

which he was at work; although he acknowledges his means to be limited and insufficient to establish comparisons with other points. The opinion of Captain Lecky, R.N.R., is also quoted from his work on "Practical Navigation." This work has received the approbation of the naval authorities of Great Britain and of the United States, and is supplied to the fleets of both these countries. In it he gives a list of 16 books which he says "may be considered absolutely essential to safe navigation in the present day, when the question of speed enters so largely into the calculation." His list includes the Admiralty "Tide Tables" and Galbraith and Haughton's "Manual of the Tides and Tidal Currents" for the waters surrounding the British Islands.

COMMENCEMENT OF THE WORK.

In the following season of 1890 a practical commencement was made. It was proposed to make some further preliminary observations; to purchase a few tide gauges; and also to make available, as far as might be possible, some old tidal records for the years 1860 and 1861, which were discovered in the archives of the Hydrographic Office, formerly at Halifax. For these purposes a sum of \$2,000 was made available; and out of this amount a sum of \$1,654.96 was expended on the above objects.

The proposed observations were made by Lient. Gordon at two points on the Atlantic coast of Nova Scotia; the object in view being to check the accuracy of the tidal differences between Halifax and other points along the coast, in order to make Halifax if possible a "port of reference" for the whole eastern coast of Nova Scotia from Scatarie Island to Cape Sable. This was the most important thing to do first, because of the hope that the records above referred to might prove a sufficient basis from which to compute tide tables for Halifax, which might serve in the meantime until a longer series of observations could be obtained. A further object in these preliminary observations, was to ascertain by the use of different appliances and methods, those which promised to give the best and most economical results. The details of this work and the descriptions of the appliances used are given in Appendix No. 16 to 23rd Annual Report, Department of Marine and Fisheries for 1890.

To ascertain the best form of tide gauge to employ, the most careful and exhaustive inquiries were made by the Minister, aided by the advice of Mr. Carpmael, Director of the Meteorological Service. The difficulties in the case were exceptional as at most points any ordinary apparatus is liable to freeze up in winter, and so to interrupt the record; and further, on grounds of economy, it was considered impossible to employ skilled observers for this special work, at the requisite number of stations.

The Tides themselves on the coasts of Canada, vary so much in their amount (from a height of four or five feet in the open Atlantic, to twelve and eighteen in the St. Lawrence River, and thirty feet and over in the Bay of Fundy) that a relatively large number of stations are required in order to follow their movements in any satisfactory way. In these circumstances a self-recording tide gauge, which will do the work of making the record of the tide day and night, with the least amount of supervision, is the most suitable and economical to use. To prevent freezing, and so to secure the record in winter as well as in summer, Mr. Carpmael made special inquiries and experiments which are referred to in his report of December, 1890. (Appendix No. 16 to Annual Report, Department of Marine, 1890.) In making choice of the best form of tide gauge, Professor G. H. Darwin, of Cambridge, the most eminent specialist on tidal questions, was consulted. He kindly gave his advice in the matter; with a view also to the reduction of the observations, and calculation of tide tables from them. The gauge finally decided upon was the one devised by Sir William Thompson, and three of these were accordingly purchased to begin with.

The records of the Halifax tides above mentioned were submitted to Mr. Edward Roberts, of the Nautical Almanac Office. Although there were breaks and imperfections in the record, he devised a special method of double computation by which these could be successfully overcome; and he was therefore able to report