A Conception of Biological Communities

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For myself, I intend to use the term "community" rather vaguely for a particular group of organisms characteristic of a given habitat, large or small. When asked to speak on this subject, I thought I had better see whether ecologists had more precise definitions to offer. Consultation of literature did not clarify the matter, merely emphasising that terms such as "community", "association", and "formation" are liable to be interchanged or used even in opposite senses by different workers. The term "biocenosis" also comes into the scene, as roughly a synonym of community, but one where the organisms are more in evidence than the habitat. Whether the introduction of cumbersome terms such as this last one is desirable seems doubtful. Unnecessary terminology may merely hinder the development of ecology, bringing to mind the flippant definition of it as "that phase of biology primarily abandoned to terminology". This seems an even more damning definition of ecology than "crude physiology" or "natural history trying to be scientific". We surely want the subject in this country to develop into something more real than a terminological discussion. Perhaps it doesn't hurt to remind ourselves of the original idea of ecology as "the study of the relationship between organisms and their environment".

Necessary preliminaries to such study involve the need to recognise the main species we are handling, when we turn to the systematists; and the need for the initial, surveying type of field-work, when we note what species occur where and their relative abundance, and record environmental factors. Both these types of work are needed. In fact, it is striking how the systematic work that has gone ahead in this country during the past few years is making ecological studies possible today that were virtually out of the question a decade ago. But it would surely be a pity if we let ourselves get into the habit of tackling only systematics or descriptive ecology. Rather let us go ahead and build on this, trying to really get down to the *relationships* between organisms and their environments—what the requirement and modifications are of ecologically important or interesting species, and by what sort of behaviour responses they come to the living place that suits them and succeed in it.

But to return to the matter of communities: my attempts to clarify my conception of them after consulting literature and biologists around, left me feeling in considerable agreement with a student from another centre who said blithely, "community—oh, that's the vague sort of term that can mean anything at all. That's why it is so useful."

The only really cut and dried definition of a community that I came across was in Allee and others' "Principles of Animal Ecology", where he says, "The major community may be defined as an assemblage of organisms which, together with its habitat, has reached a survival level such that it is relatively independent of adjacent assemblages of equal rank; to this extent, given radiant energy, it is self-sustaining."

This definition may well be reasonably applicable to terrestrial communities. A beech forest or a subalpine scrub or a sand dune may work relatively independently, if we ignore succession from one to another. Most of their plants photosynthesise, and many of the animals may be more or less confined, by their feeding preferences and other requirements to that particular plant association. The plants are fixed, the animals mobile, and the overlying medium—the air—is chiefly of importance for its inorganic contributions. In the sea, however, to some extent matters are reversed. In offshore waters the great bulk of the photosynthetic organisms—diatoms and dinoflagellates—move freely with the water mass. Of the animals, on the other hand, a surprisingly large proportion are fixed or virtually so. For instance, sponges, many coelenterates, tubicolous polychaetes, bryozoans, many molluscs, barnacles and ascidians spend the greater part of their lives staying put and drawing their food to them. Hence even the most major subdivisions of the sea, such as plankton, bottom communities and the inhabitants of intertidal rocks, are not nearly as independent of one another as are forest, sand-dune or scrub. Plankton directly or indirectly supplies the food for many bottom dwelling animals of deeper or shallower water; and the disintegrating benthos fertilises the water, enabling further plankton to develop. So we see that such major ecological divisions of sea life as plankton and benthos, each readily subdivided into many smaller communities, are, even at this top level, intimately dependent on one another. So Allee's community definition—an assemblange *relatively independent* of adjacent assemblages—is not nearly as applicable as to terrestrial groups.

When we turn to seashore communities, taking life of intertidal rocks as an example, we find a somewhat greater independence of adjacent assemblages than offshore. Here, seaweeds and lichens may abound, and provide food for browsing molluscs and some of the other animals found in the vicinity. But while there will be some examples such as this of closed food chains within the community, we must not forget that all filter-feeders are dependent on the plankton. The ecologist usually observes such a community when the tide is out, and the beasts are to all intents and purposes asleep. But they will repay study under water, in a state of activity. It is when the tide is *in* that the barnacles are busily netting plankton, and the sponges and ascidians and lamellibranchs are filtering the sea for their food. It is when they are submerged and active that they become of greatest interest—whether we observe them through goggles or glass-bottomed box in the sea, or whether we bring them indoors to an aquarium tank under more controlled though less natural conditions.

The inhabitants of intertidal rocks are my conception of an example of a major community. In this instance, tidal zoning is characteristically in evidence. On the rocky coast by the Portobello Marine Station in the middle of Otago Harbour, the picture briefly is as follows:—At the top, lichen blackening at and above high spring tides supports the usual littorinids—the common *Melaraphe cincta* and the blue-banded *M. oliveri.* At high tide neaps the red alga *Bostrychia* forms a broken band, better developed on south faces. From here to about half tide is relatively bare. The species most in evidence (seemingly more so than their food supply) are the periwinkle *Melagraphia aethiops,* the limpet *Cellana ornata* and the chiton *Sypharochiton pelliserpentis.*

Sessile barnacles (chiefly *Elminius modestus* and the larger, often yellowish *E. plicatus*) are sprinkled more especially below half tide, but they do not form the dense covering seen on some shores. Seasonal changes are marked intertidally, some algae and anemones showing spring or autumn bursts, but disappearing in the December sun.

At low tide neaps, *Hormosira banksii* usually dominates. Ulvas, red algae, oysters and mussels are also important at this level, the lamellibranchs more especially on the sides of rocks where water rushes between.

Below comes the really dense region. *Macrocystis* dominates, but every square centimetre beneath and amongst it is vigorously competed for; sponges, ascidians and other filter feeders show an astonishing range of often vivid colours. Especially in evidence are beds of the pink stalked sea-squirt, *Pyura pachydermatina.* Its stalks form the substratum for what I regard as a characteristic smaller community within the larger one. Dense growths on the stalks of the bryozoan *Elzerina* and a *Sertularia* have polychaetes, amphipods and other characteristic species living among them. Whereas ecological succession is not readily studied in a larger community such as the rocky shore example I have taken, smaller communities within it, such as of *Macrocystis* fronds and holdfasts and *P. pachydermatina* stalks, might well lend themselves to such studies.

Such, then, are examples of my conception of communities, used in both a wider and a narrower sense. Describing them is one thing. The next is to try to understand them—just what controls the particular groupings of species involved, and which taxes and responses of free-swimming larvae are responsible for bringing the larvae of the different species of barnacle, tube-worm, ascidian and so forth to the niche suited to the adult.