

Modelling & Decision Support

Coral reefs and the people that depend on them are facing a multitude of global, regional and local problems including climate change, overfishing and dredging. These problems are difficult to solve mainly because coral reefs are all interconnected.

The Coral Reef Targeted Research & Capacity Building for Management (CRTR) Modelling & Decision Support Working Group believes that when finding solutions to problems faced by coral reefs, coral reef managers and scientists must:

- Attack all problems simultaneously;
- Understand how local problems affect global problems and vice versa;
- Understand how social and economic problems affect biological and physical problems and vice versa;
- Explore the effects of different management strategies on all problems; and
- Allow managers to learn and adapt.

Modelling is an important management technology that allows decision makers and reef users to see the dynamics of the whole reef system. Models help us to visualise potential reef futures under various management scenarios, and to assess the trade-offs that might result from the tension between utilisation and conservation of reefs.

There is a distinct lack of multi-scale models for decision support in management of coral reefs and associated policy development. Given that reef systems are interconnected across regions, both biophysically through larval dispersal and transport of

sediment and pollutants, and socio-economically through social structures and regional economies, it is essential that models include both local- and regional-scale phenomena.

The value of a regional model is greatly enhanced if it can be readily adapted for diverse global regions such as the Caribbean, the Indo-Pacific, and East Africa. This requires a model structured to handle highly variable data quantity and quality, and dissimilar management questions and priorities.

Through its work, the Modelling and Decision Support Working Group is creating an integrated scientific understanding of the way in which people interact with coral reefs.

The Group's key objectives are to:

1. Develop modelling resources to enable reef managers to develop scenarios for their own areas.
2. Better understand the links between local, regional and global processes.
3. Facilitate access to relevant scientific and economic data over the Internet.

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The Group's recent research highlights are detailed below.

The Coral Reef Targeted Research & Capacity Building for Management Program (CRTR) is a leading international coral reef research initiative that provides a coordinated approach to credible, factual and scientifically-proven knowledge for improved coral reef management.

The CRTR Program is a proactive research and capacity building partnership that aims to lay the foundation in filling crucial knowledge gaps in the core research areas of Coral Bleaching, Connectivity, Coral Diseases, Coral Restoration and Remediation, Remote Sensing and Modeling and Decision Support.

Each of these research areas are facilitated by Working Groups underpinned by the skills of many of the world's leading coral reef researchers. The CRTR also supports four Centers of Excellence in priority regions, serving as important regional centers for building confidence and skills in research, training and capacity building.

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 50 research institutes and other third parties around the world.

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Modelling & Decision Support Working Group members, Merida, Mexico. Photo: Rollan Geronimo



Heron Island, southern Great Barrier Reef. Photo: Ove Hoegh-Guldberg

ReefGame

The Modelling and Decision Support Working Group has developed the next generation of an agent-based participatory modelling game – ReefGame. This formed the basis of a successful workshop at the Marine Science Institute's Bolinao Marine Laboratory.

Attended by fishing families, barangay captains and Government officials, the novelty of the process resulted in greater sharing of ideas and experiences by the fishers compared to traditional questionnaires.

These stakeholder workshops, which describe and model how people behave, are a powerful way to influence and change behaviour. By including people in the models they immediately become of greater interest to management and policy.



Local fishing community participating in ReefGame, Bolinao, Philippines. Photo: Anne Dray

Biophysical models

The Group's development of biophysical models continues. Work on the fundamental model structure to date has included refinement of the deterministic model; conversion of the discrete deterministic model to a continuous model with differential equations; and continued development of the stochastic

Fieldwork

In the Philippines, fieldwork has included socio-economic surveys of four towns in the Lingayen Gulf representing direct users of the Bolinao-Anda reef complex. The surveys were followed by two feedback workshops for Local Government officials, some of whom are already using the results and recommendations.



Healthy reef, Apo Island, Philippines. Photo: Gidi Levy

Further Information

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model. A spatial extension to the fundamental model indicates that boundary interactions do not necessarily buffer a phase shift, but rather they may strengthen the effect; and up to a threshold of interaction strength, a more healthy reef patch (with higher grazing) may help improve coral cover.

In Mexico, the Group has consolidated its database of coral and fish for 11 sites along the length of the MBRS. The data has been analysed and a powerful tool empirically validated which generates geomorphological classes from easily available imagery.

