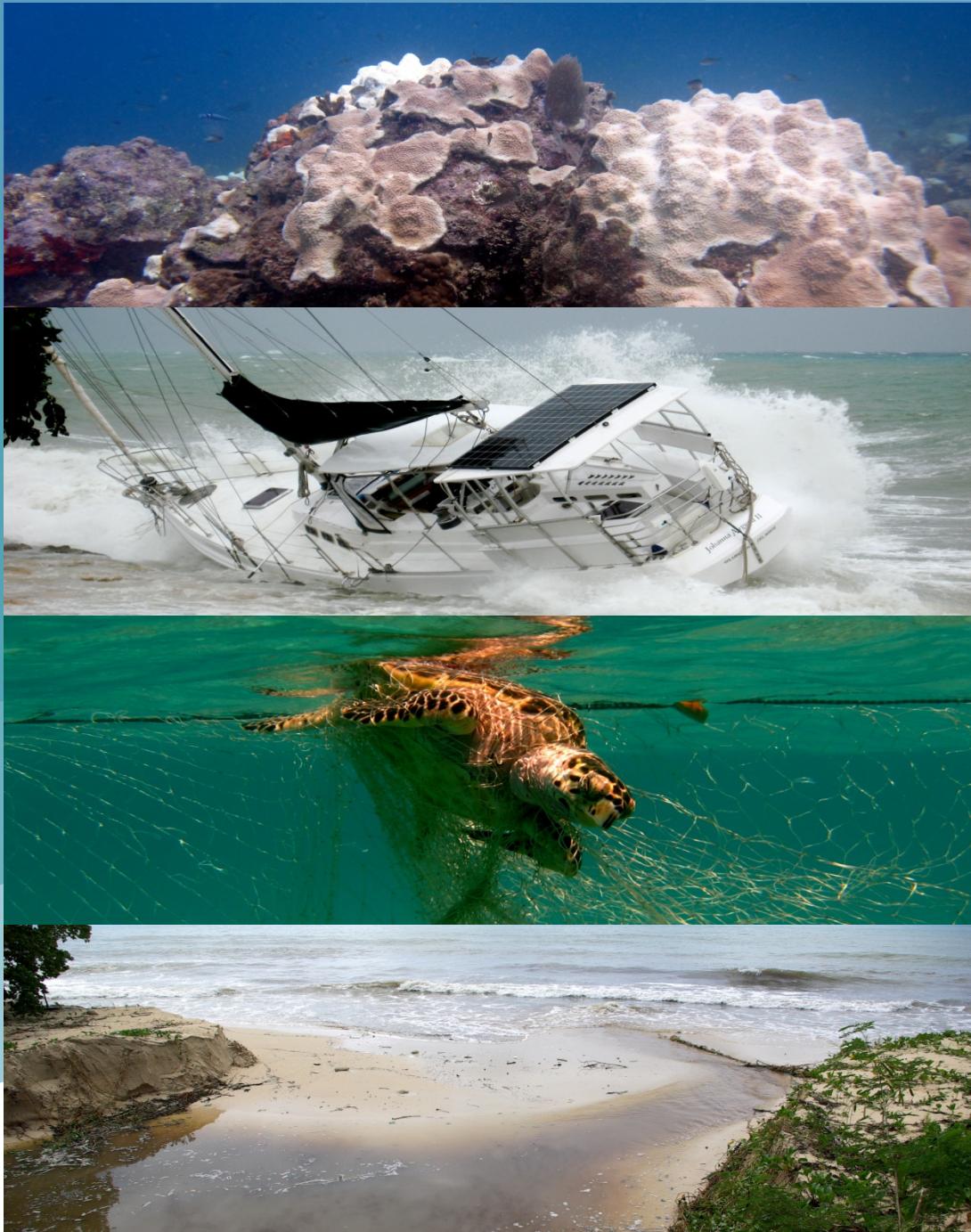


US Virgin Islands Reef Resilience Plan



“... we need to recognize that the coral reef crisis is a crisis of governance. Scientists can help by undertaking solution-focused research, by participating more vigorously in policy debates to improve coral reef legislations and implementation, and by sending the clear message that reefs can still be saved if we try harder.” - Hughes et al., 2010

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INTRODUCTION

Coral Reefs in the Caribbean, important for their many ecological, economical, and cultural uses, have been impacted by a number of natural and anthropogenic stressors that have lead to declines in species diversity and abundance throughout their range. Global climate change, for example, impacts coral reefs directly as warmer waters are leading to more frequent and more severe mass bleaching events as well as indirectly with noticeable changes in the incidence and severity of tropical weather systems. The increase of air-emitted carbon dioxide is also causing ocean acidification which negatively affects the ability for marine organisms to build calcium carbonate tests, shells, or skeletons. Climate change has caused direct and indirect negative impacts to coral reefs not only in the Caribbean but on a global scale.

In 2005, coral reefs throughout the US Virgin Islands were severely impacted by a mass coral bleaching event triggered by prolonged exposure to above normal water temperatures. The bleaching observed in 2005 caused some direct mortality and was also followed by an increased incidence of disease outbreaks. Multiple studies reported this pathway of bleaching followed by increase incidence of disease, with corals varying in degree of mortality resulting from both stresses. Miller and others (2009) observed signs of thermal stress at more than 90% of coral cover at each of their study sites (St. John and Buck Island, St. Croix) during the peak coral bleaching period in 2005. Re-colorization had still not completely occurred at the time when this study was concluded in 2007. Subsequent to bleaching, increased incidences of outbreaks of coral diseases (primarily white plague or similar) represented as much as a 13-fold increase in coral reef area loss and as much as a 55-fold increase in coral reef tissue loss during the peak period of disease activity (Miller et al., 2009). Similarly, Lundgren and Hillis-Starr (2008) observed averages of 45.8-79.8% bleaching of *Acropora palmata* at sites at the Buck Island Reef National Monument in 2005. At one site, 64.7% of the corals surveyed experienced complete mortality. Lastly, Smith and Nemeth (2008) observed high severity of bleaching (50-90% colony surface) on reefs surveys throughout the USVI during the peak of the 2005 mass bleaching event. They also observed an increase in the prevalence of diseases (primarily white syndrome) that lead to, in addition to bleaching, a 38% net reduction in monitored reef coral cover. Deep reefs, which did not bleach as severely as shallow reefs, also had an increase in the incidence of white syndrome diseases and a 22% loss of coral cover (Smith and Nemeth, 2008). Years later, many impacted reefs throughout the USVI are yet to fully recover.

In the USVI, coral reefs are further impacted by coastal development and other sources of point and non-point pollution, which degrade water quality and stress corals. These stresses can eventually lead to bleaching, outbreaks of diseases and direct mortality. The local over-

harvest of “pot fish” (a term that locally refers to a number of fish species – many of which are herbivorous coral reef inhabitants), and the die-off of the herbivorous long-spined sea urchin (*Diadema antillarum*) has caused coral reefs to shift to algal-dominated reefs. In addition to over-harvesting, destructive fishing practices along with a steady increase in the frequency of vessel groundings have all contributed to the degradation and/or loss of local coral reef habitat. The newest threat that has been identified on USVI coral reefs is the introduction of the invasive Indo-Pacific lionfish. Without natural predators, these fish may over-populate local reefs, further remove important coral reef fish species, and may further compromise the ability for coral reefs to remain “resilient” through the cumulative impacts of direct and indirect stressors.

Those three primary stressors to coral reefs in the USVI, climate change, fishing pressure, and land-based sources of pollution have also been identified by the National Oceanic and Atmospheric Administration and The Nature Conservancy as priorities for their national and international coral conservation strategies.

Resilience

Resilience refers to the ability for a system to absorb external stressors/disturbances and rebound or maintain the key functions or roles they play in their environment. Biological resilient coral reefs are, then, those that are healthy enough to not be severely impacted by stressors or those that are healthy enough to rebound after being impacted and maintain their key functions. The identification of these naturally resilient reefs is important as many may need effective management to remove anthropogenic stressors. Similarly, social resilience is the ability of communities to adapt to and withstand institutional, environmental, and economic changes to their location. Typically, these changes are often to policies and regulations which may conflict with historical habits and practices but may also involve the loss of important uses and services as a result of the degradation of natural resources.

In a review by Terry Hughes and others (2010), four case studies were used to demonstrate how human intervention can build ecosystem resilience — to positively impact marine environments and help to reverse phase-shifts such as the coral- to algal-dominated reefs shifts prevalent throughout the Caribbean. In Hawaii, the diversion of sewage offshore improved water quality resulting in a reduction in macroalgae, sponges, and filter-feeding competitors or corals. In the Great Barrier Reef, the reintroduction of herbivores lead to substantial grazing of competing macroalgae. This macroalgae, when present in large amounts can cause up to a two-thirds reduction in coral recruitment. In the Caribbean, the natural recovery of *Diadema antillarum* could result in a similar shift from algal- to coral-dominated reefs. Lastly, the implementation of no-take reserves in the Bahamas and in the Phillipines

resulted in an increase in herbivorous fishes within the reserve and, as a result, a reduction in the amount of macroalgae in the no-take reserve as compared to non-protected reefs (Hughes et al., 2010). These case studies are testament to the concept that human intervention can positively impact natural environments; that Caribbean coral reefs are not at the point of no return.

REEF RESILIENCE MODEL

The Nature Conservancy's Resilience Model is comprised of four main principles used to develop Marine Protected Area systems or efficiently managed marine areas as a mechanism to further build resiliency.

Representation and Replication

Habitat type multiples help to spread risks of damage caused from disturbances.

Critical Areas

Refugia and spawning aggregations may be needed post disturbances to re-populate impacted areas.

Connectivity

Currents and other factors that encourage water movement will help in the dispersal and transport of coral spawn or buds.

Effective Management

Controlling threats to reefs provides for better conditions on the habitat level and as a result reduces coral stress.

VIRRP Objective

The objective of the US Virgin Islands Reef Resilience Plan is to conserve coral reefs in the US Virgin Islands by providing environmental conditions that will promote coral reef resilience and help to reverse the algal-dominated reefs phase-shift through:

1. The identification and effective management of resilient reefs in the USVI;
2. The active response to coral reef disturbances and restoration;
3. The active restoration of coral reefs and propagation of coral species; and
4. The reduction of anthropogenic impacts through a territory-wide approach.

Identifying Resilient Reefs

Resilient reefs located throughout the US Virgin Islands will be identified using a review of existing scientific data as well as preliminary data collected by community volunteers followed by rigorous scientific surveys. Based on the Great Barrier Reef Marine Park Authority's resilient reefs ranking system, both above- and below-surface parameters will be used to rank general resilience at USVI reef sites. The indicators are those that influence ecological processes, anthropogenic impacts, and physical and biological processes (Maynard et. al., 2010). This preliminary data will be collected using the appended Resilience Indicators Data Sheet (Appendix A) and volunteers will also be encouraged to submit photographs of the surveyed reefs. Based on the results from volunteers and expert knowledge of the areas, the steering committee will determine specific reef areas that will be further surveyed with methodology adopted from the University of the Virgin Islands and National Park Service scientists. The results from those scientific surveys, geared at assessing coral reefs and coral reef fish and other inhabitants, will be used to map USVI resilient reefs. The threats to those areas will be assessed and recommended strategies for reducing impacts will be provided to resource managers.

BLEACHWATCH (MASS BLEACHING EVENTS)

The purpose of the US Virgin Islands BleachWatch Program is to assess and monitor coral bleaching primarily from warm water events; documenting the distribution and severity of bleaching as well as impacts to reefs and reef communities post bleaching events. This component of the VIRRP will also incorporate volunteer and scientist surveys and observations.

Early Warning System

The Coral Reef Watch products developed by the National Oceanic and Atmospheric Administration will be used to prepare and respond to mass bleaching events. Response activity will be directly based on the advisory received from NOAA along with local temperature data.

<u>Advisory</u>	<u>Response</u>
Bleaching Warning	VIRRP steering committee meets to plan response, equipment available for monitoring is prepared/gathered, and press releases and individual calls are used to spread awareness and to mobilize community volunteers. Some pre-bleaching data are collected.
Alert Level 1	Monitoring activities continue. Emphasis placed on how much reef area and which species are more effected. Begin to look for signs of impacts to reefs.

Alert Level 2	Monitoring activities continue. More emphasis is placed on post bleaching impacts (direct mortality, increased prevalence of diseases, and any other changes).
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Community Volunteer Training

Individuals from the public will be able to contribute to the assessment of coral bleaching by participating in the USVI BleachWatch program. BleachWatch assessment methods will be taught through a number of annually offered training sessions. Training sessions will be focused on the identification of reef corals, fishes, and creatures as well as the identification of coral bleaching and diseases. Each session will include survey methodology and guidelines for submitting data.

Bleaching Assessment and Monitoring

The monitoring protocol utilized by the National Park Service and the University of the Virgin Islands Territorial Coral Reef Monitoring Program will be used by scientists conducting surveys to monitor coral bleaching and post bleaching assessments (Appendix B).

USVI CORAL REEF DISTURBANCE RESPONSE POINTS OF CONTACT

There are a number of anthropogenic impacts to coral reefs in the US Virgin Islands. To streamline and coordinate response activities, the points of contact below have been identified as the natural resource managers with jurisdiction over or with the capacity to initiate response, emergency triage, and process damage claims for impacts to coral reefs.



USVI CORAL REEF DISTURBANCE RESPONSE POINTS OF CONTACT

For response, emergency triage, and damage claims for impacts to coral reefs

US Coast Guard

Oil or Hazmat: USCG National Response Center 1(800)424-8802

Sector San Juan: (787) 289-2041

NOAA Damage Assessment and Restoration Program – Coral Restoration Team

Puerto Rico: (787) 667-7750

Florida: (727) 647-6538

National Park Service

Buck Island, St. Croix: (340) 773-1460 (x235)

St. John: (340) 693-8950 (x225)

USVI Department of Planning and Natural Resources Division of Environmental Enforcement

St. Croix: (340) 773-5774 | (340) 513-4747 (mobile)

St. Thomas/St. John: (340) 714-9538 | (340) 643-6001 (mobile)

CORAL REEF RESTORATION

The purpose of active coral propagation and site restoration, as with the American Recovery and Reinvestment Act-funded Coral Restoration Program, is to enhance coral reef species and coral reefs sites that have declined or been degraded. Coral fragments that would die if not rescued, especially with the potential increase in the frequency and severity of tropical weather systems, are a great source of material for such a project. There are a number of methods utilized for in-situ propagation of corals ranging from the specific creation of structure for affixing corals (nurseries) to utilizing existing hard structures (jetties, break walls, etc). Below lists the key components important to consider when designing a coral propagation and restoration program:

1. In-situ nursery or propagation sites are established based on needed coral species specific parameters (good light, flow, and water quality, appropriate depth, substrate, etc.);
2. Stock are identified and cached if cannot be used immediately, collected from a wide range of sites to increase the probability for high genetic diversity;
3. Nursery maintenance is conducted on an appropriate time frame in an effort to prevent unfavorable competition and predation; and
4. Restoration sites are chosen based on resilience criteria (reducing risks) and monitored and maintained to increase the potential of success.

The propagation of corals is a pro-active way to build coral reef resilience. In the case of the US Virgin Islands, coral fragments that would suffer mortality if left unattended are rescued and used to restore degraded sites. Coupled with the reduction of anthropogenic impacts, coral species recovery and reef site restoration will lead to the improvement of the quality of sites ecologically, but will also have indirect improvements to the economical and cultural benefits of coral reefs.

REDUCING ANTHROPOGENIC IMPACTS

“WE NEED CORAL REEFS” AWARENESS CAMPAIGN

The purpose of the “We Need Coral Reefs” campaign is to educate, and spread awareness about the ecological, economical, and cultural importance of coral reefs to the US Virgin Islands. It is anticipated that through education and awareness, stewardship can be created which will lead to positive and pro-active behavioral changes in a number of different stakeholders and reef users; eliminating or reducing anthropogenic impacts.

The main concept of the “We Need Coral Reefs” campaign is to have well-known locals and residents share stories describing why coral reefs are important to them specifically and, as a result, to the US Virgin Islands. Topics will cover a number of local issues ranging from local fisheries to tourism. The stories will also contain information on how to positively or proactively address the impacts of pollution and other harmful practices that damage/degrade coral reefs. These stories will be told through news paper, radio, and if possible television and will help to launch the VI Reef Resilience Program. Future concepts will have the same purpose but will be used to explore different ways of creating behavioral changes.

SUSTAINABLE SEAFOOD PROGRAM

The purpose of the Sustainable Seafood Program is to spread awareness about the negative impacts of over-fishing and destructive fishing practices and to initiate a market-driven local, sustainable, fishing industry. There are three main strategies for the program:

1. To work with the Division of Fish and Wildlife to identify a local list of sustainably harvested food fishes and invertebrates;
2. To work with Commercial Fishers so that they fully understand the reason for seasons and closures and that they commit to following those regulations; and
3. To work with the restaurant industry and wider-community so that they purchase and prepare/sell seafood only when in season and when sustainably harvested or, alternatively, eco-friendly farmed.

CONCLUSION

The Virgin Islands Reef Resilience Plan provides the framework for creating a more holistic approach to coral reef management in the US Virgin Islands. Success will be realized only through implementation, active improvements, and a strong commitment to effective management of coral reefs and the natural resources of the US Virgin Islands. Success will depend on behavioral changes and the creation of a greater sense of stewardship from the many people that depend on coral reefs for their ecological, economic, and cultural benefits.

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