made in 1883, was expended in cutting a straight outlet from the Chicago river into the lake. The available depth was only 2 feet, but since then the harbour accommodation has been extended, by means of piers, dredging, and a breakwater, to accommodate vessels of 14 feet draught.

The harbour works at Chicago, as well as at other lake and river ports, are constructed simply of cribs or boxes, composed of logs 12 by 12 inches, filled with stone, and joined to each other, after they have finally settled down, by a continuous timber superstructure raised a few feet above the level of the water. On this plan break­waters, piers at the mouths of rivers, and wharves have been built within the last sixty years at the most important points along the shores of the St Lawrence lakes, as well as at most of the river harbours communicating with the Atlantic ; and experience has proved that no cheaper and better system could have been devised for such localities.

The St Lawrence leaves Lake Huron by the St Clair river at Sarnia, and after a course of 33 miles enters Lake St Clair, 25 miles long, and terminating at the head of the Detroit river, near the city of Detroit in Michigan. Eighteen miles farther on the St Lawrence, with a descent of 11 feet, enters Lake Erie. The naviga­tion through the St Clair river is easy throughout, but in Lake St Clair there are extensive sandbanks covered with a depth of water varying from 6 to 10 feet. Previous to 1858 much inconvenience was experienced in navigating the lake owing to its insufficient depth; but at the end of that year the Governments of the United States and Canada dredged a canal through the bed of the lake, which is of soft material, to a minimum depth of 12 feet, with a width of 300 feet. This channel has since been deepened to 16 feet over a width of 200 feet, and works are now in progress to deepen the rocky shoal called the “Lime-Kiln Crossing” in the Detroit river to 18 feet, to enable vessels drawing 15 feet to pass with safety from lake to lake in stormy weather.

The peculiar features of Lake Erie are its shallowness and the clayey nature of its shores, which are generally low. The south shore is bordered by an elevated plateau, through which the rivers, which are without importance as regards Lake Erie, have cut deep channels. The mean depth of the lake is only 90 feet and its maximum depth 204. Owing to its shallowness it is easily disturbed by the wind, and is therefore the most dangerous to navigate of all the great lakes. Its length is 250 miles and its greatest breadth 60. The area of the basin of Lake Erie is 39,680 square miles, including 10,000 square miles, the area of the lake. Its waters are 564 feet above the sea and 330 above Lake Ontario. The extreme difference observed in the level of the lake between 1819 and 1838 was 5 feet 2 inches, but the average annual rise and fall (taken on a mean of twelve years) is only 1 foot 11/2 inches. The mean annual rainfall is 34 inches. The navigation of Lake Erie usually opens about the middle of April and closes early in December. Besides the Erie and the Welland Canals, the lake has two other great canal systems on its south shore,—the Ohio and Erie Canal, from Cleve­land to Portsmouth, and the Miami and Erie Canal, from Toledo to Cincinnati.

Buffalo (population, 171,500 in 1883) is situated at the north- east angle of Lake Erie, and is therefore much exposed to the violence of south-west winds, in which direction the lake has a “fetch” of 200 miles. Thus more than ordinary care has been taken to provide safe harbour accommodation for the large fleets of vessels constantly arriving at Buffalo from the upper lakes. The Buffalo river, which has been made navigable for more than a mile, is protected at its mouth by a breakwater, 4000 feet long, built at about half a mile from the shore. The harbour thus formed allows of the entrance of vessels of 17 feet draught as against 13 in 1853. Not only is the port situated at the head of the Erie Canal and within an hour’s sail of the Welland Canal, but it is the western terminus of the New York Central, Erie, and several other railways. The possession of these exceptional advantages has constituted Buffalo the great commercial centre of the inland seas of North America. For the six years ending 1883 the yearly average shipments of wheat and corn received by lake at Buffalo, by the Erie

Canal, and by rail from elevators was 5,555,000 quarters by canal and 2,320,000 by rail, or 70·20 and 29·80 per cent. respectively. There are 38 elevators in the city, comprising storage, transfer, and floating elevators, with a combined storage capacity of 1,125,000 quarters and a daily transfer capacity of 333,000 quarters. During the ten years ending 1883 the annual average number of lake vessels arriving and departing from Buffalo Creek numbered 7438, the aggregate tonnage was 4,165,098 tons, and the average size of craft 560 tons.

In 1883 the enrolled tonnage of the United States vessels for the northern lakes, and the enrolled registered tonnage of steam and sailing vessels in the province of Ontario, including tugs and barges on the Ottawa river and barges at Kingston, were as follows (Table II.):—

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | United States. | | Canada. | |
| No. | Aggregate  Tonnage. | No. | Aggregate  Tonnage. |
| Sailing vessels | 1373 | 310,454 | 452 | 44,000 |
| Steam vessels | 1149 | 304,649 | 352 | 64,000 |
|  | 2522 | 615,103 | 804 | 108,000 |

Freight propellers are now rapidly doing away with sailing vessels, or causing them to be converted into barges or consorts. The rapid increase in their tonnage capacity has been remarkable. In 1841 there was only 1 freight propeller with a tonnage of 128 tons; in 1850 there were 50 with an average of 215 tons, in 1860 there were 197 with an average of 340 tons, and in 1880 there were 202 with an average of 689 tons.

The Erie Canal connects Lake Erie with the Hudson river at Troy and Albany and with Lake Ontario at Oswego. The movement of freight of all kinds by the canal was 3,602,535 tons in 1873, and 3,587,102 in 1883, and the average annual movement from 1874 to 1883 was 3,447,464 tons. This canal was constructed in 1825 by the State of New York, for the passage of vessels of 60 tons ; but by the year 1862 it was sufficiently enlarged to allow of the passage of vessels of 240 tons. The dimensions and capacity of the canal and its two principal feeders are given in Table III.:—

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Locality. | Length in Miles. | Size of Canal. | | | No. & Size of Locks. | | | Rise of Lockage. |
| width on Surface. | Width on Bottom. | Depth of Water. | No. of Locks.  .. | g |  |
| Buffalo to Albany .... Oswego to Syracuse .. Lake Champlain to Al-  bany | 351  38  66 | Feet.  70  70  50 | Feet.  56  56  35 | Feet.  7  7  5 | 72  18  20 | Feet.  110  110  100 | Feet.  18  18  18 | Feet.  655  155  180 |
| Albany to New York by the Hudson river | 455  145 |  |  |  |  |  |  |  |

The cost of construction, maintenance, and management of the 455 miles of canal up to 30th September 1873 amounted to £17,460,000. A project has for some time been under serious consideration for the enlargement of one tier of the present locks and the deepening of the canal so that between Buffalo and Albany there would nowhere be a less depth than 8 feet. The estimated cost of this work is about £1,600,000.

The Welland Canal flanks the Niagara river and is 27 miles in length from Port Colborne on Lake Erie to Port Dalhousie on Lake Ontario. It was opened in 1833 for the navigation of small vessels and was first enlarged in 1844. Vessels, however, continued to increase in size until in 1860 there were 341 with an aggregate tonnage of 143,918 tons which were unable to pass through the enlarged canal. In 1870 the number that could not pass had increased to 384, with an aggregate tonnage of 194,685 tons; in 1880 to 460, with an aggregate tonnage of 287,342 tons; and in 1883 (notwithstanding the completion of the second enlargement in 1882) to 557, with an aggregate tonnage of 398,808 tons. The cost of the canal including its maintenance up to 30th June 1883 was $20,859,605. Its dimensions are now as follows :—number of lift locks, 25 ; dimensions, 270 by 45 feet; total rise of lockage, 3263/4 feet; depth of water on sills, 12 feet. The movement of freight of all kinds by the canal was 1,330,629 tons in 1873 and 827,196 in 1883, and the average annual movement for the decade ending 1883 was 986,441 tons. This serious falling off in traffic, is partly due to the numerous competitors by lake and rail which have sprung up during the last ten years for the transportation of products to the east, but principally to the deepening of the channels and harbours of the upper lakes, a work that has encouraged the construction of