LIFE HISTORIES AND LONGEVITY OF PORIFERA

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par

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Recently in the *Proceedings of the Zoological Society of London* (1949, pages 893-915) BURTON has shown that sponges often have a characteristic pattern of placement upon the substrate. He found many clusters, each almost circular in outline, and each filled with many small (sessile) individuals, all of the same species. He states his opinion that these clusters have resulted from swarms of larvae, each cluster being the place of impact of such a free-swimming cluster. One visualizes something like a flock of birds settling on a small area in a field.

As BURTON himself comments, there is no observation at all of sponge larvae thus swimming in flocks. I have never so seen them. K. D. MCDOUGALL in the *Ecological Monographs,* 1943, pages 321-374, reported extensive experiments with various species of sponge larvae, and regularly found that they settled in such a way as to indicate no grouping or flocking in transit. BURTON'S observations as to the grouping on the substrate, however, is quite sound. I can confirm it heartly, having often observed exactly such patterns. Yet there may be another explanation for its origin.

It is first necessary to locate the phenomenon in regard to the seasons of the year. During the winter, at the places under discussion, no sponges are readily observed. BURTON found the clusters in April. By summer each cluster had altered into a continuum, because each spongelet had grown until it coalesced with its neighbors, so that now a number of incrustations faithfully maintained the pattern which had been foreshadowed by the clusters. I have often observed exactly such acts of coalescence — it is commonplace in the Porifera... then, as BURTON notes, in the unfavorable weather of autumn, disintegration sets in.

BURTON in the *Annals and Magazine of Natural History* for 1947, pages 216-220, especially page 219, shows that a large poriferan mass, as a result of unfavorable environment, may alter into many very small masses, with a great overall reduction in total mass. I have observed this, too. BURTON describes one case for which he kept careful data. He says « On July 12 in place of the two fairly well-grown sponges was a series of small individuals ranging from 3 to 4 mm across, scattered over the area previously occupied by the larger specimens. » Attention is here called to the fact that this observation dealt with *Hymeniacidon sanguinia;* this was one of the species concerning which the observations were made in the *Proceeding of the Zoological Society.* Perhaps each cluster of tiny spongelets there described arose by environmental, (but not quite complete) destruction of a pre-existing mass, much like that which later resulted from the growth and coalescence of the individuals of the cluster.

How long do sponges live? It is conceivable that a mass may flourish all summer, say 2 cm. thick and 20 cm. diameter, then in the winter die back to 20 or so almost microscopic little units, say 1 mm in diameter. The winter observers think nothing is left, but then these spongelets grow during the following spring until they restore the much larger mass as of the preceeding summer. In this case it might be said that the sponge was perennial, with a life span of perhaps scores of years.

Another possibility is worth serious consideration. Many authors have pointed out the occurrence of reproductive bodies at the plane of junction between a sponge and its substrate. In fresh-water sponges such a layer of reproductive bodies commonly forms when environmental conditions become unfavorable. Each such body comes to be surrounded by a tough, resistive capsule, and the result, called a gemmule, can resist freezing, dessication, and other hazards, for three to nine months, but then — as it were — germinate into a new sponge.

In marine sponges, larvae commonly occur which are like these gemmules except for the lack of the protective capsule, and their placement is apt to be at the base, next the substrate. I have detached thousands of sponges from their place of growth, with careful observation of the substrate, sometimes even scraping some of it loose at the same time. In the summer, such reproductive bodies are at first absent or rare, but

as autumn approaches they become more common, just as in fresh water sponges. It should be mentioned that usually we do not know if such a larva had a sexual origin or not. The surmise is here hazarded that they are usually not sexually produced. BURTON, in the *Proceedings of the Linnean Society,* 1949, page 165, states that some such basal larvae of marine sponges do have a protective capsule of spongin. With or without such a coating, they certainly might survive winter, and be ready to germinate in the spring.

Thus it may well be that the clusters of tiny sponges which BURTON assumes came from the impact of a motile flock of larvae, may instead come from the sessile larvae which formed *in situ* the preceeding Fall. As a boy, I was familiar with a certain beautiful patch of daisies. It was there, in the same place, with the identical outline or shape, every summer. One who visited that hill every year, but only in the summer, might assume that this was a group of immortal plants. Actually they were annuals, dropping their seeds on the soil around them, each autumn. Because so many biologists teach during the winter, and get to the seashore chiefly in the summer, and see the same old friends in the same old places, they may assume great age where the species actually are annuals.

Yet great old age is emphatically possible for sponges. Near Hopkins Marine Station of Stanford University, at the south side of Monterey Bay, California, is a well-marked, much studied big tidepool. A large sponge lives there, which I named *Spheciospongia confoederata,* although it is not a typical *Spheciospongia.* It was reported to me as being there year in and year out. I personally checked on it through the winter of 1928-29, and am confident it changes little with the seasons. I have recent reports from biologists at Stanford that it is still there (1951). I used to cut samples from it for study, and the wounds would soon heal. It probably does grow, but the outgrowths emerge from its shelter in crevices, and are broken off by the frequent storms which sweep the rocky, exposed point where it abides.

An interesting speculation attributes great age in years to the deep sea sponges; this is plausible because of the frigid temperatures which prevail there.

It is probable that sponge longevity varies immensely between different species, some living only for one season, others for centuries, and various lengths in between.