Observations of Thermal Bleaching and Irresponsible Development

Dear Coral Reef Scientists,

Observations of Coral Thermal Bleaching and Disease indices in Guana Cay, Bahamas and a statement opposing any nutrient enriching golf course surrounding these sensitive reef systems.

This development will fertilize and increase the abundance of macro algae species within this habitat, thereby threatening this already thermally stressed coral reef ecosystem. We are surprised that a team of marine scientists financially supported by the developer would claim that a golf course and dredge project will not harm the host tissues along with their symbioants on the surfaces of these diverse coral reefs 10 meters away from this proposed development site. There are many publications out there that show how sediment loading can effect coral physiology (**Peters, E.** 1984. A survey of cellular reactions to environmental stress and disease in Caribbean scleractinian corals. Helgol. Meeresunters. **37**: 113-137. I would be glad to supply these papers to the developers and their scientific advisors so that they can re-think their unsustainable development plans. Many marine biologists may not have an understanding of the sensitive cellular mechanisms and physiology of symbiotic corals. Therefore, we would be more than glad to provide the advisory board of Discovery Land and Co. with this literature.

Observations

Coral Diversity was high and overall reef health was in good condition before this recent thermal expulsion event. Temperatures were 84.5F at 60-70 feet. 86F at surface.

North Side of the Island (furthest tip) adjacent to the proposed development project and golf course. Thermal Coral Reef Bleaching was in critical stages of expulsion of symbiotic algae of the following corals:

Method: 90 meter horizontal transect (1m/sq) at12 meters depth

1001individual counts of *Montastraea sp.* (not *M. cavernosa*) revealed 959 in critical stages of bleaching of the 1001 counted. This is the only species that I calculated exact numbers. The below species is based on approximate estimate:

Gorgonians *Plexaurella nutans, Eunicea calculata* 25-30% critical bleaching. *Pseudopterogorgia sp*. were unaffected.

One indices of YBD, however, it is important to note that the YB disease signs may be difficult to calculate due to the bleached tissue appearance. However, the one case was evident.

Acropora palmata on surface approximately 1-2 meters. All older colonies were dead (local reports claim WBD and storm damage). However, new recruits were evident with not White Pox or WBD lesions. Colonies of *A cervicornis* were not evident, only dead rubble was seen.

Montastraea cavernosa showed signs of brown spots lesions. On 25% of the colonies observed at all North and South dive locations.

50% *Porites sp.* were in critical stages of thermal bleaching which was surprising due this species ability to withstand high thermal stress.

Siderastrea siderea all showed signs of minor or early stages of DSD or past tissue necrosis with exposed skeleton.

Stephanocoenia mechelinii were not seen bleaching. However, necrotic tissue was evident, causes wee unknown. Non appeared to have DSD lesions on the tissue surface.

Diploria strigosa all colonies showed minor to middle stages of bleaching.

Meandrina meandrites all appeared healthy. Very few were in direct sunlight.

Colpophyllia natans all colonies showed minor to middle stages of bleaching. Parrot fish lesions were seen, however, small lesions approximately 1-2 cm was the average size. Not one observation of 10-20 inch lesions were evident within a 24 hr time period as seen during the PFWSB/RWD debate during 1996-97. All of the lesions seen during this time showed no necrotic tissue border after the biting.

Fungiida (*Leptoseris cacullata*) all appeared healthy.

Agaricia lamarcki all that were in direct light appeared mildly bleached. In the more dark areas, all appeared healthy.

Agaricia tenuifolia were all in mid to late stages of bleaching. Symbiotic algae were seen in mucus streams above the coralite.

Madracis Formosa were seen in mild stages of bleaching.

Oculina tenella were in mild stages of bleaching.

Sea-fans all appeared healthy, outside of 2 cases of Sea fan Disease that were effecting the older colonies. All healthy Seaman's were juveniles between 5-10 cm long.

All reef fish were abundant and diversity seemed to be high.

Macro Algae and Ecology of this habitat.

As many of us coral biologists understand, coral reefs are known to be the most nutrient sensitive ecosystems. Coral reefs can become "eutrophic", that is, overgrown by weedy algae, at nutrient levels that are so low that they would indicate nutrient starvation in any other ecosystem (P. Bell,1992, Eutrophication and coral reefs: some examples in the Great Barrier Reef lagoon, *Water Research,* 26: 553-568; B. Lapointe, & M. Clark, 1992, Nutrient inputs from the watershed and coastal eutrophication in the Florida Keys, *Estuaries,* 15: 465-476; B. Lapointe, in press, Eutrophication thresholds for macroalgal overgrowth of coral reefs, in K. Thacker (Ed.) *Protecting Jamaica's Coral Reefs: Water quality issues*). Therefore, an immediate stop work order on the proposed development location should be established as a result of human-caused nutrient additions from The Discovery Corp. to these coastal waters surrounding Guana Cayy. This is needed to prevent the corals from being overgrown and killed by weedy algae. This golf course will be a point source and will create dangerously high levels of nutrients. Any nutrient drainage into this area will cause the reefs to deteriorate further. This includes nutrients from development projects involving dredging, which will lead to sediment loading on the surfaces of corals on the north and south side of Guana Cay, as well as from construction of the golf course and excess sewage that is usually accompanied by such projects. The Discovery & Co. EIA plans are to dredge up a portion of the 1 mile island, dump the sediment onto the surrounding reef and add soil fill combined with quartz sand for this golf course. This limestone substrate will act as a permeable filter for the nutrients to leach out into the reef thereby feeding the invasive species.

The dominant macro algae were species indicative of moderate or low nutrients, primarily *Dictyota pinnatifida*, *Laurencia poiteaui, Halimeda sp., Udotea sp,. and Penicillus sp.* These were not at invasive levels at this point in time. However, all cyanobacteria spp. (blue-green algae) *Lyngbya penicilliformis* were in low abundance. Nutrient analysis is need at this point in time to establish a base line of the chemical signatures surrounding this reef around the proposed development site and surrounding Guana Cay. Only stressed corals were in competition with *Lyngbya*, and all dead corals were overgrown with mixed algal tufts. High densities of

cyanbacteria are indicative of excessive pollution, in particular of phosphorus, and are common near sewage inputs. On shallow and deeper sandy areas the algae were more typical of lower nutrients, primarily *Halimeda, Udotea*, and *Penicillus species.* It is important to note that acceptable water quality standards for coral reefs has been established by Lapointe and Bell, and show that over fertilization by nutrients, not the lack of fishes and sea urchins, are the major reason for the almost complete replacement of corals with weedy algae (Goreau et al. http://globalcoral.org/). All areas show healthy abundance of seagrasses with low macro-algal overgrowth.

Recent research in the Caribbean and in the Great Barrier Reef of Australia has established the critical levels of nitrogen and phosphorous which must not be exceeded if reefs are to remain healthy without being overgrown by weedy algae (Lapointe et al., 1992, 1993; Bell, 1992). These concentrations are:

1.0 micromoles per litre of nitrogen as nitrate and ammonia
0.1 micromoles per litre of phosphorous as ortho-phosphate and organophosphate.
These values are in the molecular concentration units used by chemists and oceanographers. In the weight units more often used in the wastewater literature these translate into:
Nitrogen: 0.014 ppm N or 0.040 ppm NO3
Phosphorous 0.003 ppm P or 0.007 ppm PO4
This 1-2mm layer of skin (epidermis) living on the surfaces of corals is subjected to extreme conditions and are living at their critical maximum stress threshold levels during this current time. Given the state of the world's reefs is it wise for the Bahamian Govt. and an American Company to allow such an irresponsible project to take place? Thermal coral-bleaching will intensify along with the rise in heat trapping gasses over this next century. Since we cannot convince and control the current Cheney/Bush administration to control atmospheric carbon dioxide (heat trapping gasses partly responsible for global warming) would it not be wise to at least address localized threats to coral reefs? My research assistant and I would like to thank the local environmental group on Guana Cay for their efforts in preserving and respecting this coral reef ecosystem.

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About Dr. Cervino:

Dr. James Cervino earned an M.S. in Marine Biology from the Boston University Marine Program in Woods Hole in 1996; and a B.A. in Environmental Science & Physical Anthropology from New York University in 1993. His Master's research focused on the effects of temperature and pathogens on coral-zooxanthellae symbiosis in tropical reef-building Cnidarians. He worked under the mentorship of Drs. Norm Wainwright and Leonard Muscatine. James then began working with Drs. Raymond Hayes and Thomas Goreau of the Global Coral Reef Alliance (GCRA), where his Ph.D. focus investigated the links between thermal-coral bleaching and diseases in the Pacific and Caribbean. James has earned his Ph.D. in Marine Science with Dr. Garriet Smith at the University of South Carolina and Dr. Thomas Goreau of the GCRA. Currently he is studying the cellular mechanisms by which coral and anemone hosts regulate populations of symbiotic zooxanthellae during thermal stress, microbial infection and chemical pollution.