CHARACTERISTICS OF DEEP-SEA FISHES.[1]

The physical conditions under which fishes live at a depth of 100 and more fathoms affect certain parts of their organisation. We know now, chiefly from the Norwegian and North America explorations, that many littoral fishes descend within the limits of the truly abyssal fauna. These descents, however, are not permanent removals from the littoral zone, but, at the most, periodical; and therefore no conspicuous change in any of the organs of these fishes has taken place. But already, in many fishes which permanently reside at from 80 to 120 fathoms, we find indications of their habitat in the black coloration of their pharynx and in the size of their eye, which is proportionally larger than in their representatives at the surface. In the true deep-sea fishes certain organs are so conspicuously modified that every one of these fishes may be recognised as a deep-sea fish, without accompanying positive evidence of its capture at a great depth; and *vice versa*, fishes reputed to have been obtained at a great depth, and not having any of the characteristics of the dwellers of the deep sea, must be regarded as surface fishes. The question whether the amount of modification is proportioned to the depth, must be negatived from the evidence at present available, inasmuch as deep-sea fishes caught at depths of between 300 and 400 fathoms may show a much more conspicuous development of abyssal peculiarities than those from 2000 and more fathoms.

The tremendous pressure under which deep-sea fishes live must be one of the primary causes affecting their organisation. The pressure of the atmosphere at the level of the sea amounts to fifteen pounds per square inch of the surface of the body of an animal; but below the surface of the ocean the pressure is increased to a ton weight for every 1000 fathoms of depth. 'In many deep-sea fishes we find, then, that the osseous or muscular systems, or both, are, as compared with the same parts of surface fishes, very feebly developed,...as for instance in the Trachypteridæ, *Melanocetus*, *Chiasmodus*, *Plagyodus*, *Omosudis*, *Saccopharynx*. The bones have a fibrous, fissured and cavernous texture, are light, with scarcely any calcareous matter, so that the point of a fine needle will readily penetrate them without breaking.... In some the primordial cartilage is persistent in a degree rarely met with in surface fishes, and the membrane bones remain more or less membranous or are reduced in extent, like the operculum, which frequently is too small to cover the gills. When the fish is brought to the surface, all the bones, and more particularly the vertebræ, are most loosely connected with one another. Likewise the muscles, especially the great lateral muscles of the trunk and tail, are thin; the fascicles can be readily separated or torn, the connective tissue being extremely loose and

[1] The contents of this chapter formed the subject of a lecture delivered at Cambridge in 1874, and of the notes published in Introduction to a Study of Fishes, 1880, p. 296.