

his Presidential Address to the Royal Society of Edinburgh in 1872,<sup>1</sup> observations which he had made in Lochs Lomond, Tay, and Katrine during the years 1870 and 1871. Sir Robert Christison demonstrated the existence in these lochs of a substratum of relatively cold water of considerable thickness, which underwent little or no seasonal change. He also noted the existence of a discontinuity between the temperature of the upper and lower layers of water, which has been found to play such an important part in the temperature of fresh-water lakes.

Dr Buchan<sup>2</sup> next interested himself in the observations of Jardine and Christison, and by a comparison of the temperature of the cold substratum with the mean temperature of the air, he arrived at the conclusion that it is the mean temperature of the cold half of the year which determines the temperature of the lowest stratum in deep lochs.

On the return of the *Challenger* Expedition Mr J. Y. Buchanan took up the study of lake temperatures, and his explanation of the manner in which ice is formed on lakes was another step in the advance of limnology. But perhaps the most important contribution to the literature of the subject during last century was Sir John Murray's paper, published in 1888, on the effect of winds on the distribution of temperature in the sea and fresh-water lochs of the west of Scotland.<sup>3</sup> Dr John Aitken was interested in Buchanan's observations, and drew attention<sup>4</sup> to the importance of wind currents in reducing the temperature of lakes considerably below the maximum density point before freezing took place, and may justly be considered one of the pioneers of lake-temperature investigations; but previous to Sir John Murray's investigations very little account was taken of the effect of wind on the temperature distribution of lakes, and Continental limnologists do not yet seem to have realised the importance of the facts brought to light by him. From that date onwards there has been a considerable quantity of observations, made, amongst others, by Sir John Murray, Mr J. Y. Buchanan, and Dr H. R. Mill, which materially add to our knowledge of the distribution of temperature in lakes.

About the year 1897 the late Mr Fred. P. Pullar began a systematic survey of the lochs of Scotland in conjunction with Sir John Murray, and their scheme of work included an examination of the temperature conditions of various lochs surveyed. After his death

<sup>1</sup> *Proc. Roy. Soc. Edin.*, vol. vii. p. 567.

<sup>2</sup> *Op. cit.*

<sup>3</sup> *Scott. Geogr. Mag.*, vol. iv. p. 345.

<sup>4</sup> "The Distribution of Temperature under the Ice in Frozen Lakes," *Proc. Roy. Soc. Edin.*, vol. x. p. 409, 1880.