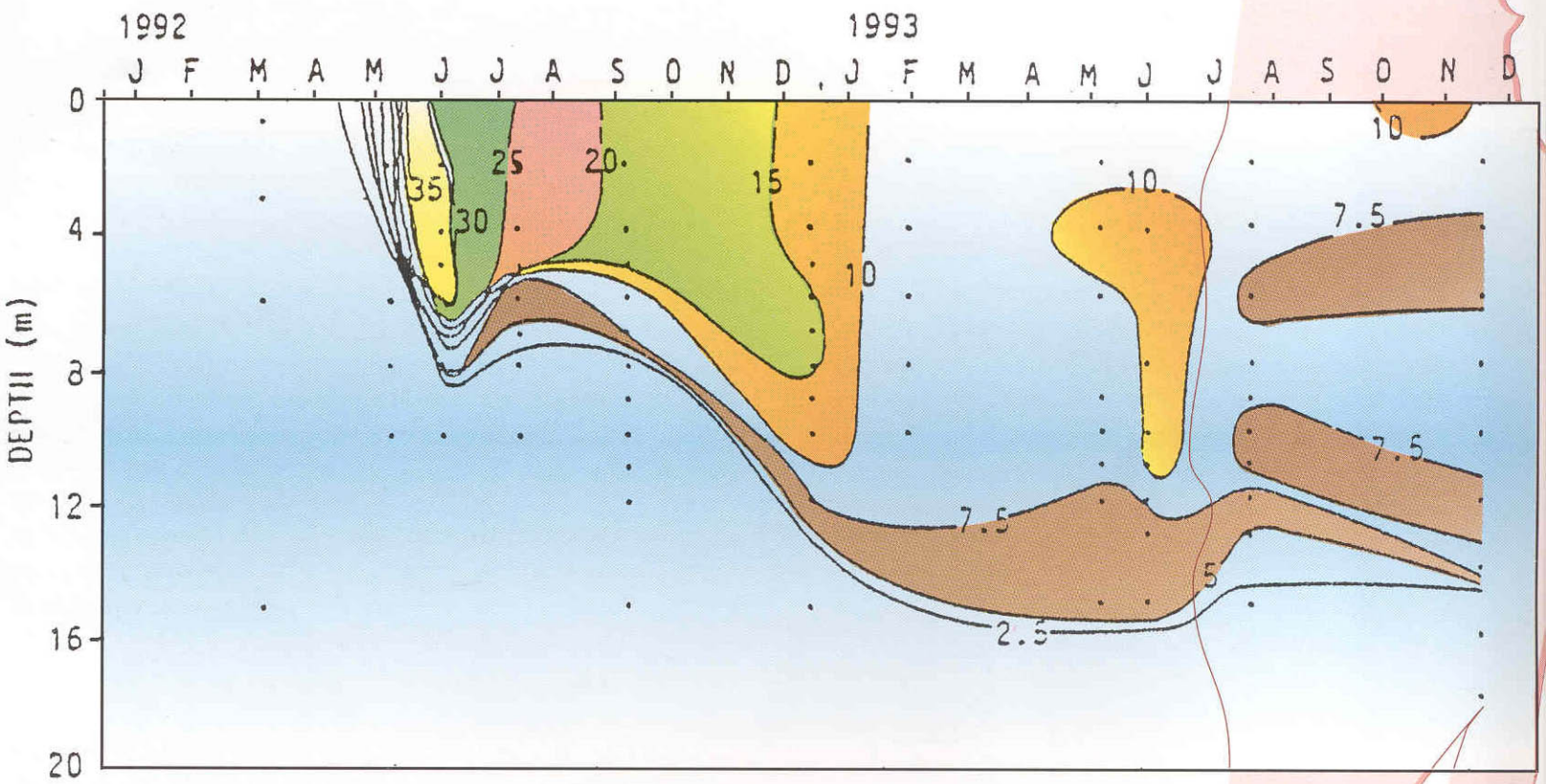
RESEARCH NOTES: Dead Sea Becomes a Red Sea

Hot, extremely salty (about 340 grams of salt per liter) and over 400 meters below sea level, the Dead Sea is one of the most inhospitable environments on earth. Higher forms of life are absent, but there is a limited, hardy community of simpler, more salt-tolerant organisms. The only photosynthetic species, the base of the food chain, is the blue green algae *Dunaliella parva*. The Dead Sea also supports several species of red, salt-tolerant halophilic bacteria (archaea) belonging to the genera: *Halobacterium, Haloferax, Haloarcula* and *Halococcus*. Usually growth is slow and populations are small, but the periodic input of large amounts of fresh, rain-induced floodwaters, in the presence of sufficient phosphate, can spark a *Dunaliella* algal "bloom" with far reaching consequences.



Israel Science Foundation (ISF) grantee Prof. Aharon Oren of Hebrew University studied one such bloom in the summer of 1980. In the relatively dilute upper 5-15 meter surface layer, *Dunaliella* concentrations up to 8800 cells/cm^3 sparked the explosive growth of around 20 million colorful *archaea*/cm^3, enough to turn the sea red. Although the *Dunaliella* bloom lasted only a year, the archaeal community stayed stable at around 5 million/cm^3 for two years.

The next nine years were lean ones for life in the Dead Sea, until rain floods in the winter of 1991/92 reestablished stratification. This created a comparatively low-salt 4-6 meter surface layer, and an even larger *Dunaliella* bloom (over 12,000 cells/cm^3) by May. Red halophilic archaea populations jumped to over 360 million/cm3 in response, again coloring the water red (due to bacterioruberin, a carotenoid pigment). Again the *Dunaliella* bloom was short-lived (a few months) and the bacterial response long-lived (over two years). The time-depth profile of the bacterial bloom is shown above (numbers represent million cells/ml). Interestingly, the pigment content of individual bacteria decreased two to three-fold over the first year. Glycerol produced by *Dunaliella* is probably the main carbon source for bacterial growth. The most abundant organism in the 1992 archael bloom seems to be, on the basis of polar lipid and ribosomal RNA studies, a previously unknown species belonging to a new genus, now named *Halobaculum gomarrense*.

Prof. Oren's Israel ISF-sponsored studies of the intricate development and decline of this transiently flourishing Dead Sea community have been published as a series of over 15 papers in the scientific literature.