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Coral diseases following massive bleaching in 2005 cause 60 percent decline in coral cover and mortality of the threatened species, *Acropora palmata*, on reefs in the U.S. Virgin Islands

Severe Bleaching in 2005

Record-high seawater temperatures and calm seas in the summer of 2005 led to the most severe coral bleaching (greater than 90 percent bleached coral cover) ever observed in the U.S. Virgin Islands (USVI) (figs. 1 and 2). All but a few coral species bleached, including the threatened species, *Acropora palmata*. Bleaching was seen from the surface to depths over 20 meters.

Disease Outbreak

With cooler temperatures in October, some corals began to regain their color. However, many corals then died partially or totally in a regional disease outbreak (Miller and others, 2006). U.S. Geological Survey (USGS) and National Park Service (NPS) scientists collaborated to increase the frequency of monitoring at five reefs, four of them within Marine Protected Areas, Virgin Islands National Park and Buck Island Reef National Monument (fig. 3). The effects of disease, primarily white plague, were recorded along permanent, randomly selected long-term transects maintained by the NPS South Florida/Caribbean Inventory and Monitoring Network (fig. 4). The number and size of disease lesions on each coral colony within one meter on either side of each transect were quantified (fig. 5). Effects of bleaching and disease on *A. palmata* colonies were followed at shallower reefs monitored by USGS.

Effects on Major Framework-building Coral Species

This bleaching/disease event caused losses of the two coral species that contribute most to the architecture and framework of USVI reefs, *A. palmata* and *Montastraea annularis*. *Montastraea annularis*, which initially made up 55.6 percent of the coral cover at the five sites, remained the most abundant species but was especially susceptible to disease, declining in relative abundance to 40.9 percent by 2007. *Acropora palmata* bleached for the first time on record in the USVI (fig. 6). About 50 percent of the *A. palmata* colonies being monitored at the time bleached, with 15 percent of these colonies dying entirely and 35 percent showing partial mortality. Although all coral species suffered some losses, some were more vulnerable to disease than others. Disease caused more mortality than bleaching on all species, except *Agaricia agaricites*.

Declines in Coral Cover

Coral cover at the five sites continued to decline through the end of 2007, even during periods of cooler water temperature. The mean coral cover dropped from 21.4 percent to 8.3 percent over the two years, a decrease of 61 percent. During the peak of the disease outbreak, the mean number of lesions increased 51-fold and the mean area killed by disease increased 13-fold when compared to disease levels before bleaching. No other studies have shown such dramatic declines in coral cover from disease over such an extensive area.

Correlation between Seawater Temperature and Disease

In a three-year study of *A. palmata* in Hawksnest Bay, St. John, within Virgin Islands National Park, Muller and others (2008) showed a correlation between temperature and disease, but only in 2005 when corals were bleached. The size of lesions from white pox and other undescribed white syndromes increased as temperature increased but only for bleached colonies.

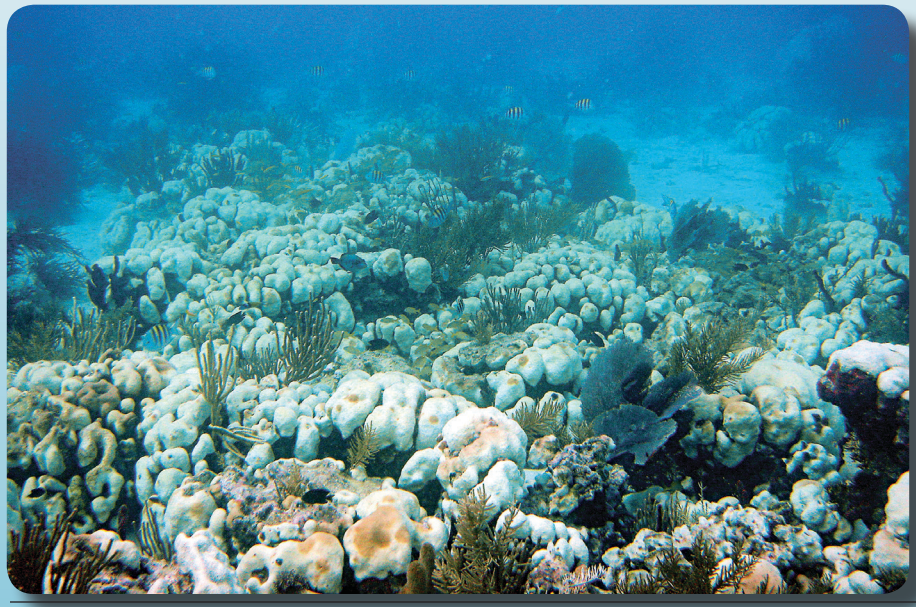

Figure 1. Extensive coral bleaching on a reef off St. John, U.S. Virgin Islands. (Photograph courtesy of C. Rogers, USGS)

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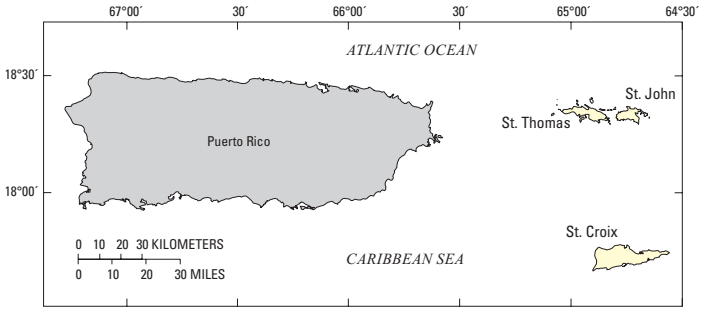

Figure 2. Location map showing the U.S. Virgin Islands and Puerto Rico.

Figure 6. Bleaching of the threatened species *Acropora palmata* had not been reported in the U.S. Virgin Islands before 2005. (Photograph courtesy of E. Muller, Florida Institute of Technology)

Figure 3. The frequency of monitoring of long-term transects on U.S. Virgin Islands coral reefs was increased to every 2-4 months in response to widespread bleaching and disease. (Photograph courtesy of C. Rogers, USGS)

Figure 4. White plague on *Montastraea annularis* colonies. (Photograph courtesy of C. Rogers, USGS)

Figure 5. USGS employees record coral diseases along permanent transects. (Photograph courtesy of C. Rogers, USGS)

Greater Coral Mortality than from any other Previous Stressors

The effects of bleaching and disease on coral reefs in the USVI have been profound, and no other stressors have caused greater or more rapid coral cover declines on these reefs (Rogers and others, 2008). These and other studies show that losses were similar for reefs inside and outside marine protected areas, including marine reserves. The anticipated benefits (for example, replenishment of fish and corals) from marine reserves (Virgin Islands Coral Reef National Monument and Buck Island Reef National Monument) established in the USVI in 2001 could be undermined by these significant declines in coral cover (Rogers and others, 2007). No measurable recovery has been documented to date. The recovery of USVI coral reefs will depend on the severity and frequency of expected future bleaching and disease events. It will also depend on their connectivity with sources of larvae for coral, fish, and other organisms.

Effective management of human activities that contribute to reef degradation could be significant in enabling coral reefs in the USVI to persist and grow, in the face of regional and global stressors such as bleaching, disease, and ocean acidification. Further research on coral diseases, and the synergy between bleaching and diseases is an urgent priority.

References

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