

arise because the conditions of existence vary in closely adjoining areas. Lohmann has found that at certain seasons 10 to 15 c.c. of sea-water amply suffice to give a representative sample of the total plankton, but it is evident that only the commonest organisms floating in the sea in any locality do occur so densely and regularly that we can be sure of securing them, or even of catching enough for ascertaining their comparative frequency, in a water-sample consisting of only a few litres of water or less. The more scattered or mobile the individuals are, the larger masses of water must we examine to get a knowledge of the quantity present in any locality.

It follows, therefore, that we must abandon all thought of a universal method. Fine silk nets give us complete collections of the larger Ceratia and diatoms, but are of no use for the smallest species, for which we are obliged to have recourse to more delicate methods of filtration, and to the centrifuge. The larger forms, too, will be found in our silk nets in sufficient quantities, if they are at all abundant, but where they are scarcer than, say, fifty specimens to the litre, the centrifuge cannot be depended on. Besides amongst these larger organisms some species are so scanty that even a vertical haul with the big net yields insufficient material, so we have been compelled to adopt the special methods described in this volume.

Various methods have been employed for estimating the quantity of plankton on the basis of catches made. We can allow the whole sample to sink to the bottom of a measuring glass, and appraise its volume, or we can weigh it while the organisms are saturated with water or spirit, or we can weigh the dry substance. Such determinations of volume and weight give us our first rough idea of the variations in the quantity of plankton, but there are many sources of error which it is unnecessary to discuss here. The worst fault is that measurements of this kind group into a whole the most diverse values, such as plants and animals, producers and consumers, one-celled organisms that are constantly reproducing themselves, and multicellular animals with a longer duration of life, or, again, organisms with slow and others with rapid metabolism. If we want to know a little about the conditions of development of organisms, we must have a method of investigation that allows us to trace the growth and retrogradation of each of the different species by itself, and counting then becomes the only method possible, as Hensen has continually asserted. Counting is a method that requires much time, and also absolute accuracy in

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