shore and shallow-water origin. In polar waters a marked peculiarity of the tow-net gatherings is the almost total absence of pelagic larvæ belonging to benthonic organisms, and we know that many of the Echinoderms and other shallow-water animals of the Arctic and Antarctic regions are furnished with pouches in which the young are reared;[1] the same appears to be true of the animals living about and deeper than the mud-line in all parts of the world. In temperate zones where there is a wide range in annual temperature the pelagic larvæ of benthonic animals appear only in the spring or summer seasons; in the tropics they are present at all times in the surface waters. If there were once a nearly universal climate over the whole ocean, we may suppose that the same species of benthonic animals were nearly everywhere present in the shallow-water zones. When cooling at the poles set in, those animals with pelagic larvæ would be killed out or be forced to migrate towards the warmer tropics. By being able to limit the reproductive process to the summer season, some of these organisms with free-swimming larvæ have been able to live on in the temperate regions, but in the tropical and coral-reef regions we have the remnants of a once universally distributed shallow-water fauna. With the disappearance of this shallow-water fauna from the polar regions its place would be occupied by the organisms from the deeper mud-line, very few of which possess pelagic larvæ. In this way we may account for the identity or similarity between the polar marine faunas and floras, the great abundance of individuals and the relatively few species in the polar areas when compared with the tropical area, as well as the greater likeness of the shallow-water polar animals to deep-sea species. In like manner we may account for the disappearance of coral reefs from the west coasts of Africa and America and off Cape Guardafui, owing to the wide range of temperature in these positions from upwelling of cold deep water. Organisms derived recently from the mud-line animals here too occupied the shallow waters, and hence more closely resemble polar faunas than any other fauna within the tropics. From the general character of fresh-water species, and from the almost complete absence of free-swimming larvæ, we may suppose that the fresh-water fauna has also been chiefly derived from mud-line animals which ascended from the mouths of great rivers and from estuaries.

ORIGIN OF MARINE AND FRESH-WATER FAUNAS.

The general similarity, and, in many cases, the identity of species of marine organisms in the Arctic and Antarctic regions, is a very remarkable fact, but probably not a more remarkable fact than that in the tropical regions there should be among benthonic animals hardly a marine species common to the east and west coasts of the continent of Africa, if we exclude some brackish-water and deep-sea species. The greater annual range and higher temperature, as well as the greater variety in the other conditions which obtain on either side of Africa, compared with those that obtain

[1] See Narr. Chall. Exp., vol. i. p. 379.