

and its velocity varies from about one to two and a half knots per hour. Again in Cabot Strait, there is a current which occupies some 10 to 15 miles of its width on the side next Cape North, also running towards the south-east with about the same velocity, and having a density nearly as low as the Gaspé current itself. The best continuous observations of the velocity and direction of these two currents, obtained during moderate weather when the conditions may be considered as normal, are shown in Plate II, where they are compared with each other and with the tides.

It will be seen from this comparison that the current in the offing of Cape North varies somewhat in its velocity, and also veers slightly in its direction; but no relation between these changes and the tide itself could be made out. The fluctuation in the velocity of the Gaspé current appears to be more regular in its relation to the tide; which will be referred to again.

The density of the water in these currents is shown in the sections given in Plate VIII. These sections, and the density in relation to the depth as there shown, may be taken as typical. The actual densities near shore however, are in both cases the lowest that were found. The undulations in the lines of equal density in the section off Cape North, are due to the disturbance caused by St. Paul Island; as the section runs past it at three miles to the south-eastward, or on the lee side with regard to the current. The density of this current is also shown in the sections given as Table C. and D. at the end of this Report.

*Tracing the water across the Gulf of St. Lawrence by its density.* In tracing this water of low density across the width of some 200 miles which lies between these currents, it was necessary to decide at what depth the densities for comparative purposes should be taken. If the density of the surface water was taken, there was the advantage of obtaining samples in all weather, however rough; while on the other hand the results would be more affected by disturbance from the surface drift caused by the wind. A comparison of the densities at a depth of 20 fathoms would be very suitable, as this would be about the middle of the layer of water in which the greater part of the movement occurs. The density contours at this depth would however be much interrupted by the banks in the Gulf area, notably the Orphan Bank, Bradelle Bank, and extensive shallows around the Magdalen Islands. A depth of 10-fathoms was found to be the best to select; as the 10-fathom line is close to shore around the Gaspé coast, Anticosti, Prince Edward Island and Cape Breton; and all the banks are cleared at this depth except around the Magdalen Islands, where the 10 fathom line lies from five to ten miles off shore. Hence at 10 fathoms the density contours are practically uninterrupted throughout the Gulf, and at this depth the disturbing influence of winds of short duration should be less felt. It appeared therefore on the whole to be the best depth for the purpose in view.

It was necessary to make the determinations of the density at the time, as it was a question of tracing the water, and ascertaining the limits of areas of less density, without any previous clue as to where the limits would probably be found. The samples of water below the surface were obtained by Negretti and Zambra's type of deep-sea water-bottle, which consists of a vertical tube with spring valves at the two ends to inclose the water at any desired depth. The valves are released by a weight sliding on the line; and the line itself must therefore be clear of all tags or knots, and it was found convenient to mark off the depths on the line with red paint. Before releasing the valves, the bottle while still open at the ends was raised and lowered a few feet through the water to rinse out any water of a different density which it might have carried down with it from an upper layer. The samples obtained ranged in temperature from 32° to 70° Fahrenheit, and they were therefore put in glass stoppered bottles and allowed to come as nearly as possible to the ordinary temperature of 60° before their densities were taken, in order to reduce the amount of the correction necessary for difference in temperature. The densities were determined by means of hydrometers of open range, specially designed for the purpose. The bottling of the samples had also the advantage of enabling the hydrometer readings to be taken while the steamer was at anchor; and although these anchorages were in the open, the rolling of the vessel did not interfere with accurate reading, as the vibration of the machinery would have done.