

Response of Caribbean Reefs to repeated Stress Events

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Abstract. In recent times, coastal ecosystems and specifically coral reefs have been experiencing varying degrees of stress from several sources. The incidence of natural phenomena such as hurricanes and bleaching events has increased to the point where one or both of these events are guaranteed to occur annually. Coupled with effects of terreginous run-off and poorly planned coastal developments, the reefs of the region are constantly bombarded with less than ideal conditions. At present coral cover is still low at most sites assessed and has been for a long while.

In Jamaica Reef Check assessments indicating coverage ranging between 2% and 37% were recorded between 2001 and 2006. Results from bleaching assessments conducted during and after the 2005 event depicted up to 75% bleaching in some countries and varied levels of recovery. Data from long-term monitoring sites in Jamaica also produced results, which indicate that the reefs are to an extent able to survive and recover from the stress events. Given the increased frequency of stress events it is still unsure what level of recovery will be realized and the duration.

Key words: Caribbean, coral, stress, recovery

Introduction

The marine environment is the most important natural resource in Caribbean countries. Hurricanes, disease, climate change, population growth and overfishing have combined to exert enormous stress on reefs of the region. Terreginous run-off and poorly planned coastal developments result in the reefs being constantly bombarded with less than ideal conditions (UNEP 2008). Increased frequency and incidences of intense hurricanes, rising sea temperatures, coral bleaching, disease are now common dilemmas facing the islands (Fig. 1).

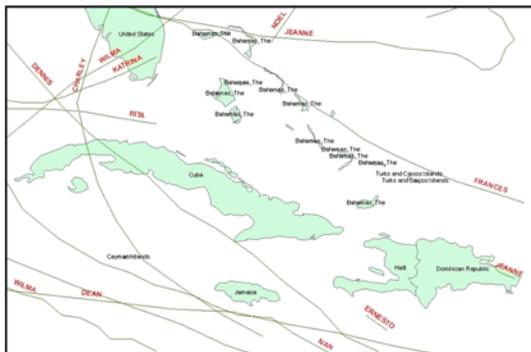


Figure 1 – Hurricane tracks 2004-2007

Current Status and Trends

The extent and severity of events varied across countries of the Northern Caribbean and Atlantic (NCA) node of the Global Coral Reef Monitoring

Network (Fig. 2). As a result over the last quarter century some reefs associated with countries of the NCA node have experienced varied effects.



Figure 2 – Countries of the NCA node

Some corals were exposed to less stress and as a result were less susceptible to disease outbreaks. In the 2004-2005 bleaching outbreak between 50%-90% of coral colonies suffered partial to total bleaching. This resulted in a decrease of live coral cover in most islands and contributed to continued decline of the fishery of some islands (Souter and Wilkinson (Eds.) 2008).

In Bermuda the 2005 Atlantic hurricane season was the most active in recorded history with three tropical storms (Franklin, Harvey and Philippe) and two

hurricanes (Nate and Wilma). The increased frequency of hurricanes, repeated bleaching events and coral disease have had little impact on coral cover. Coral cover on the outer rim has been monitored since 1992 and has remained relatively stable over the 15 years (20.5% in 1992, 20.1% in 2007). Bermuda is the most northerly located country of the node. This may account for the fact that they do not experience prolonged periods of high water temperature which may cause bleaching.

The Bermudian fishery has experienced a shift towards pelagic species, particularly Wahoo (*Acanthocybium solandri*) and yellow-fin tuna (*Thunnus albacares*). Pelagic species now account for approximately 50% of the commercial finfish landings. This is in response to the ban imposed in 1990 on fish traps.

There is limited information on the current status of Bahamian reefs. Like other reefs of the region coral colonies are being pressured by proliferation of algae. Information from Rainbow Garden Reef suggests that bleaching, bio-erosion, and storm action reduced formerly discrete coral patches to rubble (Pante *et al.*, 2007).

The Cayman Islands, specifically, Little Cayman recorded significant loss of coral cover between 1999 and 2004. There are however now signs of continued recruitment, decreased mortality and relatively stable coral cover. There has also been no increase recorded in the percent cover of fleshy macro-algae.

Episodes of coral bleaching were reported in the late 1980's, 1995, 1998, 2003, and 2005. The event was more pervasive in 2005 but did not result in mortality. From 1999 to present, there has been no overall change in the abundance or density of herbivorous fish species.

In Cuba, bleaching events of varying degrees were experienced in consecutive years during the period 2005 to 2007. Major stress events inclusive of frequent and intense hurricanes between 2001 and 2005, and microbial disease such as white plague, dark spot, white pox, yellow blotch and black band were common. Excessive algal proliferation due to scarcity of herbivores also affected several areas.

In the midst of these stress events a recovery of *Diadema* populations was observed along with resheathing on *Acropora palmata*. Reef Check surveys conducted in 2004 and 2005 indicated that hard coral mean percentage cover was 22.7% and 20.7% respectively. Atlantic Gulf Rapid Reef Assessment (AGRRA) surveys conducted in 2007 on the south and east of Golfo de Batabano provided live coral cover values of 9% to 50% for reef crests and 6% to 21% for reef zones.

The variation in reef status was again evident in the Dominican Republic. Reef conditions were dependent

on the location and distance from the numerous river discharges. Reef Check assessments conducted between 2004 and 2007 showed that average coral cover ranged between 11.4% and 21.9%. Individual sites recorded percentages between 1.9% in 2005 and 34.4% in 2006.

The main problem on the reefs is the overfishing of several essential species such as *Strombus* sp., *Panulirus* sp., and fishes of the Serranidae, Lutjanidae, and Scaridae families. Additional threats include those of port development (construction and operations) at the Boca Chica reef which is the most studied reef site in the island. Increased sedimentation along the coast also threatens reef growth.

On the other half of the island of Hispaniola, Haiti, no comprehensive surveys have been conducted since 2003. At that time the reefs appeared to be in fairly good condition but, with no public sector involvement, the condition continues to degrade. Eutrophication, sedimentation, coral harvesting, pollution, and overfishing continue to be major issues affecting the coral reefs. At present the exportation of lobster and conch has been suspended by CITES. The unsustainable harvesting of wetland resources persists as mangroves are still being exploited for fuel wood, charcoal production and construction. Illegal coral harvesting continues and seagrass beds continue to be threatened by sedimentation and pollution.

The non-governmental organisation (NGO) Foundation pour la Protection de la Biodiversite Marine (FoProBIM) continues to monitor impacts and perform educational activities.

In 2005 the Turks and Caicos Islands like most of the region suffered a major bleaching event. As much as 50%-75% of coral colonies suffered partial to total bleaching. Reef Check assessments in 2004 and 2005 recorded averages of 10.6% and 5.9% respectively. In 2007 a more comprehensive assessment was conducted on 18 sites associated with the three major islands; Providenciales, West Caicos and South Caicos. Most sites assessed were dive sites with some level of legislative protection such as no anchoring and no fishing; depths between 12 and 60 feet were surveyed. On Providenciales live coral cover ranged between a low of 6.3% and a high of 38.8%. This is higher than the figures reported in 2004. Algal percentages ranging between zero and 46.3% were recorded. West Caicos and South Caicos recorded coral averages of 17% and 13% respectively.

Near-shore support systems such as seagrass beds and mangroves continue to thrive, however comprehensive monitoring of these systems is lacking. The country is currently experiencing a construction boom and all the associated pressures that arise from these activities.

Jamaican reefs continue to show variable cover by hard corals and other benthic substrates and have rebounded from the 5% hard coral cover recorded in the early 1990s to approximately 16%. Some sites have a relatively high and stable coral cover in percentages greater than the Caribbean regional average of 20% (TNC 2006). Overall hard coral percentage cover recorded from Reef Check surveys for the period 2004 to 2007 ranged between 2.2% and 37.5%.

The trend of algal dominated reefs is still visible on several reef systems across the island. This continued proliferation is due to the continued nutrient input and the absence of grazers. Overfishing has removed virtually all large predatory species, like sharks, snappers and groupers, and has sharply reduced the size of herbivores, namely parrotfish and surgeon fish. Notwithstanding of the myriad of environmental and biological factors affecting the reefs some have been able to maintain a relatively stable coral cover. Over the period 2001 to 2007 four sites (Ireland Pen, Bloody Bay, El Punto Negrilo and Little Bay) within the Negril Marine Park have been continuously monitored (Fig. 3). They have maintained overall coral percentages of 17.5%, 9.9%, 16.0% and 17.4% respectively.

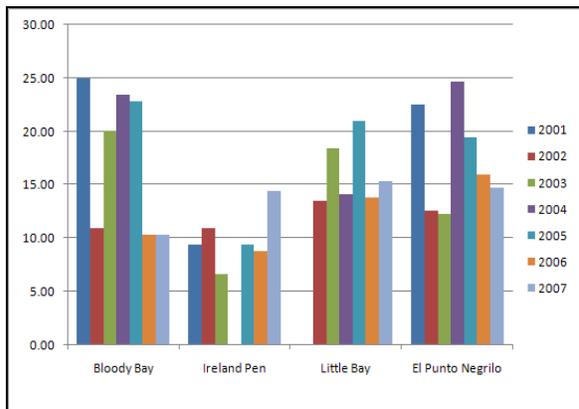


Figure 3 – Hard coral percentage cover on long-term monitoring sites in Negril, Jamaica: 2001 -2007

The region is now experiencing a new threat namely the Indo-Pacific lionfish (*Pterois volitans*). It has been reported in all the countries of the node except Haiti; this absence may however be due to a lack of monitoring. The presence of this invasive has the potential to further damage the already threatened fish population of the region and also affect coral health. This organism may also pose a threat to the highest economic earner of the Caribbean; tourism. In Jamaica they have been sighted on tourist dive sites and have also been encountered in fish pots at depths up to 60 feet.

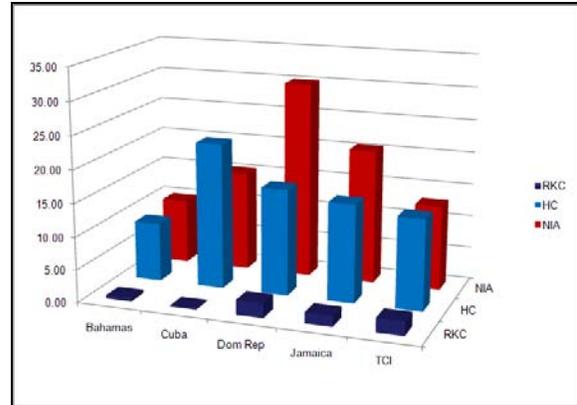


Figure 4 – Reef Check data 2004 – 2007 showing average percentage cover for recently killed coral, hard coral and nutrient indicating algae

Discussion and Conclusion

The reef ecosystems of the region are comparable with respect to challenges encountered, coral cover, species distribution and composition (Figs. 1 and 4). While some reefs are indeed in serious trouble, others remain healthy and appear to be developing some resilience to the effects of natural forces and human activity. These reef systems appear to be able to recover from stress events such as high water temperatures, intense storms and prolonged sedimentation. This is evident on several Jamaican reef sites such as Little Bay, Westmoreland and Columbus Park, St. Ann which are sediment impacted sites. The degree of recovery is however dependent on time-span between stress events.

Hope for the reefs is also evident in the recovery of *Diadema antillarum* densities on some reefs along with *Acropora* sp. recruits. Current fishing practices however need to be changed to aid in the recovery.

In several countries, active monitoring is still not a standard government tool to manage the ecosystem. Governments need to develop strategies and methodologies for the assessment of the coastal area as a base for sustainable development. They also need to implement programmes and regulations to enhance coral resilience.

The region also needs to collaborate and formulate measures to combat the effects of the common problem of climate change and ocean acidification. A programme to deal with the lionfish invasion is also critically needed.

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