

trawlings in some spots and the comparatively unsuccessful results in others at the same depth and with apparently similar surroundings. From the results of deep-sea dredgings and trawlings, up to the present time, there seems no doubt that life is on the whole more abundant at the bottom near continental shores than at similar depths towards the centres of the ocean basins.

The operations with tow-nets in surface, subsurface, and intermediate waters lead to nearly identical conclusions with reference to the pelagic fauna and flora, or Plankton, as those with reference to the fauna or flora on the deposits, or Benthos. Sometimes the captures in the tow-nets may be very insignificant, while, at a little greater or less depth, or at a different time of the day, the same nets may yield an abundant harvest. Many of the species occur at times in floating banks of vast extent, and at other times only a few specimens may be taken at the same locality. On the whole, the Planktonic species are more numerous in tropical waters, while in polar waters, although the species are less numerous, the individuals of the species have often an enormous development. The Challenger observations appear to indicate clearly that in warm oceanic currents the abundance of life is greater than in the regions of the Sargasso Seas. The pelagic fauna and flora are, again, different and probably more abundant along coasts affected by river water than in purely oceanic regions. Ascending currents of water from the deeper regions near land are sometimes heavily laden with marine organisms whose usual habitat is in deep water about the level of the mud-line surrounding the continental and other coasts.

Owing to this unequal distribution of organisms in ocean water and on the floor of the ocean, it is not possible to arrive at any satisfactory approximation of the total number of living organisms or the total amount of organic matter in the sea, but it is evident that these must, on the lowest estimate, be enormous. Assuming that the lime-secreting organisms were as abundant throughout the whole region as in the path followed by his tow-nets, Mr. Murray¹ has estimated that at least sixteen tons of carbonate of lime, in the form of shells of living organisms, were present in a mass of tropical oceanic water one square mile in extent by 100 fathoms in depth. Hensen has even made a praiseworthy attempt to count the number of individuals of each species in certain tow-net gatherings, and from these data to estimate the total numbers of each species as well as the amount of organic matter in the whole ocean.² All these calculations are interesting and valuable for the time and place of the experiments, but unreliable or insufficient when used as a basis for any wide general conclusions or deductions. When considering the amount of organic matter in the ocean, it must be remembered that a large

¹ *Proc. Roy. Soc. Edin.*, vol x. p. 508. In some ten litres of water from the Red Sea, Murray and Irvine recently found suspended carbonate of lime (shells of organisms) equivalent to 51 tons in a mass of ocean water one square mile by 100 fathoms in depth.

² Hensen, "Ueber die Bestimmung des Planktons, oder die im Meere treibenden Materials an Pflanzen und Thieren," Bericht d. Comm. z. wiss. Unters. der deutschen Meere in Kiel, 1887.