LINKS BETWEEN SEDIMENT POLLUTION AND *CAULERPA TAXIFOLIA* PROLIFERATION

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Under laboratory conditions, the productivity of free-living Mediterranean samples of *Caulerpa taxifolia* (Vahl) C. Agardh is unremarkable. Winter-acclimated specimens exhibit rates of net photosynthesis that fall well within the range of all reported productivity estimates for other species within the genus throughout the normal range of seawater temperatures encountered annually on the Côte d'Azur (GAYOL *et al.*, in press). Similarly, the growth rate of *C. taxifolia* is slow when samples are cultured in aquaria on beds of nutrient-free, glass beads (ca 2 mm diam.; unpubl. data). Typically, resources are directed toward stolon and rhizoid production rather than frond growth. These observations indicate that substrate chemistry may significantly influence the growth of *C. taxifolia* in the field.

During August and September 1994, we analysed a suite of biogeochemical properties of the interstitial waters of sediments removed from within: 1) the *C. taxifolia* population existing below the Musée Océanographique de Monaco; 2) a dense meadow of *Posidonia oceanica* in the Larvotto Reserve; 3) a mixed population of both species at Cap Martin; and 4) a mixed population of both species between the port of Fontvielle and Cap d'Ail.

Remarkable differences were observed in ammonium potentiality and production between the first two and the last two sites. At Cap Martin (3) and near Cap d'Ail (4), environments which now support vigorously growing populations of *C. taxifolia*, the microbial capacity of sediment interstitial waters to reduce a variety of added organic nitrogen substrates and generate ammonia was feeble. In contrast, actual ammonium production within sediment interstitial waters was much higher at sites 3) and 4) than at sites 1) and 2). These data indicate large supply rates of bacteria-laden organic material to the seabed at Cap Martin and near Cap d'Ail but almost no microbial activity within the sediment itself for subsequent transformation of organic nitrogen. These microbial contra-indicators are typical of sediments polluted by waste-water discharges.

Sediment interstitial water parameters below the Musée and in the Larvotto Reserve were for the most part comparable. It may be significant that photographic records now demonstrate a reduction in *C. taxifolia* abundance below the Musée. An optimistic view may be that ten years of vigorous *C. taxifolia* growth in this environment has had a remedial effect on sediment quality.

We tentatively conclude that anthropogenic pollution probably first causes degeneration of *P. oceanica* meadows. The resulting base of dead organic material, together with continuing inputs of human waste from sewage outfalls then creates a resource for *C. taxifolia* which appears better able to survive in polluted environments. Fluorescence and scanning electron microscopy confirms the presence of large numbers of bacteria living in association with the surface of the subterranean rhizoids. Preliminary measurements indicate that these populations are supplied with oxygen during photosynthesis thus facilitating aerobic microbial nutrient cycling, a process that would have obvious advantages in anaerobic sediments. Enhanced bacterial degradation of organic material and possibly also direct uptake of organic substances by *C. taxifolia* itself would serve to promote the remediation of polluted sedimentary environments.

RÉFÉRENCES

GAYOL, P., C. FALCONETTI, J. R. M. CHISHOLM and J. M. JAUBERT, in press. Metabolic responses of low-temperature-acclimated *Caulerpa taxifolia* (Chlorophyceae) to rapidly elevated temperature. *Bot. Mar.*