Sir John Murray & Johan Hjort, The Depths of the Ocean: Scientific Researches of the Norwegian Steamer Michael Sars (1912)

tween the surface water and the deep water, the pelagic algæ extended deeper; at 50 metres, for instance, the quantity was still near the maximum, and even as deep as 100 metres or more the number was considerable. This, at any rate, was what we found in the case of the diatoms that abounded at our first stations off the Irish coast-banks and in the Bay of Biscay, and this too was what Schimper discovered in the Antarctic. It is also a regular rule that plankton is far more plentiful along the coasts than in the open sea, and, judging from investigations hitherto made, the proportion between what is produced in a typical coastal area and what is developed in typical oceanic water-masses would be more accurately expressed by 100 : 1 than by 2 : 1. For this the best explanation which I can give is that the open sea generally suffers from a want of one or more nutritive substances required by the plants, for though these are brought down to the sea in comparatively large quantities by the rivers, they are almost entirely consumed by the plant life of the coastal areas.

This is why the abundant plant life of the coastal seas is confined to the surface-layers, since the water-masses lying below remain separated, and consequently cut off from the plentiful supply of nutritive substances which regulate the augmentation of plants. But out in the open sea there is another important source of nutriment to be taken into account. Nathansohn has pointed out that pelagic animals are constantly taking nutritive matter down into deep water, and that for the time being it is accordingly withdrawn from the plants, even though the metabolism of the animals and the action of bacteria liberate it once more in inorganic form. These nutritive substances may rise to the surface-layers again by diffusion, but the process will require a long time. They may also accompany the ascending water-masses where off-shore winds bring about up-welling, in cyclonic current systems, and where the surface-layers, becoming chilled, sink and make room for warmer layers from below. Wherever vertical circulation takes place, and it is assisted in its action by storms and waves, the temperature and salinity will be extremely uniform from the surface down to a depth where the water-masses have such a high salinity that their greater density sets a limit to circulation. Conversely uniformity in temperature and salinity may be taken as a sign that vertical circulation has just taken place. This was the condition of affairs at our stations to the south-west of Ireland (see Fig. 252), where we

Vertical circulation.

http://19thcenturyscience.org/HMSC/HMSC-Reports/1912-Murray/README.htm