CORAL OR ALGAL REEFS?

Ian R. Price
Botany' Department
James Cook University, Townsville; Qld 4811

ABSTRACT

Photosynthetic plants occupy a central position in all living communities, and reefs are no exception. In terrestrial communities plants are usually the largest and most obvious organisms, and 'their importance cannot be ignored. In reef communities on 'the other hand, 'certain animals, such as corals, are larger and more conspicuous than most of the plants, whose vital importance may therefore be underestimated. Although many of the species present are small, and even microscopic, plants dominate reefs in terms of overall surface cover and biomass, and are responsible 'for the high productivity of reef communities;

The major group of photosynthetic plants in reefs is the algae, although seagrasses and mangroves may also be present. A wide variety of algal species occur as normal inhabitants of reefs; from a structural and functional point of view they can be categorized in the following way:

1. Phytoplankton - free floating, and mostly unicellular and microscopic plants (eg., Trichodesmium, 'sea sawdust'),: The contribution of phytoplankton in reef communities is generally considered to be insignificant.

2. Benthic (attached) algae - ranging from microscopic, unicellular plants to seaweeds several metres long. These benthic algae are the most abundant and important plants in reefs, and include:

   A Seaweeds (the more familiar and mostly macroscopic algae)

   (i) Fleshy (non-calcareous) seaweeds; including large and, erect+' types (such as Sargassum spp.) and the minute; creeping turf algae.

   (ii) Calcareous seaweeds, including the larger:, mostly erect and jointed forms (such as Halimeda, spp.) and the encrusting coralline algae.

   B. Perforating algae - microscopic species which actively bore into calcareous reef materials, such as reef rock, calcareous algae, and the skeletons of hermatypic corals. They produce vast numbers of minute channels which greatly weaken the surface of shallow-water substrates.

   C. Symbiotic algae, comprising a range of aigal species 'living in association with a variety of reef animals. The best known are the zooxanthellae, which are intimately associated with all' reef building corals, and represent about one-third of the living tissue in a coral colony.

The larger seaweeds are the most conspicuous algae on reefs, and are particularly abundant on fringing reefs. Many of the other macroalgae are overlooked by the reef visitor, and even by some reef scientists!

The various types of algae perform several vital functions in reef growth and maintenance, such as:

primary production, the basic energy. input into the system via photosynthesis (all algae, particularly turf algae);
cementing (especially crustose coralline algae);
sediment formation (especially species of Halimeda);
bioerosion (the perforating algae); and,
nitrogen fixation ('some turf and perforating algae, and Trichodesmium).

Research into the activities of algae, in terms of the rates of these processes in reefs, has only been undertaken in the past few decades, and only a sketchy picture is so far available. It has, however, been shown that algal-dominated communities on reefs can achieve higher rates of primary production than coral-dominated communities, and equal, rates of calcification. In relation to the reef foundation, Maxwell has published the following approximate average composition of reef rock and surface sediments in the Great Barrier Reef:

corals	28%
coralline algae	30%
Halimeda spp.	30%
foraminiferans	10%
other organisms	2%

Because of the dominance of algae in both the living community and the reef foundation, the term 'algal reef' would be more appropriate than 'coral reef'. However, both terms lay undue emphasis on only one particular group of organisms in an extremely diverse and complex community. In view of the presence and importance of a wide variety of plants and animals in reefs, it has been suggested by Womersley and Bailey that the most suitable term would be 'biotic reef' (or living reef).

With regard to fringing reefs in the Great Barrier Reef Region, an important biological characteristic is the generally high cover and biomass of large. (particularly brown) seaweeds, especially on the reef flat, where coral cover may be very low. Dramatic changes . in the composition and biomass of the seaweed vegetation take place through the year. Many of the species are effectively annual, with rapid growth rates and relatively short life spans. Some of the production is consumed by grazers, while much of it breaks away following reproduction; dense bands of drift algae may form on the beaches behind fringing reefs at this time. Considerable inter-annual variation in the peak biomass of some of the seasonally abundant species has been observed.

In terms of algal species composition, fringing reefs are broadly intermediate between shelf reefs and mainland rocky shores. Large brown algae, for example, are abundant on rocky shores in the region, but are almost absent from most shelf reefs.

Probably the best studied fringing reef in Australia, from the biological aspect at least, is Geoffrey Bay on 'Magnetic Island. The distribution and abundance of the algal and coral species has been well documented by James Cook University students and staff, and the strong seasonal changes in the algal vegetation recorded. In addition to these descriptive'studies, seasonal changes in the biomass and productivity of the algae, and the rate'of production of algal detritus, have more recently been monitored,, (Morrissey and Pichon, pers. comm.). The fate of this organic detritus is yet to be determined,,but most of it probably remains within the reef system itself. Some of the algal production appears to be exported from the fringing reef, as 'large plants of Sargassum have been recorded drifting among mid-shelf reefs from which the genus is absent.

It seems probable that the seasonal development of dense beds of large algae strongly influences populations of other reef organisms, both plant and animal. Those organisms closely associated with the individual algal thalli might be most affected, but the algae may also compete with corals for resources such as space, light, and nutrients. This is an area where further research is needed. There is also little infbrmation on the level of grazing on the algal vegetation, and the grazers involved. The ultimate fate,and significance of algal detritus in the reef system also remains unclear.

The patchiness, strong seasonal changes, and inter-annual variations in the seaweed vegetation are important considerations in any monitoring programs on fringing reefs. In addition, algae can respond dramatically to environmental changes, and there may well be species which would serve as useful indicators of marked shifts in the reef environment due, for example, to coastal development.

In addition to its scientific importance, the diverse flora of reefs holds considerable interest for the environmentally aware reef visitor, because of the variety of colour, size, and form, as well as the range of ecological function. Australian publications which cater for this general interest are now readily available.