

A hypothesis regarding dependence of community
structure and density on productivity

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The hypothesis is offered that under similar general conditions the species variety is an inverse function of the community productivity.

The salps of a series of plankton samples made by Pacific Oceanic Fishery Investigations of the United States Fish and Wildlife Service in epipelagic waters of the central Pacific Ocean were studied during 1952-1954. Observations on them led to the formulation of the hypothesis presented below. The most pertinent observations were as follows. In most of the samples studied, many species of salps were taken with little predominance of any one species. In one sample, however, there were both a far greater total salp quantity and a great predominance of one species of salp, only a few others being taken and these in insignificant quantities. All salp species apparently simultaneously occupy similar niches (the concept of the niche used here is that of Elton, 1927, Animal Ecology: 63-4), and apparently also are subject to the same environmental conditions, thus apparently are ecological equivalents (in impoverished waters; see below).

Observations made by other investigators are also pertinent here. Students of marine plankton of high latitudes have described it as "monotonous", consisting predominantly of one species of organism in each niche apparently, although the term niche has not been applied in these descriptions. Most descriptions of the plankton of low latitudes, however, emphasize the great variety of species with little or no predominance by any one species (per niche) (see Steuer, 1910, Planktonkunde: 601-4; Russell and Yonge, 1936, The Seas: 123-6; Dakin and Colefax, 1940, The Plankton of the Australian Coastal Waters off New South Wales, Univ. Sydney, Dept. Zoology, Publ. I: 27-34). Another pertinent observation discussed by Steuer and Dakin is that productivity in the tropics in waters influenced by land drainage and in regions of upwelling may equal or even exceed that of high latitudes.

If these observations are considered together, it appears that in epipelagic waters with relatively great quantities of nutrient chemicals (the enriched areas), production of the plankton is great in quantity but trends toward few species of organisms--probably only one dominant species per niche--and in epipelagic waters with relatively small quantities of nutrient chemicals (the impoverished areas), the plankton is small in quantity and trends toward many species of organisms--apparently many species per niche.