



## Is mariculture the remedy to problems of coral reefs of coastal communities?

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Over-harvesting, destructive fishing practices and other harmful human activities on coral reefs give rise to concerns about the conservation of these bio-diverse and productive ecosystems and continued production of their living aquatic resources. These resources are essential for the livelihood, and social and nutritional well-being of coastal communities (McAllister, 1988). The worthy concerns about these resources in turn give rise to proposals for solving the problems. One solution which keeps surfacing, supported by resource-oriented sectors, global and regional financial institutions, conservationists and others, is mariculture: simply raising the fish or invertebrates in *ex situ* (off-site) ponds or tanks. Production of the resource will be assured and pressure will be taken off the reef. Simple solutions may in some cases be effective, but may also avoid important issues (McAllister, 1996).

A far-reaching and effective solution will take into account all the ramifications; it will be holistic; it may work on several aspects, not a single aspect; it involves the people and communities engaged in the harmful activity, and ecosystem diversity and integrity.

Mariculture as a solution to coastal zone problems may give rise to its own problems. These include:

- Destruction of natural ecosystems when creating sites for culture, e.g. removal of mangroves for shrimp culture.
- Lessening priority to solving other problems on the reefs, which, if solved, could produce a series of environmental, social and economic benefits (McAllister, 1988).
- Depriving local fisherfolk and developing countries of employment and income, when the mariculture of that country's species is conducted in a northern country or another southern country.
- Transfer of resource benefits from the poor to the rich (McAllister, 1989).
- Mariculture may impact upon environments by its own output, affecting local ecosystems; eco-aquaculture principles (McAllister, Hamilton & Harvey, 1997, p. 47–48) and practices are not widespread. Nor have we learned much from the impacts of monocultural agriculture.

- Mariculture may be based on harvest of eggs, larvae, or small adults in the wild. Grow-out mariculture may just be another form of capture fishery (Sadovy & Pet, 1998) and the harvest can be environmentally destructive (Ortiz, 1991).
- Intensive mariculture may foster diseases (e.g. in shrimp and Atlantic salmon mariculture) and pests, and transfers of eggs, larvae or adults may convey diseases to new areas and permit escape into the wild.
- Culture of exotic species may lead to the escape of those species into the wild, when local conditions are suitable for their survival. Successful establishment of exotic species in the wild may lead to degradation of ecosystems or reductions in populations of native species.
- Escape of domesticated or bio-engineered mariculture stock may result in genetic pollution of wild stocks, thereby disturbing their adaptational equilibrium.

This is not to suggest that all mariculture of exotic species is inherently bad. Sometimes it may depend on how the mariculture is carried out, by whom, and where. It might be, for example, that culture of corals and 'live rocks' in developing countries is preferable to harvesting them in the wild.

I will develop only one issue. This is the mariculture in developed countries of tropical organisms originating in developing countries. The harvest and local use or export of reef organisms provides employment and income at the local community level in tropical developing countries. Secondary employment from harvesting is provided for a variety of workers and entrepreneurs, e.g. boat builders, gear makers, middlemen and exporters. The developing countries, mostly hard-pressed for income, are able to generate much-needed hard currency for essential purchases through the export of wild-caught resources.

When mariculture of a tropical reef species is moved to a developed country, then the country of origin loses the community- and national-level benefits it once derived. Investors in the wealthy country benefit; those in the less-well-off country lose.

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This is a problem that the countries negotiating the International Convention on Biological Diversity wrestled with. The North wanted free and open access to the biodiverse resources of the South, since the South contains most of the countries on the planet displaying megadiversity. But the South argued that it was hardly worth their while to set aside protected areas and sustainably use their resources, if they received none of the bio-industry benefits; they might as well just clear cut their forests and heavily exploit their coral reefs. After much tugging back and forth between North and South, it was decided to include articles in the Convention which provided access by the North, but which assured a fair and equitable sharing of the benefits derived from biodiversity. The first article reads:

*The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over these resources and to technologies, by appropriate funding.*

Over one hundred and seventy countries have signed and ratified this agreement. The major exception is the United States, which signed but did not ratify the Convention. If signatories to this Earth Summit agreement hold to their commitments, then there is hope that both North and South, our grandchildren and the environment will benefit.

A current concern is that free trade and investment agreements, like the Multilateral Agreement on Investment (MAI), new MAI-like policies being adopted by the International Monetary Fund, and plans under consideration by the World Trade Organization, will circumvent the responsibilities shouldered under the Biodiversity Convention. If that happens, then the world's poor, and the environment, will become poorer. The touted economic benefits of globalisation have never stood up to close scrutiny, and do so even less today as one card after another begins to fall in the global economy.

The culture of exotic organisms outside their country of origin certainly has the capacity to deprive the South of a share in the benefits to which they are entitled. These and other disadvantages need to be considered when proposing solutions to the many problems occurring on coral reefs.

A planet which is equitably and fairly shared by its humans and wild species, is, I suggest, a better planet to live on, and one which will endure longer. Quick hi-tech fixes alone, such as starting up mari-

culture and putting in place artificial reefs, will not do the job alone. Not when the clear-cut forests and mono-cultured agricultural fields and paddies are shedding their soils and chemicals onto the reefs. Not when coastal people, with small-scale sustainable approaches are kept out of their traditional fishing grounds by mega-trawlers, and not when women are deprived of a voice, education, economic and family planning tools. And growing populations take more than their fair share of the Earth. Not when national 'leaders' siphon US\$ 42 billion from development funds and the economy, and when corporations, not democratic societies, make most of the important decisions.

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