The World's Columbian Water Commerce Congress

CHICAGO, 1893

THE CHIGNECTO SHIP RAILWAY

BY

H. G. C. KETCHUM

Chief Engineer of the Chignecto Ship Railway

AMHERST, NOVA SCOTIA

BOSTON
DAMRELL & UPHAM
The Old Corner Bookstore
283 Washington Street

THE CHIGNECTO SHIP RAILWAY.

The transportation of heavy and bulky merchandise over great distances at a cheap cost is of vital importance to consumers everywhere, and this is best done by the water. Water carriage has the advantage over railways that railways have over common roads. Ship railway transportation combined with water carriage, by avoiding transshipment of freight, by short cuts over isthmuses, by the saving of distance, and by avoiding the dangers of the sea, has a manifest advantage over common railways. The introduction of ship railways will mark a revolution in means of transport. A ship railway may be considered the evolution of the ordinary railway. It is the outcome of the necessity of carrying heavy loads. A ship railway is simply a large scale railway, designed for the most economic transport of freight overland. The vessel may be considered as a large car, where the dead weight bears a small proportion to the paying load. As the biggest horses, the strongest vehicles, carry with the greatest economy on ordinary roads, so, with low speed, powerful locomotives and the most capacious cars become the economic desiderata of transportation on railways. The rolling stock of railways has grown to great dimensions of late years. Train loads have nearly doubled in weight and length within the last fifteen years, requiring engines of growing power and cars of growing capacity, involving larger rails, better ballast, and stronger fish joints. This is in order to reduce the cost of transportation of freight and increase the speed for passenger service. The struggle with all railways has been to reduce the dead weight, so as to increase the paying load. Ten-ton cars were in vogue up

to 1875. Then in 1882 this was increased to twenty-ton cars; and recently a standard car to carry thirty tons has been decided on, while the car itself shall not exceed twelve tons.

Fortunate are the companies that are already supplied with permanent way and bridges adequate to the increasing weight of locomotives and ever-growing trains. The experience so tardily and expensively gained by common railways teaches the advantages of ship railway transportation.

The object of the Chignecto Ship Railway is to afford cheap, rapid, and safe passage for vessels between the Gulf of St. Lawrence and the Bay of Fundy. Over two-thirds of the sea-going traffic of the Bay of Fundy is with the United States and the country south. The Atlantic Ocean bordering on Nova Scotia, with its iron-bound coast, its fogs, its shifting currents, its reefs and shoals, its Sable Island (the graveyard of commercial navies), its risks and out-lying dangers to vessels, operate as almost a prohibition to that extension of commercial intercourse by water between the Gulf of St. Lawrence and the Eastern States which is the great want of the day. Vessels have now to make a long detour around the Atlantic Coast, either passing through the Strait of Canso or round Cape Breton. The loss inflicted on commerce for lack of the short means of transit across the isthmus is simply incalculable. The object of the ship railway is therefore to cut the barrier of the Isthmus of Chignecto, to extend the commerce of the Bay of Fundy into the Gulf of St. Lawrence, and to extend the navigable water communication of the Gulf and River St. Lawrence indefinitely south. The ship railway will offer a considerable saving for steamers and sailing vessels, which may thus be summarized: —

(1) Steamers passing through the Gulf of St. Lawrence to St. John, N.B., via the Straits of Canso, will save 500 miles, and from 300 miles and upwards to Portland, Boston, etc., so that in many cases steamers will be able to

make two trips where now only one can be made. Large sailing vessels, which are unable to pass through the Straits of Canso without waiting for favorable winds, and which have in consequence to pass round Cape Breton, would save 700 miles. Such a saving is of the utmost importance in the case of vessels with perishable cargoes, such as vegetables, fresh fish, etc.

(2) There will be a saving in marine insurance premiums, the present rates from Boston to ports in the Gulf of St. Lawrence being about double those to the Bay of Fundy, owing to the increased risk of navigation round Nova Scotia and Cape Breton.

(3) Vessels will be able to pass by the railway earlier in the spring and later in the autumn than they could otherwise do when the Straits of Canso are blocked with ice, thus extending the period of navigation three weeks or thereabouts.

(4) Vessels which from their build are not suited to navigate the ocean coast of Nova Scotia will be able to pass from the north to the south side of the isthmus, so that vessels built and adapted only for inland waters will be able to continue their course with safety from the St. Lawrence and even the western lakes to St. John, N.B., Portland, and Boston, or *vice versa*, thus opening a new channel of trade.

The existing commerce between Canada and the United States would in this way be greatly stimulated and developed by the railway. A large trade may be anticipated between the western lake ports and those of the New England States, when a vessel loaded with grain can come direct from Montreal and the lakes to Boston without breaking bulk, thus avoiding transshipment of cargoes and carriage by rail, as at present.

No corresponding district of country in America possesses resources that are at once so diversified and so extensive as the territories bordering the Gulf of St. Lawrence. The fisheries will be for all time a source of

food supply for the nations and of boundless wealth to the provinces. For a hundred years the forests of Northern New Brunswick have been an important element of supply in the British lumber markets. The lumber now going to England in the form of deals will find a more certain market in the United States. Where is there a more prolific soil than the rolling lands of Prince Edward Island or along the south shores and rivers of the gulf? Added to these resources are coal mines and quarries yet in the infancy of their development. The territory east of Quebec does a foreign business, entering and clearing, amounting to 7,000,000 tons of shipping. With rapid, cheap, and safe transit across the Isthmus of Chignecto, with freer trade between the United States and Canada, no one will venture to state a limit to the growth and development of a territory that is so grand in its resources. If the ports along the Bay of Fundy can to-day afford a business with the United States and the country south of 2,000,000 tons inwards and outwards, being almost two-thirds of their total tonnage, who is bold enough to predict that the more abundant resources of the St. Lawrence will not produce a commerce vastly greater? When a new avenue of commerce is opened between the Atlantic and the gulf, those pent-up energies will receive a great impulse. A revolution in trade will result, for the possibilities of future development of wealth and of prosperity are well-nigh boundless. By the Chignecto Ship Railway, propellers and vessels of 1,000 tons' burthen now navigating the lakes will be able to come even from Chicago to the gulf, and continue their course in quiet water, through the sheltered Bay of Fundy to St. John, Portland, and Boston.

The distance saved would be 500 miles between St. John and the great cities of Canada over the present route by Canso and 700 miles via Cape Breton. An inland lake vessel loaded with grain would be able to come direct from Chicago to Boston without breaking bulk;

while the usual vessel, on account of its build, could not face the present route by the ocean coast of Nova Scotia. There is practically an unlimited market in the Western States and Canada for Bay of Fundy lime, plaster, coal, and building stone, which could be exchanged for flour, meal, oil, and manufactures of the West. At present, building stone quarried on the shores of the Bay of Fundy is carried by rail from Sackville, N.B., to Toronto and Buffalo. These products would find a more profitable market if the Bay of Fundy were in ready access to the St. Lawrence by water. Prince Edward Island has an annual surplus of farm products, principally potatoes. These require quick transit at cheap rates, which cannot be given by the long route by Cape Canso or by rail. A ship railway would allow steamers to place the island products in the markets of New England three weeks earlier in the spring and later in the fall of the year than by the present route through the Strait of Canso, owing to ice accumulating there.

The trade between Canada and the West Indies and South America now amounts to $10,000,000 per annum. It is certain that this trade will be greatly stimulated on the completion of this ship railway, because the varied products of Canada can be collected and shipped to these places without expensive rail carriage, and exchanged for products of the tropics.

Preliminary steps have been taken for the purpose of organizing a steamship company to run from Montreal, or some farther inland port, to ports in the West Indies in summer and from St. John in the winter. The open port of St. John would likely become the depot of all tropical products, which would be forwarded as return cargoes in exchange for the manufactures of the Western Provinces and States.

It has already been stated that the tonnage of the St. Lawrence and Bay of Fundy inwards and outwards amounts to 11,000,000 tons.

The revenues are estimated on a basis of tolls which will induce ship-owners to send their vessels across the isthmus. Vessels in ballast will be carried at almost nominal rates, and the toll of vessels with cargoes will be graduated according to the value of the cargo and the toll it can bear. It is resolved to make it a commercial success.

This work is unique among the public works of Canada. The Canadian government has granted a subsidy of $170,600 a year for twenty years after the completion of the work, but this subsidy is repayable to the government as soon as there is any excess over seven per cent. dividend on the capital of the company. No money has been furnished directly or indirectly by the treasury of Canada. A more advantageous plan for carrying on a public work in the interests of the people of Canada could scarcely be devised. The money spent has been wholly found in England by a private company on the basis of the government guarantee and Canadian credit.

It may be of interest to refer for a moment to the question, "Why was the ship railway finally adopted in place of a canal?"

The construction of the proposed canal has been variously estimated at from $5,500,000 to $8,000,000, every dollar of which would have had to be provided by the taxpayers of Canada; for no company would have undertaken it as a commercial venture. The ship railway accommodates paddle-wheel steamers such as navigate the Bay of Fundy and the gulf, but these could not pass through the canal of the width proposed by the government engineers. The maintenance and repairs of the ship railway will be less expensive than a canal. The construction of a canal would be attended with unusual difficulty, not only from the nature of the work, but from the great difference in the elevation of the respective tides, amounting to about 20 feet. One of the difficulties to be overcome in the canal was the great ebb and flow of the Bay of Fundy tide.

At neap-tides there is a range of 40 feet, and at spring-tides there is a range of 48 feet. At the famous Saxby tide in 1868 the range was 53 feet. The supply of water for the canal would have to come from the turbid waters of the Bay of Fundy. For these reasons and to save the immense cost, the contemplated project was finally abandoned by the Canadian government, which then adopted the scheme of the ship railway.

The line of the ship railway is 17 miles long, in a straight line from Fort Lawrence on the Bay of Fundy to Tidnish on the gulf side, and is practically without a gradient. There are to be 2 tracks, with rails of 110 pounds each to the yard, 1 line of which is now laid for 13 miles, leaving only 4 miles to connect the 2 docks. The Fort Lawrence Dock is a spacious basin, capable of containing at a time 6 ships of 1,000 tons each. It is excavated 40 feet deep, is 500 feet long and 300 feet wide. Walls of massive masonry rise on either side of the gate, to retain the waters of the basin. A gate 30 feet high and 60 feet wide opens at high water to admit shipping. When admitted, the vessel is floated over a gridiron (which forms a movable part of the track), which with the cradle upon it is immersed to the bottom of the lifting dock to receive the vessel for transportation. There is no danger whatever of injury to vessels from being strained either from being raised up vertically from the dock, or during transportation, or depositing again in the water by the means proposed to be used in this railway, which will be a great improvement on other lifting docks and marine railways. Keel blocks in the centre of the cradle and adjustable bilge blocks afford ample support to the sides and bottom of the vessel, and the cradle rests on springs affording just sufficient elasticity to render any strain impossible without causing oscillation. The cradle is about 230 feet long, 40 feet wide; it is carried on 192 wheels, and consists of 3 sections.

The hydraulic rams and presses to lift vessels to the

level of the track are 20 in number, 10 on each side of the track. The length of their stroke is 40 feet. Each set of lifting apparatus is composed of 2 cylinders, the inner one, performing the functions of a piston and ram, and the outer one, which is called the press. When the vessel is floated over the cradle and received into its place, the whole mass (comprising ship, gridiron, and cradle) is raised to the level of the main track. The gridiron is then locked to the sides of the quay, thus forming a bridged platform. Hydraulic machinery will then be applied to haul the cradle and vessel from the gridiron to the track of the railway. A couple of locomotives are attached, and the journey across the isthmus can then be proceeded with. To sustain such great weights, the road-bed is of the most solid construction and the foundation of the most stable character. Arriving at Tidnish, the vessel is placed over the gridiron in the lifting dock by hydraulic capstans, and lowered into the dock. At this place the dock and basin, instead of being excavated as at Amherst, are built out into the bay. The water is shallow, and the moles, or breastwork, are run out nearly half a mile to deep water. Beyond the moles, the entrance channel is dredged 3,000 feet. As the tide rises here only six feet, no gate is required. The bottom of the basin between the moles is to be dredged to a depth of 20 feet at low water, affording ample depth and secure haven for all classes of vessels using the railway. The moles are made of cribs filled with rock. They are supplied with mooring posts, and are decked over and protected from the sea by piles and riprap-work. Thus, at both termini, large and safe harbors and good entrances are provided for shipping.

Like all novel enterprises, this ship railway has encountered its full share of scepticism and hostility, and run the gauntlet of the gibes of the incredulous and the criticism of its opponents; but it has steadily made headway among capitalists, commercial men, and engineers, so that no

one to-day doubts that the scheme is feasible and practicable as an engineering work, and the doubters are those who now argue that it will not be commercially a success.

When one considers the great advantages and resources of this country for a maritime business, which is to-day in its infancy, and looking at the growth and progress made during the last generation alone, and then at the vast possibilities of the future, one cannot but feel that the ship railway will eventually be a commercial success beyond all expectation. The present tonnage adjacent to it is over 11,000,000, arrivals and departures. The annual increase is nearly half a million tons per annum. It rose from 8,000,000 in 1884 to 11,000,000 in 1890. If the ship railway draws but 10 per cent. of the present tonnage, it will pay a dividend on the capital of the company sufficiently large as not to necessitate calling on the government for any portion of the subsidy agreed to be given.

The reason of this is, that the working expenses will be very small, much smaller than by ordinary railways, and because it so nearly approaches the requirements of a perfect railway. The standard of a perfect railway is to be straight and level, to have a solid, smooth road-bed, and first-class works of art. The promoters have striven to obtain these conditions for the ship railway. The line is absolutely straight. One-half is dead level. Where gradients have been necessary, they have nowhere exceeded 1 in 500. The rails, made of toughened steel, are the heaviest yet rolled for any railway. The ballast is of broken stone. The road-bed is well drained. Where embankments occur, care has been taken to remove all elastic material, and to form good foundations of rock on the hard substrata. The ship railway is located and constructed especially for the carrying of steamers of 2,000 tons' weight and 14 feet draft. The working expenses will be very small. The work is substantially built. It will need but little repairs and maintenance. The speed will be from 5 to 10 miles an hour. Fuel is cheap in the coal-

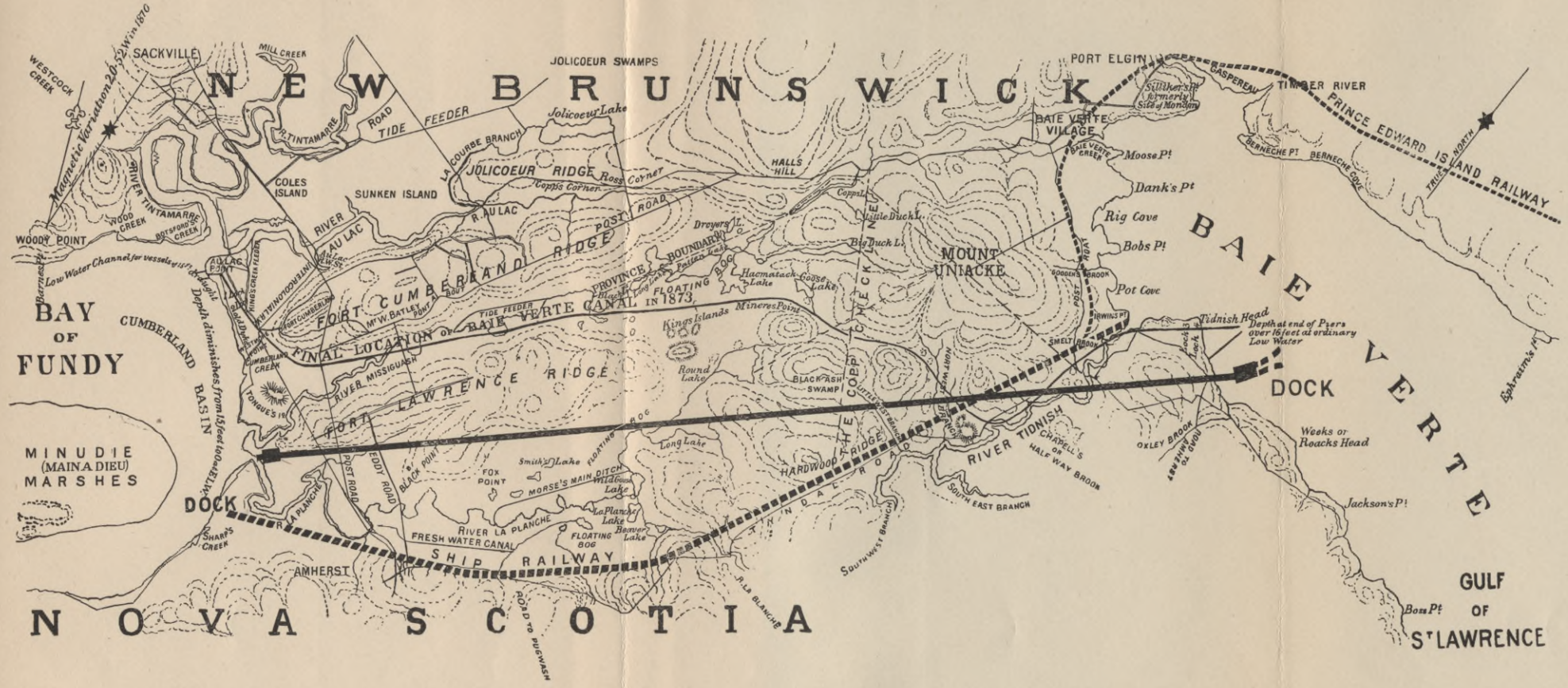
producing country of Nova Scotia. The terminal expenses, consisting of raising and depositing vessels, will be trifling. There is no freight to load or unload. This work is done automatically in the docks. The expense of transportation consists almost entirely of the cost of locomotive power, added to the expense of working the hydraulic lifts, the expense of docking vessels (in which the crews of the vessels will assist), and the small cost of maintenance and administration. Counting the cost of locomotive power what experience has shown it to be, on the average,— viz., 17 per cent. on English railways,— it may be fairly estimated that the other named expenses will make up the balance of 30 per cent. of the receipts. The Chignecto ship railway is the pioneer ship railway of the world. It is now three-fourths complete. It will be finished in 1895. The construction account up to date amounts to almost four million dollars. It will cost one million and a half more to complete. The contracts to finish and equip are all made. Work will be resumed as soon as the company can float the remainder of its prior lien bonds.

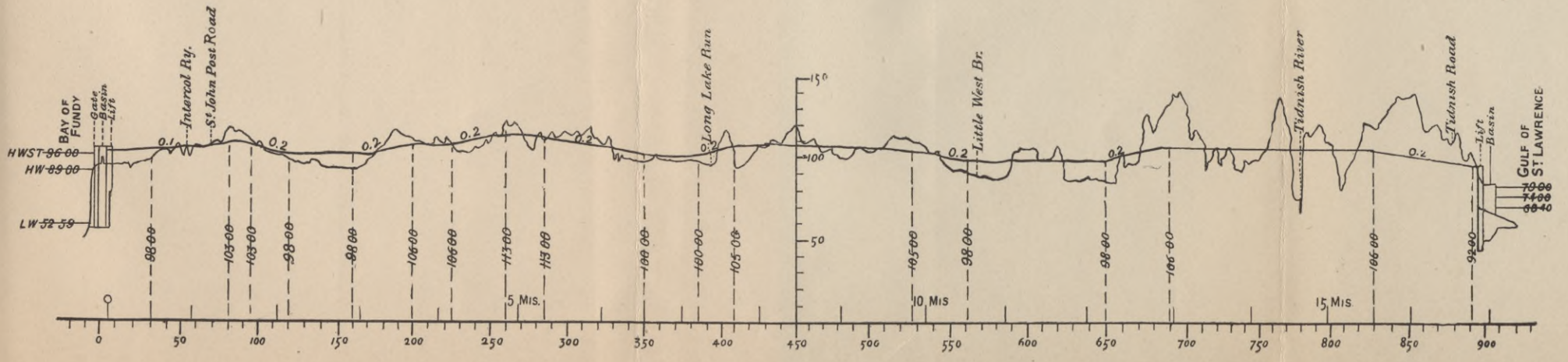
The safe transit of a ship in cargo across the Isthmus of Chignecto will be the signal for many other ship railway schemes to begin construction. The Tehuantepec, the Panama, the Cape Cod, the Ontario, and Michigan isthmuses will be vanquished by this means; and various obstructions can be overcome and short cuts made in different parts of the world.

The money so ill-spent on the Panama Canal would have been more than sufficient to complete a ship railway over that isthmus. Sooner or later the world will discover that the only way to solve that problem at Panama, by which the world's water commerce will be so materially extended, is by means of a ship railway.

AMHERST, NOVA SCOTIA.

CHIGNECTO SHIP RAILWAY.






RIVER St LAWRENCE
C. MacDALEN
C. GASPE
Gaspe Bay
GASPE
Mal Bay
COUNTY OF GASPE
PERCE
Bonaventure
COUNTY OF BONAVENTURE
CARLISLE
CHALEUR BAY
NIPISIGHT BAY
DALHOUSIE
BATHURST
CAMPBELTON
NEW BRUNSWICK
NEWCASTLE
CHATHAM
MIRAMICHI BAY
Miscou I.
Shippigan I.
GULF OF St LAWRENCE
Shipping 1890. Total 6,422,976, Tons of Entries and Clearances in Gulf and River St Lawrence from Quebec eastwards
Byron I.
Gross I.
MAGDALEN ISLANDS
Allright I.
Amherst I.
C. St LAWRENCE
C. NORTH
Aspee Bay
CAPE BRETON
Mire Bay
N.SYDNEY COAL MINES
SYDNEY
SYDNEY COAL MINES
C. BRETON
BADDECK
ISLAND
COAL MINES
PORTHOOD
BRASDOR LAKE
EAST Pt
PRINCE EDWARD ISLAND
NORTH Pt
Shipping 1890. 1,362,861 Tons
GEORGE'S TOWN
CHARLOTTE TOWN
SUMMERSIDE
C. ECMONT
C. TRAVERS
C. TORMENTIN
HILLSBOROUGH
PRIM Pt
NORTHUMBERLAND STRAIT
C. GEORGE
STRAITS OF CANSO
GEORGE BAY
Pt HAWKESBURY
TRACADIE
CANSO
CHEDABUCTO B
C. CANSO
ANTICONISH
Tor Bay
RICHIBUCTO
BUCTOUCHE
SHEDIAC
SHIP RAILWAY
BAYVERTE
TIDNISH
PICTOU COAL MINES
DORCHESTER
AMHERST
MONCTON
HILLSBORO
SACKVILLE
LONDONDERRY
TRURO
NOVA SCOTIA
SHEPODY
PARSBORO
NOEL
MINAS BASIN
LOGGINS COAL MINES
Clam Bay
WINDSOR
St MARTINS
CORNWALLIS
HALIFAX
FREDERICTON
MAGARETSVILLE
LAURENCETOWN
Mahoney Bay
St JOHN
CARLETON
St John Har
BRIDGETOWN
C. Le Havre
Port Medway
ANNAPOLIS
DIGBY CUT
DIGBY
LIVERPOOL
St GEORGE
ST ANDREWS
Passamaquoddy B.
CAMPORELLO
WEYMOUTH
NEW EDINBURGH
GRAND MANAN
LUREC
S.W. HEAD
CHETICAMP
SHELBOURNE
MACHIAS
YARMOUTH
Machias Bay
LURCHER SHOAL
C. SABLE
Englishman's B.
Pleasant River Bay
BANGOR
Goldsboro' Bay
Frenchman's Bay
Penobscot Bay and River
UNITED STATES
BAY OF FUNDY
CHIGNECTO BAY
Shipping 1890. Total 3,853,932, Tons With Cargo
ATLANTIC OCEAN
NOVA SCOTIA
Map
SHEWING
CHIGNECTO SHIP RAILWAY
Total Tonnage 1890, 11, 641, 769, Tons
NAUTICAL MILES
0 10 20 30 40 50 60