Benthic communities of McMurdo Sound

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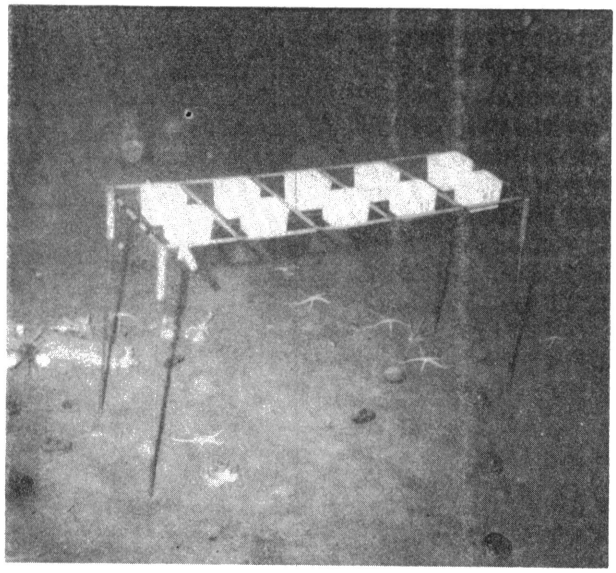
The extremely predictable nature of the McMurdo Sound marine environment emphasizes the importance of biological interactions to the evolution of long-lived benthic species. This community may thus have parallels with such obviously different communities as those of the deep sea and some tropical habitats.

While the specific objectives of this research program are to design and execute carefully controlled experimental tests of specific hypotheses, the general goal is directed toward an evolutionary evaluation of types of selective pressures at work in such a biologically accommodated marine community in hopes that enlightening parallels can be made with other similarly controlled communities. In addition to establishing several new programs, our field work from September to December 1975 included monitoring and expanding an ongoing experimental investigation of the dynamics of the McMurdo Sound sponge community.



Photos by author

Figure 1. Rack of experimental containers with different sediment types. This rack is set off the bottom to test hypotheses regarding the demersal habitats of larvae. Other racks were set on the bottom and had various types of cages.

The predator exclusion cages and their controls established in 1967 at Hut Point and Cape Armitage showed measurable growth of only three sponge species *(Mycale acerata, Haliclona dancoi,* and *Isodictya erinacea),* with very little change in the volume of other species.

These generally low growth rates add to the picture of very slow growth discussed earlier (Dayton *et al.,* 1974). The only exception to this was a dramatic proliferation of the sponge *Homaxinella* sp., which was very rare in 1968 and now dominates 50 to 75 percent of the space in zone II, north of Hut Point (Dayton *et al.,* 1970). It is interesting to note that by 1974 three species of carnivorous starfish were beginning to decimate the *Homaxinella.* We established many permanently marked transects in zone II and in the main Cape Armitage study area to investigate rates of survivorship, recruitment, and individual growth of the various sessil organisms. Several experiments were established to study the encrusting association of hydroids and bryozoans that settled on the cages. These experiments test hypotheses about interactions between these encrusting species, and the possible effects of such other environmental parameters as predation and sedimentation. The same association of encrusting species occurs on a rock wall, where we also are doing experiments and long-term baseline monitoring.

Jeff Rude, Scripps Institution of Oceanography, began a Ph.D. program designed to evaluate reproductive and defense strategies of selected sponge species, especially those that are not prey *(Latrunculia apicalis, Dendrilla membranosa,* and *Leucetta leptorhapsis),* those that have high recruitment and growth rates *(Mycale acerata, Homaxinella* sp., *Isodictya erinacea),* and representative rosselid species *(Rossella racoritzae, R. nuda,* and *Scolymastra joubini),* which contribute most of the community's structure and biomass. This research involves histological analysis of reproductive patterns and physical and chemical resistence to predation, and detailed *in situ* analysis of growth patterns of many colonies of each species.

A new program was initiated to study the mechanisms that determine patterns of distribution and abundance of species in the McMurdo Sound region's soft-bottom community. Soft-bottom samples were collected from in front of McMurdo Station and along the west side of Hut Point Peninsula, and from Turtle Rock, Hutton Cliffs, Cape Evans, Cape Royds, and New Harbor. Samples were also taken in areas subject to such natural disturbances as underwater landslides and very recent iceberg scars, to such pollution as diesel oil in Winter Quarters Bay, and to many types of experimental perturbations. John S. Oliver, Scripps Institution of

Oceanography, will include aspects of this research in his Ph.D. program.

Several components of all of these programs are integrated by the common denominator of larval settling behavior and subsequent survival. To this end much effort has been spent devising and testing hypotheses regarding aspects of larval ecology. Triplicated sediment traps have been established at three depths (15, 30, and 40 meters) at eight stations between Cape Armitage and Cape Royds, and at three stations in New Harbor. Established adjacent to each sediment trap array were several types of settling plates and other material such as tuffy scrubbers designed to offer various types of habitat to settling larvæ. In each case these larval habitats were placed on the bottom and at heights of 50 centimeters and 1 meter above the bottom in order to evaluate hypothesized demersal larval habits. Larvæ distribution in the water column is also being investigated by suspending various settling surfaces beneath subsurface floats. Finally, almost 300 experiments were established above the sponge and soft-bottom communities to test larval selectivity of different habitats such as sponge spicules, various marine sediments subject to several treatments, and nonmarine sediments from the dry valleys. The effects of several levels of enrichment as well as fish, asteroid, and ophiuroid cropping are being tested.

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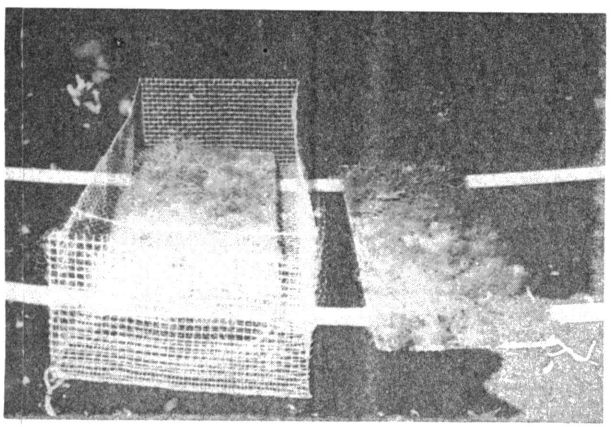

Figure 2. Heavily encrusted panels from cages established in 1967. These panels were manipulated to test various hypotheses regarding the effects of cropping, sedimentation, and competition between encrusting species.

Lake Bonney ecosystem

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From November 5, 1974, to January 17, 1975, two faculty and student field teams* continued to collect information pertinent to understanding carbon flow through the Lake Bonney ecosystem. Special emphasis in this third consecutive field season at Lake Bonney was given to correlations of solar radiation induction of glacier melting, to input of meltwater carrying nutrients into the lake, and to measurements of photosynthetic production of phytoplankton and attached algal mats.

This season's analytical chemical data on alkalinity, dissolved oxygen, ortho- and condensed phosphates, nitrate, nitrite, ammonia nitrogen, and sulfate, probably are the best ever collected for the Lake Bonney water column. Many algæ were identified: the two dominant phytoplankton algæ are *Chlorella vulgaris* and *Chlamydomonas* sp., both now in axenic clonal culture. These two green algæ also occur in attached algal mats along with the blue-green algæ *Schizothrix calcicola, Phormidium frigida, Nostoc* sp., *Oscillatoria* sp., the diatom *Navicula* sp., etc.

Many planktonic bacteria also were identified to genus, and select aspects of their physiological ecology were explored. For example, approximately 30 percent of all bacterial isolates are nitrate reducers, while about 20 percent are sulfate reducers. At least one bacterium from Lake Bonney is a psychrophile. Bacterial counts and some chemical data for this field season, as with the 1973-1974 austral summer, point to a major influence on the lake metabolism by meltwater input to the lake's east lobe from Sollas and LaCroix glaciers. The probable input of subterranean water also is implicated. Ammonia nitrogen and orthophosphate, two

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