

A first attempt in this direction was made by Sir John Murray during the cruise of the "Challenger," by calculating the amount of calcium carbonate in the form of living organisms per square mile of the ocean by 100 fathoms in depth.

Quantitative estimations of organisms in the ocean.

No one has devoted more time and thought to this problem than V. Hensen, who has been indefatigable in his endeavours to devise methods for an absolute determination of the quantities of organisms contained in the ocean, his avowed intention being to ascertain the quantities of "primitive food for marine animals."<sup>1</sup> From theoretical considerations he concluded that the primitive food of marine animals necessarily consisted of the microscopic plants living in the surface waters of the ocean, and that the effect of currents would be to distribute these minute plants quite regularly and uniformly. He held the idea that a hoop-net hauled vertically from bottom to surface would filter a column of water with a diameter very nearly corresponding to the diameter of the net, and that in this way it was possible to calculate the catch per square metre of surface. The volume of the catch might be measured, and the number of individuals belonging to all the species might be counted. Definite figures might thus be obtained representing the abundance of each species per square metre of surface, and the area of the water being known, the aggregate quantities might be calculated. In order to count all the micro-organisms he invented a method based on the principle employed in physiology for the purpose of counting blood corpuscles, viz. to dilute a sample of known volume with a known volume of liquid in which the organisms become evenly distributed. With a specially devised instrument a small sample (say 1 c.c.) is taken out and its contents counted.

This method has added greatly to the practical working of biological ocean research, and will undoubtedly increase in importance in future. Like all other means of research it must be employed with judgment, and the special nature of the investigations must decide whether it may be applied and at what stage with advantage. The application of the method has led to much discussion, the enthusiastic advocates of the method considering it imperative that it should be used in all "truly scientific" investigations on the micro-organisms of the ocean, while its opponents have looked upon it as a means of

<sup>1</sup> V. Hensen, "Über die Bestimmung des Planktons," *V. Bericht der Commission zur wiss. Untersuchung der deutschen Meere in Kiel*, 1887.