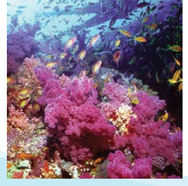
Coral Reef Targeted Research & Capacity Building for Management

Over one-half
of the world's population lives
within 100 kilometres
of the sea.



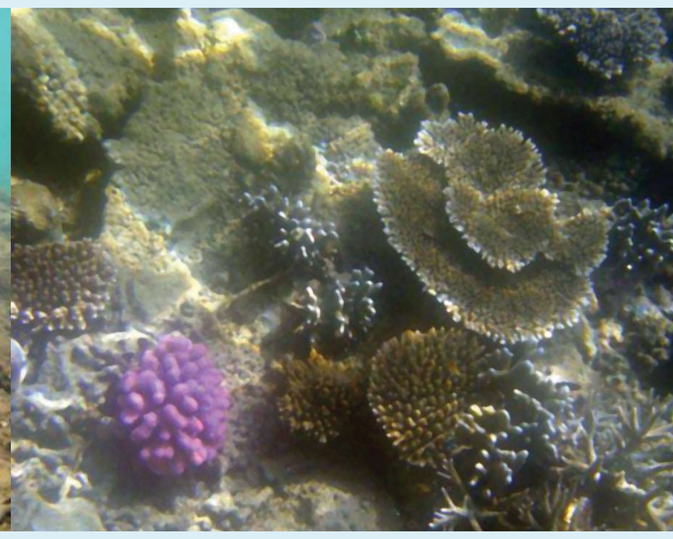


Coral Reef Targeted Research & Capacity Building for Management

Restoration and Remediation Working Group

Long-term efficacy and cost-effectiveness of restoration interventions



Goals

- **To improve our understanding of natural recovery processes on reefs so that we can better advise managers on appropriate management options for degraded reef areas.**
- **To evaluate and compare the long-term cost-effectiveness of a range of the active restoration interventions currently available.**
- **To investigate ways of improving implementation of existing restoration techniques so as to minimize environmental impacts, maximize survival of transplants, and lower costs.**

Progress to Date

For the initial five years of the CRTR Program, the Restoration and Remediation Working Group (RRWG) have set up three research programs:

Enhancing recovery by culture and transplantation of corals

This program focuses on asexual propagation of corals to assist restoration. The key to cost-effectiveness in restoration using transplants is balancing the costs of nursery rearing and effective use of limited source material against the likelihood of survival of transplants. This program is investigating the effect of the size and structure of coral fragments on subsequent growth and survival for a range of species. Low-cost approaches involving direct transplantation are being compared to more costly approaches involving periods of *in situ* culture prior to transplantation to damaged reefs.

Enhancing larval recruitment

This research program focuses on the sexual propagation of corals from the larval stage following spawning. This involves a higher level of technology and at present much higher costs, but does offer the potential of rearing hundreds of thousands of sexual recruits for restoration.

Long-term efficacy and cost-effectiveness of restoration interventions

Efficacy of restoration interventions should be judged in terms of what these interventions achieve in comparison to what occurs with natural recovery over at least a 5-10 year timescale. The natural reef is varied and it is difficult to perform adequately controlled comparisons using patches of natural reef as there are too many potentially confounding factors. To get round this problem, this program is using standardized artificial structures of sufficient scale and replication to allow long-term statistically rigorous comparisons to be made between the outcomes of natural processes and the outcomes of a range of interventions.

Expected Outcomes

We intend to produce at least two outputs specifically for managers. These include *Reef Restoration Concepts and Guidelines: making sensible management choices in the face of uncertainty* and towards the end of the project a more substantial *Reef Restoration Manual*.

Among a range of questions which we hope to be able to better answer are:

- **What minimum local conditions and management need to be in place for active restoration interventions to have a chance of success?**
- **Under what circumstances is active restoration likely to be of little benefit?**
- **What is the relative cost-effectiveness of a range of restoration interventions?**
- **How is asexual coral transplant survival related to size in different species and in different environments?**
- **Which coral species are not well suited for transplantation?**
- **What effects do pruning coral colonies for asexual fragments have on the reproduction, growth and survival of donor colonies; how much can be safely excised?**
- **How does the nursery rearing environment affect survivorship of outplanted corals on the reef?**
- **At what size is it most cost-effective to outplant sexual recruits reared from coral spawn?**

Implications for Coral Reef Management

Coral reefs worldwide are suffering degradation from a number of disparate natural and man-induced causes. Tackling the root-causes of degradation through effective coastal management measures is likely the best way both to reduce further damage and to allow reefs to return to viable healthy states. Nevertheless, there can also be opportunities for direct intervention to actively restore degraded coral reefs.

At present we have only a rudimentary understanding of a) the complex processes that contribute to natural recovery of coral reef systems from disturbance, and b) the types and advisability of interventions (i.e. restoration actions). It is therefore difficult to assess both the recovery potential of different sites and the likelihood of any given site benefiting from active restoration interventions. Criteria are needed that can specify the degree to which an injured site might benefit from better management and/or active restoration. To develop these, we need to understand more about the factors and processes that contribute to both the time-course and the success or failure of natural recovery and of active restoration interventions.

The research being carried out by the CRTR Restoration and Remediation Working Group (RRWG) is seeking not only to address many of the knowledge gaps which hinder restoration but also to channel advice (however limited this may be) to the management community so that restoration projects can be undertaken in a more informed way and with better chance of success.

Tenets

- **Coral reef restoration is in its infancy. We *cannot* create fully functional reefs.**
- **Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.**
- **Improved management of reef areas is the key to their health. However, within an overall management plan, active restoration offers managers a useful and potentially powerful tool for assisting recovery of degraded reefs.**

Society for Ecological Restoration 2004

More information

The University of Queensland is the Project Executing Agency (PEA). More information about the CRTR Program can be obtained from the PEA:

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The CRTR Program is a partnership between the Global Environment Facility, The World Bank, The University of Queensland (Australia), the United States National Oceanic and Atmospheric Administration (NOAA) and approximately 40 research institutes and other third parties around the world.
The four sites or Centers of Excellence are **Southeast Asia**: Marine Science Institute of Bolinao, University of the Philippines; **East Africa**: Institute of Marine Sciences, University of Dar es Salaam, Zanzibar, Tanzania; **Mesoamerica/Western Caribbean**: Unidad Academica Puerto Morelos, Universidad Nacional Autonoma de Mexico, Mexico; and **Australasia/South Pacific**: Heron Island Research Laboratory, Centre for Marine Studies, The University of Queensland, Australia.