carried out in conjunction with work on the salt ratio by Dr. N. W. Rakestraw.

Alkalinity and oxygen estimations were made by the Author's assistant, Gladys Seiwell. Samples for analyses were taken along with the regular hydrographic hourly series of observations.

Studies on the ammonia content of Frenchman's and Penobscot Bays were made by adding Nessler's reagent to sea water previously treated with salt seignette and sodium hydroxide. The yellow brown color developed was compared against standardized ammonia color standards.

Continuous records of air temperatures and pressures were kept by recording thermographs and barograph. A water thermograph attached to a floating dock gave a continuous record of surface water temperatures during the first two months of the season.

5. REPORT ON THE CHEMICAL WORK OF THE OCEANOGRAPHIC PROGRAM

By Norris W. Rakestraw, *Brown University*

The chemical work which has been carried on in connection with the oceanographic program of the Laboratory may be divided into several parts. During the summer of 1929 emphasis was placed upon the analysis of the water from various localities for its phosphate and nitrate content. These so-called "nutrient salts" have been shown to be intimately concerned, in the open ocean, with the growth of diatoms, and therefore indirectly with all other forms of life. Water collected at various depths from the several stations established in Frenchman's Bay and the vicinity was analyzed for these and certain other constituents in the hope of finding a similar relation in shore waters and in the effort to detemine the contribution which the outflow of water from the land makes to these food factors in the sea.

The analytical results showed large variations in the concentrations of phosphate and nitrate, not only at different places but at different times at the same station. Concentrations were also somewhat higher than those found in the open ocean. Evidently conditions are very different, and in view of these findings it seems hopeless to demonstrate any relation between the growth or abundance of diatoms or other forms of life and the concentrations of such chemical constituents.

Nitrite nitrogen was also determined in most of the samples and was found to be present in significant amounts in the sub-surface samples but very seldom on the surface. Determinations of silicate and dissolved oxygen yielded no new information of importance.

Work carried on between the summers of 1929 and 1930 at Brown

University improved the method for nitrate determinations somewhat, but it became perfectly evident that its accuracy is only sufficient to give roughly quantitative results.

During the summer of 1930 the determination of phosophate and nitrate was continued intensively and with improved technique. Instead of distributing the work over a large area the variations at one or two stations were studied at frequent intervals. A general confirmation of the results of the previous year was obtained; values of the same magnitude and of the same wide range of variability were found. Without a doubt these changes are not caused by variations in the abundance of life or in growth processes. The source of nitrate and phosphate and its relation to the outflow from the land is still to be found. It is probably significant that high concentrations of nitrate were found far up the Sullivan River, especially in the shallow, muddy Hog Bay.

A study was also made of the ionic ratios in the water—the relations which exist between the sodium, potassium, calcium, magnesium, sulphate and chloride ions, which compose nearly all of the salt content. The relative proportions of these constituents have always been reported to show remarkable constancy, notwithstanding the influence of river water flowing into the sea. No data have been available, up to the present time, from the North Atlantic Coast. The relation between the sulphate and chloride in a large number of samples at various stations and depths in Frenchman's Bay was determined, as well as in a series of samples extending far up into Sullivan River. Since the fresh water outflow from Sullivan River is very limited a number of samples were collected from several stations in Penobscot Bay and River and a fairly complete analysis of these was carried out to determine the concentrations of the various ions listed above. A few samples from Frenchman's Bay were analyzed in the same way for comparison. Due to the limitations of time and of laboratory equipment it was not possible to attain more than a moderate degree of accuracy in this study, but the results were in full agreement with those from other localities, although with some indication of variations which will be the subject of further study. A possible influence of the fresh water from the Penobscot River upon the ionic ratios is indicated, but not demonstrated as yet with sufficient certainty.

6. PHYTOPLANKTON STUDIES

By P. R. Burkholder, *Buffalo Museum of Science*

During the summer of 1930 investigations were carried out to determine the kinds and quantity of phytoplankton occurring in the waters