



**ITMEMS 3**  
**Global Problems, Local Solutions**  
**Cozumel, Mexico**  
**16-20 October 2006**



### **Caribbean Bleaching and Disease Workshop: 2005 Event Response and Assessment**

Sunday, October 15, 2006, 13:00-18:00  
Donatello Room, El Cozumeleño Hotel, Cozumel, Mexico

This half-day Pre-ITMEMS workshop is designed for coral reef and MPA resource managers, environmental assessment specialists, marine field investigators, tourism operators, advanced students and litigators. The workshop will involve presentations on the 2005 Caribbean Bleaching Event from researchers and managers in the Caribbean region, and discussions on (1) the total extent of bleaching, mortality, recovery, and survival of affected corals, (2) next steps in the response and assessment effort, and (3) planning for future events in this region. The workshop will also include presentations and discussions on the coral diseases in the Caribbean.

In 2005, coral reefs in the wider Caribbean suffered a widespread and severe bleaching event that has resulted in extensive coral death in much of the region. NOAA's Coral Reef Watch first alerted managers and scientists about bleaching conditions in the Florida Keys in August 2005, and issued alerts for Puerto Rico and the US Virgin Islands (USVI) in September 2005. Thermal stress measured from NOAA Polar-orbiting Operational Environmental Satellite (POES) satellites exceeded values that trigger mass bleaching throughout most of the Caribbean and reached nearly twice that value around the northern Lesser Antilles near the USVI. Corresponding with these alerts, coral bleaching has been reported in much of the Caribbean. The US Coral Reef Task Force (USCRTF) and the International Coral Reef Initiative (ICRI) both passed resolutions in November 2005 to mobilize efforts across the Caribbean to monitor, assess, and research short- and long-term impacts of the 2005 warming and bleaching event.

The half day workshop is organized as outlined below:

1. Presentations from Caribbean researchers and managers on the 2005 Caribbean Bleaching Event.
2. Presentations on Caribbean coral diseases
3. Discussion: next steps in the response and assessment effort for future events in the Caribbean.
4. Discussion: potential series of multi-authored papers and reports by NOAA and GCRMN.

*Organizers:* Dr. Mark Eakin ([Mark.Eakin@noaa.gov](mailto:Mark.Eakin@noaa.gov)) and Jessica Morgan ([Jessica.Morgan@noaa.gov](mailto:Jessica.Morgan@noaa.gov))  
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*Website:* <http://coralreefwatch.noaa.gov/caribbean2005/>

*Partners and Sponsors:*



The CRCP and GCRMN are co-sponsors of this workshop.



IMSG provided meeting and staff support.

## PROGRAM OF EVENTS

### 13:00 Caribbean 2005 Bleaching Event and Response - Introduction

*Mark Eakin, Coordinator, NOAA Coral Reef Watch*

- Description of the event
- Regional patterns of bleaching
- ICRI and USCRTF Resolutions on bleaching,
- New “A Manager’s Guide to Coral Bleaching”
- Brief presentation of recent data

Upcoming GCRMN Report on Caribbean Bleaching and Hurricanes

*Clive Wilkinson, Coordinator, Global Coral Reef Monitoring Network*

Caribbean Coral Diseases - Introduction

*Drew Harvell, Cornell University*

### 14:15 Presentations - 15 minutes long, with 5 additional minutes for questions

<i>Cori Kane</i> <i>The Reef Check Foundation</i>	Coral Reef Impacts of the 2005 Caribbean Bleaching Event
<i>Robert Ginsburg</i> <i>AGGRA and U. Miami/RSMAS</i>	The simplified BLAGRRA Protocol for rapid response to bleaching events, outbreaks of disease, and other disasters
<i>Loureene Jones</i> <i>University of the West Indies</i>	Caribbean Seas too HOT for corals - Jamaica
<i>Daniel Ponce-Taylor</i> <i>Global Vision International</i>	The effects of bleaching in Mexico following the active 2005 hurricane season
<b><i>BREAK</i></b>	
<i>Drew Harvell</i> <i>Cornell University</i>	Coral Disease Working Group
<i>Ernesto Weil</i> <i>University of Puerto Rico</i>	Coral Reef Targeted Research and Capacity Building: Caribbean Coral Reef Diseases

### 16:55 Future Plans and Open Discussion - Brief notes:

- General Discussion: Managers’ needs, Monitoring approaches, Ways to improve collaboration, Resource needs, Rapid response teams
- Importance of sampling, How much sampling is needed to establish a baseline?, Look at grotty reefs
- Corals we have left are the real survivors, Diversity has fallen
- Are management actions possible/effective?, In areas where you can’t shut down, need MPAs
- Can’t compare Carib vs. Indo-Pacific
- Still no good answer for stakeholders on disease, Will closures to people/fishing help disease, Culling diseased corals
- Need to balance science and management, Need for manager-scientist dialogs on needs and capabilities, Science can’t answer all management needs -- under critical threats we need to try new approaches, monitor them well, and document them for other practitioners
- Global warming, Population growth
- Communication strategies

## ABSTRACTS

### **Coral Reef Impacts of the 2005 Caribbean Bleaching Event**

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Global warming and El Niño have led to an increased frequency of coral bleaching since the 1980s. In late 2005, elevated seawater temperatures resulted in an extensive Caribbean bleaching event. While this event was not as geographically extensive as the 1997-1998 bleaching event in the IndoPacific, regarded as the largest and most damaging bleaching event to date, both maximum seawater temperature and temporal duration of the Caribbean event were similar to those measured in the 1997-98 IndoPacific event. Coral reef surveys conducted in 16 countries by Reef Check teams before, during and after the Caribbean bleaching event revealed that significant coral bleaching but relatively low mortality occurred as compared to the 1997-98 IndoPacific bleaching event. Caribbean bleaching ranged from 4-62% and mortality from 0-27%, whereas bleaching levels neared 100% and mortality reached as high as 95% in many locations following the IndoPacific bleaching event. While bleaching was extensive in Belize, Jamaica, St. Lucia and the British Virgin Islands, mortality was not significant in these areas. By using a standardized approach to monitor and quantify bleaching for the past 10 years, the Reef Check data are useful to help track and compare reef impacts on a regional and global basis. As the threat of global warming to coral reefs increases, it would be wise to invest in a more complete network of surveys to aid in monitoring large-scale environmental stressors and their impacts on coral reefs.

### **The simplified BLAGRRA Protocol for rapid response to bleaching events, outbreaks of disease, and other disasters**

Judith Lang<sup>1,2</sup>, Robert Ginsburg<sup>2,3</sup>, Kenneth Marks<sup>3</sup>, Hazel Oxenford<sup>4</sup>, Jean-Philippe Maréchal<sup>5</sup>, and Shannon Gore<sup>6</sup>

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The BLAGGRRRA line-transect protocol ([www.agrra.org](http://www.agrra.org)) is a simple and rapid, easily mastered method for assessing coral health during ecological emergencies. The ability to quickly assess many transects/site allows repeated coverage of large areas, which is essential when monitoring the immediate and delayed mortality of stony corals after mass bleaching events or outbreaks of disease. Our experiences in developing benthic assessments have taught us that well-trained volunteer divers can learn to reliably score extent of bleaching of live coral tissues as “normal,” “pale” or “bleached” and loss of live coral, by distinguishing “live, fully bleached” tissues from “newly exposed” skeletal surface, and to seek help from experts when causes of death are unclear in the field. Color and percent loss of live coral, measured as intercept lengths under haphazardly placed, transect lines, should take about 15 minutes to complete. Results are independent of total coral cover and, with appropriate sampling effort, could discriminate severity of impacts as relative bleaching and “new mortality” among reefs locally or at larger geographic scales. To collect time-series data on the delayed effects of bleaching or other catastrophes, it will also be necessary to tag and monitor some affected corals to ground truth the local transition of exposed skeletons from “recent mortality” to “old mortality” (as terms are defined at the AGRRA website). The ease and rapidity of applying the BLAGRRA Protocol makes it especially useful to managers who, with limited resources, must assess the impacts of bleaching or disease.

El protocolo de línea-transecto BLAGRRA ([www.agrra.org](http://www.agrra.org)) es un método muy fácil para evaluar el estado de condición coralino durante emergencias ecológicas. La capacidad de evaluar rápidamente múltiples transectos/sitios hace posible la cobertura de grandes áreas repetidamente. Esto es esencial para monitorear la mortalidad coralina inmediata y como secuela de eventos blanqueamientos masivos o procesos infecciosos. Nuestras experiencias en desarrollo de protocolos de evaluación bentónicos, nos han enseñado que buzos voluntarios bien entrenados pueden registrar existosamente nivel de blanqueamiento de tejido “normal,” “pálido” o “blanqueado” y pérdida de coral vivo, distinguiendo entre “tejido vivo completamente blanqueado” y “esqueletos expuestos recientemente”; así como aprender a buscar ayuda de especialistas cuando exista duda en la causa de mortalidad. La coloracion y el porcentaje de pérdida de coral vivo se miden en cobertura

bajo la línea en transectos de 10 m posicionados al azar, estos toman cerca 15 minutos c/u para ser evaluados. Los resultados son independientes de la cobertura total de coral, y con un esfuerzo muestral adecuado, se pueden discriminar grados de severidad de los impactos de blanqueamiento y “mortalidad nueva” entre arrecifes a escalas locales y regionales. Para coleccionar datos en series temporales acerca de los efectos de blanqueamiento u otras catástrofes, se marcan y se monitorean colonias para corroborar transiciones locales de esqueletos expuestos, desde “mortalidad reciente” hasta “mortalidad antigua” (términos definidos en la página web de AGRRA). La facilidad y rapidez para aplicar el protocolo BLAGRRA lo hace particularmente útil para administradores quienes, con recursos limitados, deban monitorear impactos por blanqueamiento o enfermedades.

### **Caribbean Seas too HOT for corals.**

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From November 2005 to May 2006 Reef Check surveys with an additional bleaching component from Coral Watch were conducted at several sites across the island. Bleaching was first noted on the north coast of the island in August and later manifested on the south coast in late September to early October. The sites assessed were spread along the north-east and south-east coasts of the island and were located in Portland, the Port Royal Cays and the Portland Bight Protected Area. Low to high incidences of bleaching ranging between 10% and 95% were noted. On the resurvey, up to 50% of the affected corals had recovered. The effects of the bleaching episode were more pronounced on the massive corals located on the south coast.

Key words: Lourene Jones, bleaching, Reef Check, Jamaica

### **The effects on bleaching in Mexico following the active 2005 hurricane season.**

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Global Vision International (GVI), a UK based conservation organization, on behalf of Amigos de Sian Ka'an (ASK) and Comision Nacional de Areas Naturales Protegidas (CONANP), has been collecting data on the Mexican Mesoamerican barrier reef since 2004 at two locations on the Yucatan peninsula. Using non-specialist volunteers, MBRS SMP transects were conducted at Pez Maya in the Sian Ka'an Biosphere reserve, and in the town of Mahahual throughout 2005. The Caribbean mass bleaching event of 2005 also saw two Category 5 hurricanes hit the Yucatan region, Hurricanes Emily and Wilma. Colonies were observed from 549 transects at the locations, including data taken from as soon as 9 and 19 days after each hurricane respectively. A total of 8627 colonies were observed during 2005. In comparison with baseline data from 2004, the data shows a sustained general increase in bleached colonies during the course of the year, with coinciding peaks in figures immediately after Hurricane Wilma, particularly notable in Mahahual. The average bleaching seen at the two locations is comparable to preliminary figures released by NOAA for Mexico. 10m sites contributed most to the bleaching values for both locations. The Faviidae, Siderastreidae and Agariciidae families all displayed consistent high values of bleaching throughout the year in both locations, with notable increase in bleached colonies after Hurricane Wilma in Mahahual. The monitoring programme being conducted by GVI is ongoing in both locations, and the expanding database will be continually analysed, in part to monitor bleaching levels for the region.

### **Blanqueamiento en corales pétreos del Archipiélago Jardines de la Reina, Cuba.**

#### **[Bleaching in stony corals of the Archipelago Gardens of Reina, Cuba]**

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[Unfortunately unable to attend workshop - please email for more information on the event in Cuba]

Se estudian las comunidades de corales pétreos, al Sur del Archipiélago Jardines de la Reina, para analizar su estado de afectación por Blanqueamiento en los meses de septiembre y diciembre del 2005. La zona se divide en cinco áreas: Reserva Centro (RC), Reserva Este (RE), Reserva Oeste (RW), No Reserva Oeste (NRW) y No Reserva Este (NRE), entre las cuales se establecieron 31 sitios de muestreo en el arrecife frontal. De las especies afectadas por Blanqueamiento se analizó el porcentaje de afectación, tanto para crestas, como para pendientes arrecifales, y entre los meses de septiembre y

diciembre. De las 30 especies identificadas en el biotopo de cresta arrecifal, en la zona de NRW el 26% presentaba Blanqueamiento, mientras que en la RC y RW solo el 13 %. Nueve especies se apreciaron con Blanqueamiento, en dicho biotopo, fundamentalmente; *M. complanata*, *A. agaricites* y *M. alcornis*. En pendientes arrecifales el porcentaje de afectación, del total de especies (36), osciló entre el 25 % y el 33 %. En este biotopo 17 especies se observaron con Blanqueamiento, de éstas cinco coincidieron en todas las zonas del área de estudio; *Agaricia* sp, *Porites porites*, *M. alcornis*, *A. agaricites* y *Montastraea annularis*. En el mes de septiembre el área donde incidió más el Blanqueamiento fue en la Oeste, específicamente, en las crestas arrecifales, donde las especies afectadas llegaron a alcanzar más del 20 %. En diciembre se apreció, generalmente, mayor porcentaje de afectación en pendientes arrecifales. El nivel de afectación por Blanqueamiento, en el archipiélago, fue moderado.

We are studying the communities of stony corals to the South of the Archipelago Gardens of Reina, to analyze whether they were affected by bleaching in the months of September and December of 2005. The zone is divided in five areas: Reserve Center (RC), Reserve East (RE), Reserve West (RW), Non-Reserve West (NRW) and Non-Reserve East (NRE), among which were established 31 monitoring sites in the forereef. Of the species affected by bleaching we analyzed the percent of affected areas, both for reef crests and slopes, and between the months of September and December. Of the 30 species identified as present in the reef crest in the zone of NRW, 26% were affected by bleaching, whereas in RC and RW only 13 % were. Nine species were observed with bleaching, principally; *M. complanata*, *A. agaricites* and *M. alcornis*. In reef slopes the percentage of bleaching among the total number of species (36) ranged between 25 % and 33 %. In this area, 17 species were observed with bleaching, five of which were affected by bleaching in all zones of the study area: *Agaricia* sp, *Porites porites*, *M. alcornis*, *A. agaricites* and *Montastraea annularis*. In the month of September the area where bleaching was strongest was the West, specifically in the reef crests, where the affected species reached more than 20 %. In December, a greater level of bleaching was observed in the reef slopes. Overall, the level of bleaching in the archipelago, was moderate. [translated from Spanish]

### **Coral reef bleaching in the French West Indies: a quantitative diagnostic**

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[Unfortunately unable to attend workshop - please email for more information on the event in FWI]

Since 2002, long term coral reef monitoring is ongoing in the islands of Guadeloupe, Saint-Barthélemy and Martinique. Twice yearly surveys are conducted on benthic and fish communities at 9 reef sites. In the French West Indies, seawater temperature annually fluctuates between 26 and 29°C. Coral bleaching appears when seawater temperature exceeds 29°C. That usually occurs during a short period almost every September. In 2005, the sea temperature overshoot 29°C from the mid of May to the mid of November with maximum values reaching 31°C. Major coral (and other zooxanthellate Cnidarian) bleaching resulted from this phenomenon. Depending on the reef site, between 55 % and 80 % of the coral species were affected. About 50 % of the colonies presented some form of bleaching. Total bleaching affected one third of the colonies and two thirds were partially bleached. At the end of November, when the temperature returned to 28°C, very little mortality was observed on the corals (maximum 7 %). In July 2006, numerous corals were still bleached and an important phenomenon of delayed mortality had developed. Coral decay was minimal on the reef flats where the coral colonies best recovered. On the outer reef slopes of the three islands, coral mortality fluctuated between 25 to 52 % according to the reef sites. Globally, the average coral coverage of the reef slope dropped from 32 %, before August 2005 to 20 % in mid 2006. That represents an average loss of coral coverage of 30 % for the outer reef slopes of the French West Indies. For the moment, the reef fish communities have not yet been affected in terms of species richness, numerical abundance and biomass.

### **High Coral Mortality in Barbados following the 2005 Mass Coral Bleaching Event**

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In late summer 2005 a significant sea surface temperature (SST) hot spot developed in the northeastern Caribbean which subsequently spread, precipitating a Caribbean-wide mass coral bleaching event. Quantitative surveys to assess the extent of coral bleaching and subsequent mortality on Barbados' reefs were conducted every 4 months from September 2005 to

June 2006 along 30 transects, representing 6 reef habitats on the island's west and southwest coasts. Benthic water temperatures were recorded concurrently for each habitat type.

Water temperatures rose in excess of 30 °C down to a depth of 22 m by mid-August 2005 and remained high through mid-October. Coral bleaching was first observed in the last week of August and spread rapidly. All reef habitats and coral species were affected, representing the most severe bleaching event ever recorded in Barbados. Nearshore reefs suffered the most extensive bleaching, with a mean of 80.6% of all coral colonies being affected, whilst 60.5% of all colonies bleached on the deeper offshore reefs. Susceptibility to bleaching also varied significantly among corals, with some species experiencing over 80% of colonies bleaching while others had less than 20% of colonies affected. Bleaching remained widespread across all reefs for many months with overall mean values of 70.6% in September-October 2005, 37.5% in February 2006 and 17.2% of all colonies still bleached in June 2006, some 10 months after the initial onset.

Coral mortality (estimated as % of any colony recently dead, and as % loss of total live coral cover) was initially low at an overall mean of 3.8% colony death or 4.8% loss of live coral cover by February 2006. However, mortality increased considerably over the following 4 months reaching estimated overall mean values of 18.7% colony death or 25.9% loss of live coral cover by June 2006. Coral mortality was attributed directly to bleaching stress, since disease incidence remained low throughout the survey period. Nearshore reefs have suffered significantly greater mortality than offshore reefs, and extent of mortality varied significantly among species. Coral species which showed high susceptibility to bleaching during the 2005 event (>70% colonies bleached) exhibited significantly greater mortality than those which were less susceptible (<20% colonies bleached).

Coral mortality of this magnitude has serious implications for Barbados, which relies heavily on coral reef ecosystem services for coastal protection, fisheries and tourism. Barbados, like other small coastal states, therefore has good reason to be concerned about the trend of rising air and sea surface temperatures associated with global warming.

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