Plankton less abundant in the open sea than in coastal waters.

species is very considerable, yet the total quantity of individuals is surprisingly small compared with what we might find, for instance, off the coasts of Europe. In the Skagerrack one often gets plant-cells in tens of thousands or even hundreds of thousands in every litre of sea-water from the upper layer, and, what is more, they are much larger and more nutritive than the stunted forms which make up the bulk of this ocean plankton.

It cannot be denied that our investigations are as yet too incomplete to justify us in framing laws for plant production in the ocean. Still the great expeditions which have made researches in the open sea have given us a general conception of the conditions prevailing over wide stretches of water at certain seasons; on the other hand, careful investigations of the variations in the plankton throughout the year have been carried out at a number of coast stations, while our international researches have resulted in a great deal of material being collected at all seasons from the North Sea and adjoining areas. Though these investigations have not all been devoted to studying quantity, they have nevertheless enabled us to form some idea of the annual variations.

One thing at any rate we may learn even from this incomplete material. The development of the plankton is much more irregular than it would be if merely such simple factors as warmth and light controlled production. It is not in the warmest waters that the greatest amount of organic substance is to be found. On the contrary we get larger masses of plants in temperate seas than we have ever yet come across in tropical or subtropical areas,[1] at any rate so far as the open ocean is concerned. Even when we come as far north as the coast of Norway we find that it is not in the hottest months of summer that the plankton attains its maximum, but in the early part of the spring or the end of autumn. Now it is certainly true that the quantity of vegetable matter present at any given moment is no direct measure of production. According to the law of Van 't Hoff, metabolism always takes place quicker *ceteris paribus* at a high temperature than at a low temperature, and a plant-cell in the tropics may perhaps produce more organic matter than a similar cell would do in the North Sea in the same space of time. The small tropical plants may

Plankton less abundant in tropical than in temperate seas.

Van 't Hoff. Metabolism more rapid in warm water than in cold water.

[1] The "Challenger" met with diatoms in the Arafura Sea in as great abundance as in the Antarctic regions, but neritic in character (see lists of species in Summary of Results, Chall. Exp., pp. 515 and 733).