

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

## Coral Reef Targeted Research & Capacity Building for Management Disease Working Group

### Causes, origins and impacts of coral disease worldwide

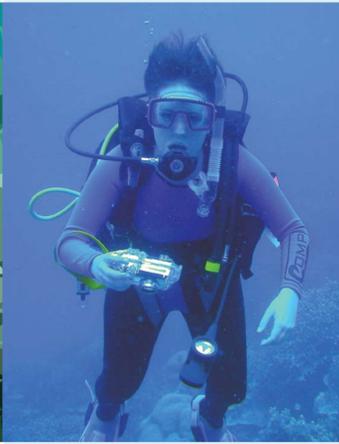
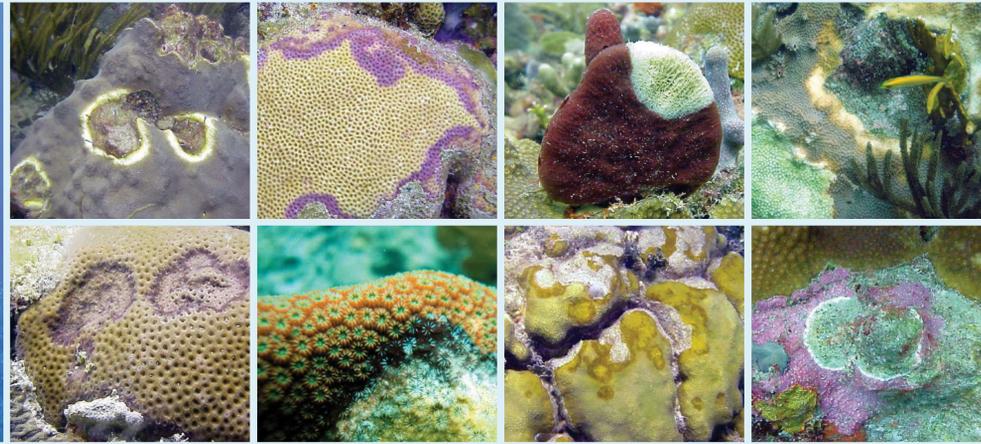


image: Ernesto Weil



images: Ernesto Weil

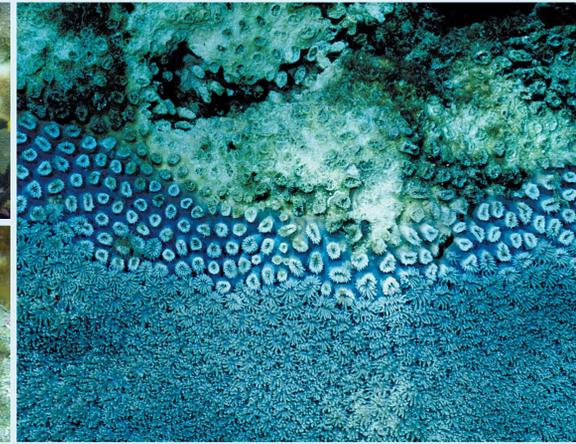


image: Woolcott Henry

#### Goals

To fill critical information gaps about coral reef disease, build capacity internationally, and develop solutions for managing and conserving reef ecosystems.

Our program is providing the scientific background to formulate recommendations to assist managers and developers of environmental policy. For instance, correlations between water quality and disease prevalence are of growing concern but evidence of direct links and synergistic effects are limited.

Many MPAs are established specifically with the goal of protecting the fishery in mind, but disease that alter a reefs ability to support a diverse fish population is of concern. Understanding the specific ways in which coral diseases can alter reef function will help develop predictions as to when outbreaks may occur, and provide stronger links and rationale for local stakeholders as to exactly why improvements in waste water treatment, solid waste disposal and land use practices are essential.

#### Progress to Date

##### 1. Global Impact of Coral Disease

Coral disease stands out as a primary factor in the deterioration of many Caribbean coral reefs.

At approximately 24 sites globally we are conducting a coral disease census. The Global Assessment is designed to catalogue disease syndromes worldwide for the first time and reveal whether disease outbreaks are correlated with climate warming anomalies. At each

location (e.g. Philippines, Central Visayas, Palau, Hawaii, Australia, Caribbean) we are measuring disease impact and prevalence, to cataloging existing diseases and investigating the impact of disease.

##### 2. Global Warming & Anthropogenic Inputs

An increase in disease following warming events may be because corals are less able to fight disease while under temperature stress, or because bacteria are more virulent. While correlations between poor water quality (nutrient loading and sedimentation) and disease prevalence are of growing concern, evidence of direct links and synergistic effects are limited.

We are measuring nitrogen and sediment loading, and using molecular and enzymatic techniques to assess differences in the microbial communities in coral mucus, water and sediment between sites with different loadings and to assess changes in microbial communities between healthy and bleached corals. We will evaluate climate and anthropogenic influences on changes within microbial communities.

##### 3. The Causes, Reservoirs & Vectors of Coral Disease

We lack knowledge of the pathogens causing the majority of coral diseases. To date, there are only 5 coral diseases for which the microbial cause is known: black band disease; white plague type II, aspergilliosis, white pox and bleaching of a non-reef building coral, *Oculina patagonica*, by a bacterium, *Vibrio shiloi*.

##### 4. Coral Resistance to Disease

The microbial communities associated with corals are very complex, existing both inside the coral animal and in the surface mucous layers (SML). These normal communities, which may be specific to their host, protect the coral from disease. When the community structure changes, corals may become more susceptible to disease. Both bleaching and disease appear to change the microbial community profiles in the SML. The goals of our immunological work are to develop assays to determine general antimicrobial activity. Once resistance compounds are identified, they will be incorporated into a chip of biomarkers for stress. Field sampling will eventually allow us to quantify and estimate the response of corals to different experimental treatments of enhanced nutrients and temperature, and map the spatial extent and variation of disease resistance in the field.



image: Phillip Dustan, College of Charleston, SC



Participants in Disease Working Group workshop, East Africa, 2005.

### Implications for Coral Reef Management

Coral diseases potentially impact both well-managed and unmanaged reefs indiscriminately. However, strategies for dealing with disease outbreaks are currently non-existent. The increasing frequency with which diseases influence and alter reef communities necessitates their consideration and incorporation in management plans.



image: Ernesto Weil

### Outcomes

Over the past two years our Targeted Research has:

- Established baseline disease surveys at 3 of the 4 Centers of Excellence, with permanent transects established on the Yucatan and Great Barrier Reef, Australia.
- Demonstrated for the first time links between disease and warm temperature anomalies in Australian and Caribbean reefs.
- Preliminary evidence linking nutrients as facilitators of some disease syndromes.

- Made significant advances in epidemiology, notably through molecular studies of black band disease, yellow blotch, and Aspergilliosis.
- Made substantial inroads in uncovering enzymatic mechanisms of resistance to disease. A new frontier has been opened in investigating potential for phage therapy of coral disease.
- Evaluated what management approaches will be successful in limiting conditions that facilitate coral disease.

We have also sponsored informative regional workshops on coral disease and training graduate and postdoctoral scholars. Our scholarship program has supported four graduate students and one postdoctoral fellow from the Philippines, Palau, Venezuela, and Mexico. We have run workshops on the Microbiology of Coral Disease in Mexico, Australia, Palau, and East Africa. In partnership with the Living Oceans Foundation we held a regional scale workshop at the Institute of Marine Science in Zanzibar. Twenty-five East

African scientists from Mozambique, Tanzania, Zanzibar, Kenya, and the Seychelles participated in a 5 day workshop that included coral taxonomy, coral microbiology, and coral disease survey methods.

In 2006, our Disease Working Group Chair gave the keynote address at the 2006 US Coral Reef Task Force meeting in Washington, D.C. about links between climate warming and coral disease outbreaks.

#### 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.