Rapid assessment of Mona Island's coral reefs following the 2005-2006 post-bleaching mass mortality event: Evidence of climate change i[redacted]

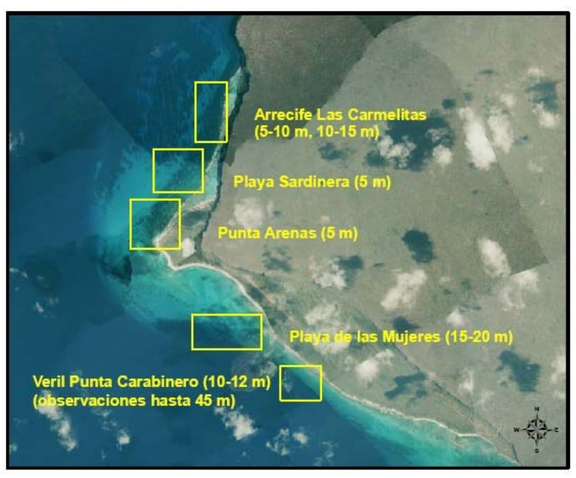
Abstract

Mona Island, located nearly halfway between La Hispaniola and PR, is considered a unique and pristine natural wonder in the Caribbean. Its coral reef ecosystems are paramount for maintaining the meta-population connectivity of most commercially-important fish species in the region. But an unprecedented sea surface warming event occurred during 2005 throughout the northeastern Caribbean Sea that caused a mass regional coral bleaching event. It was followed by significant coral mortality. This study is the result of an exploratory expedition carried out in June 2006 by *Sociedad Ambiente Marino* and the *UPR-Coral Reef Research Group* to conduct a rapid ecological assessment to address what was the impact of the bleaching and coral mortality event in Mona Island. Digital video-imaging was used to document the status of benthic community structure at six locations.

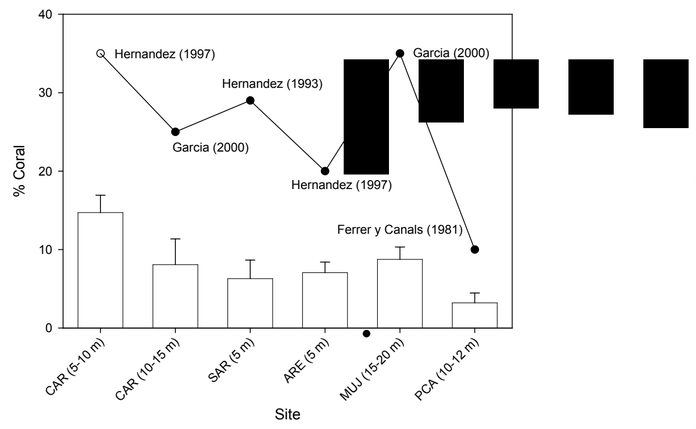
Coral reefs were characterized by a dramatic phase shift favoring macroalgal-cyanobacterial dominance. Percent coral cover ranged from 3 to 14%, when estimates conducted between 1981 and 2000 showed % coral cover values ranging from 10 to 35%. Percent macroalgal cover ranged from 42 to 85%, often dominated by unpalatable brown algae, *Dictyota* spp. Percent cyanobacterial cover ranged from 0.3 to 13%. Most large reef-building coral species were showing significant signs of mortality. There was also a significant difference (p=0.0002) in community structure among sites, which were clustered in four different patterns according to degree of mortality and post-mortality trajectory. Differences were actually attributed to the high frequency of other benthic categories such as recently dead corals (RDC), crustose coralline algae (CCA) and rubble (SPR). This is the first known mass coral mortality event reported in Mona Island and represents an unequivocal sign of climate change impacts.

Methods

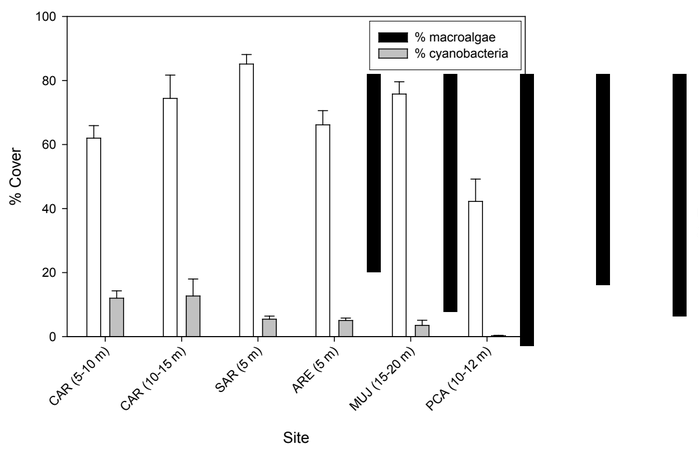
Data collection and analysis: A total of 73 digital video-transects were randomly filmed at 6 different locations in Mona Island during June 2006. Five replicate digital images were randomly selected from each transect and analyzed for benthic component cover (i.e., coral, algal functional groups, sponges, others) using CPCE v3.4. Data was analyzed using multivariate statistical approaches.



Results



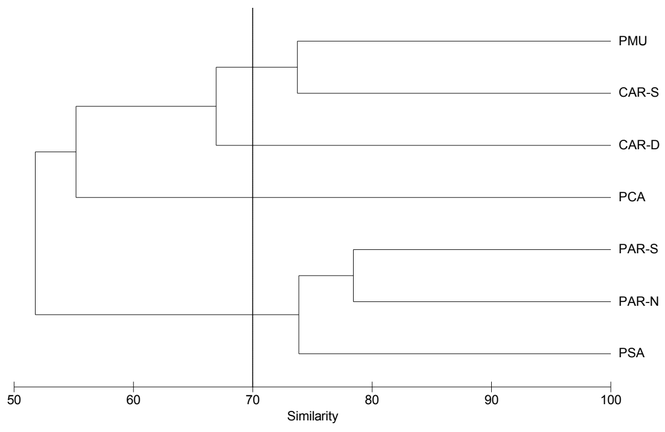
Percent change in living coral cover. Bars (±one standard error) represent data from this study. Line represents data from previous studies



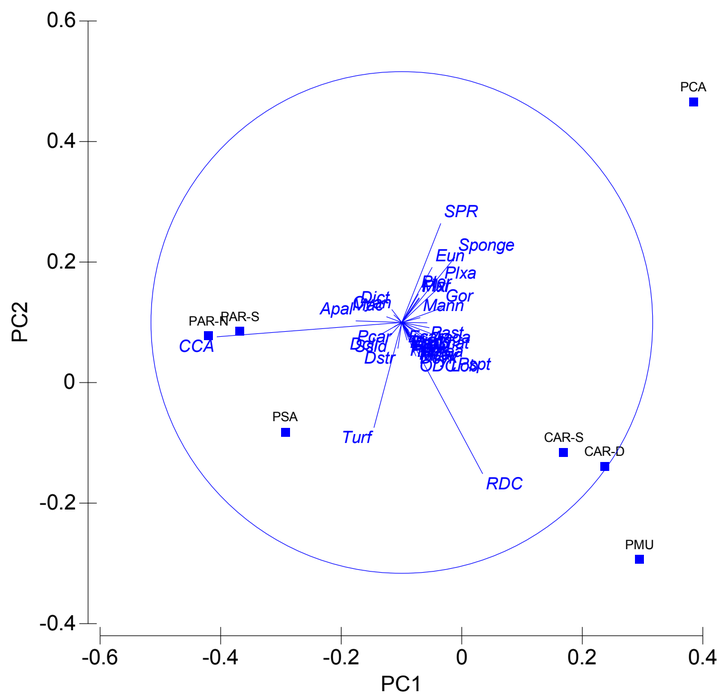
Percent macroalgal and cyanobacterial cover (±one standard error)

ANOSIM test of community structure

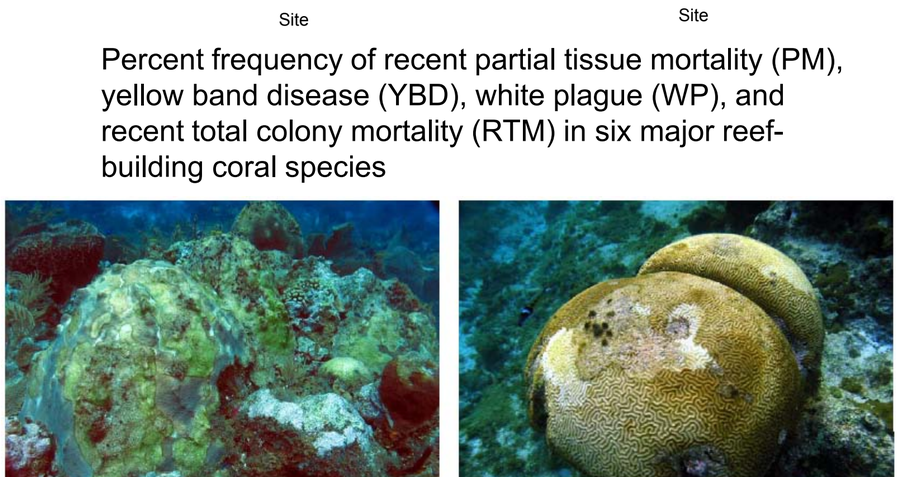
Parameter	Global R	*P*
Site	0.629	0.0002



Ordination analysis of community structure



Principal component analysis to explain differences in community structure among sites



Percent frequency of recent partial tissue mortality (PM), yellow band disease (YBD), white plague (WP), and recent total colony mortality (RTM) in six major reef-building coral species

Examples of typical post-bleaching coral conditions: Left: Massive colony of star coral, *Montastraea faveolata*, showing partial colony mortality and active YBD infections. Right: Brain coral, *Diploria clivosa*, infected with WP

Conclusions

There was a significant coral mortality event in Mona Island following prolonged mass coral bleaching as a result of unprecedented sea surface warming during 2005-2006. Benthic community structure shifted from coral to macroalgal-cyanobacterial dominance. Most colonies of large reef-building species suffered significant tissue mortality, thus dangerously compromising their reproductive output. Under the forecasted trend of sea surface warming and ocean acidification, particularly under overfished conditions, this may compromise net reef accretion rates. If these types of events become recurrent in the near future, coral reef ecosystem resilience might be significantly impaired and coral reefs might be about to suffer an entire ecosystem collapse with potential negative consequences to regional fisheries due to a connectivity loss.

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