

## Dengue Fever, International Year of the Reef, and the Future

30 January Mark Patterson, Chief Scientist

As our nearly month long expedition concludes I feel a mixture of conflicting emotions. The satisfaction of a ground-breaking expedition safely accomplished by humans and machines. “Every day is a good day when the AUV comes home” was our insider joke slogan. Sadness at our imminent departure, leaving the friends we have made with our island hosts and among ourselves, the stunning scenery below and above the waterline, the break-up of a tight team that worked well during demanding long days and nights. Relief at the upcoming break from grueling daily labor lugging dive gear and robots hither and yon.

The second half of the expedition was punctuated for me by interesting new experiences, one not welcome! I contracted dengue fever the third week, a viral illness transmitted by mosquito. Dengue is the #1 emerging tropical disease according to the World Health Organization. I found its nickname, break-bone fever, apt. Every day with the disease was no fun. The team rose to the challenge of my physical (and mental!) limitations, carrying my dive gear, enforcing food, water, and rest, making merciless fun of my condition. And on the seventh day, still feeling as bad as on the second, my immune system starting rowing with all oars and within the span of 4 hours I felt completely cured. A very bizarre ending to a very bizarre illness. Unfortunately, dengue is spreading rapidly around the tropical and subtropical zones of the planet, a consequence of global warming. Tropical illnesses are spreading around the planet rapidly. A Harvard medical school researcher, Paul Epstein, remarked to the Washington Post that things that were projected to occur in 2080 are happening in 2006. So as we study changes to Bonaire below the waterline unfortunately things are changing above the waterline in unexpected unwelcome ways.

Last week was the kickoff of the International Year of the Reef, and NOAA, our expedition patron, held its own conference with an international flavor to highlight the US government’s commitment to protecting the world’s coral reefs. We were invited by the NOAA Administrator, Vice Admiral Conrad Lautenbacher, to participate in the news conference from Bonaire. We quickly decided that our local hosts, the management body STINAPA, and the island government leaders should be completely involved in the event. Bonaire is an international treasure and the island government’s foresight to enact various protective measures stretching back to 1961, with full protection in 1979, was a driving reason why we were here to re-survey.

The press conference came off without a hitch. Myself, Jim Leichter from Scripps, and Art Trembanis from U Delaware, gave succinct overviews of the expedition’s technology, approach, and initial findings. To quote what I said to the press: *“We decided to come to Bonaire for scientific research because it has been viewed as being a pristine environment. However, like reefs world-wide, we found Bonaire, is changing, and this rate of change is accelerating. We are seeing some troubling factors including: the spread of macroalgae from the deep to shallow reef, the spread of an invasive species of*

*tunicate, and a cyanobacterium mat (blue-green algae) that may be killing coral. We are seeing more dead and dying coral than we should be seeing on healthy reefs. These troubling aspects are most evident between 10 to 30 meters depth. With our robotic technology and divers in the water, we are sighting some really large colonies (several hundred years old) of brain and star corals that appear to have recently declined. And we have evidence from prior observations that the water clarity for Bonaire, which is an oceanic island, is not what it should be. There are some signs of hope that the health of Bonaire's reefs, arguably still the best left in the Caribbean, can be improved. First, in the shallow reefs, recruitment of staghorn and elkhorn coral species is evident in sections where hurricanes have caused past damage. Second, we are seeing a small number of black spiny sea urchins (*Diadema*) living amongst the coral heads. An important omnivore on coral reefs, this species was obliterated by a pathogen back in the early 80's, so it is good to see it returning slowly. Third, herbivorous fishes are in seemingly good shape. These fishes are vital to keeping algae on the reef in check. Finally, our preliminary work indicates the deeper reef, greater than 30 m depth, appears to be in better shape than the 10 to 30 meters depth range. We are conducting a unique inventory by using 3 free-swimming robots, called Autonomous Underwater Vehicles, or AUVs for short. This is the first time a field campaign using such technology has been conducted in a reef setting. We hope our maps will prove valuable to the island government of Bonaire as they consider new ways to manage their underwater park."*

The press conference concluded with the Honorable Herbert Domacassé, Lt. Governor of Bonaire, and the island's leader, presenting a passionate view of how Bonaireans view their reefs and how they will be unwavering in stewardship. Later that week, we gave a standing-room only talk open to the lay public hosted by the Council on International Educational Exchange (CIEE) in Kralendijk. The talk showed us how interested the average Bonaire resident was in what lay underwater and how importantly they viewed reef protection, which was gratifying to see.

The expedition's data are voluminous. The robots dove hundreds of times and the trimix and Nitrox teams logged dozens of dive hours. Everyone's skin took a beating from the constant immersion, the hot sun, the regular application of DEET to avoid ending up like the Chief Scientist. There is a sense that in addition to the many science papers we will write about our research here, we want to create something special that will help the stewards of Bonaire's reefs.

Initial discussions among team members took place concerning plans to make our own atlas, that would be similar in spirit to van Duyl's effort published in 1985. The aim is to produce something useful to a marine park manager or government planner, but also beautiful to look at. Work on the atlas will begin sometime in 2009, after we have processed our sonar, photo, and video data.

A heartfelt thanks to the US taxpayers who funded our work, and "masha danki" to the tireless government workers of the island of Bonaire, especially Ramón de Leon, Elsmarie Beukenboom, and Frank van Slobbe, and the residents of Bonaire who provided

impromptu support of many kinds. We will remember this expedition fondly the rest of our lives.