time than the Census figures, discloses more plainly the enormous growth in steam tonnage—from 136,980 tons in 1870 to 1,838,136 in 1906, over thirteenfold. The increase in unrigged vessels is much less striking. In explanation of the very great difference in the statistics of unrigged vessels between 1875 and 1880 and the later years it should be stated that prior to April 18, 1874, the navigation laws were construed as applying to canal boats and requiring that they be documented, but on that date an act of Congress became effective which provided that—

the act to which this is a supplement shall not be so construed as to extend the provisions of the said act to canal boats, or boats employed on the internal waters or canals of any state; and all such boats, excepting only such as are provided with sails or propelling machinery of their own adapted to lake or coastwise navigation, and excepting such as are employed in trade with the Canadas, shall be exempt from the provisions of the said act, * * *

This legislation had the immediate effect of dropping from the list of documented vessels a very large number of canal boats which were registered at lake ports.

It will be seen by reference to Table 41 that power vessels were principally steamers, the horsepower of which amounted to 976,847; the others were gasoline boats, aggregating 5,700 horsepower, nearly all pleasure craft, and one yacht of 8 horsepower, electric. According to the reports received, 1,616 of these vessels were equipped with screw propellers, 51 were side wheel steamers, 8 were stern wheelers, and 1 was a "chain" ferryboat. At the census of 1889 there were 62 side wheel passenger steamers reported, with a gross tonnage of 27,259; thus there has been a decrease in the number of these vessels. There were no stern wheel vessels reported at that census, although some were probably in use. According to authoritative works on the subject of lake navigation the first propeller steamer on the lakes appeared in 1841.¹ At the present time boats of other types are in comparison numerically insignificant.

Metal and wooden vessels.—Fully as remarkable, perhaps, as the great change noted in the method of propulsion of lake vessels is the revolution in the materials used in their construction, which is indicated in Tables 7 and 8.

¹ Eleventh Census, Transportation Business, Part II, page 247.

TABLE 7.—Number, gross tonnage, and value of vessels, by character of construction: 1906 and 1889.

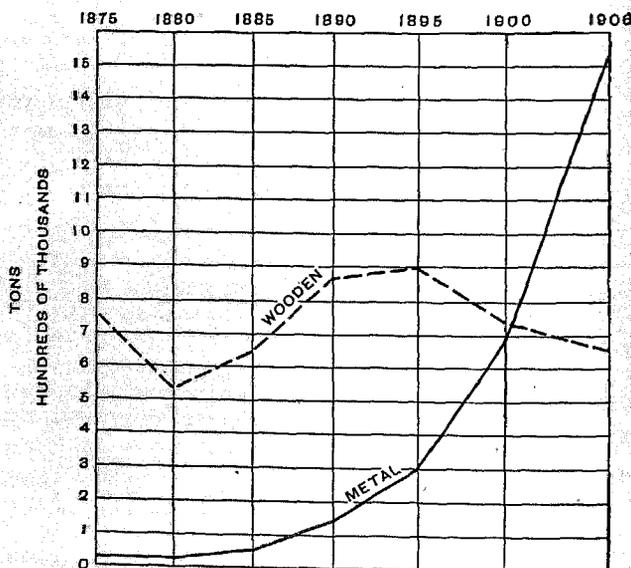
CHARACTER OF CONSTRUCTION.	Cen-sus.	Number of ves-sels.	Gross tonnage.	Value of vessels.	Average tonnage per vessel.	Average value per ton.
Total.....	1906 1889	2,990 2,737	2,392,863 920,294	\$130,805,640 48,580,174	800 336	\$55 53
Iron.....	1906 1889	33 45	27,827 35,922	2,025,050 3,225,224	843 798	73 90
Steel.....	1906 1889	539 40	1,606,326 75,488	103,704,366 7,349,000	2,980 1,887	65 97
Wood.....	1906 1889	2,391 2,641	737,386 794,128	24,075,474 36,777,950	308 301	33 46
Composite.....	1906 1889	27 11	21,324 14,756	1,000,750 1,228,000	790 1,341	47 83

TABLE 8.—Number and gross tonnage of metal and wooden vessels, with average tonnage per vessel: 1875 to 1906.¹

YEAR.	METAL.			WOODEN.		
	Number of vessels.	Gross tonnage.	Average tonnage per vessel.	Number of vessels.	Gross tonnage.	Average tonnage per vessel.
1906.....	543	1,526,506	2,811	2,022	656,199	324
1900.....	318	686,675	2,159	2,447	836,182	342
1895.....	190	300,648	1,582	2,770	900,316	325
1890.....	88	127,926	1,454	2,829	876,177	310
1885.....	34	34,028	1,001	2,800	650,596	250
1880.....	18	15,973	887	2,511	541,522	216
1875.....	16	15,585	974	4,573	756,050	165

¹ Reports of the Commissioner of Navigation, 1885 and subsequent years, and "Commerce and Navigation of the United States," Treasury Department, 1875 and 1880.

DIAGRAM 2.—Relative amount of tonnage of metal and wooden vessels: 1875 to 1906.



It is hardly necessary to explain that the classification into iron, steel, wood, and composite vessels is used solely with reference to the construction of the hull. The salient facts apparent from the tables are that iron

ships are gradually becoming obsolete; that steel is the principal material used in the construction of vessels of large tonnage; that wooden vessels have decreased in number, tonnage, and value; and that this class of construction is being confined to comparatively small vessels. It is possible that the statistics relating to vessels of composite construction are not strictly accurate, owing to the confusion which exists as to the precise meaning of the term when applied to shipping; that is, as to the proportion of the different materials used which entitle vessels to be so classified. In the reports of the Bureau of Navigation they are included in the metal class, and are so reported in Table 8. The explanation made on page 124 for the great decrease in unrigged vessels between 1875 and 1880 applies also to the decrease in the number of wooden vessels shown in Table 8 for 1880 as compared with 1875.

In the early days of iron shipbuilding, while the future possibilities were vaguely described by some, there were many who could see no good in iron as applied to the art of shipbuilding, and many objections were advanced, which appear ridiculous in the light of present developments. But even those most sanguine of success could hardly have foreseen the great supremacy in tonnage eventually to be attained by metal ships over those built of wood. Their efficiency was questioned, their longevity as compared with wooden vessels was doubted, it was averred that lacking buoyancy they would sink too easily and rapidly, and that their effect upon the compass was dangerous. Their merits, however, were soon demonstrated. Their greater strength and carrying capacity when compared ton for ton with wooden ships were the chief factors in their favor, and proved sufficient to insure a constant increase in the tonnage of this class of vessels.

Iron and steel have not been used long enough as a material in shipbuilding to determine with certainty the extreme length of service of which such vessels are capable. It has been observed that there are some metal ships, built in the earliest days of such construction on the lakes, still in commission. The real veteran ships of the service, however, on the lakes, as elsewhere, are constructed of wood. In this connection a tabular statement setting forth some of the leading features of a few of the older ships is of some interest. The vessels included in this statement are all made of wood.

The oldest vessels included in the statement are the sailing ships; while those built later, all in 1862, are screw propellers. All are in active operation, except two, which were reported as out of commission in 1906. The *Empire State*, the largest vessel in the group, is constantly engaged in carrying passengers and freight between Chicago, Milwaukee, and Racine.

Statement of the old vessels engaged in transportation on the Great Lakes.

NAME OF VESSEL.	Year built.	Propulsive power.	Home port.	Gross tonnage.	Class of business.
Lydia E. Raesser..	1847	Sail.....	Milwaukee, Wis.	131	Freight.
Seaman.....	1848	Sail.....	Milwaukee, Wis.	181	Freight.
Josephine Dresden.	1852	Sail.....	Milwaukee, Wis.	84	Freight.
Challenge.....	1852	Sail.....	Milwaukee, Wis.	87	Out of commission.
Plymouth.....	1854	Sail.....	Cleveland, Ohio.	776	Freight.
Empire State.....	1862	Steam, screw.	Milwaukee, Wis.	1,116	Freight and passenger
Monitor.....	1862	Steam, screw.	Buffalo, N. Y....	45	Towing.
Success.....	1862	Steam, screw.	Chicago, Ill.....	26	Towing.
Badger State.....	1862	Steam, screw.	Port Huron, Mich.	802	Freight.
Kate Williams....	1862	Steam, screw.	Marquette, Mich.	164	Out of commission.

Tonnage.—Table 9 gives statistics in regard to the number, tonnage, and value of vessels, classified according to the material used in their construction, for steam, sail, and unrigged craft, and schooner barges; and also the horsepower of the engines in steamers.

TABLE 9.—Number of vessels, tonnage, horsepower of engines, and value, by character of construction and class: 1906.

CHARACTER OF CONSTRUCTION AND CLASS.	Number of vessels.	TONNAGE.		Horsepower of engines.	Value of vessels.
		Gross.	Net.		
Total.....	2,000	2,392,863	1,905,176	982,555	\$130,805,040
Iron.....	33	27,827	23,034	16,638	2,025,050
Steam.....	32	27,752	22,963	16,638	1,995,050
Sail.....	1	75	71		30,000
Unrigged.....					
Schooner barges.....					
Steel.....	539	1,606,326	1,236,273	623,373	103,704,366
Steam.....	457	1,461,729	1,101,773	623,373	97,410,073
Sail.....	3	4,335	3,913		221,300
Unrigged.....	48	33,287	31,030		1,601,534
Schooner barges.....	31	106,975	99,557		4,381,459
Wood.....	2,391	737,386	628,750	334,092	24,075,474
Steam.....	1,172	410,104	315,469	334,092	16,677,489
Sail.....	408	161,136	95,888		1,607,787
Unrigged.....	725	173,119	167,308		4,897,773
Schooner barges.....	86	53,027	50,085		892,425
Composite.....	27	21,324	17,119	8,452	1,000,750
Steam.....	15	16,201	12,023	8,452	901,200
Sail.....	2	23	21		2,300
Unrigged.....	10	5,100	5,075		97,250
Schooner barges.....					

The increase in the measured tonnage and consequently in the carrying capacity of lake shipping and the vast improvement in the engines with which the steamers are equipped, have been no less remarkable than the progress made in other directions. The necessity for increased tonnage, the progress made in the application of steampower to navigation, and the successive improvements in metallurgical science, which have produced a better metal for shipbuilding purposes, acting and reacting upon each other, have resulted, on the lakes as in other maritime quarters, in the extraordinarily effective fleet of to-day.

TRANSPORTATION BY WATER.

Table 7 shows that the average tonnage of all vessels enumerated increased from 336 in 1889 to 800 in 1906. The average tonnage of steam vessels, according to Table 5, increased from 406 to 1,143; and that of sailing vessels from 192 to 500. A decrease is noted in the average tonnage of unrigged vessels, but how far this is caused by the confusion in regard to schooner barges and the manner of reporting them at the two censuses, it is impossible to say. As indicated by Table 7, steel ships increased in average tonnage from 1,887 to 2,980 and wooden vessels from 301 to 308. The small increase noted in this respect in iron vessels and the decrease for those of composite construction, have no other significance than that they serve

to emphasize the gradual passing into disuse of these types of craft.

The extent of the increase in the tonnage of lake shipping can not be fully understood from a consideration of average figures, and only a study of individual cases will convey the whole significance of the progress that has been made. As a partial means to this end, Tables 10 and 11 are introduced, the first showing the number and total tonnage, in 1906, for the four kinds of vessels—steam, sail, unrigged, and schooner barges—divided into classes according to their gross tonnage, and the second, similar statistics for steam and sailing vessels from 1889 to 1906 as reported by the Commissioner of Navigation.

TABLE 10.—VESSELS GROUPED ACCORDING TO GROSS TONNAGE: 1906.

CLASS.	TOTAL.		STEAM.		SAIL.		UNRIGGED.		SCHOONER BARGES.	
	Number of vessels.	Gross tonnage.								
Total.....	2,990	2,392,853	1,676	1,915,786	414	105,569	783	211,506	117	160,002
5 to 49 tons.....	843	18,096	578	12,569	181	2,876	69	2,261	15	390
50 to 99 tons.....	420	28,899	213	15,319	28	2,140	168	10,711	11	729
100 to 199 tons.....	307	44,130	86	12,787	32	5,094	187	25,884	2	365
200 to 299 tons.....	199	49,117	49	11,792	44	11,011	101	25,103	5	1,211
300 to 399 tons.....	159	58,549	49	17,198	33	11,463	72	28,154	5	1,734
400 to 499 tons.....	148	66,770	28	12,757	30	13,497	81	36,319	9	4,197
500 to 999 tons.....	279	193,546	115	82,850	54	36,694	87	58,581	23	15,421
1,000 to 1,499 tons.....	108	133,872	81	99,962	6	7,482	15	18,921	6	7,507
1,500 to 1,999 tons.....	113	198,261	108	189,648	1	1,729	2	3,092	2	3,792
2,000 to 2,499 tons.....	118	264,346	104	233,297	1	2,339	1	2,480	12	26,230
2,500 to 2,999 tons.....	35	95,414	30	82,067	3	8,026			2	5,321
3,000 to 3,999 tons.....	80	286,463	60	218,937	1	3,218			19	64,298
4,000 to 4,999 tons.....	103	469,803	100	456,123					3	13,080
5,000 to 5,999 tons.....	29	158,894	26	143,767					3	15,127
6,000 to 6,999 tons.....	40	262,375	40	262,375						
7,000 tons and over.....	9	64,338	9	64,338						

There were no tables similar to Tables 10 and 11 presented in the report on water transportation on the Great Lakes for the census of 1889, although information can be gleaned from various sources, which reveals the immense increase that has been made and is constantly being made in the carrying capacity of vessels engaged in lake commerce.

The highest class shown in Table 10 is that which includes vessels of over 7,000 tons, and there are but 9 ships, all steel steamers, in that class. These vessels are engaged in the iron ore trade and range in gross tonnage, by measurement, from 7,053 to 7,438; their carrying capacity, however, is much greater. All of the vessels in the higher classes, from 3,000 tons to the highest, are constructed of steel, and there is but one wooden ship with a tonnage in excess of 2,500.

To illustrate the tremendous carrying capacity of the steamers that exceed 7,000 gross tons each, it may be stated that their combined gross tonnage is 64,338, and that according to the estimates of the best authorities on the subject, their combined capacity in iron ore amounts to 101,000 tons. These 9 vessels are expected to make, on the average, about 25 round trips

each season, although some can make 30, and they are capable, therefore, if operated and loaded to the limit of their capacity, of transporting nearly 3,000,000 tons of ore from Duluth to ports on Lake Erie between the opening and the close of navigation.

It is not only in the transportation of iron ore that these large carriers are employed. Vessels of equal capacity are used in the grain trade and in carrying coal, and since 1906 vessels of even greater dimensions have been constructed and were in commission during the season of 1907. As an example, it is recorded that during December of the latter year a new steel steamer, the *LeGrand S. DeGraff*, carried 421,000 bushels of wheat from Superior to Buffalo, which was the largest cargo ever loaded on the lakes up to that time; its equivalent in net tons was 12,630. Moreover, it is authoritatively announced that steamers are now being constructed that will exceed that record, vessels that if loaded down to a draught of 19 feet of water can carry 14,000 tons of coal, and if loaded to their full capacity, drawing 24 feet of water, will be capable of carrying 19,000 tons. This latter amount of cargo, however, the depths of the channels will not permit.

GREAT LAKES AND ST. LAWRENCE RIVER.

TABLE 11.—STEAM AND SAIL VESSELS, INCLUDING SCHOONER BARGES, CLASSIFIED ACCORDING TO GROSS TONNAGE: 1889 TO 1906.^{1,2}

YEAR.	TOTAL.		5 TO 49 TONS.		50 TO 99 TONS.		100 TO 199 TONS.		200 TO 299 TONS. ³		300 TO 399 TONS. ³		400 TO 499 TONS. ³		500 TO 999 TONS.		1,000 TO 2,499 TONS.		2,500 TO 4,999 TONS.		5,000 TONS AND OVER. ⁴	
	Number of ves-sels.	Gross tonnage.	Number of ves-sels.	Gross tonnage.	Number of ves-sels.	Gross tonnage.	Number of ves-sels.	Gross tonnage.	Number of ves-sels.	Gross tonnage.	Number of ves-sels.	Gross tonnage.	Number of ves-sels.	Gross tonnage.	Number of ves-sels.	Gross tonnage.						
STEAM.																						
1906.....	1,844	1,841,438	683	16,903	238	17,581	254	61,302							120	86,658	299	531,658	187	740,909	63	386,427
1905.....	1,820	1,647,793	650	16,845	247	18,164	262	62,703							120	87,364	318	561,709	182	717,563	32	183,445
1904.....	1,820	1,592,270	642	16,456	250	18,320	271	65,157							137	110,544	320	564,220	180	707,780	20	109,793
1903.....	1,796	1,467,992	635	16,410	248	18,201	280	67,701							127	92,622	337	591,469	153	595,295	16	86,294
1902.....	1,795	1,377,872	647	16,805	245	18,009	289	70,136							129	94,047	339	591,248	129	496,321	17	91,306
1901.....	1,778	1,243,500	648	16,683	239	17,510	306	74,340							129	94,670	347	607,347	94	353,784	15	79,157
1900.....	1,739	1,110,565	648	16,644	240	17,703	302	73,808							125	90,877	341	591,378	83	320,155		
1899.....	1,732	1,014,561	662	16,956	232	17,012	312	75,680							127	92,695	332	573,432	67	238,756		
1898.....	1,764	993,644	666	16,046	235	16,952	155	22,037	70	17,063	74	25,854	35	15,713	128	92,783	344	590,768	57	195,528		
1897.....	1,775	977,235	675	17,407	236	17,000	159	22,637	71	17,412	71	24,708	37	16,499	127	92,116	346	588,275	53	181,091		
1896.....	1,792	924,631	701	18,092	225	16,092	168	23,834	73	18,016	74	25,781	36	15,984	132	95,827	343	582,442	40	128,593		
1895.....	1,755	857,735	696	17,930	215	15,544	167	23,967	76	18,772	70	24,329	37	16,400	134	97,532	334	566,522	26	76,739		
1894.....	1,731	843,240	695	17,954	207	14,791	162	23,341	74	18,252	68	23,582	39	17,350	127	93,502	337	570,908	22	63,560		
1893.....	1,731	828,702	700	17,883	206	14,694	156	22,683	77	19,050	72	24,924	41	19,017	142	132,285	318	525,779	69	52,378		
1892.....	1,631	763,063	649	16,778	199	14,188	158	23,155	74	18,345	66	22,783	35	15,493	117	86,361	321	534,400	12	31,470		
1891.....	1,592	736,752	624	16,137	198	14,169	159	23,057	77	19,231	62	21,222	33	14,618	118	86,892	310	512,788	11	28,638		
1890.....	1,527	652,923	620	16,076	188	13,513	137	22,216	75	18,726	59	20,113	33	14,601	119	87,009	272	439,787	68	20,882		
1889.....	1,455	575,307	612	15,805	180	12,851	137	20,017	77	19,104	56	18,998	32	14,144	123	93,496	233	367,862	5	13,030		
SAIL.																						
1906.....	519	269,136	131	2,880	44	3,261	202	60,008							88	59,027	27	48,014	24	80,813	3	15,127
1905.....	583	301,115	143	3,133	47	3,491	230	67,579							102	69,444	33	56,420	24	80,882	4	20,166
1904.....	623	308,820	155	3,465	53	3,901	249	73,216							104	70,622	34	57,199	24	80,251	4	20,166
1903.....	676	315,195	178	3,843	58	4,259	272	79,222							109	74,564	31	52,800	24	80,251	4	20,166
1902.....	726	318,032	196	4,340	65	4,744	297	85,564							111	75,773	31	52,620	22	74,825	4	20,166
1901.....	784	332,289	207	4,051	78	5,731	327	92,616							112	76,736	34	57,504	22	74,825	4	20,166
1900.....	832	335,183	221	5,038	84	6,237	353	99,328							115	78,752	35	56,227	24	89,601		
1899.....	874	318,175	239	5,416	92	6,801	374	104,145							114	77,748	35	53,885	20	70,180		
1898.....	960	333,704	245	5,464	105	7,636	104	15,862	150	38,024	110	37,055	54	24,035	135	93,398	41	59,966	16	52,464		
1897.....	993	334,104	254	5,926	111	8,096	111	16,725	149	37,827	118	39,848	55	24,518	140	96,748	41	58,670	14	45,746		
1896.....	1,044	309,152	270	6,257	120	8,730	121	18,188	160	40,527	123	43,232	57	25,425	146	101,121	38	52,778	4	12,891		
1895.....	1,100	300,642	294	6,817	122	8,844	132	19,955	169	42,839	140	47,192	59	26,265	149	102,740	35	45,990				
1894.....	1,139	302,985	299	7,027	133	9,643	140	21,145	180	45,599	143	48,081	61	27,202	151	104,503	32	39,785				
1893.....	1,205	317,789	312	7,304	136	9,817	150	22,055	206	52,045	148	49,759	63	28,068	159	110,070	31	38,071				
1892.....	1,226	319,618	310	7,252	139	10,073	156	23,679	218	55,241	153	51,433	64	28,520	160	110,775	26	32,645				
1891.....	1,243	325,131	301	7,031	141	10,248	164	24,948	225	57,091	160	53,609	65	28,956	162	111,874	25	31,374				
1890.....	1,272	328,656	308	7,409	144	10,422	172	26,124	235	59,581	162	54,304	64	28,521	164	113,442	23	28,853				
1889.....	1,285	325,083	313	7,538	143	10,330	176	26,724	245	62,129	166	55,035	65	28,972	156	107,036	21	26,719				

¹ From the reports of the Commissioner of Navigation.
² Lake Champlain vessels included.

³ Not reported separately after 1898.
⁴ Not reported separately prior to 1901.

⁵ 100 to 499 tons.
⁶ 2,500 tons and over.

Value of shipping.—The value of active lake shipping in 1906, as shown by Table 1, was \$130,805,640, and in 1889 it was \$48,580,174, an increase of \$82,225,466, or 169.3 per cent. The percentages of increase in the value of steam vessels and of sail and unrigged craft combined, for the same period, were 186.2 and 79.2, respectively. The value of steamers as reported for 1880 was \$13,918,925, and the increase of over \$100,000,000 from that amount to \$116,983,812, the value reported for the same class of vessels in 1906, is in some respects a fairly accurate statistical measure of the advance made during that time in steam navigation on the lakes. As in regard to all statistics in which value is the standard of measurement and comparison, the changing character of that standard from time to time should be kept in mind in considering the statistics of capital. The value of the vessels alone was not the only item of capital reported in 1906; a value was reported also of \$6,282,755 for the item "all other property," and of \$285,900 for "leases." The total capital invested was therefore \$137,374,295.

In Table 5 of this section the values of steam, sail, and unrigged vessels are presented separately for both

censuses, and in Table 7 the values are given for iron, steel, wood, and composite vessels. The per cent that each class represents of the total value is shown in Table 12.

TABLE 12.—Value of vessels—per cent of total, by class and character of construction: 1906 and 1889.

CLASS AND CHARACTER OF CONSTRUCTION.	PER CENT OF TOTAL VALUE.	
	1906	1889
Steam.....	89.4	84.1
Sail.....	5.5	8.7
Unrigged.....	5.1	7.1
Iron.....	1.5	6.0
Steel.....	78.3	15.1
Wood.....	18.4	75.7
Composite.....	0.8	2.5

If any additional evidence were needed to prove the growing substitution of steampower for sails and of steel for other materials used in construction, it is amply supplied in Table 12. Especially notable is the large increase in the percentage of steel vessels in 1906 over 1889 and the corresponding decrease in wooden ships. The increase in the percentage of steam ves-

sels, while less striking, is full of significance when compared with the proportion the value of sailing vessels forms of the total, especially as it indicates the almost total disappearance of the latter type of craft from the lakes. The schooner barges compose a part of the 5.5 per cent that the value of sailing vessels forms of the total value, and the elimination of these reduces the proportion for 1906 to 1.4 per cent.

The average value per gross ton of steam vessels, according to the statistics, was \$69 in 1889, and \$61 in 1906, a slight reduction. There was a small increase in the average value per ton of sailing vessels, from \$23 in 1889 to \$27 in 1906. The corresponding values for steel and wooden vessels were for the former \$97 in 1889 and \$65 in 1906, and for the latter \$46 in 1889 and \$33 in 1906.

The numerical increase in vessels is insignificant. The tremendous growth in the capital invested in transportation on the Great Lakes is the result of the great increase in the carrying capacity of vessels; the increased use of steel in construction; the marked improvement that has been made in the engines, in power, and in general effectiveness; and the greater volume of steam tonnage.

SHIPBUILDING.

The shipbuilding establishments on the Great Lakes have at all times proved equal to the exacting demands made upon them for additional floating equipment adapted to the requirements of lake navigation, and on a fair basis of comparison with shipyards in other sections of the country are in many respects of vital importance to the growth of the American merchant marine.

Table 13 is a statement of the annual additions to lake shipping for a series of years, according to the

statistics reported by the United States Commissioner of Navigation.

TABLE 13.—Vessels built: 1880 to 1906.¹

YEAR.	Number of vessels. ²	Gross tonnage.
1906.....	152	259,778
1905.....	79	90,708
1904.....	95	155,851
1903.....	107	135,164
1902.....	100	165,462
1901.....	109	161,744
1900.....	94	127,207
1899.....	108	78,732
1898.....	67	51,775
1897.....	84	111,978
1896.....	108	107,753
1895.....	82	35,128
1894.....	95	40,801
1893.....	158	97,305
1892.....	141	43,039
1891.....	162	107,388
1890.....	161	105,860
1889.....	179	102,052
1888.....	183	96,315
1887.....	117	52,454
1886.....	66	18,255
1885.....	95	24,609
1884.....	110	27,883
1883.....	134	24,552
1882.....	199	51,749
1881.....	175	65,128
1880.....	117	20,857

¹ Reports of the Commissioner of Navigation, 1884 and subsequent years, and "Commerce and Navigation of the United States," Treasury Department, for years preceding 1884.

² Exclusive of canal boats.

GOVERNMENT VESSELS.

While the vessels which are employed in the performance of various governmental functions for the Federal Government and for states and municipalities can not, strictly speaking, be considered as a factor in the system of water transportation, they should receive some consideration as forming a part of the shipping of the country. Table 14 is a summary of the statistics pertaining to craft owned by states and municipalities.

TABLE 14.—VESSELS OWNED AND OPERATED BY STATE AND CITY GOVERNMENTS: 1906.

	Number of vessels.	TONNAGE.		KIND OF CRAFT.		Horse-power of engines.	CONSTRUCTION.		Value of vessels.	EMPLOYEES.	
		Gross.	Net.	Steamer, scrow.	Un-rigged.		Steel.	Wood.		Number.	Wages.
Aggregate.....	38	9,605	8,077	20	18	10,750	10	28	\$1,048,093	246	\$246,379
Chicago.....	24	7,393	6,597	8	16	3,640	2	22	349,000	100	91,372
Fire boats.....	5	796	315	5	—	2,700	1	4	254,000	52	51,680
All other.....	19	6,597	6,282	3	16	940	1	18	95,000	48	39,692
Buffalo, fire boats.....	3	431	252	3	—	1,500	3	—	176,000	42	40,248
Cleveland, fire boats.....	2	191	70	2	—	850	1	1	79,000	22	24,351
Detroit, fire boats.....	2	408	237	2	—	1,910	2	—	190,703	24	22,798
Milwaukee.....	6	1,106	877	4	2	2,600	2	4	249,300	54	65,420
Fire boats.....	4	634	425	4	—	2,600	2	2	248,800	52	64,420
All other.....	2	472	452	—	2	—	—	—	—	2	1,000
State of Ohio.....	1	76	44	1	—	250	—	1	10,000	4	2,280

It should be stated that while the statistics in this table are presented separately here, they are also included in the general tables of this report.

The vessels reported by municipalities consist mainly of fire boats for the protection from fire of waterside and floating property, the other craft, which are largely scows and barges, being employed for miscellaneous

work, such as dredging, pile driving, and the transportation of sand, stone, and other materials and supplies required in public works.

Chicago leads both in fire boats and in craft employed in public works. The craft reported for Buffalo, Cleveland, Detroit, and Milwaukee are all fire boats, except 2 scows in Milwaukee, which are used for the

removal of ashes and garbage. The vessel reported for the state of Ohio is operated under the fish and game commission for patrol purposes and for taking and distributing spawn.

The vessels operated by the several departments of the United States Government, which are not included in the tables in this report, number 89 craft of various kinds. Six vessels are in the naval service; these have a total displacement tonnage of 4,769, and a total horsepower amounting to 4,333. Five of these vessels are screw propellers and 1 is a side wheel steamer; 1 is constructed of iron, 2 of steel, and 3 of wood; 1 vessel is in the regular naval service of the United States and 5 are loaned to the states bordering upon the lakes and are used for naval militia purposes. The Treasury Department operated 6 vessels—1 in the customs service, a gasoline launch at Duluth, and 5 in the Revenue Cutter Service—with a total displacement tonnage of 1,671. One is an iron ship, 2 are steel, and 3 wooden, and all are screw propellers. The larger part of the Government vessels are in the service of the engineers of the War Department, and are engaged in the various improvements to the channels, harbors, etc., authorized by law. As far as reported there were in this service in 1906, 42 wooden, 13 steel, and 2 iron vessels. The details in regard to the tonnage and horsepower were not completely available for these vessels; in particular there was no uniformity in the tonnage reported, but it was given in gross, net, and displacement, and the total of the different kinds was 5,130 tons. These vessels comprised the varied types of craft used in construction work, such as tugs; hydraulic, dipper, and suction dredges; scows, catamarans, etc., as well as steamers and launches. The Bureau of Fisheries of the Department of Commerce and Labor has 1 wooden vessel of 20 gross tons stationed on Lake Erie. The Light-House Service employs 19 vessels as light-ships and tenders, 2 of which are built of iron, 6 of steel, and 11 of wood, while 11 are screw propellers equipped with engines of 5,000 horsepower, 4 are sail vessels, and 4 are scows; the combined gross tonnage of these vessels is 5,376.¹

THE FISHERIES.

As stated in the note preceding Table 1, there were a large number of vessels engaged in the fishing industry on the Great Lakes. According to the annual report of the Bureau of Fisheries for 1904, there were in 1903, 194 vessels of 3,506 net tons, valued at \$634,450, which were engaged in fishing, and 12 vessels of 340 net tons, valued at \$56,000, employed in carrying

¹ Official Register of the United States, 1907, pages 706 to 731.

equipment to the fishing grounds and in transporting the catch to market. In addition there were 3,170 boats and gasoline launches, with a reported value of \$317,060. This fishing fleet should be taken into account in any comprehensive survey of lake shipping.

INCOME.

Table 15 shows the gross income of lake shipping during 1906. This represents the gross receipts reported for all active lake shipping in 1906, the amounts received for each particular kind of service being segregated.

TABLE 15.—Gross income: 1906.

	Income.
Total	\$65,274,702
From freight	52,076,533
From passengers	4,806,904
From all other sources	8,391,265

The gross amount earned by lake shipping during 1906 was \$65,274,702, while that reported at the census of 1889 was \$35,463,852, an increase between the two censuses of 84.1 per cent. Of the total income reported in 1906, 79.8 per cent came from the carriage of freight, 7.5 per cent from passenger traffic, and 12.8 per cent from the remaining sources.

FREIGHT TRAFFIC.

The statistics of freight for the Great Lakes are derived entirely from the reports of the Bureau of Statistics of the Department of Commerce and Labor. At the commencement of the census it was found that many of the transportation companies objected to the preparation of duplicate or similar statements of their freight business for two different bureaus of the same Department, and it was recognized that the collection of such duplicate reports might embarrass or interfere with the success of the inquiry in that or other directions. An agreement was accordingly made between the two offices that the Census Bureau would abandon the collection of freight statistics and confine its efforts to the other items of statistical inquiry. The ship-owners were informed to this effect by mail and by the special agents.

The statistics of freight movements on the Great Lakes are collected by the Bureau of Statistics by means of supplementary manifests of the cargo, which are filed by the masters of vessels with the collector of customs and by him are forwarded weekly and monthly to the Bureau of Statistics. The following is the form of this manifest:

Facsimile of Manifest.

SUPPLEMENTARY MANIFEST OF VESSEL (name)

ARRIVING at the Port of , on the day of , 190
 CLEARED from the Port of , on the day of , 190
 Sail, Steam, or Tow, ; Registered tonnage (net tons)
 (Situ which) Name of Master,

ARTICLES.	CARGO LOADED—				CARGO DISCHARGED—			
	AT ORIGINAL PORT.	AT INTERMEDIATE PORTS.	AT INTERMEDIATE PORTS.	AT FINAL DESTINATION.	AT INTERMEDIATE PORTS.	AT INTERMEDIATE PORTS.	AT INTERMEDIATE PORTS.	AT FINAL DESTINATION.
	PORT.	QUANTITIES RECEIVED.	PORTS.	QUANTITIES RECEIVED.	PORTS.	QUANTITIES DISCHARGED.	PORTS.	QUANTITIES DISCHARGED.
Coal, hard ¹								Coal, hard ¹
Coal, soft ²								Coal, soft ²
Coal (fuel) ³								
Flour								Flour.
Wheat								Wheat.
Corn								Corn.
Oats								Oats.
Barley								Barley.
Rye								Rye.
Flaxseed								Flaxseed.
Iron ore								Iron ore.
Iron pig								Iron, pig.
Iron, manfid								Iron, manfid.
Salt								Salt.
Copper								Copper.
Firewood								Firewood.
Logs								Logs.
Lumber								Lumber.
Unclassed freight net tons								Unclassed freight.

NOTE.—Net tons, 2,000 pounds; gross tons, 2,240 pounds. ¹Anthracite. ²Bituminous. ³For steamer's consumption.

Department of Commerce and Labor

BUREAU OF STATISTICS

LAKE COMMERCE

SUPPLEMENTARY MANIFEST OF VESSEL

(NAME)

filed at office of Collector of Customs

at _____,

on the _____ day of

_____, 190

INSTRUCTIONS.

This manifest is to be forwarded by the Collector to the Bureau of Statistics, Department of Commerce and Labor, Washington, D. C., at the end of each week and on the last day of each month.

It is acknowledged by the officials of the bureau that their statistics do not wholly cover the freight movement on the lakes, but have certain limitations. In the first place, the figures represent the freight shipped and received in domestic trade and are exclusive of imports from and exports to Canada. Only partial account is taken of what may be called purely local traffic, inasmuch as the collectors of the ports do not take cognizance of vessel movements within the same district. The freight which is omitted for this latter reason is undoubtedly of considerable value in districts with several subports, and is chiefly package freight. It is admitted, too, that river traffic about the Thousand Islands is not reported fully and that freight delivered at lake ports, with the exception of Buffalo, by vessels operating on the Erie or other canals, or on rivers other than the St. Lawrence, is not included.

It was explained in the report on transportation on the Great Lakes for the census of 1889, in reference to the freight statistics published in that report, that—the sources from which these statistics of traffic have been obtained are, first, reports from the customs offices of receipts and shipments; second, reports from leading shippers at ports having no customs offices; and third, reports from the important transporta-

tion lines operating on the Great Lakes and covering that portion of the traffic not included in port manifests.

It was further stated that the trade between American and Canadian ports by domestic vessels was included, in which respect the figures for 1889 differ from those for 1906. This trade, however, was of comparatively small volume and does not materially affect the showing made.

It should be constantly borne in mind in the consideration of this report, that the statistics of vessels, their tonnage, valuation, income, etc., are not strictly comparable with the figures of freight, in this respect, that the former relate to all American vessels of 5 tons or over engaged in domestic trade and in trade with Canada, while the freight for which figures are given in 1906 is entirely domestic and is otherwise limited as before described.

Table 16 is a comparative statement for 1889 and 1906 of the tonnage of the principal commodities received and shipped, with the exception, as before stated, of imports to and exports from Canada.

In this table those commodities whose unit of measure is not the net ton, but which are reported as shown in Table 25, have been reduced to net tons by the application of the standard equivalents.

TABLE 16.—DOMESTIC RECEIPTS AND SHIPMENTS OF PRINCIPAL COMMODITIES, WITH PER CENT EACH COMMODITY IS OF TOTAL: 1906 AND 1889.

COMMODITY.	RECEIPTS.				SHIPMENTS.			
	Tons (net).		Per cent of total.		Tons (net).		Per cent of total.	
	1906	1889	1906	1889	1906	1889	1906	1889
Total.....	73,178,213	25,936,132	100.0	100.0	175,609,649	25,266,974	100.0	100.0
Barley.....	443,924	(²)	0.6	.....	438,054	(²)	0.6	.....
Coal, hard.....	2,980,606	15,162,471	4.1	19.9	3,087,227	6,105,799	4.1	24.2
Coal, soft.....	12,552,169	(²)	17.2	.....	14,488,240	(²)	19.2	.....
Copper.....	140,487	(²)	0.2	.....	140,551	(²)	0.2	.....
Corn.....	981,075	1,583,901	1.3	6.1	1,218,883	1,929,614	1.6	7.6
Flour.....	1,338,189	(²)	1.8	.....	1,334,979	(²)	1.8	.....
Iron manufactures.....	610,093	(²)	0.8	.....	620,563	(²)	0.8	.....
Iron ore.....	41,318,928	7,626,073	56.5	29.4	41,297,209	7,677,107	54.6	30.4
Iron, pig.....	434,178	(²)	0.6	.....	414,110	(²)	0.5	.....
Logs.....	354,860	(²)	0.5	.....	378,025	(²)	0.5	.....
Lumber.....	3,497,110	6,867,257	4.8	26.4	3,615,140	5,348,398	4.8	21.2
Oats.....	518,984	(²)	0.7	.....	538,209	(²)	0.7	.....
Rye.....	60,460	(²)	0.1	.....	62,379	(²)	0.1	.....
Salt.....	554,811	296,513	0.8	1.1	567,986	252,837	0.8	1.0
Wheat.....	1,459,029	919,162	2.0	3.5	1,431,804	969,150	1.9	3.8
Unclassified freight.....	5,933,380	3,490,755	8.1	13.5	5,986,200	2,984,069	7.9	11.8

¹ Includes 2,003,453 net tons of bunker coal.

² Included in unclassified freight.

³ Includes coke.

It is impossible to present the freight movement on the lakes in tabular form in greater detail than in Tables 16 and 25. The latter shows the receipts and shipments of certain commodities at the principal ports.

Had these statistics been collected by the Bureau of the Census along the lines followed for the other water transportation divisions of the country, it would be possible to present data for freight carried by the different types of vessels—steam, sail, and unrigged;

also to present the statistics reported for the different forms of ownership, such as individual, firm, and incorporated organizations. Under the circumstances this can not be done. It is to be regretted, too, that no statement can be made in regard to the harbor traffic and its tonnage in freight, which in ports such as Chicago, Buffalo, or Cleveland assume vast proportions.

It will be observed that for 1906 the tonnage of shipments exceeds that of receipts, the difference in

favor of shipments being 2,431,436 tons. This apparent discrepancy is explained in a letter from the officials of the Bureau of Statistics, as follows:

(1) The shipments include 2,003,453 net tons of fuel or bunker coal, for which there is no corresponding return under the head of receipts. (2) There is a class of freight which is carried in bond; this merchandise is destined to or shipped from domestic ports on the Great Lakes, but in order to reach its destination passes through Canadian territory. The shipments of this freight from United States lake ports amounted to 299,433 net tons, and the like receipts, 47,885, an excess of shipments over receipts of 251,548 net tons. (3) Some difference in tonnage is due to the fact that certain shipments credited to 1905 appear as receipts in 1906, while similarly, certain 1906 shipments appear only as 1907 receipts; as the volume of traffic is constantly growing, it is reasonable to assume that shipments at the end of 1906, which figure as receipts in 1907, are larger in volume than corresponding figures for 1905. (4) Other less important factors which cause discrepancies between figures of receipts and shipments are wrecks of vessels. In such cases the Bureau of Statistics tries to obtain information regarding the cargo carried, and credits the port or ports at which the cargo was loaded. In other cases where, owing to the stress of weather or shallowness of the water channel, part of the cargo has to be thrown overboard, similar differences between the totals shipped and received are bound to result.

The per cent of increase in the receipts and shipments of freight from 1889 to 1906 was 182.1 and 199.2, respectively. Considering the various commodities, the most important development indicated by the table was the enormous increases in the shipments of iron ore and coal. Indeed, if these two items are eliminated from the account, the increase in the total of all other commodities is comparatively insignificant—that in shipments being from 11,484,068 tons in 1889 to 16,736,973 tons in 1906. A notable decrease of approximately one-third has taken place during the interval between the two censuses in the transportation of lumber. A large decrease is shown for corn, and an increase of 47.7 per cent for wheat. The quantity of salt carried on the lakes has more than doubled. The increase over 1889 for the last class of merchandise given in the table, "unclassified freight," which comprises package freight and other miscellaneous merchandise, is actually greater than appears in the table, as receipts of 3,901,165 tons and shipments of 3,916,870 tons which were reported separately in 1906 for several commodities—barley, copper, flour, iron manufactures, pig iron, logs, oats, and rye—were included in "unclassified freight" in 1889. If these

amounts are added to the unclassified freight shown in the table for 1906, totals are obtained of 9,834,545 and 9,903,160 tons, respectively, which should be used in comparing traffic for the two years. This shows an increase of 231.9 per cent in the quantity of unclassified freight handled.

Freight, by ports.—Table 17 is introduced in order to show the relative importance of the different ports in the quantity of freight handled, together with the gain or loss in that respect between 1889 and 1906. A total of the receipts and shipments for each port is given, but a similar total is not made for all the ports on the lakes, as such a quantity would be a duplication and would lead to erroneous conclusions as to the real quantity of freight transported.

The leading ports in the receipt and shipment of freight, with the principal commodities handled in each, are, in the order of their importance, as follows: Duluth, iron ore and wheat shipped, and coal received; Buffalo, iron ore, grain, flour, and package freight received, and coal and package freight shipped; Superior-West Superior, iron ore and wheat shipped, and coal received; Cleveland, iron ore received, and soft coal shipped; Chicago-South Chicago, iron ore, coal, lumber, salt, and miscellaneous merchandise received, and corn, wheat, and flour and miscellaneous merchandise shipped; Ashtabula, iron ore received, and soft coal shipped; Two Harbors, iron ore shipped, and soft coal received; Conneaut, iron ore received, and soft coal shipped; Escanaba, iron ore shipped, and soft coal received; Milwaukee, coal, iron ore, salt, and miscellaneous merchandise received, and flour, barley and other grain, and miscellaneous merchandise shipped; Ashland, iron ore shipped, and soft coal received; Lorain, iron ore received, and soft coal shipped; Toledo, soft coal shipped, and iron ore received. Reference to Table 17 will disclose the relative standing of other ports with respect to the freight handled.

A prominent feature of lake transportation, indicated by Table 17, is the great preponderance of east bound over west bound tonnage. The receipts at Lake Erie ports far outweigh the shipments, while on Lake Superior the reverse is even more conspicuously the case. Conditions on Lake Michigan are more nearly balanced.

TRANSPORTATION BY WATER.

TABLE 17.—DOMESTIC SHIPMENTS AND RECEIPTS OF FREIGHT AT PRINCIPAL PORTS, WITH PER CENT EACH PORT SHOWS OF TOTAL: 1906 AND 1889.

PORT.	TOTAL FREIGHT TON- NAGE HANDLED AT PORT.		SHIPMENTS.				RECEIPTS.			
			Tons (net).		Per cent of total.		Tons (net).		Per cent of total.	
			1906	1889	1906	1889	1906	1889	1906	1889
Total.....			175,600,640	25,266,974	100.0	100.0	73,178,213	25,936,132	100.0	100.0
Ashland, Wis.....	4,407,031	2,247,242	3,774,931	1,759,884	5.0	7.0	632,100	487,358	0.9	1.9
Ashtabula, Ohio.....	10,157,785	2,695,180	2,481,670	489,585	3.3	1.9	7,076,115	2,205,595	10.5	8.5
Buffalo, N. Y.....	14,345,007	6,730,137	4,201,316	2,683,993	5.6	10.6	10,143,691	4,046,144	13.9	15.6
Cheboygan, Mich.....	173,403	218,940	148,530	194,417	0.2	0.8	23,873	24,523	(?)	0.1
Chicago-South Chicago, Ill.....	10,357,038	7,984,038	2,510,632	2,914,065	3.3	11.5	7,846,406	5,069,973	10.7	19.5
Cleveland, Ohio.....	11,670,328	3,621,570	3,434,962	883,862	4.5	3.5	3,235,366	2,737,708	11.3	10.6
Conneaut, Ohio.....	6,972,996	(?)	888,854	(?)	1.2	(?)	6,084,142	(?)	8.3	(?)
Detroit, Mich.....	1,184,862	764,553	203,223	148,803	0.3	0.6	981,639	615,750	1.3	2.4
Duluth, Minn.....	16,786,937	1,114,048	14,632,066	420,886	19.4	1.7	2,154,871	683,162	2.9	2.6
Erie, Pa.....	3,906,739	1,271,988	1,070,415	498,958	1.4	2.0	2,836,324	773,030	3.9	3.0
Escanaba, Mich.....	6,937,210	3,626,360	6,412,483	3,430,832	8.5	13.6	524,727	195,558	0.7	0.8
Fairport, Ohio.....	2,506,993	998,459	295,439	59,438	0.4	0.2	2,211,464	939,021	3.0	3.6
Frankfort, Mich.....	831,161	(?)	441,823	(?)	0.6	(?)	389,338	(?)	0.5	(?)
Gladstone, Mich.....	546,531	287,500	224,825	155,234	0.3	0.6	321,706	132,356	0.4	0.5
Grand Haven, Mich.....	420,541	169,546	145,249	68,396	0.2	0.3	275,292	101,150	0.4	0.4
Green Bay, Wis.....	726,958	159,810	107,008	55,441	0.1	0.2	619,950	101,369	0.8	0.4
Hancock-Houghton, Mich.....	526,554	286,191	66,572	78,144	0.1	0.3	450,982	208,047	0.6	0.8
Huron, Ohio.....	1,659,690	70,180	783,273	56,486	1.0	0.2	876,417	13,694	1.2	0.1
Kewaunee, Wis.....	143,466	32,627	60,768	23,354	0.1	0.1	82,708	9,273	0.1	(?)
Lorain, Ohio.....	4,211,733	620,773	1,698,823	273,874	2.2	1.1	2,612,910	346,899	3.4	1.3
Ludington, Mich.....	1,663,718	627,627	956,563	351,398	1.3	1.4	707,125	276,229	1.0	1.1
Manistee, Mich.....	521,841	629,910	488,239	601,814	0.6	2.4	33,602	28,006	(?)	0.1
Manistique, Mich.....	499,350	144,011	332,562	140,321	0.4	0.6	166,788	3,690	0.2	(?)
Manitowoc, Wis.....	1,237,790	113,377	577,064	25,023	0.8	0.1	660,726	88,354	0.9	0.3
Marine City, Mich.....	81,054	61,001	36,362	15,426	(?)	0.1	46,692	45,575	0.1	0.2
Marquette, Mich.....	1,810,685	1,710,885	1,531,965	1,567,539	2.0	6.2	278,720	143,346	0.4	0.6
Menominee, Mich.....	200,924	272,629	97,069	265,103	0.1	1.0	103,825	7,426	0.1	(?)
Milwaukee, Wis.....	6,236,146	1,935,808	1,233,293	351,554	1.6	1.4	5,002,853	1,584,254	6.8	6.1
Muskegon, Mich.....	119,877	1,002,743	61,517	851,440	0.1	3.4	58,360	151,303	0.1	0.6
North Tonawanda, N. Y. ¹	1,078,146	1,046,895	23,968	(?)	(?)	(?)	1,055,178	1,046,895	1.4	4.0
Ogdensburg, N. Y.....	465,337	662,904	56,082	192,860	0.1	0.8	409,255	470,044	0.6	1.8
Oswego, N. Y.....	54,777	691,118	37,436	288,271	(?)	1.1	17,341	402,847	(?)	1.6
Port Huron, Mich.....	358,077	170,073	211,232	18,000	0.3	0.1	146,845	152,073	0.2	0.6
Racine, Wis.....	176,988	160,537	17,147	1,225	(?)	(?)	159,841	159,312	0.2	0.6
Sandusky, Ohio.....	954,290	602,403	824,813	297,374	1.1	1.2	129,477	805,029	0.2	1.2
Sault Ste. Marie, Mich.....	438,954	76,125	243,565	39,062	0.3	0.2	195,389	37,063	0.3	0.1
Sheboygan, Wis.....	535,018	124,387	15,089	8,392	(?)	(?)	509,929	115,995	0.7	0.4
Superior-West Superior, Wis.....	12,582,263	1,180,297	8,447,890	304,605	11.2	1.2	4,134,373	875,692	5.6	3.4
Toledo, Ohio.....	4,167,813	1,436,991	2,850,837	930,640	3.1	3.7	1,816,976	506,351	2.5	2.0
Two Harbors, Minn.....	9,316,743	936,541	9,018,987	936,541	11.9	3.7	237,758	(?)	0.4	(?)
Washburn, Wis.....	373,119	183,393	170,072	133,301	0.2	0.5	203,047	55,092	0.3	0.2
All other ports.....	7,452,079	4,532,289	5,295,985	3,741,433	7.0	14.8	2,156,094	790,856	2.9	3.0

¹ Includes 2,003,453 net tons of bunker coal.

² Less than one-tenth of 1 per cent.

³ Not reported.

⁴ Includes Portage.

⁵ Includes Tonawanda.

The relative importance of the different ports from another standpoint is presented in Table 18, which gives for each port the total number and the total tonnage of all vessels arriving and clearing during 1906.

TABLE 18.—Domestic arrivals and clearances of vessels on the Great Lakes, by ports: 1906, with totals for 1904 and 1905.¹

PORT.	TWELVE MONTHS ENDING DECEMBER, 1906.			
	Arrivals.		Clearances.	
	No.	Net tons.	No.	Net tons.
Alexandria Bay	45	12,470	49	7,028
Alpena	462	304,327	488	312,308
Ashland	3,753	1,876,781	3,812	2,019,200
Ashtabula	1,540	4,141,202	1,614	4,198,664
Benton Harbor	568	405,849	610	430,278
Buffalo	3,302	6,472,750	3,323	6,466,348
Charlevoix	151	139,032	156	139,544
Charlotte	174	108,865	143	110,543
Cheboygan	636	451,394	772	501,741
Chicago-South Chicago	6,846	7,621,979	6,434	7,400,305
Cleveland	4,150	6,445,385	3,732	6,046,818
Conneaut	1,049	3,261,775	1,216	3,505,481
Detour	302	256,257	353	234,517
Detroit	3,141	2,409,823	2,790	8,904,499
Duluth	3,486	8,077,778	3,554	3,640
Dunkirk	49	4,630	974	2,000,854
Erie	939	2,040,702	2,132	3,361,519
Escanaba	2,038	3,284,951	512	1,202,194
Fairport	511	1,222,921	1,038	824,110
Frankfort	1,007	794,253	1,431	325,793
Gladstone	455	379,051	1,212	1,347,239
Grand Haven	1,155	1,321,621	207	82,311
Grand Marais	108	65,571	792	341,157
Green Bay	889	372,989	642	979,620
Hancock-Houghton ²	622	941,756	201	216,658
Harbor Beach	222	240,640	341	307,027
Holland	328	278,633	453	730,997
Huron	438	751,372	489	171,689
Kelleys Island	494	107,372	521	155,669
Kenosha	537	359,468	401	354,679
Kewaunee	425	383,032	406	175,769
Lake Linden	118	185,306	106	1,802,292
Lorain	854	1,794,024	726	2,765,355
Ludington	2,301	2,821,719	2,370	688,585
Mackinac	958	639,453	860	622,105
Manistee	1,242	650,527	1,208	548,876
Manistiquie	573	549,885	582	1,756,517
Manitowoc	1,632	1,779,619	1,647	89,196
Marine City	232	94,197	228	113,216
Marquette	353	112,499	333	918,417
Marquette	509	870,340	510	240,964
Menominee	755	253,387	628	210,573
Michigan City	274	228,888	242	6,941,613
Milwaukee	5,707	7,070,440	5,621	297,259
Muskegon	480	302,175	437	7,165
Niagara Falls	25	14,638	14	327,602
North Tonawanda	619	415,414	467	308,880
Ogdensburg	345	303,215	303	33,632
Oswego	115	41,837	84	200,579
Peshigo	152	205,928	150	645,852
Port Huron	755	550,690	1,005	789,104
Presque Isle	247	618,350	209	172,694
Put-in-Bay	288	230,944	209	1,300,962
Racine	1,709	1,297,804	1,714	75,390
St. Clair	200	74,693	217	292,447
St. Ignace	411	284,729	544	483,324
St. Joseph	333	330,225	571	3,346
Sacketts Harbor	116	4,123	89	538,074
Sandusky	650	493,677	806	648,256
Sault Ste. Marie	474	503,712	681	511,657
Sheboygan	803	567,372	786	305,457
South Haven	326	291,030	348	226,295
Sturgeon Bay	629	194,269	766	5,727,088
Superior-West Superior	2,340	5,775,509	2,370	2,181,426
Toledo	1,749	2,121,624	1,680	162,526
Tonawanda	158	87,955	277	4,373,670
Two Harbors	1,442	4,350,984	1,449	246,696
Washburn	2,788	257,461	2,877	197,795
Waukegan	625	238,011	589	2,885,105
Waukegan	7,437	2,903,818	7,885	
All other				
Total, 1906	80,829	94,528,194	81,271	94,893,961
1905	79,370	87,810,640	79,908	87,978,397
1904	68,732	67,622,126	68,967	67,773,295

¹ Bureau of Statistics, Department of Commerce and Labor, Monthly Summary, Internal Commerce of the United States, December, 1906, page 568.
² Includes Portage.

Iron ore.—As indicated by Table 16, iron ore is the principal article of freight, representing, in 1906, 56.5 per cent of the total tonnage of all lake receipts, as against but 29.4 per cent in 1889.

TABLE 19.—Movement of iron ore for the principal ports of the Great Lakes: 1906 and 1889.

PORT.	RECEIPTS (NET TONS).		SHIPMENTS (NET TONS).	
	1906	1889	1906	1889
Total	41,318,928	7,626,073	41,297,269	7,677,107
Ashland	7,534,108	2,199,109	3,627,593	1,663,021
Ashtabula	5,186,744	333,827	3,192	
Buffalo	4,762,150	731,188	18,637	
Chicago-South Chicago	7,461,495	1,951,564	370	26,644
Cleveland	6,061,615	(¹)	(¹)	(¹)
Conneaut	2,348,985	10,691	12,492,775	
Duluth		418,426	63	
Erie			6,335,682	3,364,097
Escanaba	2,052,538	928,616		
Fairport	871,697	761	11,891	
Huron	2,417,109	335,162		
Lorain			1,518,043	1,541,495
Marquette	305,443	124,312	10,285	
Milwaukee	320,034	17,166	448	
North Tonawanda ²			1,580,656	
Presque Isle				
Sandusky	35,861	208,411		
Superior-West Superior			6,700,740	
Toledo	1,611,004	97,476		
Two Harbors			8,862,028	936,541
All other ports	350,145	269,364	128,806	143,339

¹ Not reported.

² Includes Tonawanda.

There is a very large fleet engaged solely in freighting ore, and the proportion of the total tonnage of freight which this product forms does not greatly exceed the proportion which the ore fleet represents of the total vessel tonnage. With the exception of a small amount consumed at Duluth and small rail shipments (about 1,000,000 tons in 1906) to furnaces in Michigan and Wisconsin, practically the entire quantity of iron ore produced in the Lake Superior region is shipped over the lakes. It is therefore evident that the production of ore and the facilities for shipping it to ports on Lake Erie and Lake Michigan have kept pace with each other and must continue to do so. How far this parity between the ore mined and that shipped over the lakes may be affected by the establishment of blast furnaces near the mines, which has been contemplated by some of the more important producers, is a question for the future.

The principal shipping ports for iron ore are Duluth, Superior-West Superior, and Two Harbors, on Lake Superior, through which ports the product of the Mesabi and Vermilion ranges finds its outlet; Ashland and Marquette, also on Lake Superior, for the Gogebic and Marquette fields, respectively; and Escanaba, on Lake Michigan, which is the shipping point for Menominee ore. It is the fact of this enormous production of iron ore that gives to Lake Superior its leading position among the other lakes in respect to the shipment of freight tonnage.

On the other hand, the principal ports of receipt are Ashtabula, Cleveland, Conneaut, Fairport, Huron, Lorain, and Toledo, in Ohio; Buffalo, N. Y.; and Erie, Pa., all on Lake Erie; and the port of Chicago-South Chicago. Much of this ore is smelted at the point of receipt, but a very large proportion is transshipped to other blast furnace centers in Pennsylvania and Ohio.

The facilities for loading and unloading iron ore at lake ports are probably as highly specialized as those for handling freight of any kind, and they have a most important bearing upon the traffic. The docks and mechanical equipment for the work are of the most efficient character and are briefly described as follows:

These docks are so constructed that the cars from the mines are run out on them. The hoppers in the bottom of the cars are let down, and ore is discharged by gravity into pockets from the bottom of which iron chutes lead to the vessel lying alongside the dock. Through the hatches of the vessel the ore is chuted by gravity into the hold at as many points as there are hatches. In this way very little manual labor is necessary. A cargo of 9,277 tons of ore has been loaded into the steamer *E. J. Earling*, at Mesabi dock No. 4, at Duluth, in seventy minutes, or an average of 7,288 tons per hour. * * *

Practically the entire success of a dock for receiving ore from a vessel, like a dock for loading vessels, depends on the ability to unload quickly and cheaply, and place in cars the tonnage that is daily brought alongside the docks by the gigantic ore carriers so constructed as to permit the hoisting and dumping by the most modern appliances, both electric and otherwise, of the greatest number of tons per hour in order to accomplish the quickest possible release of the vessel and effect the maximum saving in the cost of operation.

The efficiency of the machinery for unloading is shown by the record of the *George W. Perkins*, 10,346 tons having been taken off in four hours and ten minutes; or at an average rate of 2,582 tons per hour. * * *

Just here we have the keynote of the transportation service on the lakes, which is to secure for each vessel the least possible delay at port of loading or of discharge and consequently the greatest number of round trips possible in a season. The average number of trips that a modern vessel is able to make from the head of Lake Superior to Lake Erie is usually estimated at 20 per season, although with good dispatch at terminals some boats may make 25, and even more. Every additional trip in a season reduces the average cost of transportation, and the entire carrying trade is ever pressing to reduce delay, whether at terminals or en route. To the genius displayed in devising plans to accomplish this result is due in no small degree the record the lakes have made in affording the cheapest transportation in the world.¹

The extremely low rates charged for ore transportation also greatly stimulate the traffic. According to the reports of the Bureau of Statistics, the average contract rate per gross ton in 1906 from Ashland and other ports at the head of Lake Superior to Ohio ports was 75 cents. The charge for trimming and unloading, according to the same authority, was 20 cents per ton, which makes a total charge of 95 cents per gross ton for the delivery at destination. The distance from Duluth to Cleveland, for example, is 834 miles; the rate per ton per mile, therefore, was 1.14 mills.

¹Walter Thayer, "Transportation on the Great Lakes," Annals of the American Academy.

TABLE 20.—Movement of coal and coke for the principal ports of the Great Lakes: 1906 and 1889.

PORT.	RECEIPTS (NET TONS).		SHIPMENTS (NET TONS).	
	1906	1889	1906	1889
Total.....	15,532,715	5,162,471	17,575,467	6,105,799
Ashland.....	521,195	201,241	2,202	489,585
Ashtabula.....			2,477,885	2,156,670
Buffalo.....	1,112		3,112,577	350,000
Charlotte.....			180,034	
Chicago-South Chicago.....	938,151	1,329,304	120,578	
Cleveland.....	4,629	1,200	2,005,500	825,030
Conneaut.....		(?)	846,948	(?)
Detour.....	147,292		115,598	
Detroit.....	26,905	141,900	62,770	3,504
Dollar Bay.....	130,880			
Duluth.....	1,580,382	485,000	13,052	
Erie.....			926,099	410,403
Escanaba.....	512,672	194,199	8,649	
Fairhaven.....			2,635	119,317
Fairport.....	3,400		276,328	59,438
Frankfort.....	125	(?)	228,813	(?)
Gladstone.....	224,773	122,000	60	
Green Bay.....	380,757	70,374	3,705	12
Hancock-Houghton ³	395,373	144,261	333	25,075
Huron.....		235	771,375	56,000
Lake Linden.....	354,484		53	
Lorain.....			1,697,370	273,671
Ludington.....	20,893	4,583	513,948	
Manitowoc.....	444,190	75,000	5,894	
Marquette.....	273,443	126,421	175	
Milwaukee.....	3,659,491	907,743	13,986	
Ogdensburg.....	192,569	66,231	1,752	65,356
Oswego.....	681		37,265	282,098
Sandusky.....		1,561	749,084	275,385
Sault Ste. Marie ⁴	168,082	24,938	32,156	1,000
Sheboygan.....	440,216	50,000	578	200
Superior-West Superior.....	3,749,737	720,000	4,668	
Toledo.....	23,957	93,309	2,325,259	650,000
Two Harbors.....	288,935		1,859	
Washburn.....	164,519	51,614	867	
All other ports.....	878,872	351,237	134,800	62,995

¹Includes 2,003,453 net tons of bunker coal.
²Not reported.

³Includes Portage.
⁴St. Marys Falls.

Coal.—Coal is next in importance to iron ore in tonnage, the combined shipments of hard and soft coal amounting in 1906 to 17,575,467 net tons, an increase since 1889 of 11,469,668 tons, or 187.8 per cent. The explanation of the excess of shipments of soft coal over receipts in 1906, that "the shipments include 2,003,453 net tons of fuel or bunker coal, for which there is no corresponding return under the head of receipts," should be repeated here. The quantities shown for the two censuses are not strictly comparable, as coke is included in 1889 and the figures for it can not be separated. Much of this coal forms the return cargo from New York, Pennsylvania, and Ohio ports of vessels engaged in carrying iron ore from Lake Superior.

The shipments of anthracite coal are nearly all from Buffalo, as that city is the western terminus of some of the principal so-called "hard coal roads." As the chief use of this is for domestic purposes it finds a market in the large centers of population like Chicago and Milwaukee. A large quantity is also received at Superior for rail shipment farther west.

As previously pointed out, nearly all soft coal shipments are from Ohio ports on Lake Erie, the principal

ones ranking in importance as follows in the order named: Cleveland, Ashtabula, Toledo, Lorain, Conneaut, Huron, and Sandusky. Ludington, Mich., also is an important shipper of soft coal. This city is the western terminus on Lake Michigan of the Pere Marquette railroad, which has at that place water connection with Chicago and Milwaukee. As that railroad traverses the state of Michigan and has its headquarters at Detroit, it forms an important link for the transportation of the coal of Pennsylvania and Ohio during the time from December to April, when the Detroit river, St. Marys Falls canal, and the straits of Mackinac are closed to navigation. The figures of the Bureau of Statistics show that much more than one-half of the total westward coal shipments from Ludington were during the winter season. The leading receiving ports for soft coal are Superior-West Superior, Milwaukee, and Duluth. Chicago receives nearly all of its bituminous coal by rail from the coal fields of Illinois and Indiana.

As coal is the only important commodity freighted westward in bulk, it is for a large number of vessels the only cargo available for return to Lake Michigan and Lake Superior ports, and as a consequence there is brisk competition for the business, for without it, these vessels would be obliged to return either light or empty. The rates, therefore, are lower for coal than for any other article, the average rate on hard coal during 1906, as reported by the Bureau of Statistics, being 46 cents a ton from Buffalo to Chicago and 35 cents a ton to Duluth. The rates on soft coal are equally moderate.

Lumber.—Lumber ranks next to coal in volume of shipments. This commodity shows a decrease of 32.4 per cent, which is explained by the rapid exhaustion of the forests of Michigan, Wisconsin, and Minnesota, and the consequent decay of the lumber milling industry in those states. The principal ports for the shipment of lumber in 1906, as shown in Table 25, are Duluth, Manitowoc, Manistee, Manistique, Two Harbors, Milwaukee, Ashland, and Cheboygan, in the order given; each reported shipments exceeding 50,000,000 feet. Naturally the populous centers where the rough lumber is manufactured for the market lead in receipts of this commodity, Chicago being first. The increasing needs of these centers for manufactured and unmanufactured lumber are, however, now being supplied by railroad shipments, the receipts by lake shipments having been for many years on the decline. It is extremely probable that the lumber traffic on the Great Lakes will continue to diminish in importance unless under changed legislative conditions the product of Canadian forests is permitted to enter the American market. Should such a change be brought about, a large proportion of that product would probably be carried by water.

TABLE 21.—Movement of lumber for the principal ports of the Great Lakes: 1906 and 1889.

PORT.	RECEIPTS (NET TONS).		SHIPMENTS (NET TONS).	
	1906	1889	1906	1889
Total.....	3,497,110	6,857,257	3,615,140	5,348,398
Alpena.....			88,468	373,204
Bry City.....	61,084	4,200	2,804	481,596
Buffalo.....	275,420	408,951	4,484	
Chicago-South Chicago.....	810,844	2,588,004	1,626	2,106
Cleveland.....	350,200	565,626	3,026	1,092
Detroit.....	182,186	314,995	1,270	10,261
Duluth.....	6,546		922,954	13,110
East Tawas.....		383	1,656	212,467
Ludington.....	281,540		60,018	258,320
Manistee.....	800		199,136	477,785
Manitowoc.....	19,408	8,126	281,224	5,625
Marinette.....	6,410	278	105,610	341,445
Menominee.....	2,432		50,362	265,103
Milwaukee.....	143,912	412,479	114,669	
Muskegon.....	23,366	119,530	28,212	846,615
North Tonawanda ¹	712,918	1,029,729	2,926	
Oscoda.....			33,972	489,962
Oswego.....	5,370	283,058	100	
Toledo.....	75,598	282,369	374	5,108
All other ports.....	535,876	844,499	1,757,558	1,564,399

¹ Includes Tonawanda.

Wheat.—With the exception of wheat and corn it is impossible to compare the receipts and shipments of the various cereals during 1906 with those for 1889, for the reason that barley, oats, and rye were not shown separately for the earlier period.

The principal features indicated in the statistics of the movement of wheat are the large increase of receipts at Buffalo, the decrease in the shipments from the port of Chicago, and the very large increase in the shipments from Duluth and Superior-West Superior, these two ports leading now in that respect.

TABLE 22.—Movement of wheat for the principal ports of the Great Lakes: 1906 and 1889.

PORT.	RECEIPTS (NET TONS).		SHIPMENTS (NET TONS).	
	1906	1889	1906	1889
Total.....	1,450,029	919,162	1,431,804	969,150
Buffalo.....	1,268,085	781,548		
Chicago-South Chicago.....	21,072		261,658	312,203
Detroit.....	30,395	1,810		80,757
Duluth.....			535,733	207,732
Erie.....	69,419	33,779		
Milwaukee.....	5,010		54,245	29,101
Superior-West Superior.....			538,107	191,623
Toledo.....	8,714		10,849	132,363
All other ports.....	56,334	102,016	31,722	15,281

Corn.—A notable decrease in the transportation of corn on the lakes is exhibited by Table 23, Buffalo and Chicago, which are respectively the principal ports of receipt and shipment, both showing large losses. In explanation of this decrease it may be stated that since 1898, when the lake movement of corn rose to the maximum, there has been an almost constant annual reduction in the amount shipped by way of the lakes, the share diverted to the railroads showing a steady growth. An additional explanation is sug-

gested in the increased consumption at or near the place of production in stock feeding and in the manufacture of corn products and distilled liquors. The large excess of shipments over receipts shown in the total for all cities in 1906 is caused by the fact that the east bound bonded corn shipments are very heavy. This freight enters Canada at points on Georgian bay, is transhipped to the railways, and again enters the United States at points in northern New York or Vermont, and is not included in the tables as freight received.

TABLE 23.—Movement of corn for the principal ports of the Great Lakes: 1906 and 1889.

PORT.	RECEIPTS (NET TONS).		SHIPMENTS (NET TONS).	
	1906	1889	1906	1889
Total.....	981,075	1,583,901	1,218,883	1,929,614
Buffalo.....	698,735	1,319,560		
Chicago-South Chicago.....			1,082,519	1,709,621
Detroit.....	12,359	4,242		27,536
Duluth.....			192	49,901
Erie.....	38,677	98,633		
Milwaukee.....	2,893		84,225	1,434
Ogdensburg.....	131,543	131,907		
Superior-West Superior.....			33,982	5,211
Toledo.....				73,952
All other ports.....	96,868	29,569	17,965	1,959

Freight, by lakes.—The tables previously presented have indicated in part the relative positions of the several lakes in regard to the freight received and shipped on each, but this phase of lake transportation is brought out more clearly in Table 24.

This table was prepared from the table of the Bureau of Statistics which gives the freight figures for all lake ports. It should be explained that there were some lake ports of minor importance which could not be

definitely located on any of the lakes either by the Bureau of Statistics or at the office of the Chief of Engineers of the War Department, to whom the matter was referred. These places were unimportant, their total receipts of freight amounting to only 27,126 tons and the shipments to 12,925 tons, or less than one-twenty-fifth and one-fiftieth of 1 per cent, respectively, of the totals for all lakes, and as it was generally believed by those well informed concerning lake navigation that most of these ports were lumber camps on Lake Superior, the statistics accordingly were credited to that body of water.

It should be stated, too, that ports on the Detroit river were considered as located on Lake St. Clair and those on St. Marys river as on Lake Superior.

If the total volume of both receipts and shipments is taken into account, Lake Erie occupied the most important position in lake traffic in 1906 as it did in 1889. Lake Superior was second in this respect in 1906, but was first in the quantity of freight originating on its shores. The most striking fact shown is the great gain made by Lake Superior in the actual and relative importance of the tonnage of its shipments, from about one-fifth in 1889 to more than one-half of the whole in 1906. The decrease shown in the tonnage of Lakes Huron and St. Clair and of Lake Ontario and the St. Lawrence river is almost equally noteworthy. The statistics for Lakes Huron and St. Clair should not be accepted as indicating a small amount of traffic on those lakes, for it is obvious, of course, that all vessels making the trip between the upper and lower lakes must traverse those waters. The amount of this traffic is fairly indicated elsewhere in this report where the operations on the Detroit river are shown.

TABLE 24.—SHIPMENTS AND RECEIPTS OF FREIGHT ON EACH OF THE GREAT LAKES, WITH PER CENT EACH IS OF TOTAL: 1906 AND 1889.

LAKE.	SHIPMENTS.				RECEIPTS.			
	Tons (net).		Per cent of total.		Tons (net).		Per cent of total.	
	1906	1889	1906	1889	1906	1889	1906	1889
Total.....	1,75,609,649	25,266,974	100.0	100.0	73,178,213	25,936,132	100.0	100.0
Superior.....	40,332,392	5,434,781	53.3	21.5	9,042,572	2,491,149	12.4	9.6
Huron and St. Clair.....	1,460,276	2,344,451	1.9	9.3	1,699,032	1,029,356	2.3	4.0
Michigan.....	15,073,679	10,090,366	19.9	39.9	18,359,780	8,480,892	25.1	32.7
Erie.....	18,455,131	6,386,392	24.4	25.3	43,633,816	12,957,483	59.6	50.0
Lake Ontario and St. Lawrence river.....	288,171	1,010,984	0.4	4.0	443,013	977,252	0.6	3.8

¹ Includes 2,003,453 net tons of bunker coal.

The supremacy of Lake Superior in the amount of freight shipped is to be attributed mainly to its iron ore and in less degree to its grain. Iron ore and grain swell the receipts of Lake Erie, while coal is the principal commodity shipped, with unclassified freight next in importance. Lake Michigan's large volume of freight shipments is made up principally of corn and other grains, flour, and unclassified freight from Chicago and Milwaukee and iron ore from Escanaba, and its receipts

of iron ore, coal, and unclassified freight at Chicago and Milwaukee.

With the future development of the lake region and the growth of the cities on its shores the freight traffic on all the lakes except Ontario must continue to increase. There seems no probability of any increase in American commerce on Lake Ontario until a canal of reasonable depth connecting it with Lake Erie, within the United States, shall be constructed. It is

evident that the Welland canal does not fully serve the purpose of increasing to any extent the passage of American freight between the two lakes, as the tonnage so carried during the year ending June 30, 1904, amounted only to 252,481 tons.¹ These figures show a decrease over the preceding year, and as a matter of fact are smaller than those for every year previous as far back as 1882. The following quotation in regard to the commerce of Lake Ontario at the beginning of the last century affords a very vivid contrast between comparative conditions then and now:

The commerce of Lake Ontario increased so fast that in 1800 it exceeded that of all the other lakes together.²

It has now less than one-half of 1 per cent of the combined commerce of the other lakes, if we consider only the ships of the United States.

There is another feature in connection with the statistics of freight that should receive mention here. When the figures were tabulated, for the purpose of verification they were carefully compared with those contained in other reports which presented corresponding data, such as the annual reports of chambers of commerce and other local trade bodies. This disclosed many discrepancies, some very large, between the statistics collected by the Government and those published by the boards of trade. Buffalo, Cleveland, Chicago, and Milwaukee were the principal cities for which these discrepancies were noted.

The matter was brought to the attention of the Bureau of Statistics, and in reply it was stated that the question had previously been the subject of repeated investigations, and that the discrepancies resulted from differences in the methods of compiling the figures and the different sources from which they were obtained. In addition a representative of the Bureau of the Census, while collecting general information concerning lake transportation, made inquiry into this question, calling for that purpose upon the secretaries of the commercial bodies and the collectors of customs in the principal cities, and was convinced as a result of his investigations that the discrepancies were not remarkable under the circumstances.

It is required of the master of a vessel engaged in commerce on the lakes that before the departure of his vessel from port he shall present at the custom-house duplicate manifests of his cargo, such manifests being subscribed and sworn to by him before the collector, who indorses thereon his certificate of clearance, retaining one copy for the files of his office and delivering the other for the use of the master, who afterwards files it at the custom-house of the port of destination. These manifests are sometimes presented and clearance obtained before the loading of the cargo, and it frequently occurs that the actual quantity of

cargo and the quantity declared at the custom-house are different. Indeed, cases have been known where the cargo loaded was altogether different in character from the cargo declared at the custom-house. If in such cases the local trade body accepts the figures filed for its records of shipments, as is usually done, those records will not be a correct account of the traffic of the port.

After a vessel is loaded and leaves port it is customary for the owners to mail to the master at the port of destination a bill of lading which is a correct account of the contents of the cargo. This paper usually reaches its destination before the vessel, and the master, upon his arrival, if the bill of lading differs from the manifest, is enabled to correct the latter before filing it at the custom-house. This is not always done, however; sometimes by reason of delay in the mails the bill of lading is not received, and again masters, through indifference or carelessness, frequently fail to make the necessary corrections on the manifest.

Another cause of difference between the statistics of the Government and those of other organizations is found in the fact that the latter sometimes obtain their information, not from the custom-houses but from the shippers or consignees direct. This is done in Buffalo, where the receipts of grain are compiled by the chamber of commerce from reports of the elevator companies, which explains the large discrepancies in these statistics.

Discrepancies in the statistics of grain receipts for Cleveland, which are very large, are explained in the same manner as are those for Buffalo.

Although the Chicago board of trade is supplied with shippers' memoranda of cargoes taken out, the statistics in its annual report were compiled in 1906 from the clearance manifests, both for shipments and receipts, which accounts for the wide difference between the statistics of that body and those printed in this report for certain commodities. Recently, however, changes in methods have been adopted, which it is believed will tend to greater uniformity.

Conditions in Milwaukee are somewhat different from those found in the other large cities on the lakes, in respect to these statistics. Milwaukee being what is termed an "intermediate port" between Chicago and Lake Erie ports, masters of vessels are not required by law to take out clearance papers in addition to the ones granted to them at the original port of departure, and the secretary of the chamber of commerce was unable, formerly, to compile statistics of port receipts and shipments. Congressional action was therefore sought with a view to requiring a report to the collector of customs of all cargoes landed at or shipped from that port. The Lake Carriers' Association, representing a very large proportion of the tonnage, being opposed, it is stated, to such legislation, agreed on the part of its members, as a compromise,

¹ Annual Report, Department of Railways and Canals, Dominion of Canada, page LXXII.

² One Hundred Years of American Commerce, vol. 1, page 26.

to supply the chamber of commerce with complete statements of freight loaded and unloaded, and from such statements the annual statistical report is now compiled. The figures in that report for certain commodities, especially flour, differed to a considerable extent from those published by the Bureau of Statistics. In order to ascertain the cause of those differences, a comparison was made of some of the supplementary manifests containing figures for cargoes of flour with the corresponding returns made to the chamber of commerce, and it was ascertained that in many cases, according to the manifests, the cargoes consisted of flour exclusively, while the returns made to the chamber of commerce indicated that in addition to flour a considerable proportion of the cargoes was feed. It is hardly reasonable to suppose that feed would have been reported if it had not formed part of the cargo, while it can very readily be seen that through indifference or carelessness it might be omitted from the manifest at destination, notwithstanding the regulations requiring a corrected report.

The questionable accuracy of these statistics has been before adverted to, and the following extract describing conditions which formerly surrounded the collection of the data, and which have not yet been completely corrected, is pertinent at this point:

First of all, the laws governing the filing of manifests are not what they should be. * * * Under existing laws vessels carrying goods from a port in one collection district to another port in the same district are not required to report or clear at the custom-houses, and there is, therefore, no record in the custom-houses of the commodities so carried. But as the local business on the lakes is very small, this does not seriously impair the accuracy of the records. Second, there are a number of small ports on the lakes where there are no custom-houses, but at which a large lake business is done. Third, under the regulations that now obtain, a ship may clear from a port on the lakes for another port, and may stop at one or more intermediate ports, where she may receive and discharge cargo without reporting at the custom-houses of the intermediate ports. * * *

Inaccuracies are due to the following causes: (1) Masters are permitted, under certain circumstances, to clear at the same time they enter—this custom is productive of error because masters may not, for a variety of reasons, take aboard what they supposed they would when they cleared; (2) masters do not often know what they have on board when they clear, even after their vessels are loaded—in some cases the statements on the basis of which freight is collected are made up after the ship has left port, and forwarded to the captain by mail or telegraph, and in numerous instances cap-

tains never know what they have on board, as they are simply directed to go to a certain place and load (the manager of the dock being informed how much to put on), and then ordered to depart for a certain port, where the manager of the dock assumes all responsibility for records: (3) in the case of miscellaneous cargoes, it would be necessary to delay the departure of the boats in some cases in order to give a correct statement of the cargoes, so the manifests are likely to be the captains' estimates of what they have on board; and (4) some errors are due to indifference—in the minds of some captains the filing of a manifest is a mere form, for statistics, in their opinion, have no value.

Any attempt to remedy these evils should take cognizance of the fact that vast sums of money have been expended in terminal facilities, in order to secure dispatch in loading and unloading, and therefore regulations that would detain vessels would undo that which has been gained at an enormous expenditure of money and energy. If captains are forced to file correct statements of cargoes, vessels would in many cases be detained for some hours, and captains put to great inconvenience and to considerable expense. The docks are usually scattered over an enormous extent of territory. If a vessel finishes loading at 1 o'clock at night, the captain may be forced to walk several miles to the custom-house, as the street cars have probably stopped running, or secure a carriage at no little inconvenience and expense. Perhaps accurate statistics could be obtained and greater dispatch given to vessels by making the shippers instead of the captains responsible for reports. * * *

The methods of collecting these statistics ought to be radically changed, if for no other reason, simply because the Government can not afford to permit its work to be held up to scorn. Lake shippers ought gladly to cooperate with the Government, for an accurate knowledge of the situation is absolutely necessary in order to enable Congress to make a wise appropriation of money to facilitate commerce on these waters. Without a positive basis of facts it is impossible to plan a judicious scheme of improvements. Any change in the regulations governing the collection of statistics which will delay traffic may be expected, in the future as in the past, to meet the opposition of the lake carriers. If the shipper instead of the carrier were called upon for a statement, there need be no delay.¹

It is doubtful if the last recommendation, that the shipper instead of the carrier should be called upon for a statement, would in all cases be practicable. The method would be perfectly feasible if the cargo were owned by a single or a few shippers, but if the shipments were by numerous owners and were of a miscellaneous character, it might prove to be less effective than the present practice. It would seem, therefore, that the key to accurate and complete statistics is in customs regulations effectively and uniformly enforced.

¹George G. Tunell, Statistics of Lake Commerce, 1898, pages 19 to 21.

GREAT LAKES AND ST. LAWRENCE RIVER.

TABLE 25.—DOMESTIC RECEIPTS AND SHIPMENTS AT PRINCIPAL PORTS, OF PRINCIPAL COMMODITIES: 1906.

PORT.	TOTAL (TONS, NET).		IRON ORE (TONS, GROSS).		IRON, PIG (TONS, GROSS).		IRON MANUFACTURES (TONS, GROSS).		COAL, HARD (TONS, NET).	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Total.....	73,178,213	175,600,649	36,891,900	30,872,508	387,659	309,741	544,726	554,074	2,980,606	3,087,227
Ashland.....	632,100	3,774,931		3,238,922		19,433	30	5	29,439	
Ashtabula.....	7,076,115	2,481,070	6,726,882	2,850	77,414	72,460	13,103	156,420	1,112	2,099,606
Buffalo.....	10,143,691	4,201,316	4,631,021	16,640					800	
Cheboygan.....	23,873	148,530							810,988	3
Chicago-South Chicago.....	7,846,406	2,510,632	4,261,920		30,556	155	19,759	6,952		
Cleveland.....	8,235,366	3,434,962	6,062,049	330	10,981	3,005	788	277,575		16,962
Conneaut.....	6,084,142	888,854	5,412,156		5,958		19	36,500		17,600
Detroit.....	981,639	203,223	158,036	1,400	3,305		72,191	5,049	2,200	
Duluth.....	2,154,871	14,632,066		11,154,203	940	53,333	135,326	508	148,909	
Erie.....	2,836,324	1,070,415	2,097,308	56	31,106	81		8,880		257,340
Escanaba.....	524,727	6,412,483		5,656,859	12	38,064	452	967	25,412	
Fairport.....	2,211,464	295,439	1,832,623		22,250	7,729		125	1,900	
Frankfort.....	389,338	441,823	26,101		31,356	28,267	806	20,457		2,535
Gladstone.....	321,706	224,825		12,198		17,750	29,941	117	7,130	
Grand Haven.....	275,292	145,249			212	161	150			3,797
Green Bay.....	619,950	107,008		2,550	50		868	1	88,568	26
Hancock-Houghton ²	459,982	66,572					7,872		36,619	
Huron.....	876,417	783,273	778,301	10,617			60			2,532
Kewaunee.....	82,708	60,758			252		4,897			
Lorain.....	2,512,910	1,698,823	2,188,133		26,935			30		
Ludington.....	707,125	956,593	1,447	404	2,482	14,755	4,078	23,817	1,550	26,153
Manistee.....	33,602	488,239							1,000	
Manistique.....	166,788	332,562		3,862	23,347	56,637	19,397	1,284	1,513	
Manitowoc.....	660,726	577,064		885	9,309	426	13,739	770	20,244	
Marine City.....	45,692	35,362						50	652	
Marquette.....	278,720	1,531,005		1,355,396		8,006	850		17,287	
Menominee.....	103,825	97,090		22,493	40		1,537	298	2,621	
Milwaukee.....	5,002,853	1,233,293	272,717	9,183	14,088	521	26,354	3,381	722,156	1,638
Muskegon.....	58,300	61,517				420			1,835	
North Tonawanda ³	1,055,178	23,968	285,745	400	6,200	75	984	3,495		3,530
Ogdensburg.....	409,255	56,082					35	60	11,003	
Oswego.....	17,341	37,436							681	35,519
Port Huron.....	146,845	211,232		1,000			81	250	8,506	
Racine.....	159,841	17,147							33,214	
Sandusky.....	129,477	824,813	32,019		1,835					4,000
Sault Ste. Marie.....	195,389	243,565	8,500	4,400			548		24,627	
Sheboygan.....	509,929	15,089					21		133,560	
Superior-West Superior.....	4,134,373	8,447,890		5,982,804		58,695	118,471		671,554	
Toledo.....	1,816,976	2,350,837	1,438,396		1,117		250	280	23,937	11,012
Two Harbors.....	297,756	9,018,987		7,912,525		32,504	7,857			
Washburn.....	203,047	170,072	3,844						4,371	
All other.....	2,156,094	5,295,985	115,202	1,482,381	14,794	25,930	64,302	6,743	137,917	7,446

¹Includes 2,003,453 net tons of bunker coal.

²Includes Portage.

³Includes Tonawanda.

TRANSPORTATION BY WATER.

TABLE 25.—DOMESTIC RECEIPTS AND SHIPMENTS AT PRINCIPAL PORTS, OF PRINCIPAL COMMODITIES:
1906—Continued.

PORT.	COAL, SOFT (TONS, NET).		SALT (TONS, NET).		COPPER (TONS, GROSS).		LOGS (M FEET).		LUMBER (M FEET).		FLOUR (TONS, NET).	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Total.....	12,552,109	14,488,240	554,811	567,956	125,435	116,564	70,970	75,605	1,748,555	1,807,570	1,338,189	1,334,979
Ashland.....	491,756	2,202	200				16,076	1,200	124	56,889		
Ashtabula.....	2,477,885	2,477,885					225		483			
Buffalo.....		412,911	632	53,818	76,975				137,710	2,242	936,260	
Cheboygan.....	9,874	971					1,200	1,507		50,717		30
Chicago-South Chicago..	127,163	120,375	204,939	2,629	4,108	25	2,400	350	495,422	813	419	297,687
Cleveland.....	4,629	2,888,544	548	223	565		132		175,100	1,513	1,413	1,009
Conneaut.....		829,348							93		17	
Detroit.....	24,705	62,776	9,678	1,250	6,519				91,063	635	2,070	5
Duluth.....	1,431,413	13,052	43,922		8,402	100	20,824	1,625	3,273	461,477		224,288
Erie.....		668,759			8,522	150			9,440		190,097	173
Escanaba.....	487,260	8,649	476					476	530	10,412		2
Fairport.....	1,500	276,328			4,780		300		31		64,309	
Frankfort.....	125	226,278	4	1,423	6,096		179		58,912	14,397	5,172	
Gladstone.....	217,643	60	5,243	147						5,264		90,770
Grand Haven.....		27,273	18	3,961	103	75	32		14,958	721	54,529	377
Green Bay.....	292,189	3,679	8,343	183					318	9,556	9	10
Hancock-Houghton ²	361,754	333	297			50,107		275		3,415	855	
Huron.....		771,375							855			
Kewaunee.....	52,817	1,048	361			25			346	2,843		1,993
Lorain.....		1,697,370							6,301			
Ludington.....	19,343	487,795	30	127,220	2,422		438	120	140,770	33,600	54,841	119
Manistee.....		16,326	209	244,319				267	430	99,568	912	
Manistique.....	65,577	5,314	451			125		46	761	91,413		5,160
Manitowoc.....	417,946	5,894	8,955			6,051		35	9,749	115,612	60	38,484
Marine City.....	41,796	2,785		30,751					691	337		
Marquette.....	256,156	175	95							2,621		
Menominee.....	40,329	30	4,713	23				128	1,241	25,281		
Milwaukee.....	2,937,335	12,348	134,076	33	275	2,379	1,085	104	71,956	57,030	429	313,424
Muskegon.....		8,003							11,683	14,106	85	50
North Tonawanda ³		11,585					900		356,459	1,463		
Ogdensburg.....	181,599	1,752							13,367	158	14,665	
Oswego.....		1,746							2,685	50		
Port Huron.....	74,355	5,102	515	36,749					2,627	600	8,120	
Racine.....	57,688	15							4,509			
Sandusky.....		745,084	3,896	50					27,454			
Sault Ste. Marie.....	143,455	32,156	212					7,000	850	10,166	90	
Sheboygan.....	306,647	578	25,326				87		8,523	440		25
Superior-West Superior..	3,078,183	4,668	20,590		299	17,191	290		952	45,405	867	350,403
Toledo.....	20	2,314,247	28,423						37,799	187		
Two Harbors.....	288,955	1,859							5	57,540		
Washburn.....	162,148	867					4,600	400	430	38,517		72
All other.....	977,801	339,995	47,689	65,207	6,360	40,336	22,202	62,672	150,625	593,773	2,970	1,898

¹ Includes 2,003,453 net tons of bunker coal.² Includes Portage.³ Includes Tonawanda.

GREAT LAKES AND ST. LAWRENCE RIVER.

TABLE 25.—DOMESTIC RECEIPTS AND SHIPMENTS AT PRINCIPAL PORTS, OF PRINCIPAL COMMODITIES:
1906—Continued.

PORT.	WHEAT (BUSHELS).		CORN (BUSHELS).		OATS (BUSHELS).		BARLEY (BUSHELS).		RYE (BUSHELS).		UNCLASSIFIED FREIGHT ¹ (TONS, NET).	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Total.....	48,634,291	47,726,778	35,038,398	43,531,540	32,436,489	33,638,055	18,496,834	18,252,250	2,159,308	2,227,813	5,933,380	5,986,290
Ashland.....				3,278							30,043	3,495
Ashland.....											53,212	593
Buffalo.....	42,260,484		24,954,822	20	24,105,071	30	14,131,440		1,161,201		837,312	832,688
Cheboygan.....						3,600					7,198	38,902
Chicago-South Chicago.....	702,415	8,701,930		38,661,377		6,316,307		726,795	20,000	476,786	1,035,317	102,943
Cleveland.....	678,000	161,000	157,805		385,000	2,000	158,200				367,891	205,716
Connecticut.....	1,002		1,058		8,455						15,455	959
Detroit.....	1,013,168		441,400		6,148		340,000				440,864	130,699
Duluth.....		17,857,752		6,800		4,264,448	62,000	29,606		292,000	256,385	300,416
Erie.....	2,313,952		1,381,310				11,500				125,006	133,875
Escanaba.....											10,000	1,231
Fairport.....			608,250						293,389		34,125	10,315
Frankfort.....	20,100		5,155		1,270,535		1,304,570		245,250		133,963	128,222
Grandstone.....		583,271		123,000		2,106,764		620,994		200,700	58,156	13,033
Grand Haven.....	21,704		629,809		1,429,729		679,873		47,703		131,334	108,135
Green Bay.....	1,050					2,580,530	208	1,003,433	8,142	182,000	228,912	10,675
Hancock-Houghton.....	3,500		3,800		36,255						50,848	1,914
Huron.....											2,943	7
Keweenaw.....		1,075		9,400		127,000	9,000	591,317		229,956	20,368	29,017
Lorain.....											53,032	1,419
Ludington.....	79,340	2,205	1,006,652	1,765	3,876,983	1,920	1,385,159	6,100	364,655	13,500	199,898	204,264
Manistee.....			18,255		89,900						28,672	27,123
Manistique.....		24,098		25,360		89,775	1,000	5,960		8,565	49,427	66,556
Manitowac.....		20,100		53,144		4,809,338	11,100	1,973,573	15,500	303,999	161,509	157,262
Marine City.....											1,562	1,096
Marquette.....											4,230	66
Menominee.....							76				51,911	20,318
Milwaukee.....	167,000	1,808,180	103,311	3,008,050		3,664,468	5,000	4,178,990		317,985	694,780	467,650
Muskegon.....	15,546		30,048		29,915		5,680				31,152	23,882
North Tonawanda ²											9,680	1,481
Ogdensburg.....	476,741		4,697,950		815,502						16,355	53,947
Oswego.....	46,000						388,150				594	71
Port Huron.....			938,260		103,500						22,077	166,781
Racine.....											59,921	17,132
Sandusky.....	507,696				146,800						15,177	75,679
Sault Ste. Marie.....					2,200						15,136	151,149
Shobogon.....				300		9,200					26,882	13,451
Superior-West Superior.....		17,939,902		1,213,630		6,744,656		8,931,323		143,540	226,832	308,812
Toledo.....	290,450	361,632									67,749	14,041
Two Harbors.....											11	3,548
Washburn.....		238,983		424,590		2,796,383		123,875		44,940	8,923	22,067
All other.....	27,143	26,050	60,433	786	130,466	31,066	3,878	60,284	3,468	13,842	347,938	1,635,360

¹Includes Portage.

²Includes Tonawanda.

PASSENGER TRAFFIC.

One of the most important features at the different censuses of water transportation has been the obtaining of statistics as to the transportation of passengers, and the results for the Great Lakes are presented in the following table:

TABLE 26.—Passengers carried: 1880 to 1906.

	1906	1889	1880
Number of passenger carrying vessels	282	405	(1)
Passenger and freight vessels	236	365	(1)
Ferryboats	46	40	28
Income from passengers ²	\$4,865,736	(1)	(1)
Passenger and freight vessels	\$4,408,880	(1)	(1)
Ferryboats	\$456,856	(1)	(1)
Number of passengers carried ²	14,079,121	2,235,993	1,356,010
On passenger and freight vessels	5,814,639	1,612,519	926,250
On ferryboats	8,264,482	623,474	429,760

¹ Not reported separately.

² Exclusive of \$1,168 reported as income from 1,025 passengers carried on tugs and other towing vessels.

Although the census of 1880 was limited to steam vessels, the statistics included in this table are no less valuable for comparative purposes on that account, as practically no passengers are carried for hire in sailing or unrigged vessels. It will be noted that the income received from passenger traffic was not reported separately either in 1880 or 1889, so that no comparisons of such data can be made.

The increases in the number of passengers, both on ferryboats and on other vessels, between 1889 and 1906 are most striking, but it is probable that the statistics for 1889, especially those for ferry passengers, are very much understated. In the report for that census it is stated:

The figures of passenger traffic are interesting so far as they go, but it must be confessed that the returns were not made with that scrupulous care which characterized the schedule reports of traffic and equipment.

As indicated by the table, the passengers were reported in two classes, those carried on ferryboats and those on other vessels engaged in the passenger business exclusively or in the passenger and freight business. It hardly seems necessary to state that ferry passengers are those transported between two neighboring points, usually a short distance apart, and that the others are those traveling longer distances between different localities and in a large measure are made up of summer excursionists on pleasure trips.

Attention is called to the fact that although the ferry passengers for 1906 constitute considerably more than one-half of the total number, the income received from that source is less than one-tenth of the total; or, stating it in another form, the average fare per ferry passenger was 5.5 cents and for those carried on passenger and passenger and freight vessels 75.8 cents, showing the longer distance traveled by the

latter class and the superior accommodations furnished.

At the census of 1889 the number of "regular" and "excursion" passengers were reported separately and a similar inquiry was made a part of the schedule at the present census. There was some confusion shown as to the precise meaning of the term "excursion" passengers and the manner in which they should be reported, whether all passengers purchasing return tickets came under that head or only those taking ordinary day excursions, and whether they should be reported twice or only once. Because of this doubt the number of excursion passengers is not given in this report. It is probable that this classification of passengers was no less confusing at the census of 1889 and that the statistics were thereby more or less affected.

Vessels licensed to carry passengers are required by law to report periodically the number of passengers carried to the officers of the United States Steamboat Inspection Service, and the total number reported by that branch of the service for 1906 on the Great Lakes was 16,301,220, or 2,221,074 in excess of the Census figures.

TABLE 27.—Passengers reported for each district of the United States Steamboat Inspection Service on the Great Lakes: 1906.¹

LOCAL INSPECTION DISTRICT.	Number of passengers.
Total.....	16,301,220
Buffalo.....	805,549
Chicago.....	1,818,104
Cleveland.....	805,340
Detroit.....	7,403,154
Duluth.....	1,051,074
Grand Haven.....	770,536
Marquette.....	478,515
Milwaukee.....	484,601
Oswego.....	480,014
Port Huron.....	549,007
Toledo.....	1,566,056

¹ Annual report of the Steamboat Inspector-General.

The discrepancy between the statistics of the two offices can not be fully accounted for. A representative of the Census Office spent several days in examining the methods employed by the Inspection Service in reporting the transportation of passengers and discovered considerable lack of uniformity, as between the several local inspection districts, in returning this information. Furthermore, in a letter received from the Supervising Inspector-General the statement was made that "it is a matter of discretion with the master of the steamer as to which board he may report," and "a steamer running between Buffalo and Cleveland, for instance, may report to Buffalo the whole number of passengers carried both ways, or she may report some at Buffalo and some at Cleveland." With such latitude allowed it would not be surprising if some masters failed occasionally to report, or if some reported twice, at the port of departure and the port of distribution, as there appears to be no system of checking these returns. It is but

fair to state in this connection that the general rule was to report only the passengers departing from the port, but the rule was not uniformly applied.

A comparison of the returns on file in several of the more important districts disclosed several instances of duplication, amounting in the aggregate to 600,000 passengers at least, which explains that degree of difference.

Canadian vessels made no reports to the Bureau of the Census, but in the statistics of the Steamboat Inspection Service the returns of at least 2 such vessels, reporting 181,192 passengers at Buffalo, were included.

Another instance of a difference in the methods of the two offices was in regard to vessels carrying passengers, but not for hire. Those passengers were not reported to the Census, but were included, to a large extent, in the reports of the Inspection Service. It was ascertained that this was the practice in nearly every district, and those passengers were in the aggregate very numerous. From Cleveland especially, during the summer season, large numbers of passengers, the officers or directors of the transportation companies or allied concerns and their friends, take free passage to resorts on Lake Superior on the iron ore freighters, which are in some cases luxuriously fitted up for a limited number of passengers. It was ascertained also that in one case men employed on a harbor lighter at Chicago were reported as passengers.

Accurate records of the number of passengers carried during the year were not always kept by the transportation companies, and in such cases the reports furnished to the Steamboat Inspection Service were perhaps more nearly correct than those made to the Bureau of the Census, as the reports to the former were made either at the end of each trip or at stated short periods, while the reports to the Census were made at the end of the year and were in many instances rough estimates.

A careful examination of all the returns received shows that the passengers carried on the lakes may be separated into three main groups in order of number—ferry passengers, summer day excursionists for recreation and pleasure, and passengers traveling between cities distant from each other, either on business or pleasure.

Fully three-fourths of the ferry passengers were reported from Detroit by the lines operating between Detroit and Windsor and Walkerville, Ontario, and between Detroit and Belle Isle park in the Detroit river. Ferries were also reported at Buffalo, Duluth, Superior, Port Huron, Milwaukee, and other points.

The day excursionists were naturally most numerous at the large centers of population, and this business in the summer time keeps a large number of vessels in commission.

There are many lines in the passenger business between the important cities on the lakes, and some

are engaged in interlake traffic. Many of the vessels operated by these lines are splendid products of the shipbuilding art, being equipped with every convenience for the comfort and luxury of the passengers. During the season of navigation these vessels, which are frequently taxed to their utmost capacity, are active competitors of the railroads, and, giving lower rates where the route is direct, and affording greater comfort, have every advantage over them except those of speed and the frequency with which the trips may be taken.

EMPLOYEES AND WAGES.

Table 28 presents all the comparative data available in regard to employees and wages as reported at the censuses of 1889 and 1906.

TABLE 28.—*Employees and wages, by class, with per cent of increase: 1906 and 1889.*

CLASS.	Census.	Number of employees.	Wages.
Total.....	1906 1889	24,916 22,726	\$13,280,716 8,038,191
Per cent of increase.....		9.6	64.0
Steam.....	1906 1889	20,515 15,271	11,179,882 5,796,895
Per cent of increase.....		34.3	92.8
Sail.....	1906 1889	2,258 5,758	962,542 1,804,003
Per cent of increase.....		160.8	146.6
Unrigged.....	1906 1889	2,143 1,697	1,138,292 497,293
Per cent of increase.....		26.3	128.0

¹ Decrease.

The above table includes both for 1889 and 1906 only those employed on vessels and the wages they received. The report on steam navigation, census of 1880, gives the number employed on steamers at that time as 9,143, who received \$3,293,964 in wages.

The statistics for sailing vessels in Table 28 indicate even more clearly the decadence of that class of craft, which has already been noted in other tables, and this is still more strongly emphasized by deducting the figures for those employed on schooner barges, which leaves 1,490 employees, receiving \$622,341 in wages.

The Census report on this subject for 1889 contains statistics of employees and wages in very great detail. The wages are reported for steam, sail, and unrigged vessels, by lakes and for the principal ports on each. The number of employees of the various grades from captains to deck hands, with their monthly wages, are given in the same manner. When it is considered that of the total number of craft reported at that census, 2,737, the employees and wages were reported only for 1,841 vessels and that the data were estimated for the remaining 896 vessels, "the estimate being based on the figures actually reported for 1,841 craft," the conclusion seems inevitable that not much dependence can be placed upon the accuracy of the figures. They may or may not closely approximate the facts.

The number of employees on vessels reported at the census of 1906 is the number ordinarily required for their operation, including officers of all grades, seamen, stewards, cooks, laborers, etc., or what is termed the "crew" or "ship's company," and very complete returns were received from practically all shipmasters and owners to whom the schedule was presented. The statistics for 1889 have practically the same meaning, the schedule having called for the "number making up ordinary crew of vessel."

Employees on the Great Lakes, both those on board vessels and those on shore, are strongly organized for mutual protection and advantage. The several organizations are the Lake Seamen's Union, the International Longshoremen's Marine and Transport Workers' Association, the Marine Cooks and Stewards' Union, the Marine Firemen, Oilers and Water-Tenders' Union, and the Marine Engineers' Beneficial Association. Annual agreements regulating wages and other conditions of employment are entered into between these organizations and the Lake Carriers' Association, with which nearly all the leading owners are associated. The officers of vessels are not organized for the regulation of salaries, but yearly contracts governing the scale are made with those below the grade of master. The salary of the master is a matter of individual arrangement between him and the owner who employs him, and is chiefly dependent upon the size and tonnage of the boat, and the value which the owner places on his services. Some owners pay considerably more than others on boats of the same size, particularly on the larger vessels. The salaries generally run from \$1,000 for a 1,000-ton boat, \$1,500 to \$1,700 for a medium-sized boat, and \$2,000 to \$2,200 for boats of 10,000 tons carrying capacity. In some cases \$2,500 is paid if the owner regards the master as a particularly efficient officer; this, however, is exceptional.

Below is printed a copy of the "card of wages" for 1906, which presents, in tabular form, the wage scale governing the compensation of all officers and men employed on board vessels, with the exception of masters.

Card of wages adopted by the Lake Carriers' Association for the year 1906.

STEEL STEAMERS.		Per month.
FIRST CLASS.		
Chief engineers.....	Class A, (see note).	\$175.00
First assistant engineers.....		115.00
Second assistant engineers.....	Class B, (see note).	80.00
Chief engineers.....		150.00
First assistant engineers.....		100.00
Second assistant engineers.....		75.00
First mates.....		115.00
Second mates.....		80.00
Cooks, vessels over 4,000 gross tons.....		80.00
Second cooks and waiters, to Oct. 1.....		30.00
Second cooks and waiters, Oct. 1 to close of navigation.....		37.50
Porters, to Oct. 1.....		25.00
Porters, Oct. 1 to close of navigation.....		35.00
Firemen, oilers, and water tenders, to Oct. 1.....		45.00
Firemen, oilers, and water tenders, Oct. 1 to close of navigation.....		65.00
Wheelmen and lookouts, to Oct. 1.....		45.00
Wheelmen and lookouts, Oct. 1 to close of navigation.....		65.00
Ordinary seamen, to Oct. 1.....		27.50
Ordinary seamen, Oct. 1 to close of navigation.....		37.50

Notes.

Class A.—Steel steamers of over 5,500 gross tons, Government register.
 Class B.—Steel bulk freight steamers of 2,100 to 5,500 gross tons, Government register, and steel package freight steamers of over 3,000 gross tons, Government register.

Card of wages adopted by the Lake Carriers' Association for the year 1906—Continued.

STEEL STEAMERS—Continued.		Per month.
SECOND CLASS.		
Chief engineers.....		\$125.00
Assistant engineers.....		90.00
Chief engineers, steel package freight steamers, 1,800 to 3,000 gross tons.....		150.00
First assistant engineers, steel package freight steamers, 1,800 to 3,000 gross tons.....		100.00
First mates.....		100.00
Second mates.....		70.00
Cooks, vessels less than 4,000 gross tons.....		70.00
Second cooks and waiters, to Oct. 1.....		30.00
Second cooks and waiters, Oct. 1 to close of navigation.....		37.50
Porters, to Oct. 1.....		25.00
Porters, Oct. 1 to close of navigation.....		35.00
Firemen, oilers, and water tenders, to Oct. 1.....		45.00
Firemen, oilers, and water tenders, Oct. 1 to close of navigation.....		65.00
Wheelmen and lookouts, to Oct. 1.....		45.00
Wheelmen and lookouts, Oct. 1 to close of navigation.....		65.00
Ordinary seamen, to Oct. 1.....		27.50
Ordinary seamen, Oct. 1 to close of navigation.....		37.50
THIRD CLASS.		
Chief engineers.....		\$105.00
Assistant engineers.....		75.00
First mates.....		90.00
Second mates (when carried).....		60.00
Cooks.....		70.00
Second cooks, to Oct. 1.....		30.00
Second cooks, Oct. 1 to close of navigation.....		37.50
Firemen, oilers, and water tenders, to Oct. 1.....		45.00
Firemen, oilers, and water tenders, Oct. 1 to close of navigation.....		65.00
Wheelmen and lookouts, to Oct. 1.....		45.00
Wheelmen and lookouts, Oct. 1 to close of navigation.....		65.00
Ordinary seamen, to Oct. 1.....		27.50
Ordinary seamen, Oct. 1 to close of navigation.....		37.50
WOODEN STEAMERS.		
FIRST CLASS.		Per month.
Chief engineers.....		\$125.00
Assistant engineers.....		90.00
First mates.....		100.00
Second mates.....		70.00
Cooks.....		70.00
Second cooks and waiters, to Oct. 1.....		30.00
Second cooks and waiters, Oct. 1 to close of navigation.....		37.50
Porters, to Oct. 1.....		25.00
Porters, Oct. 1 to close of navigation.....		35.00
Firemen, oilers, and water tenders, to Oct. 1.....		45.00
Firemen, oilers, and water tenders, Oct. 1 to close of navigation.....		65.00
Wheelmen and lookouts, to Oct. 1.....		45.00
Wheelmen and lookouts, Oct. 1 to close of navigation.....		65.00
Ordinary seamen, to Oct. 1.....		27.50
Ordinary seamen, Oct. 1 to close of navigation.....		37.50
SECOND CLASS.		
Chief engineers.....		\$114.00
Assistant engineers.....		84.00
First mates.....		90.00
Second mates (when carried).....		60.00
Cooks.....		70.00
Second cooks and waiters, to Oct. 1.....		30.00
Second cooks and waiters, Oct. 1 to close of navigation.....		37.50
Firemen, oilers, and water tenders, to Oct. 1.....		45.00
Firemen, oilers, and water tenders, Oct. 1 to close of navigation.....		65.00
Wheelmen and lookouts, to Oct. 1.....		45.00
Wheelmen and lookouts, Oct. 1 to close of navigation.....		65.00
Ordinary seamen, to Oct. 1.....		27.50
Ordinary seamen, Oct. 1 to close of navigation.....		37.50
BARGES.		

Mates on barges shall receive not less than \$10 per month more than seamen on the same vessel; and donkey men \$5 per month more than seamen.

Mates' wages on tow barges of the larger class (vessels which paid their mates \$70 a month last year) shall be \$70 per month for the entire season.

Abie-bodied seamen on tow barges shall receive \$45 per month until October 1, and \$65 per month from October 1 to the close of navigation.

The engineers on tow barges carrying towing machines shall receive \$67.50.

The cooks on tow barges shall receive the same wages as the seamen on the same barges.

Wages of seamen, firemen, oilers, and water tenders employed in fitting out shall be \$1.75 per day while they are not boarded on the vessel.

The provisions of the formal agreements between the owners and the men cover employment only on steamers and tow barges, and do not apply to sailing vessels; nor are the passenger carrying companies parties to the contracts, which will explain the absence of pursers and stewards from the scale of wages. It will be noticed that for employees below the grades of mates and engineers the wages are increased from October 1 to the close of navigation. This is the result of the severity of the weather and the

increased danger and privation that attends the work at that season. In addition to the scale of wages the contracts embody provisions in relation to the number of the various classes of workmen to be employed on vessels of different kinds and sizes; the return of the employees to their homes under certain circumstances; the hours of labor; the conditions and equipment of sleeping quarters, etc.

The greater percentage of increase in the wages paid as compared with that in the number of men, shown in Table 28, indicates that the rates of wages were considerably higher in 1906 than in 1889. This conclusion is borne out by information received from the secretary of the Lake Carriers' Association. Since the association was organized substantial advances have been made in the wages paid to all classes of employees. A comparison carried back to 1887 shows general increases in the compensation of all grades of employees. The following is a comparative statement of the monthly wages paid at certain periods in 1887 and 1906, which, together with other information on the subject, was furnished by the official referred to above:

Monthly wages paid on the Great Lakes: 1906 and 1887.

	Year.	Wages.
First engineer.....	1906	\$105.00 to \$175.00
	1887	90.00 to 110.00
Second engineer.....	1906	75.00 to 115.00
	1887	65.00 to 75.00
First mate.....	1906	90.00 to 115.00
	1887	65.00 to 80.00
Second mate.....	1906	60.00 to 80.00
	1887	45.00 to 60.00
First cooks.....	1906	70.00 to 80.00
	1887	45.00 to 55.00
Cooks' helpers, or second cooks.....	1906	30.00 to 37.50
	1887	10.00 to 15.00
Wheelmen and firemen.....	1906	50.00 to 65.00
	1887	37.50 to 55.00
Watchmen.....	1906	45.00 to 65.00
	1887	37.50 to 52.50
Deck hands.....	1906	27.50 to 37.50
	1887	15.00 to 30.00

The range of wages shown in the statement, from the lower rates to the higher, for engineers and mates results from the different classes of vessels upon which they are employed, and for the other employees, marks the difference between summer and winter wages. The annual reports of the Bureau of Navigation contain rates of wages paid to American seamen of the several grades who are employed in the merchant marine in the coastwise and foreign trade from Atlantic and Pacific coast ports. While accurate comparisons can not be made between those figures and the statistics for the Great Lakes, it would appear from an examination of both that on ocean going vessels the range of compensation for employees of the higher grades is much wider than on the freight carrying vessels on the lakes, corresponding to the more widely varying types of craft engaged in ocean transportation.

It is reported by those interested in the commerce of the lakes that the relations between the seamen and their employers are and have been for several years marked by mutual understanding and harmony, with the exception of a few occasions of disagreement which were of a trifling character and soon settled, and that no interruptions to lake traffic of much consequence have occurred within recent years as a result of disagreements concerning the scale of wages.

In addition to the men employed on board vessels, the schedule of inquiry provided that a report should be made of those "employed on land, but incident to the operation of the vessel or craft," together with their wages, such employees to include longshoremen, laborers, etc., and also "officers, managers, clerks, and all other salaried employees." It was reported in reply to this inquiry that in shore work at lake ports there were employed 1,974 officers, managers, clerks, etc., who received as compensation \$1,874,357, and 4,363 other employees, such as stevedores, laborers, etc., with wages amounting to \$3,015,223. These amounts added to the wages paid to the men employed on vessels make the total amount of \$18,170,296 paid as wages and salaries in 1906 to all classes of employees, afloat and ashore.

In reference to the number of shore employees and their wages it should be stated that while the greatest pains were taken to secure complete returns, it is not at all certain that the Office was entirely successful in this regard. The difficulty of securing correct information in answer to this query, especially from the larger transportation companies, makes the figures of questionable accuracy.

The detailed statistics of employees and wages are presented in Table 41 at the end of this report. It will be seen by reference to that table that steam vessels employ about five-sixths of all the wage-earners reported, with sail vessels next, and unrigged vessels the least in number.

FUEL CONSUMPTION.

At the census of 1880 an inquiry was made into the consumption of fuel on steam vessels, and in the special report on steam navigation in the United States for that census it was reported that the fuel used on the Great Lakes amounted to 488,610 tons of coal and 255,629 cords of wood. At the census of 1889, 1,530,997 tons of coal and 85,288 cords of wood were reported as consumed during 1889, these figures being based in part on actual returns and in part on estimates. It is quite probable that the decrease in the quantity of wood reported is an accurate indication of actual conditions, as the use of wood for fuel on steamers has for years steadily decreased until at the present time it can hardly be regarded as a factor in the management of a vessel.

At the census of 1906 the question of fuel consumption was not considered of sufficient statistical impor-

tance to warrant an inquiry into the subject. The Bureau of Statistics, however, makes statistics on this point a feature of its reports on the internal commerce of the United States, and according to the figures of that office the amount of bituminous coal consumed on the Great Lakes during 1906 was 2,703,401 tons. The consumption of anthracite coal for power producing purposes on steam vessels is very small; the quantity reported by the Bureau of Statistics for 1906 was but 2,427 tons, which, however, was probably less than the actual amount consumed.¹

RAILWAY SHIPPING.

The railway companies form a very important element in the transportation interests of the lakes. Their interests are represented by car ferry lines, which form, usually, a short connecting link between two points of a railway system; by transportation companies, which have a separate corporate organization, but are usually subsidiary to the railroad companies, the whole or a majority of their stock being owned by those companies; and by floating equipment, which is owned and operated directly by the railroad companies and which consists of ferryboats and harbor craft, such as tugboats, lighters, barges, scows, dredges, etc.

The second class of companies named having in a sense independent organizations and keeping separate accounts of their operations were able to and did make very complete reports. Reasonably complete information was obtained in regard to the harbor craft of railroad companies with the exception of certain items of inquiry, such as income, answers to which could not be given in many cases with any degree of accuracy by reason of the peculiar difficulties involved. But it was in connection with the car ferries that the greatest difficulty was encountered in securing full reports. As before stated these form connecting links in railroad lines and transport for short distances whole trains of cars, both freight and passenger; the passengers are undisturbed in their journey and there is no transshipment or unloading and reloading of freight. There was no uncertainty attached to the question of the physical equipment and characteristics of these vessels and this information was supplied without difficulty; but the income received from passengers and freight and the number of passengers and quantity of freight carried presented questions that by some companies could not be answered at all, and by others only approximately.

The statistics reported for the car ferries operated by railroad companies on the Great Lakes are presented in Table 29.

¹Bureau of Statistics, Department of Commerce and Labor, Monthly Summary, Internal Commerce of the United States, December, 1906, page 578.

TABLE 29.—*Craft operated in connection with steam railroads: 1906.*

Number of vessels.....	14
Gross tonnage.....	30,054
Net tonnage.....	18,252
Horsepower of engines.....	37,500
Value of vessels.....	\$2,790,482
Number of employees.....	461
Wages.....	\$225,861
Number of passengers carried.....	390,708

These statistics are included in the various tables of this report, and are presented separately here on account of their questionable and peculiar character. While there is no question but that these vessels, with their tonnage and value, form a part of the transportation interests of the Great Lakes, it is a matter of some doubt as to whether the passengers and freight carried by them should be considered as features of railway or of water transportation.

It was recognized previous to the canvass that it would be difficult to secure information in regard to the operation of these vessels, and the special agents in the field were instructed that, "where craft are operated as a connecting link in a railway system, the agent will not be required to obtain an estimate of the value of property and of the land force of employees that can be considered as incident to the operation of the craft unless it can be furnished without much difficulty. In such instances the Office will not insist upon answers to the inquiries concerning the gross income, or to the quantity of freight carried." Since freight statistics, as previously explained, were not collected for the Great Lakes by the Bureau of the Census, the inquiry in respect to that subject was not affected. The passengers carried were satisfactorily reported. The answers to the question concerning the income earned by these vessels were, however, very incomplete. There were a number of railway companies that reported car ferries, of which one was unable to segregate from its general accounts the income earned by its ferryboats. This company operated 22.3 per cent of the total tonnage, and this indicates, probably, the measure of the incompleteness of any figures which might have been given to represent income.

The railway companies which operate car ferries on the lakes as connecting links in their systems and the number of boats reported by each are as follows: The Michigan Central Railroad Company, 4 boats running between Detroit, Mich., and Windsor, Ont.; the Manistique, Marquette, and Northern Railroad Company, 1 vessel plying between Northport, Wis., and Manistique, Mich.; the Mackinac Transportation Company, operating 2 vessels between Mackinaw City and St. Ignace, Mich., conjointly for the Michigan Central Railroad Company, the Grand Rapids and Indiana Railway, and the Duluth, South Shore, and Atlantic Railway; and the Pere Marquette system, operating 1 boat between Detroit, Mich., and Windsor, Ont., 1

vessel running from South Chicago, Ill., to Peshtigo harbor, Wis., and 5 boats plying between Ludington, Mich., Milwaukee, Manitowoc, and Kewaunee, Wis., and Muskegon, Michigan.

As these car ferries are essential to the uninterrupted operation of the railway lines, the vessels are strongly constructed for ice breaking purposes in the winter and with a few exceptions compose the entire fleet navigating the lakes during that season. All except 3 of these vessels are of steel construction, the others being built of wood. Eleven are screw propeller steamers and 3 side wheel steamers.

It is not desirable to publish separately the statistics reported for harbor craft owned by railroad companies nor for the water transportation companies which are subsidiary organizations of those companies. The vessels operated by the latter form a not inconsiderable proportion of the total lake tonnage. They are principally engaged in transporting package freight between Chicago, Milwaukee, Gladstone, Duluth, and Superior at the western end of the lakes and Buffalo, Cleveland, Erie, and Fairport at the eastern. In addition to the general merchandise they carried, which in 1906 amounted to 1,572,900 tons for the east bound shipments alone, they are engaged also in transporting the heavier commodities, such as grain, ore, and lumber. Some of the vessels do a considerable passenger business. Most of the general merchandise shipped westward originates on the lines of the railways interested, and is transshipped at Buffalo and the other eastern ports from the railway cars to the boats. Conversely, the eastern shipments from Chicago and Milwaukee are, for the most part, destined for cities tributary to the railroad companies.

The railroads connecting the Atlantic seaboard with the Great Lakes have established lines of vessels on the lakes both to enable them to ship from eastern points by rail and water route to the middle West, and to enable them to secure for their railroad lines in the East as large a share as possible of the traffic originating about and beyond Lakes Superior and Michigan. The transcontinental railroads having lake lines have established such lines in order to secure a greater volume of the through passenger and freight traffic between the eastern and western sections of the United States.¹

These water transportation companies that are affiliated with, controlled by, or otherwise have traffic arrangements with railroad companies, are organized into what is known as the "Association of Lake Lines." The following is a list of the lines forming its membership in 1906, with the ports between which the boats of each company travel:

Western Transit Company, operating between Buffalo, N. Y., Chicago, Ill., Milwaukee, Wis., Houghton, Mich., Hancock, Mich., Dollar Bay, Mich., Duluth, Minn., and Superior, Wisconsin.

Union Steamboat Line, operating between Buffalo, N. Y., Chicago, Ill., and Milwaukee, Wisconsin.

Erie and Western Transportation Company, operating between Buffalo, N. Y., Erie, Pa., Cleveland, Ohio, Chicago, Ill., Milwaukee,

Wis., Detroit, Mich., Port Huron, Mich., Mackinac Island, Mich., Sault Ste. Marie, Mich., Marquette, Mich., and West Superior, Wisconsin.

Mutual Transit Company, operating between Buffalo, N. Y., Cleveland, Ohio, West Fairport, Ohio, Detroit, Mich., Houghton, Mich., Hancock, Mich., Dollar Bay, Mich., Lake Linden, Mich., Port Arthur, Ont., Fort William, Ont., Duluth, Minn., and West Superior, Wisconsin.

Lackawanna Transportation Line, operating between Buffalo, N. Y., Chicago, Ill., and Milwaukee, Wisconsin.

Lehigh Valley Transportation Company, operating between Buffalo, N. Y., Chicago, Ill., and Milwaukee, Wisconsin.

Minneapolis, St. Paul, and Buffalo Steamship Company, operating between Buffalo, N. Y., Cleveland, Ohio, West Fairport, Ohio, Escanaba, Mich., and Gladstone, Michigan.

Cleveland and Buffalo Transit Company, operating between Buffalo, N. Y., and Cleveland, Ohio.

Detroit and Buffalo Steamboat Company, operating between Buffalo, N. Y., and Detroit, Michigan.

Detroit and Cleveland Navigation Company, operating between Cleveland, Ohio, Toledo, Ohio, Detroit, Mich., Port Huron, Mich., St. Clair, Mich., Mackinaw, Mich., and St. Ignace, Michigan.

Canada Atlantic Transit Company, operating between Depot harbor, Ont., Fort William, Ont., Chicago, Ill., Milwaukee, Wis., Duluth, Minn., Superior, Wis., and West Superior, Wisconsin.

Rutland Transit Company, operating between Ogdensburg, N. Y., Cleveland, Ohio, Chicago, Ill., and Milwaukee, Wisconsin.

Port Huron and Duluth Steamship Company, operating between Port Huron, Mich., and Duluth, Minnesota.

Baltimore and Ohio Lake Line, operating between West Fairport, Ohio, Chicago, Ill., and Milwaukee, Wisconsin.

The combined freight capacity of the vessels operated by the above lines is in excess of 200,000 tons. The association prints an annual statement of the east bound movement of the package freight carried by its vessels, and the following statistics, which represent the miscellaneous freight moved eastward by the principal lines for a series of years, are taken from the statement for 1906. The most striking and significant feature of these statistics is the lack of growth indicated in the volume of this commerce. The movement of west bound traffic is also considerable, but a record of such business, it appears, is not kept in any central office.

Eastward movement of package freight by the Association of Lake Lines: 1895 to 1906.

YEAR.	Total (net tons).	From Lake Michigan (net tons).	From Lake Superior (net tons).
1906.....	1,572,900	967,692	605,208
1905.....	1,586,258	1,009,503	516,755
1904.....	1,006,317	620,203	386,114
1903.....	1,701,458	1,072,708	628,750
1902.....	1,700,407	909,355	791,052
1901.....	1,427,515	754,323	673,192
1900.....	1,574,186	880,425	693,761
1899.....	1,580,422	918,225	662,197
1898.....	1,620,966	894,781	726,215
1897.....	1,950,174	1,120,286	829,888
1896.....	1,775,640	977,656	797,984
1895.....	1,430,409	655,705	774,704

CHARACTER OF OWNERSHIP.

An inquiry designed to elicit information in regard to the various forms under which the shipping of the country was owned was made a part of the schedule in order that the extent of each form of ownership—

¹ Emory R. Johnson, Ph. D., "Ocean and Inland Water Transportation," page 356.

individual, firm, incorporated company, and miscellaneous—and their relative proportions might be presented in the statistics. A similar inquiry was not made a part of previous censuses; it is impossible, therefore, to publish comparative data from which the extent of the changes in form of ownership from time to time can be determined.

A statement of the statistics for character of ownership is given in Table 30.

TABLE 30.—Number, gross tonnage, and value of vessels, by character of ownership, with per cent in each class: 1906.

OWNERSHIP.	VESSELS.		TONNAGE.		VALUE OF VESSELS.	
	Number.	Per cent.	Gross tons.	Per cent.	Amount.	Per cent.
Total.....	2,990	100.0	2,392,863	100.0	\$130,805,640	100.0
Individual.....	975	32.6	204,175	8.5	8,355,470	6.4
Firm.....	429	14.3	132,836	5.6	4,025,536	3.1
Incorporated company.....	1,536	51.4	2,044,131	85.4	117,310,941	89.7
Miscellaneous.....	50	1.7	11,721	0.5	1,113,693	0.9

The most striking fact shown by these statistics is the great preponderance of the corporate form of ownership. In the light of present day conditions, in this as well as in other fields, it may reasonably be assumed that the incorporated company as a factor in water transportation is constantly increasing in relative importance. The interests concerned in lake commerce are so large that it requires corporate organization to

care for them properly. The Pittsburg Steamship Company, a subsidiary company of the United States Steel Corporation, engaged principally in the transportation of iron ore from Lake Superior to Lake Erie, owns approximately one-sixth of the total tonnage on the lakes. Other corporations employ large fleets in transporting the heavier commodities, while the lake lines subsidiary to the railroad companies carry most of the miscellaneous merchandise and their vessels comprise a considerable proportion of the total shipping.

Except in number the vessels under individual ownership are of relatively small importance. The figures indicate that while 32.6 per cent of the total number of vessels was owned by individuals, these vessels were of comparatively small tonnage, the average being 209 gross tons, compared with 1,331 for corporations. Table 41 at the end of this section, in which are presented the detailed statistics, shows the figures reported for yachts owned by individuals, and if these were deducted, it would make a considerable reduction in the percentage of the total number of vessels engaged in lake commerce that were operated by individuals.

Firms rank third in importance in the extent of their operations as lake carriers, and the miscellaneous form of ownership, which includes cooperative associations and municipal and state governments, is last.

Table 31 shows the statistics reported for each form of ownership, according to the occupation of the vessels.

TABLE 31.—NUMBER AND GROSS TONNAGE OF VESSELS, BY CHARACTER OF OWNERSHIP AND BY OCCUPATION: 1906.

CLASS AND OCCUPATION.	TOTAL.		INDIVIDUAL.		FIRM.		INCORPORATED COMPANY.		MISCELLANEOUS.	
	Number of vessels.	Gross tonnage.	Number of vessels.	Gross tonnage.	Number of vessels.	Gross tonnage.	Number of vessels.	Gross tonnage.	Number of vessels.	Gross tonnage.
Total.....	2,990	2,392,863	975	204,175	429	132,836	1,536	2,044,131	50	11,721
Steam.....	1,676	1,915,786	536	126,160	207	71,009	905	1,714,669	28	3,948
Freight and passenger.....	932	1,842,251	196	114,702	113	67,317	621	1,659,308	2	924
Tugs and other towing vessels.....	382	22,663	94	3,502	59	2,226	225	16,446	4	299
Ferryboats.....	48	35,581	12	603	5	137	30	34,721	1	39
Yachts.....	236	6,210	204	5,673	23	445	6	66	3	26
All other.....	78	9,081	30	1,500	7	784	23	4,123	18	2,663
Sail.....	531	265,571	301	59,578	115	34,900	112	170,267	3	826
Freight and passenger.....	403	263,837	199	58,321	90	34,428	112	170,267	2	821
Yachts.....	122	1,458	97	1,170	24	283			1	5
All other.....	6	276	5	87	1	189				
Unrigged.....	783	211,506	138	18,437	107	26,927	519	169,195	19	6,947

The Lake Carriers' Association.—This association includes in its membership all of the important freight carriers with the exception of a few of the "lake lines" that are affiliated with railroad companies, and of those, the more important are members of the association. The passenger companies are not included in the printed list of members. Its membership owns or represents 68.4 per cent of the total tonnage on the lakes, and it is plain, therefore, that it exercises a commanding influence in all affairs pertaining to the

commerce of the lakes. Its objects and purposes are set forth as follows:¹

1. To establish and maintain shipping offices for the convenient securing of seamen for vessels on the Great Lakes, their connecting and tributary waters.
2. To establish, maintain, and procure the establishment and maintenance of aids to navigation, and improve and secure the improvement of channels, docks, wharves, loading and unloading, and terminal facilities.

¹ Annual Report, Lake Carriers' Association, 1906, page 3.

3. To establish and maintain, by contract or otherwise, such amicable relations between employers and employed as will avoid the public injury that would result from lockouts or strikes in the lake carrying service.

4. To provide for the prompt and amicable adjustment of matters affecting shipping and the interests of vessel owners on the Great Lakes and on their connecting and tributary waters.

CHARACTER OF OPERATIONS.

The schedule of inquiry was framed with a view to securing information in regard to the occupation of the vessels.

TABLE 32.—All vessels, by occupation, with per cent of increase: 1906 and 1889.

OCCUPATION.	Census.	Number of ves-sels.	Gross tonnage.	Value of vessels.
Total.....	1906 1889	2,990 2,737	2,392,863 920,294	\$130,805,640 48,580,174
Per cent of increase.....		0.2	160.0	169.2
Freight and passenger.....	1906 1889	1,335 1,760	2,106,088 745,225	114,821,511 41,249,174
Per cent of increase.....		124.1	182.6	178.4
Tugs and other towing vessels.....	1906 1889	382 489	22,663 24,451	2,630,097 2,556,300
Per cent of increase.....		121.9	17.3	2.9
Ferryboats.....	1906 1889	48 40	35,581 4,702	3,429,532 498,000
Per cent of increase.....		20.0	656.7	588.7
Yachts.....	1906 1889	358 54	7,668 2,121	1,877,850 312,700
Per cent of increase.....		563.0	261.5	506.5
All other.....	1906 1889	867 394	220,863 143,795	8,046,650 3,964,000
Per cent of increase.....		120.0	53.6	103.0

¹ Decrease.

TABLE 33.—All vessels, by occupation, with per cent each is of total: 1906.

OCCUPATION.	Number of ves-sels.	Gross tonnage.	Value of vessels.	Gross income.
Total.....	2,990	2,392,863	\$130,805,640	\$65,274,702
Freight and passenger.....	1,335	2,106,088	114,821,511	56,850,553
Per cent of total.....	44.6	88.0	87.8	87.1
Tugs and other towing vessels.....	382	22,663	2,630,097	2,474,121
Per cent of total.....	12.8	0.9	2.0	3.8
Ferryboats.....	48	35,581	3,429,532	922,838
Per cent of total.....	1.6	1.5	2.6	1.4
Yachts.....	358	7,668	1,877,850	4,494
Per cent of total.....	12.0	0.3	1.4	(1)
All other.....	867	220,863	8,046,650	5,022,696
Per cent of total.....	29.0	9.2	6.2	7.7

¹ Less than one-tenth of 1 per cent.

Vessels employed in carrying freight or passengers are of much greater importance than all others combined, as is shown by the percentages that the tonnage and value of such vessels and their income represent of the totals for the entire lake fleet.

The class of "tugs and other towing vessels" does not include freight propellers which tow barges as well as carry freight.

According to Table 32, the largest percentages of increase are shown for ferryboats and yachts.

CONGRESSIONAL APPROPRIATIONS.

The General Government has for many years expended large sums of money for the improvement and maintenance of waterways and harbors, and, as supplementary to the general statistics, it has been deemed of importance that data pertaining to these expenditures be presented. As the shallowest point in the ship channels of the Great Lakes determines the extreme draught of vessels engaged in interlake commerce, and hence in a measure their carrying capacity, these improvements have therefore a very important relation to the great volume of commerce now carried on in those waters.

It can hardly be assumed that the work that has been done by the Federal Government could have been nearly so well performed by the states or municipalities, either individually or in cooperation. The collection of data in regard to the improvement of lake ports and channels by the states and municipalities was contemplated, but the records and information available were so meager that nothing of value in that line could be accomplished. There is no doubt that such expenditures amount to a large sum in the aggregate.

The following from the Annual Report of the Lake Carriers' Association for 1906 explains the necessity for the continuance of these expenditures:

The improvement of the channels connecting the Great Lakes to 20 feet has not only reduced the cost of transportation, but the enormous stimulus given to every manufacture has added largely to the population and wealth of the cities encircling these waterways. It is indisputable that our waterways have acted as a most powerful regulator of rates. * * * Major Potter stated in his annual report covering the year 1904 that the saving on freight alone to Lake Superior that year was within five million dollars of all the sums of money ever expended on the whole system of lakes by the Government.

The figures used in this report relative to Congressional appropriations have been compiled from the reports of the Chief of Engineers of the United States Army. The figures are from the compilation of preliminary examinations, surveys, projects, and appropriations prepared in accordance with section 13 of the rivers and harbors act of June 13, 1902, and published in House Document 421, Fifty-seventh Congress, second session, from the report of the chief of

engineers for the fiscal year ending June 30, 1906, and the rivers and harbors act of March 2, 1907. The discrepancies between the figures shown at the present census and those presented at the census of 1890 are due either to the inclusion of some figures in this report under a different locality from the one shown in 1890, to the diversion of appropriations from the original project, or to apparent errors in the earlier census.

Table 34 shows, by periods, the amounts appropriated by Congress for the survey, improvement, and maintenance of the harbors, channels, and tributary streams of the Great Lakes and the St. Lawrence river, allotted to the respective lake or river on which the harbors are located or into which the streams empty.

TABLE 34.—Congressional appropriations for the survey, improvement, and maintenance of the harbors, channels, and tributary streams of the Great Lakes and St. Lawrence river, by periods and lakes.

LAKE.	APPROPRIATIONS.			
	Total.	Up to and including 1890.	1891 to 1906, inclusive.	March 2, 1907.
Total.....	\$97,791,108	\$37,522,937	\$50,980,283	\$9,287,888
Superior.....	27,969,410	9,469,000	16,399,410	2,101,000
Huron and St. Clair.....	10,835,772	3,803,764	4,637,506	2,404,500
Michigan.....	23,831,630	11,137,784	10,536,394	2,167,452
Erie.....	26,363,126	9,149,597	14,932,123	2,220,436
Ontario.....	4,452,051	3,397,631	735,850	319,500
St. Lawrence river.....	705,506	251,506	379,000	75,000
General.....	3,462,683	122,683	3,340,000	.....

The appropriations made up to and including March, 1907, amounted to \$97,791,108. Of this amount, 38.4 per cent was reported at the census of 1890 and the balance has been appropriated since that year. The amount appropriated by the rivers and harbors act of 1907 was 9.5 per cent of the total.

As may be seen from Table 39 over \$17,000,000, or 61.1 per cent of the total amount appropriated for the various localities on Lake Superior, was for the construction and maintenance of the St. Marys Falls canal and the improvement of St. Marys river, which connects Lake Superior with Lake Huron. Nearly \$6,000,000, or 21.4 per cent of the entire amount allotted for improvements on Lake Superior, was appropriated for the improvement of the harbors at Duluth, Minn., and Superior, Wisconsin.

Of the localities on Lake Huron and Lake St. Clair which have received Federal aid, the Detroit river, which connects Lake St. Clair with Lake Erie, has had appropriated for its improvement \$5,854,500, or over one-half of the total appropriations shown for these two lakes.

The appropriations for localities on Lake Michigan are nearly a quarter of the total for the Great Lakes,

the number of harbors and tributary rivers improved exceeding that for any other of the lakes. The largest sums have been appropriated for Chicago harbor and river, Calumet harbor and river, Milwaukee bay and harbor, and Michigan City harbor, the total for these localities amounting to \$10,309,555.

The aggregate appropriations for improvements on Lake Erie are next in amount to those for Lake Superior. Erie harbor, Pa., was the first locality on the lakes to receive Congressional aid, the first appropriation being made in 1823. Several harbors of Lake Erie, notably Buffalo, Cleveland, Toledo, Erie, Ashtabula, Sandusky, and Lorain have had over \$1,000,000 appropriated for improvements.

Less money has been appropriated for improvements on Lake Ontario than on any other of the Great Lakes, and 47.8 per cent of the total was for the improvement of Oswego harbor.

On the St. Lawrence river less than \$1,000,000 has been expended by the United States, and over one-half the entire amount was appropriated for the improvement of Ogdensburg harbor.

The general appropriations, which amount to 3.5 per cent of the total shown in Table 35, were for no specified locality, but were made for such purposes as the construction of dredging machinery and the improvement of the ship channel of the Great Lakes.

Table 35 shows the appropriations for the different states which lie around the Great Lakes. In some instances, however, it has been impossible to segregate appropriations for localities lying in two states.

TABLE 35.—Congressional appropriations for the survey, improvement, and maintenance of the harbors, channels, and tributary streams of the Great Lakes and St. Lawrence river, by periods and states.

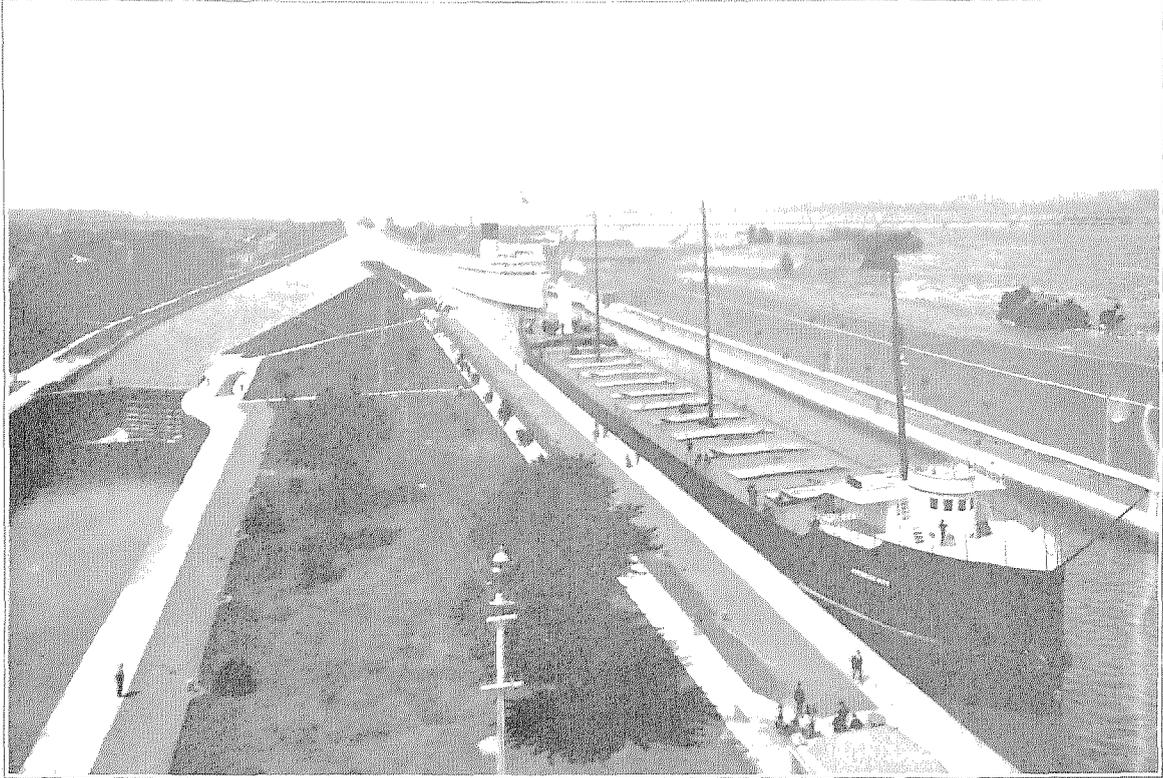
STATE.	APPROPRIATIONS.			
	Total.	Up to and including 1890.	1891 to 1906, inclusive.	March 2, 1907.
Total.....	\$97,791,108	\$37,522,937	\$50,980,283	\$9,287,888
Illinois.....	6,265,192	2,701,405	2,943,787	620,000
Indiana.....	1,651,669	1,118,169	473,500	60,000
Michigan.....	39,359,504	15,652,949	19,799,103	4,407,452
Minnesota.....	425,053	179,850	236,208	9,000
New York.....	15,417,423	7,176,335	6,310,152	1,930,936
Ohio.....	14,478,618	4,675,987	9,250,631	552,000
Pennsylvania.....	1,436,867	891,867	425,000	120,000
Wisconsin.....	7,442,708	3,330,493	3,445,210	667,000
Illinois and Indiana ¹	974,219	180,000	602,719	191,500
Michigan and Wisconsin ²	404,420	266,000	133,420	5,000
Minnesota and Wisconsin ³	5,972,747	1,227,194	4,020,553	725,000
General.....	3,462,683	122,683	3,340,000	.....

¹ Calumet river.

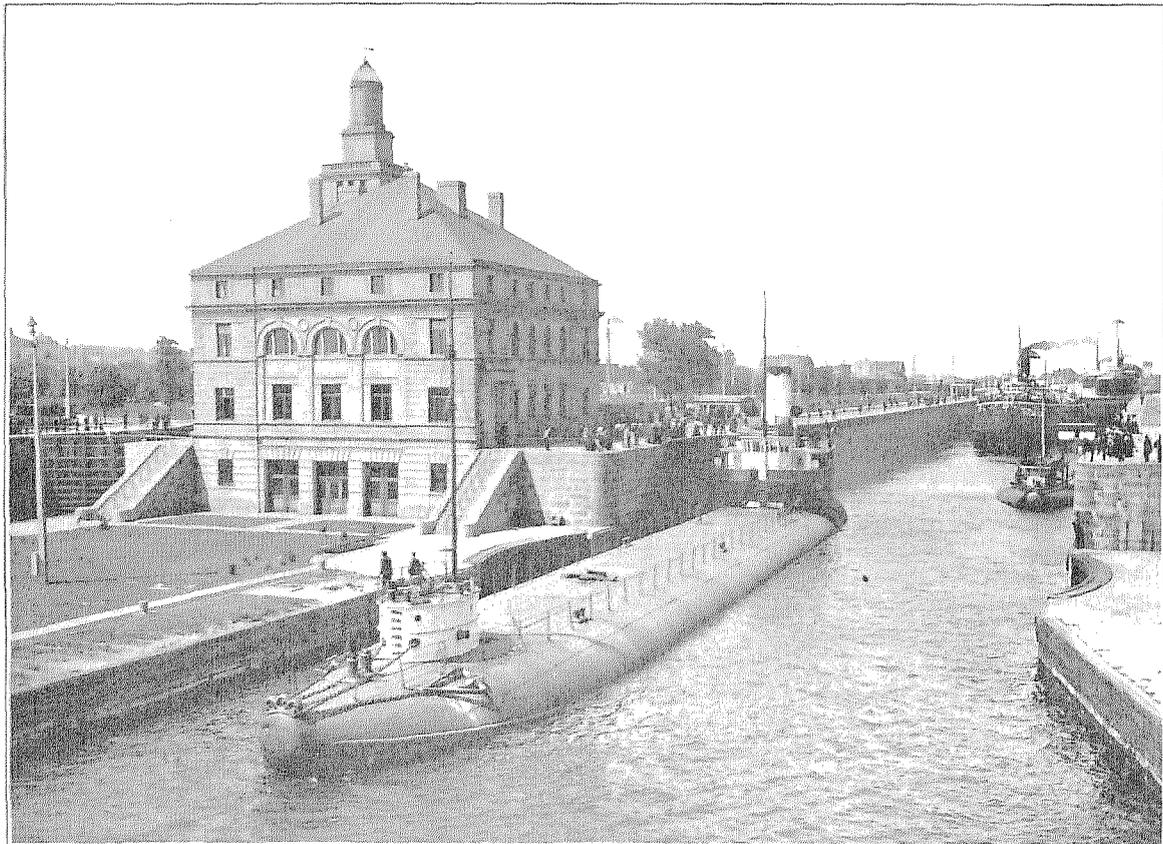
² Menominee harbor and river.

³ Duluth harbor, Minnesota, and Superior harbor, Wisconsin.

Of the different states, Michigan shows more than a third of the aggregate appropriated. This is due to the large appropriations made for the improvements in St. Marys and Detroit rivers, as well as to the fact that more localities on the shores of this state than of any



MAKING A LOCKAGE IN THE SOO CANAL, ST. MARYS RIVER AT THE FALLS, MICHIGAN.



WHALEBACK PASSING THROUGH THE SOO CANAL.

other on the Great Lakes have received Federal assistance. Large appropriations have also been made for harbors in New York, Ohio, Wisconsin, and Illinois.

By reference to Table 39, which shows the appropriations by localities, it will be seen that, ranked according to the amount of appropriations, the leading localities are as follows: St. Marys river and canal, Buffalo and Black Rock harbors, Duluth and Superior harbors, Detroit river, Cleveland harbor, Chicago harbor and river, Toledo harbor, Oswego harbor, and Milwaukee bay and harbor. The appropriations for these localities aggregate \$53,720,569, or 54.9 per cent of all appropriations for improvements on the Great Lakes and St. Lawrence river.

Owing to the constantly increasing commerce of these waters, Congress authorized, by the rivers and harbors act of July, 1892, the improvement of the channel connecting the waters of the Great Lakes between Chicago, Duluth, and Buffalo by excavating channels to a minimum width of 300 feet, with a navigable depth of 20 feet, through the shoal places in the specified waters, at an estimated cost of \$3,340,000. The improvement was limited to shoals not already provided for and was completed in 1897. The rivers and harbors act of March, 1905, authorized a preliminary examination and survey, with a view to enlarging the channel to depths of 22 and 25 feet, respectively, and to sufficient width. In the latter part of 1906 the board of engineers for rivers and harbors recommended that the contemplated improvement should be deferred until it was evident that a safe and reliable 20-foot channel was not equal to the necessities of lake commerce, although it did recommend an auxiliary channel in the Detroit river 22 feet deep, and this latter improvement was authorized by the rivers and harbors act of March, 1907, at an estimated cost of about \$6,500,000.

The increasing commerce passing through the St. Marys Falls canal has necessitated the construction of a third lock on the American side of the river. The rivers and harbors act of March, 1907, authorized the commencement of work on this new lock, which is north of the Poe lock, and is to be 1,350 feet long, 80 feet wide, and of 24.5 feet minimum depth. A new canal approach is also to be constructed, having a width of from 260 to 300 feet and the necessary depth. The total cost of this improvement is estimated at about \$6,000,000.

In order to illustrate the important bearing that these improvements, particularly those of the Sault canals and Detroit river and St. Clair Flats canal, have upon the commerce of the lakes, the following statistics, taken from the Annual Report of the Chief of Engineers of the United States Army for the fiscal year ending June 30, 1906, are introduced:

TABLE 36.—Statistical report of lake commerce through canals at Sault Ste. Marie, Michigan and Ontario, for the fiscal year ending June 30, 1906.¹

ITEM.	Total.	United States canal.	Canadian canal.
Vessel passages, number.....	21,957	16,299	5,658
Lockages, number.....	14,118	10,016	4,102
Net tonnage:			
Registered.....	37,570,191	32,559,602	5,010,589
Freight.....	46,015,016	41,276,862	4,738,154
Passengers, number.....	55,331	29,344	25,987
Coal:			
Hard, net tons.....	882,447	834,702	47,745
Soft, net tons.....	6,062,732	5,212,511	850,241
Flour, barrels.....	6,151,853	4,556,985	1,594,868
Wheat, bushels.....	78,769,762	51,146,562	27,623,200
Grain, other than wheat, bushels.....	48,128,812	40,004,606	8,124,146
Manufactured and pig iron, net tons.....	307,999	244,626	63,373
Salt, barrels.....	404,576	294,003	110,573
Copper, net tons.....	105,142	96,283	8,859
Iron ore, net tons.....	31,887,544	29,828,694	2,058,850
Lumber, M feet B. M.....	994,407	929,141	35,266
Silver ore, net tons.....	41	41	.....
Building stone, net tons.....	6,261	6,261	.....
General merchandise, net tons.....	978,473	523,687	454,786

¹ Annual Report, Chief of Engineers, United States Army, 1906, Part II, page 1860.

According to the reports of the Bureau of Statistics, 60,577,608 net tons of freight passed through the Detroit river during the navigation season of 1906. This considerably exceeded the traffic through the St. Marys Falls canal.

TABLE 37.—Domestic freight movement through the Detroit river: 1906.¹

ARTICLE.	North bound.	South bound.	Total.
Coal, hard..... tons (net).....	2,960,920	.....	2,960,920
Coal, soft..... tons (net).....	11,561,111	.....	11,561,111
Flour..... tons (net).....	872	1,237,652	1,238,524
Wheat..... bushels.....	46,968,671	.....	46,968,671
Corn..... bushels.....	32,086,383	.....	32,086,383
Qats..... bushels.....	24,311,170	.....	24,311,170
Barley..... bushels.....	14,786,080	.....	14,786,080
Rye..... bushels.....	1,328,517	.....	1,328,517
Flaxseed..... bushels.....	17,758,376	.....	17,758,376
Iron ore..... tons (gross).....	12,506	32,208,009	32,220,515
Iron, pig..... tons (gross).....	5,895	337,088	342,981
Iron manufactures..... tons (gross).....	453,809	1,437	455,246
Salt..... tons (net).....	74,401	41,463	115,864
Copper..... tons (gross).....	.....	89,534	89,534
Logs..... M feet.....	.....	1,257	1,257
Lumber..... M feet.....	9,796	869,254	879,050
Unclassed freight..... tons (net).....	1,303,042	966,738	2,269,780
Total..... tons (net).....	16,448,812	44,128,796	60,577,608

¹ Bureau of Statistics, Department of Commerce and Labor, Monthly Summary, Internal Commerce of the United States, December, 1906.

It should be remembered that the statistics in Table 36 include Canadian commerce, which, it is estimated, forms about 5 per cent of the whole with respect to the tonnage of freight, as well as American, and therefore will not bear strict comparison with the general statistics of transportation on the lakes published elsewhere in this report. It is clear, however, that a very large proportion of the traffic passes through these channels, and that they really are the key to the whole lake system of navigation. It is therefore vitally essential that their improvement should be equal to the demands of the constantly increasing traffic.

Another improvement which was authorized by the rivers and harbors act of March, 1905, is to provide a

channel for deep draft vessels between Buffalo and Tonawanda around the rapids at the head of Niagara river. This is to be accomplished by widening Black Rock harbor, situated at the head of Niagara river, by removing the wall which separates it from the Erie canal, thus making it from 250 to 500 feet wide, and deepening the waterway sufficiently to accommodate the largest vessels of the lakes. A lock 650 feet long and 70 feet wide at its downstream end is to overcome the fall of the river. When completed, any vessel engaged in lake commerce can pass from Lake Erie into the natural harbor of the Niagara river below the shoals and rapids at its head. This improvement would also be an essential part of any plan for a ship canal from the lakes to the sea, and will fit into the plan for the enlarged Erie canal.

Table 38, which gives the maximum draft that can be carried at mean low water in the main channels and canals, and in the principal harbors of the Great Lakes, according to the latest surveys and improvements, shows in part the results that have been accomplished.

TABLE 38.—Maximum draft that can be carried at mean low water in channels and harbors.¹

HARBORS.			
	Depth.		Depth.
	Fect.		
Ashland.....	18	Ludington.....	18
Ashfabula.....	20	Manistee.....	15
Buffalo.....	23	Manitowoc.....	20
Chicago.....	20	Marine City.....	15
Cleveland.....	24	Marquette.....	18
Conneaut.....	20	Menominee.....	19
Detroit.....	21	Milwaukee.....	21
Duluth.....	20	Muskegon.....	17
Erie.....	20	Ogdensburg.....	15
Fairport.....	20	Port Huron.....	16
Frankfort.....	18	Racine.....	18
Grand Haven.....	18	Sandusky.....	18
Hancock-Houghton.....	20	Sheboygan.....	20
Keweenaw.....	16	Superior-West Superior.....	20
Lorain.....	20	Toledo.....	20

CHANNELS AND CANALS.			
Detroit river.....	21	St. Marys canal and river.....	25
Lake Superior canal.....	20	Sturgeon Bay canal.....	21
St. Clair Flats canal.....	20		

¹ Annual Reports of the Chief of Engineers, United States Army.

Table 39 gives the Congressional appropriations by localities and periods.

TABLE 39.—CONGRESSIONAL APPROPRIATIONS FOR THE SURVEY, IMPROVEMENT, AND MAINTENANCE OF THE HARBORS, CHANNELS, AND TRIBUTARY STREAMS OF THE GREAT LAKES AND ST. LAWRENCE RIVER, BY LOCALITIES AND PERIODS.

LOCALITY.	Date of earliest appropriation.	APPROPRIATIONS.			
		Total.	Up to and including 1890.	1891 to 1900, inclusive.	March 2, 1907.
Aggregate.....		\$97,791,108	\$37,522,937	\$50,980,283	\$9,287,888
Lake Superior.....	1856	27,969,410	9,469,000	16,399,410	2,101,000
Agate Bay harbor, Minn.....	1886	252,708	62,500	186,208	4,000
Ashland harbor, Wis.....	1886	464,500	142,500	232,000	90,000
Duluth harbor, Minn., and Superior harbor, Wis.....	1867	5,972,747	1,227,194	4,020,553	725,000
Eagle harbor, Mich.....	1867	97,000	97,000		
Grand Marais harbor, Minn.....	1879	172,350	117,350	50,000	5,000
Grand Marais harbor of refuge, Mich.....	1880	485,598	231,250	224,348	30,000
Keweenaw Point waterway, Mich.....	1886	1,891,675	380,000	1,511,675	
Marquette harbor, Mich.....	1867	697,230	394,230	273,000	30,000
Ontonagon harbor, Mich.....	1867	368,100	308,100	55,000	5,000
Presque Isle harbor of refuge, Mich.....	1896	58,500		58,500	
Portage Lake harbor of refuge, Mich.....	1879	379,500	100,500	269,000	10,000
Port Wing harbor, Wis.....	1902	46,992		44,992	2,000
St. Marys river, falls, and canal, including Hay Lake and Neebish channels, Mich.....	1856	17,082,510	6,408,376	9,474,134	1,200,000
Lakes Huron and St. Clair.....	1852	10,845,772	3,803,766	4,637,506	2,404,500
Alpena harbor, Mich.....	1876	55,500	35,000	16,500	4,000
Au Sabie river and harbor, Mich.....	1867	113,970	113,970		
Belle river, Mich.....	1881	29,000	14,000	15,000	
Black river, Mich.....	1888	96,000	45,000	45,000	6,000
Cheboygan harbor, Mich.....	1871	198,500	148,000	35,500	15,000
Clinton river, Mich.....	1852	80,564	51,500	26,564	2,500
Detroit river, Mich.....	1874	5,854,500	703,000	3,001,500	2,150,000
Pine river, Mich.....	1875	15,500	5,000	10,500	
St. Clair river and canal, Mich.....	1852	1,445,928	944,546	501,382	
Saginaw river, Mich.....	1866	943,750	568,750	300,000	75,000
Sand Beach harbor of refuge, Mich.....	1871	1,053,500	1,160,000	643,500	150,000
Sebewaing river, Mich.....	1875	59,000	15,000	42,000	2,000
Lake Michigan.....	1826	23,851,630	11,137,784	10,546,394	2,167,452
Algoma (Ahnapee) harbor, Wis.....	1871	249,000	166,000	40,000	43,000
Arcudia harbor, Mich.....	1905	12,000		6,000	6,000
Calumet harbor, Ill.....	1870	1,567,230	432,400	1,114,830	20,000
Calumet river, Ill. and Ind.....	1884	974,219	180,000	602,719	191,500
Cedar River harbor, Mich.....	1882	30,000	30,000		
Chicago harbor and river, Ill.....	1833	4,037,402	2,104,005	1,383,457	550,000
Charlevoix harbor, Mich.....	1876	224,500	102,500	98,000	20,000
Frankfort harbor, Mich.....	1866	478,160	273,660	184,500	20,000
Gladstone harbor, Mich.....	1905	14,000		14,000	
Grand Haven harbor, Mich.....	1852	918,866	623,866	245,000	50,000
Grand river, Mich.....	1881	513,000	50,000	375,000	88,000
Green Bay harbor, Wis.....	1866	529,078	297,550	226,528	5,000
Holland (Black Lake) harbor, Mich.....	1852	702,767	274,615	289,700	138,452
Kalamazoo river, Mich.....	1896	175,000		175,000	(1)
Kenosha harbor, Wis.....	1844	516,307	245,307	249,000	22,000
Keweenaw harbor, Wis.....	1881	177,800	75,000	97,800	5,000
La Plaisance bay, Mich.....	1826	19,714	19,714		
Ludington harbor, Mich.....	1867	763,435	352,435	311,000	100,000

¹ Included with appropriation for Saugatuck harbor.

TABLE 39.—CONGRESSIONAL APPROPRIATIONS FOR THE SURVEY, IMPROVEMENT, AND MAINTENANCE OF THE HARBORS, CHANNELS, AND TRIBUTARY STREAMS OF THE GREAT LAKES AND ST. LAWRENCE RIVER, BY LOCALITIES AND PERIODS—Continued.

LOCALITY.	Date of earliest appropriation.	APPROPRIATIONS.			
		Total.	Up to and including 1890.	1891 to 1906, inclusive.	March 2, 1907.
Lake Michigan—Continued.					
Manistee harbor, Mich.	1867	\$472,000	\$298,000	\$149,000	\$25,000
Manistique harbor, Mich.	1880	56,000	6,000	25,000	25,000
Manitowoc harbor, Wis.	1852	658,560	307,820	250,740	100,000
Menominee harbor and river, Mich. and Wis.	1871	404,420	266,000	133,420	5,000
Michigan City harbor, Ind.	1836	1,643,669	1,118,169	465,500	60,000
Milwaukee bay and harbor and harbor of refuge, and South Milwaukee, Wis.	1836	2,086,975	881,087	1,005,888	200,000
Muskegon harbor, Mich.	1867	779,500	320,000	375,500	75,000
New Buffalo harbor, Mich.	1852	83,000	83,000	.....	.....
Oconto harbor, Wis.	1881	96,000	68,000	28,000	.....
Pensaukee harbor, Wis.	1882	16,000	15,000	1,000	.....
Pentwater harbor, Mich.	1867	325,820	233,820	72,000	120,000
Petoskey harbor, Mich.	1890	125,500	15,000	93,000	17,500
Port Washington harbor, Wis.	1870	204,900	177,500	27,400	.....
Racine harbor, Wis.	1844	560,720	264,785	245,935	50,000
St. Josephs harbor and river, Mich.	1836	888,563	370,613	501,950	16,000
Saugatuck harbor, Mich.	1868	292,230	140,439	76,800	75,000
Sheboygan harbor, Wis.	1852	623,071	318,449	264,622	40,000
South Haven harbor, Mich.	1867	407,300	207,000	160,300	40,000
Sturgeon Bay and Lake Michigan Ship Canal and harbor of refuge, Wis.	1873	873,705	168,000	685,705	20,000
Two Rivers harbor, Wis.	1871	330,100	203,500	45,600	90,000
Waukegan harbor, Ill.	1852	600,500	165,000	445,500	50,000
White Lake harbor, Mich.	1867	347,550	274,550	73,000	(8)
Wolf Lake outlet, Ind.	1896	8,000	.....	8,000	.....
Lake Erie.					
Ashtabula harbor, Ohio.	1826	1,389,069	468,211	900,858	20,000
Black River (Lorain) harbor, Ohio.	1828	1,063,205	232,205	801,000	30,000
Buffalo and Black Rock harbors, N. Y.	1826	8,267,873	2,520,693	4,214,344	1,533,436
Cattaraugus creek, N. Y.	1830	57,410	57,410	.....	.....
Cleveland harbor, Ohio.	1825	5,596,189	1,523,632	3,849,557	223,000
Conneaut harbor, Ohio.	1829	807,637	112,629	735,068	20,000
Cunningham creek, Ohio.	1826	19,781	19,781	.....	.....
Dunkirk harbor, N. Y.	1827	984,837	511,579	473,258	.....
Erie harbor, Pa.	1823	1,436,867	891,867	425,000	120,000
Fairport harbor, Ohio.	1825	950,734	320,874	529,860	100,000
Huron harbor, Ohio.	1826	511,774	139,274	356,500	16,000
Monroe harbor, Mich.	1835	262,440	225,515	31,500	5,425
Port Clinton harbor, Ohio.	1872	104,000	66,000	35,000	3,000
Portland harbor, N. Y.	1836	56,616	56,616	.....	.....
Rocky River harbor, Ohio.	1872	39,000	39,000	.....	.....
Rouge river, Mich.	1853	66,265	20,000	30,630	6,375
Sandusky harbor and river, Ohio.	1826	1,175,192	418,480	631,712	125,000
Toledo harbor, Ohio.	1866	2,598,700	1,209,200	1,889,500	.....
Tonawanda harbor and Niagara river, N. Y.	1881	692,200	181,500	507,700	3,000
Vermilion harbor, Ohio.	1836	163,277	126,701	21,576	15,000
Lake Ontario.					
Black River harbor, N. Y.	1836	42,401	42,401	.....	.....
Charlotte harbor, N. Y.	1828	753,328	469,328	195,500	88,500
Great Sodus Bay harbor, N. Y.	1829	547,497	437,647	59,850	50,000
Little Sodus Bay harbor, N. Y.	1852	470,442	310,942	84,500	75,000
Oak Orchard harbor, N. Y.	1836	207,250	205,000	2,250	.....
Olcott harbor, N. Y.	1867	178,000	163,000	15,000	.....
Oswego harbor, N. Y.	1826	2,223,613	1,765,613	358,000	100,000
Port Ontario harbor, N. Y.	1836	50,000	50,000	.....	.....
Pultneyville harbor, N. Y.	1870	85,000	73,000	6,000	6,000
Sacketts Harbor harbor, N. Y.	1826	20,000	15,000	5,000	.....
Sandy Creek, N. Y.	1828	300	300	.....	.....
South shore of Lake Ontario, harbors of.	1828	400	400	.....	.....
Wilson harbor, N. Y.	1875	74,750	65,000	9,750	.....
St. Lawrence river.					
Cape Vincent harbor, N. Y.	1896	128,000	.....	128,000	.....
Grass river, N. Y.	1882	9,000	9,000	.....	.....
Ogdensburg harbor, N. Y.	1852	417,006	202,006	140,000	75,000
St. Lawrence river, N. Y.	1890	116,000	5,000	111,000	.....
Waddington harbor, N. Y.	1873	35,500	35,500	.....	.....
General appropriations.					
Dredging machinery.	1836	122,683	122,683	.....	.....
Ship channel, Great Lakes.	1892	3,350,000	.....	3,340,000	.....

¹ Includes appropriation for White Lake harbor. ² Includes appropriation for Kalamazoo river. ³ Included with appropriation for Pentwater harbor.

POPULATION AND LAKE COMMERCE.

In the special report on lake transportation, at the census of 1890, a tabular statement showing the population in 1880 and 1890 of cities of 8,000 inhabitants

and over, located within a radius of 50 miles of the Great Lakes and St. Lawrence river, was presented for the purpose of indicating the parallelism between the increase of population in the regions contiguous

to the lakes and the growth of lake commerce. A similar table is presented here, but only lake ports for which there are for 1906 port records of the receipt or shipment of freight are included. The cities that are not situated on navigable waters of the lakes are omitted, for the reason that there is but a remote relationship, if any, between their development and that of the commerce of the lakes.

TABLE 40.—Population of lake ports of 8,000 population and over: 1880 to 1900.

	1900	1890	1880
Aggregate.....	3,670,243	2,496,919	1,319,050
Lake Superior.....	117,730	69,907	11,726
Ashland, Wis.....	13,074	9,976	951
Duluth, Minn.....	52,960	35,115	3,483
Marquette, Mich.....	10,058	9,063	4,690
Sault Ste. Marie, Mich.....	10,538	5,760	1,947
Superior, Wis.....	31,091	11,983	655
Lakes Huron and St. Clair.....	344,292	258,541	152,060
Alpena, Mich.....	11,802	11,283	6,153
Bay City, Mich.....	27,628	27,839	20,693
Detroit, Mich.....	285,794	205,876	116,340
Port Huron, Mich.....	19,158	13,543	8,883
Lake Michigan.....	2,185,353	1,450,601	701,518
Chicago, Ill.....	1,008,575	1,009,850	503,185
Escanaba, Mich.....	9,549	6,808	3,026
Green Bay, Wis.....	18,684	9,069	7,464
Kenosha, Wis.....	11,606	6,532	5,039
Manistee, Mich.....	14,260	12,812	6,930
Maritowoc, Wis.....	11,786	7,710	6,367
Marinette, Wis.....	16,195	11,523	2,750
Menominee, Mich.....	12,818	10,030	3,288
Michigan City, Ind.....	14,850	10,776	7,366
Milwaukee, Wis.....	285,315	204,468	115,587
Muskegon, Mich.....	20,818	22,702	11,262
Racine, Wis.....	29,102	21,014	16,031
Sheboygan, Wis.....	22,962	16,359	7,314
Traverse City, Mich.....	9,407	4,833	1,897
Waukegan, Ill.....	9,426	4,915	4,012
Lake Erie.....	988,036	684,966	422,280
Ashtabula, Ohio.....	12,949	8,338	4,445
Buffalo, N. Y.....	352,387	255,664	155,134
Cleveland, Ohio.....	381,768	261,353	160,146
Dunkirk, N. Y.....	11,616	9,416	7,248
Erie, Pa.....	52,733	40,634	27,737
Lorain, Ohio.....	16,028	4,863	1,595
North Tonawanda, N. Y.....	9,069	4,793	.....
Sandusky, Ohio.....	19,664	18,471	15,838
Toledo, Ohio.....	131,822	81,434	50,137
Lake Ontario and St. Lawrence river.....	34,832	33,504	31,457
Ogdensburg, N. Y.....	12,633	11,662	10,341
Oswego, N. Y.....	22,199	21,842	21,116

¹ Township figures for 1880.

It is an interesting subject of speculation to attempt to measure the extent of the influence exerted upon the general progress of these cities by their situation as lake ports. It may be regarded as an established fact that their original location was the direct result of their situation; their subsequent development, however, may have been in part produced by other causes.

The great wave movements of the population from the older countries to the newer which have resulted from the increase in population or from other causes, have been generally along the natural highways to regions of better natural resources, and the early settlement of the lake region and its subsequent development have been characterized by all the phases which have marked similar movements elsewhere.

The first settlements along these waters were the military posts made necessary for defensive and stra-

tegic purposes, by the fact that the lakes formed the boundary between the British colonies and the French dominions, and later between the United States and Canada. These posts were located at the most advantageous points for aggression and defense at river mouths and on the channels between the lakes, and naturally formed central points of future populous settlements by attracting many to their vicinity for protection against the Indians and for better social intercourse. The fur trading stations also were in some cases the nuclei of what are now important cities.

A comparison of the statistics of population for certain cities shown in Table 40 with the figures for the receipts and shipments of freight in Table 17 discloses some interesting parallels. If the aggregate figures in both tables are compared, it is seen that the growth in population has been accompanied by a greater growth in lake commerce. It is by comparison of the figures for individual cities, however, that the most marked effects of this commerce upon population may be observed. With the exception of Marquette, Mich., all the cities shown for Lake Superior exhibit substantial increases in their population, and it is not an unreasonable conclusion that the great development of the traffic in iron ore and grain was largely responsible for this growth. The freight statistics show that the shipments of iron ore, which is the principal source of Marquette's lake traffic, were about equal for that port in 1906 and 1889, and to this fact may be attributed the slight increase in population from 1890 to 1900.

The decay of the lumber industry and the consequent decrease in the shipments from Alpena and Bay City on Lake Huron, are accompanied by an arrested growth of the population of those cities. Detroit, in so far as its receipts and shipments of lake freight are concerned, is not an important port considering its population, but its other interests, manufacturing and commercial, are so large that the growth of the city is not materially affected.

The effect that the exhaustion of the timber supply has had in retarding the growth of cities is also observed in several of the cities on Lake Michigan. This is notably the case with Muskegon, which, during the decade from 1890 to 1900, suffered a loss in population. From 1889 to 1906, as shown by Table 17, the receipts of lake freight at the port declined very much, while its shipments dwindled to about one-fourteenth of their former proportions.

Of the ports on Lake Erie, with but a single exception—Sandusky, Ohio, which shows but a slight increase in population—the cities included in Table 40 have made very large increases in their population, and it may fairly be assumed that the enormous increase in their lake commerce has exerted no small influence in promoting this growth.

Finally, Ogdensburg and Oswego, ports on the St. Lawrence river and Lake Ontario, respectively, have remained almost stationary in population at the

last three censuses, and this condition has been accompanied by a steadily diminishing importance of American commerce on those waters.

In connection with the lessening importance of the lumber ports, it may be said that in some of the cases cited, the shipment of this commodity is but incident to its manufacture, so that it may reasonably be claimed that the arrested development noted is caused by the reduction in their importance in that regard rather than in the concomitant decrease in shipments. This can not, however, be said of those ports which derive their importance from the volume of receipts or shipments of other commodities, for example, iron ore and grain. In such cases the cities are not directly affected by the production of these staples, the source of which is more or less remote, but are affected only as they afford an outlet to distant markets or as they stand as receiving ports.

CONCLUSION.

The chain of Great Lakes forms the natural highway for the transportation of the great staples of the Northwest from the farm, factory, forest, and mine to eastern points of consumption, and for the shipment westward of coal, principally, and of other merchandise in smaller proportions, when the charge for breaking bulk does not exceed the difference between the rail and the water rate and when the greater length of time required is not of serious moment.

The continued expansion of the shipping interests in the future must depend chiefly upon the transportation of these bulky commodities, such as iron ore, grain, and coal; but there is also much room for greater development in the transportation of the lighter miscellaneous merchandise and for improvement in the methods of handling it at the wharves in the shape of better depot, warehouse, and terminal facilities. In recognition of these facts new freight vessels of large tonnage are constantly being added to the lake fleet, although this can not continue indefinitely without increasing the depth of the main channels, while the lakes will share with the rest of the world the advan-

tages of whatever progress may be made in the future in ship and engine construction.

The general interest now being manifested in the improvement of the waterways of the country will probably result in greater attention being paid to the needs of the lakes. In view of this widespread interest the remarks of Alexander Hamilton in regard to the improvement of navigation seem singularly pertinent at this time.

The symptoms of attention to the improvement of inland navigation, which have lately appeared in some quarters, must fill with pleasure every breast warmed with a true zeal for the prosperity of the country. * * * This is one of those improvements which could be prosecuted with more efficacy by the whole than by any part or parts of the Union.¹

A great desideratum, in particular in connection with lake navigation, undoubtedly is better communication within the United States between Lakes Erie and Ontario.

As early as 1853 James Fenimore Cooper, in the preface to one of his works of fiction, forecasted the progress that would be made in the region of the Great Lakes:

Ontario in our time has been the scene of important naval evolutions. Fleets have maneuvered on those waters, which half a century ago were as deserted as waters well can be; and the day is not distant when the whole of that vast range of lakes will become the seat of empire and fraught with all the interests of human society.²

This prevision of events was but a faint conception of the actual developments, and it was little thought at that time that Ontario would prove the least important member of this great system of commercial highways.

The merchant marine of the Great Lakes considered in all its aspects can not but be regarded as a highly beneficent element of the commercial interests of the United States. It is in freight reduction and regulation that its greatest benefits are felt, although the profits received by those participating directly in the trade and the wages paid to those employed by it are not inconsiderable.

¹ Alexander Hamilton, Secretary of the Treasury, Report on the Subject of Manufactures, page 238.

² The Pathfinder, preface.

TABLE 41.—ALL VESSELS, BY CLASS,

	CLASS, OCCUPATION, AND OWNERSHIP.	Number of vessels.	TONNAGE.		RIGGED.				HORSEPOWER OF ENGINES.		
			Gross.	Net.	Screw.	Side wheel.	Stern wheel.	All other.	Steam.	Gasoline.	All other.
1	Aggregate.....	2,990	2,392,863	1,905,176	1,616	51	8	1	976,847	5,700	8
2	Steam.....	1,676	1,915,786	1,452,228	1,616	51	8	1	976,847	5,700	8
3	Freight and passenger.....	932	1,842,251	1,406,674	890	37	5		811,004	1,333	
4	Tugs and other towing vessels.....	382	22,663	13,312	376	5	1		89,451	164	
5	Ferryboats.....	48	35,581	21,621	43	3	1	1	49,001	116	
6	Yachts.....	236	6,210	4,280	235		1		12,387	3,923	8
7	All other.....	78	9,081	6,341	72	6			15,004	164	
8	Individual.....	536	126,160	97,555	527	8	1		40,606	4,733	8
9	Freight and passenger.....	196	114,702	89,888	192	4			65,232	986	
10	Tugs and other towing vessels.....	94	3,592	2,084	93	1			11,494	68	
11	Ferryboats.....	12	693	431	11		1		1,121	70	
12	Yachts.....	204	5,673	3,880	204				11,408	3,445	8
13	All other.....	30	1,500	1,272	27	3			1,351	164	
14	Firm.....	297	71,009	54,402	202	3	2		55,957	515	
15	Freight and passenger.....	113	67,317	52,071	112	1			43,409	228	
16	Tugs and other towing vessels.....	59	2,326	1,338	57	1	1		10,668	16	
17	Ferryboats.....	5	137	93	5				160	6	
18	Yachts.....	23	445	318	22		1		979	265	
19	All other.....	7	784	582	6	1			741		
20	Incorporated company.....	905	1,714,669	1,297,949	850	40	5	1	818,058	370	
21	Freight and passenger.....	621	1,659,308	1,264,024	584	32	5		701,423	119	
22	Tugs and other towing vessels.....	225	16,446	9,718	222	3			65,888	80	
23	Ferryboats.....	30	34,721	21,072	26	3	1		47,720		
24	Yachts.....	6	66	58	6					171	
25	All other.....	23	4,128	3,077	21	2			3,027		
26	Miscellaneous.....	28	3,948	2,322	28				12,226	82	
27	Freight and passenger.....	2	924	601	2				940		
28	Tugs and other towing vessels.....	4	299	172	4				1,401		
29	Ferryboats.....	1	30	25	1					40	
30	Yachts.....	3	26	24	3					42	
31	All other.....	18	2,669	1,410	18				9,885		
32	Sail.....	531	265,571	249,535							
33	Freight and passenger.....	403	263,837	247,891							
34	Yachts.....	122	1,458	1,354							
35	All other.....	6	276	260							
36	Individual.....	301	59,578	56,586							
37	Freight and passenger.....	199	58,321	55,395							
38	Yachts.....	97	1,170	1,110							
39	All other.....	5	87	81							
40	Firm.....	115	34,900	33,032							
41	Freight and passenger.....	90	34,428	32,584							
42	Yachts.....	24	283	260							
43	All other.....	1	189	179							
44	Incorporated company.....	112	170,267	159,137							
45	Freight and passenger.....	112	170,267	159,137							
46	Yachts.....										
47	All other.....										
48	Miscellaneous.....	3	826	780							
49	Freight and passenger.....	2	821	775							
50	Yachts.....	1	5	5							
51	All other.....										
52	Unrigged.....	783	211,506	203,413							
53	Canal boats.....	6	1,134	1,122							
54	All other.....	777	210,372	202,291							
55	Individual.....	138	18,437	18,055							
56	Canal boats.....	2	264	262							
57	All other.....	136	18,173	17,793							
58	Firm.....	107	26,927	25,320							
59	Canal boats.....										
60	All other.....	107	26,927	25,320							
61	Incorporated company.....	519	159,195	153,346							
62	Canal boats.....	4	870	860							
63	All other.....	515	158,325	152,486							
64	Miscellaneous.....	19	6,947	6,692							
65	Canal boats.....										
66	All other.....	19	6,947	6,692							

GREAT LAKES AND ST. LAWRENCE RIVER.

OCCUPATION, AND OWNERSHIP: 1906.

CONSTRUCTION.				Value of ves- sels.	INCOME.			Number of employees.	Wages.	Number of passengers carried.	
Iron.	Steel.	Wood.	Com- posite.		Freight.	Passengers	All other.				
33	539	2,391	27	\$130,805,640	\$52,076,533	\$4,866,904	\$8,331,265	24,916	\$13,250,716	14,080,146	1
32	457	1,172	15	116,983,812	47,227,424	4,866,904	4,245,899	20,515	11,179,882	14,080,146	2
24	388	510	10	107,897,440	46,832,834	4,408,880	1,271,337	17,279	9,269,490	5,814,639	3
0	33	342	1	2,630,097	357,944	1,168	2,115,009	1,659	1,081,913	1,025	4
2	14	34	4	3,429,532	456,856	465,982	465,982	656	308,156	8,264,482	5
2	10	220	4	1,673,000	36,646	4,422	4,422	441	151,055	6	6
12	66	66	4	1,353,743	389,149	389,149	389,149	480	399,268	7	7
11	30	487	8	6,664,550	2,639,573	297,043	671,897	2,503	1,216,624	1,333,019	8
7	17	169	3	4,509,800	2,506,193	267,163	160,896	1,592	824,373	1,081,178	9
2	5	86	1	440,050	73,380	348,394	348,394	359	183,589	1,025	10
2	8	12	4	60,800	28,712	3,600	3,600	37	11,773	250,816	11
2	8	100	4	1,544,700	4,350	4,350	4,350	406	141,673	12	12
2	11	103,200	4	103,200	154,657	154,657	154,657	109	55,216	13	13
2	11	194	4	2,813,500	1,921,755	112,786	411,484	1,534	737,711	592,956	14
1	6	109	7	2,373,750	1,802,505	98,386	192,112	1,213	577,349	304,956	15
1	3	55	7	270,200	119,250	191,031	191,031	250	129,216	16	16
2	2	5	7	12,350	14,400	14,400	14,400	13	5,250	288,000	17
2	7	21	7	111,700	28,341	28,341	28,341	25	6,942	18	18
2	7	7	7	45,500	28,341	28,341	28,341	33	18,954	19	19
19	405	474	7	106,473,369	42,645,226	4,456,425	3,154,905	16,241	8,992,737	12,141,171	20
16	305	233	7	100,991,390	42,443,266	4,043,331	915,893	14,462	7,856,896	4,428,505	21
3	23	199	7	1,880,847	165,314	1,574,429	1,574,429	1,032	756,956	22	22
3	14	16	7	3,346,782	413,094	413,094	413,094	603	290,533	7,712,666	23
3	8	8	7	13,600	50	50	50	6	2,016	24	24
3	3	20	7	240,750	36,646	202,151	202,151	138	86,336	25	25
3	11	17	7	1,032,393	20,870	650	7,613	237	232,810	13,000	26
2	2	2	7	22,500	20,870	2,436	2,436	12	10,872	27	27
2	1	1	7	39,000	1,155	1,155	1,155	18	12,152	28	28
2	3	3	7	3,600	650	650	650	3	600	13,000	29
2	3	3	7	3,000	22	22	22	4	424	30	30
2	9	9	7	964,293	4,000	4,000	4,000	200	208,762	31	31
1	34	494	2	7,135,271	4,317,542	23,632	23,632	2,258	962,542	32	32
1	33	370	2	6,924,071	4,317,542	10,960	10,960	2,161	940,174	33	33
1	1	118	2	204,850	72	72	72	84	20,143	34	34
1	6	6	2	6,350	3,600	3,600	3,600	13	2,225	35	35
1	1	299	2	1,136,260	1,192,747	11,763	11,763	863	332,516	36	36
1	1	199	2	967,510	1,192,747	9,291	9,291	783	313,583	37	37
1	1	95	2	104,400	72	72	72	72	17,508	38	38
1	5	4,350	2	4,350	2,400	2,400	2,400	8	1,425	39	39
1	113	471,361	2	471,361	875,402	8,800	8,800	514	224,343	40	40
1	90	430,411	2	430,411	875,402	7,600	7,600	498	221,208	41	41
1	22	38,950	2	38,950	1,200	1,200	1,200	11	2,335	42	42
1	1	2,000	2	2,000	1,200	1,200	1,200	5	800	43	43
1	33	79	2	5,517,150	2,229,840	3,069	3,069	872	399,500	44	44
1	33	79	2	5,517,150	2,229,840	3,069	3,069	872	399,500	45	45
1	3	10,500	2	10,500	19,553	19,553	19,553	9	6,183	46	46
1	2	9,000	2	9,000	19,553	19,553	19,553	8	5,883	47	47
1	1	1,500	2	1,500	19,553	19,553	19,553	1	300	48	48
1	48	725	10	6,080,557	531,567	4,061,734	4,061,734	2,143	1,138,292	49	49
1	6	13,800	10	13,800	6,500	1,290	1,290	15	2,801	50	50
1	719	6,072,757	10	6,072,757	525,067	4,060,444	4,060,444	2,128	1,135,491	51	51
1	180	554,600	1	554,600	25,730	332,216	332,216	206	93,802	52	52
1	2	4,000	1	4,000	25,730	900	900	2	221	53	53
1	134	550,600	1	550,600	25,730	331,316	331,316	204	93,581	54	54
1	4	103	1	740,675	98,899	623,366	623,366	338	169,922	55	55
1	4	103	1	740,675	98,899	623,366	623,366	338	169,922	56	56
1	43	467	9	5,320,422	406,938	3,106,002	3,106,002	1,559	846,737	57	57
1	4	9,800	9	9,800	6,500	390	390	13	2,580	58	58
1	43	463	9	5,310,622	400,438	3,103,612	3,103,612	1,546	844,157	59	59
1	19	70,800	9	70,800	150	150	150	40	27,831	60	60
1	19	70,800	9	70,800	150	150	150	40	27,831	61	61
1	19	70,800	9	70,800	150	150	150	40	27,831	62	62
1	19	70,800	9	70,800	150	150	150	40	27,831	63	63
1	19	70,800	9	70,800	150	150	150	40	27,831	64	64
1	19	70,800	9	70,800	150	150	150	40	27,831	65	65
1	19	70,800	9	70,800	150	150	150	40	27,831	66	66