

NITROGEN FIXATION ON A CORAL REEF: EFFECTS OF FISH GRAZING AND DAMSELFISH TERRITORIALITY

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Relative rates of nitrogen fixation were determined for dead coral substrate subjected for one year to experimentally varied levels of fish grazing. Freshly killed but uncleaned coral (*Pachyseris speciosa*) were cut into plates of relatively uniform size. Sets of these attached to metal grids and implanted subtidally under the following three conditions:

1. Within territories of the damselfish, *Hemiglyphidodon plagiometopon* (Pomacentridae) in which other grazing fish are excluded;
2. outside these territories, fully exposed to total fish grazing; and
3. within fish-exclusion cages.

After 12 months the plates were assessed for nitrogen fixation rates using the acetylene reduction technique. Preliminary results are reported here.

Mean algal biomass (mg cm^{-2}) was 16.27 (decalcified dry weight) on caged plates, 7.74 within territories, and 0.26 on plates fully exposed to fish grazing. The chlorophyll *a* content ($\mu\text{g cm}^{-2}$) however, did not vary greatly between treatments, ranging from 8.93 within cages to 9.31 within territories and 9.79 outside territories. Much of the algal biomass on plates within cages and

territories, therefore, was skeletal or inert tissue. The amount of nitrogen fixed (acetylene reduced — u $1.\text{cm}^{-2}.\text{h}^{-1}$) was much higher outside territories (1.50) than within territories (0.52) or cages (0.10).

There is a positive correlation between the extent of fish grazing and rates of nitrogen fixation. Fish appear to graze upon the larger, more accessible algae, maintaining the algal community in its earliest stages of succession. This favours the growth of 'r-selected' species, including blue-green algae, capable of rapid colonization and growth. Many blue-green algae were found on the grazed plates, including species of *Calothrix*, *Lyngbya*, *Oscillatoria* and *Phormidium*. The removal of fleshy red and green algae may also result in greater light penetration to the blue-green algae.

Nitrogen fixation is apparently enhanced by fish grazing. Other investigators have found that as a result of nitrogen fixation there is release of ammonia and nitrate into the water; thus, fish grazing may actually enhance algal growth rates.