

Involving Communities in the Implementation of Reef Check: Strategies for Co-management of Marine Resources in St. Vincent and the Grenadines

KIMBERLY BALDWIN¹, SOPHIA PUNNETT² and CASPER SMITH³

¹*Centre for Resource Management and Environmental Studies
University of the West Indies, Cave Hill Campus
Barbados, West Indies*

²*St. Vincent Fisheries Division
Kingstown, St. Vincent*

St. Vincent and the Grenadines, West Indies
³*Sustainable Grenadines Project
Union Island, St. Vincent and the Grenadines, West Indies*

ABSTRACT

A healthy marine environment in St. Vincent and the Grenadines is essential not only for the conservation of marine biodiversity but to ensure the sustainable livelihoods of local communities through the long-term success of fishing and tourism. Marine monitoring is an essential procedure to ensure that sound management decisions are made involving the marine resources on the Grenadines Bank. In this context, collaboration between the St. Vincent Fisheries Division, The Sustainable Grenadines Project and a variety of local marine resource user groups was made to implement the St. Vincent and the Grenadines Reef Check monitoring program. Volunteers were trained in Reef Check methodology and a total of seven sites were surveyed in early 2005. Initial results from preliminary Reef Check surveys provide an indication of the effects that increased fishing pressure, rapid development and other human activities are having upon the marine environment.

It is recommended that the St. Vincent Fisheries Division utilise the Reef Check program as part of a monitoring 'design framework'; consisting of at least two program levels: a community-based relatively broad-bush program such as Reef Check conducted often by volunteers at many sites, and a high-resolution scientific program (such as AGRRA) carried out at less frequently at fewer sites. This combination of monitoring can provide governments with a cost-efficient early-warning indicator system for detecting major anthropogenic changes in the marine environment as well as facilitate community support for marine management.

Considering the importance of marine resources to the people of St. Vincent and the Grenadines; a greater understanding of the abundance and distribution of key resources, their user groups as well as areas of user conflict is needed. This information can be used to support the broader goal of a marine space-use plan for the Grenadines including a network of marine protected areas for the Grenadines Bank.

KEY WORDS: Reef Check, marine monitoring, community-based management

Implementando “Chequeo de Arcifes” en San Vicente y las Grenadinas: Recomendaciones para Manejo Comunitario de Recursos Marinos dentro de los Bancos Grenadinos

Un Ambiente sano en Sn. Vicente y las Grenadinas es esencial no solamente para la conservacion de la biodiversidad marina sino también para asegurar una subsistencia sostenida de comunidades locales a través del éxito a largo plazo de la pesca y el turismo. El monitoreo marino es esencial para asegurar que decisiones sólidas sobre manejo sean tomadas que involucren los recursos marinos existentes en los bancos grenadinos. Dentro de este contexto, una colaboracion entre la Division de Pesca de San Vicente, el proyecto Grenadinas Sostenible y una variedad de recursos marinos locales fue creada para implementar el programa de monitoreo de chequeo de arrecifes. Se capacitaron voluntarios en la metodologia de chequeo de arrecifes y un total de siete sitios fueron inspeccionados a inicios de año. Los resultados preliminares arrojados por estas inspecciones de chequeo de arrecifes indican que el rapido desarrollo en las Grenadinas al igual que otras actividades humanas estan impactando el ambiente marino.

Se recomienda que la Division de Pesca de San Vicente implemente este programa de chequeo de arrecifes como parte de una “estructura de diseño”; consistiendo al menos de dos niveles de monitoreo: un programa con base comunitaria relativamente amplio tal como el de chequeo de arrecifes conducido por voluntarios en varios sitios, asi como un programa de alta definicion cientifica como AGRRA llevado a cabo en menos sitios. Esta combinacion de monitoreo puede proveer a los gobiernos de un sistema de indicador de bajo costo y temprana advertencia para detectar mayores cambios antropocentricos en el ambiente marino como también brindar apoyo a la comunidad para el manejo marino dentro del area.

Considerando la importancia que juegan los recursos marinos para los pobladores de las Grenadinas; se hace necesarian una mayor comprension sobre la cantidad y distribucion de recursos claves, sus usuarios y las areas de conflicto entre usuarios. Estas inspecciones igualmente proveeran informacion que podra ser utilizado para apoyar una meta mas extensa de un plan de utilizacion de espacio marino para las Grenadinas que podria incluir un sistema de Areas Protegidas Marinas

(MPA's) para los bancos Grenadinos.

PALABRAS CLAVES: Chequeo de arrecifes, monitoreo marino, manejo comunitario

INTRODUCTION

The main goal of a government coral reef monitoring program is to acquire the data that is needed for management decisions. Management initiatives in turn require community education and support in order for successful implementation, acceptance and enforcement. By involving local communities in monitoring programs such as Reef Check, governments can help build a sense of stewardship for marine resources as well as increasing public education and support for management plans (Burke and Maidens 2004). Additionally, by utilizing community volunteers a cost-effective source of standardised scientific information can be collected for comparison on local, regional, and global scales. It has been shown that the success of establishing long-term sustainable community-based monitoring programs such as Reef Check is increased if there is collaboration between the local government, NGO's, private sector, and the communities (Burke and Maidens 2004). From January through April 2005, The Amadis Project trained and assisted the country of St. Vincent and the Grenadines in implementing Reef Check, the country's first standardized community-based marine monitoring program.

Ideally, the benefits of a government run long-term monitoring program can be fully utilized by implementing the Reef Check monitoring program as part of a two level 'design framework'. This cost-effective framework consists of at least two levels of monitoring: a community-based relatively broad-bush program (such as Reef Check) conducted at many sites, as well as a high-resolution program carried out by more scientific teams at fewer sites (Hodgeson 1998). If Reef Check surveys are repeated at quarterly intervals monitoring provides governments with an early-warning indicator system for major changes in the marine environment such as coral bleaching, diseases, over-fishing, eutrophication, and sedimentation (Hodgeson and Stepath 1998). Additionally, implementing the Reef Check program in this fashion facilitates collaboration between the government, NGO's and marine resource users in building support for coral reef monitoring and management decisions (Hodgeson and Stepath 1998).

What is Reef Check?

Reef Check was developed in 1996 as a volunteer, community-based monitoring protocol designed to measure the health of coral reefs on a global scale in areas with limited economic resources. Now in its eighth year of operation, Reef Check is active in over 82 countries and territories throughout the tropical world. During this time,

Reef Check has evolved into the largest international marine monitoring environmental organization with the following goals:

- i) To educate the public about the coral reef crisis;
- ii) To create a global network of volunteer teams which regularly monitor and report on reef health;
- iii) To scientifically investigate coral reef processes;
- iv) To facilitate collaboration among academia, NGOs, governments and the private sector; and
- v) To stimulate local community action to protect remaining pristine reefs and to rehabilitate damaged reefs worldwide using ecologically sound and economically sustainable solutions.

Reef Check scientists teach teams of volunteers about the value of coral reefs and their ecology, and show them how to scientifically monitor them. Teams are composed of a diverse range of community groups ranging from scientists, government agencies, local NGOs, recreational divers, village fishermen, school children, and tourists. Around the tropical world Reef Check volunteer teams have collected a wealth of standardised data about the health of reefs used for comparison by Reef Check and other global databases such as the Global Coral Reef Monitoring Network (GCRMN) and Reef Base.

Reef Check teams collect four types of data:

- i) A description of each reef site based on over 30 measures of environmental conditions and expert rating of human impacts in the area;
- ii) Fish counts over 400 m² of shallow reef;
- iii) Invertebrate counts over the same area; and
- iv) A measure of the percentage of seabed covered by different substrate types (including live and dead coral) as well as coral bleaching and disease monitoring.

Reef Check and the GCRMN have selected sixteen global and eight regional indicator organisms and substrates to serve as specific measures of human impacts on coral reefs (Hodgeson 1998). These indicators were chosen based on their global economic and ecological value as well as their sensitivity to human impacts. Furthermore, Reef Check survey methodology can be easily adapted for site-specific use by implementing additional indicator organisms to survey for use in local management decisions, or to examine the effectiveness of marine protected areas. For example, in the Eastern Caribbean important marine resource indicators include the spiny lobster, queen conch, sea turtles, West Indian sea egg, groupers, and snappers, all of which are threatened throughout the region by over-

fishing. Therefore, in areas where these 'indicator organisms' are targeted, their populations are expected to decrease. The Reef Check monitoring program uses specific 'indicator organisms' in order to get a temporal 'snapshot' of the local marine environment.

Reef Check is a relatively fast method of examining the general health of coral reefs, fish, and invertebrates at up to two sites a day (Hodgeson and Stepath 1998). As the number of Reef Check sites increases in a particular area the resolution of this 'snapshot' is increased. By utilising Reef Check volunteer teams, more sites can be examined in an area than is possible with more intensive scientific methods, as the latter tend to be more costly in time, trained professional staff, and funding (Hodgeson 1998).

METHODS

Project Overview

To ensure the successful implementation of a sustainable Reef Check monitoring program, a formal proposal was prepared outlining the responsibilities of each stakeholder group (government, NGO, and community volunteer teams).

Institutional arrangements for the Reef Check monitoring program were made with the St. Vincent Fisheries Division. Consultations with the Chief Fisheries Officer determined the role of the Fisheries Division and various stakeholders' involvement in the monitoring programme. A member of the Fisheries Division was designated as the 'Reef Check Country Coordinator'. A coordinator's responsibilities include working with team leaders to arrange annual surveys, as well as assisting with training new survey teams when necessary. In St. Vincent, additional training was conducted on data handling and the management of information obtained from the Reef Check surveys. A formal proposal of the requirements for the implementation of Reef Check in St. Vincent and the Grenadines was agreed upon and approved by the Minister of Agriculture in January 2005. Subsequently, all participants of the Reef Check monitoring program were given a copy of the monitoring program proposal.

From January to April 2005, a team of five volunteers aboard the 38' sailing vessel *Amadis* acted as a roving 'Reef Check' research training team in the islands of St. Vincent, Bequia, Mustique, Union Island, and the Tobago Cays. By partnering with the Fisheries Division and a local NGO (the Sustainable Grenadines Project), a variety of stakeholders which included government agencies (namely the Tobago Cays Marine Park), several local NGOs, schools, and members of the private sector were solicited in each island to gain support as well as volunteer teams for the Reef Check monitoring program. Additionally, The Sustainable Grenadines Project agreed to add 'Reef Check Monitoring' to its annual work plan thereby acting as the 'Reef Check NGO Coordinator' for St. Vincent and the Grenadines. Responsibilities include

spearheading annual surveys (from an NGO perspective), gaining community support through the dissemination of information regarding the monitoring program, and acting as a liaison to the Fisheries Division. Furthermore, a member of the Sustainable Grenadines Project was trained to use their data for educational purposes, and to be a 'Reef Check Team Trainer', providing additional support for the government in subsequent years. Collaboration with the Sustainable Grenadines Project proved invaluable during the implementation of Reef Check. By partnering with a trusted local community non-governmental organisation the *Amadis* Project was quickly able to organise community meetings, locate appropriate contacts, and most importantly, readily gain the trust and acceptance of each island community throughout the project.

On each island, informational meetings were held to notify the community of the overall Reef Check project, and to solicit volunteers to train for Reef Check survey teams, thereby becoming responsible for annual surveys. Local community members assisted *Amadis'* scientists in locating appropriate survey sites and donated boats, fuel, SCUBA gear, tank air-fills, and divers as they were needed to perform surveys. Thanks to a PADI Project AWARE grant, all training and survey equipment was free to new survey teams. Teams were provided with training videos, identification slide shows, underwater species identification cards, transect tapes, clipboards, underwater paper, plumb lines, PVP pipes, and pencils needed for 'Reef Check' surveys in St. Vincent and the Grenadines.

In each of the Grenadine islands of Bequia, Mustique, the Tobago Cays, and Union Island, a local Reef Check 'Island Coordinator' was appointed to oversee the Reef Check team(s) and act as liaison to the Fisheries Division and the Sustainable Grenadines Project. These Island Coordinators are also responsible for spearheading subsequent annual team surveys in their respective islands, as well as reviewing and entering survey data that is entered into automated Reef Check spreadsheets. These are then sent to the Fisheries Division who submits the data to Reef Check.

Reef Check Training

A total of five new teams were trained in Reef Check methodology and 7 sites were set up and surveyed from January to April 2005. Visits to each island ranged from one to two weeks in order to encourage and train local communities (including dive shops operators, marine park rangers, fishers, community groups, schools, tourists, and hoteliers) to get involved in the new Reef Check monitoring program. Each Reef Check training session was specifically tailored around the capacity and specific interests of the volunteers on each island. Professional dive operators tended to be the busiest yet easiest groups to train. As a result of their extensive dive experience they generally knew all of the various indicator fish, invertebrates and benthic substrates. Therefore training sessions

with dive operators were short (two to three hours) and more informal. Training consisted of reviewing Reef Check indicator organisms and focused primarily on survey techniques, data entry, and analysis. Others survey teams such as the marine park rangers, school groups and environmental clubs were trained in a more formal fashion over a week-long period. Training consisted of a number of classroom sessions, which introduced Reef Check and the importance of reef monitoring. Through a combination of slideshows in the classroom, and field identification of fish, invertebrates, benthic substrates, and survey techniques by snorkelling, volunteers were able to practice before performing the actual surveys. A separate data entry/analysis session was conducted giving the volunteers a well-rounded initiation of Reef Check surveying.

Reef Check Surveys

All surveys were conducted parallel to shore, at the same depth contour, and in relatively shallow reef areas ranging between 2 and 13 meters in depth. For each survey, a site description and associated socio-economic uses questionnaire was completed by the members of the team. A total of four 20 meter transects, each five meters wide were surveyed for fish, invertebrates and benthic substrates. Sites surveyed were chosen based on recommendations from both the Fisheries Division and the Reef

Check volunteer teams. Initial sites surveyed were chosen to represent the “best” reef in the area. These were areas that were perceived to possess the highest amounts of living coral cover, fish, and invertebrate populations and be the least affected by human impacts, such as fishing and pollution. In many cases, sites chosen were areas that were popular dive sites or reefs located in marine protected or conservation areas. If multiple sites were surveyed on an island, the additional sites chosen were representative of moderate to heavy human impacts. A list of the various sites surveyed during this project and their GPS locations are listed in Table 1.

Local modifications to the Reef Check surveys included adding supplementary ‘indicator species’ and socio-economic ‘site description’ questions which are of particular interest to either the Fisheries Division, local community groups or NGOs. Specifically, ‘indicator species’ added to the Reef Check surveys included sea turtles, queen conch, bristle worms, and the West Indian sea egg, as well as questions regarding boat traffic (including motor boats/water taxis), storm drain outfalls, turtle nesting beaches, turtle, and whale harvesting, water pollution and the presence of any known environmental regulations within the area.

Table 1. Reef Check survey sites by depth (m), GPS coordinates (degree-minutes-seconds) and site descriptions set up in St. Vincent and the Grenadines during January to April 2005.

Island	Site Name	Depth	GPS Coordinates	Site Description
St.	Young Island Cut	7	13.07.09 N, 61.12.21 W	Conservation Area
Vincent	The Gardens	13	13.09.79 N, 61.14.88 W	Popular Dive Site
Bequia	Moonhole	12	12.59 35 N, 61.16.32 W	Popular Dive Site
Mustique	Plaintain	9	12.86.99 N, 61.19.46 W	Conservation Area
Tobago	Horseshoe Reef	2	12.38.09 N, 61.21.01 W	Marine Protected Area
Cays	Petite Tabac	3	12.37.28 N, 61.21.02 W	Marine Protected Area
	Petite Bateau	2	12.37.59 N, 61.21.33 W	Marine Protected Area

RESULTS

The following results demonstrate the type of information that can be easily produced from Reef Check monitoring and used for management decisions or educational purposes. These preliminary surveys comprise the baseline information needed for comparison with subsequent marine monitoring and therefore no statistical analyses were conducted.

Seven Reef Check sites were surveyed in four islands on the Grenadine Bank from January to April 2005 (Table 1).

Analysis of substrate data indicate mean hard coral abundances ranged from 2.5 % per transect at the Gardens site in St. Vincent to a high of 17.25 % hard coral cover at Plantain, Mustique (Table 2). Recently killed corals were only found at the Moonhole and Plantain sites and in negligible amounts (less than 1%). Generally, marine protected and conservation area survey sites comprised the lowest hard coral abundances as compared to sites that were chosen due to their popularity as dive sites.

Nutrient indicator algae (NIA) were present at all sites although it was generally found in low abundances. The Horseshoe Back Reef site had the lowest percent cover of NIA at 2.25%, whilst Petite Bateau showed the highest percent cover of NIA at 16.25%. The Gardens site had the highest mean sponge abundance (13.00%), whereas

Plantain and Petite Tabac sites had no sponges recorded. Substrate categories of rubble, silt/clay and other all consisted of less than 5% mean cover of each per transect at all sites (Figure 1).

The highest overall densities of indicator fish species were seen at Petite Bateau (65 individuals) and Young Island Cut sites (58 individuals) per 400 m² transect (Table 3). On average, the indicator fish families (grunts and butterflyfishes) were the most abundant families found across all sites, whereas larger high market-value fish were found in lower abundances. Fish data confirm that mature groupers (greater than 30 cm in length) are a scarce resource at reef sites in St. Vincent and the Grenadines, as they were only seen at two sites: Young Island Cut (mean of 1 individual per 400 m²) and Plantain (mean of 4.5 individuals per 400 m²). Snappers were not seen at the Young Island Cut, the Gardens or the Horseshoe Back Reef sites; highest densities of snappers were at the Plantain site (8.25 fish per 400 m²). Mature parrotfish (greater than 20 cm in length) were seen in low abundances at all sites, averaging about two individuals per 400 m² transect across sites. Overall fish diversity (by family) was highest at the Plantain site in Mustique whereas the lowest fish diversity was seen at the Horseshoe Back Reef site in the Tobago Cays Marine Park.

Table 2. Mean benthic abundances (% cover) per 20m² transect by Reef Check survey site in St. Vincent and the Grenadines from January – April 2005.

Island	Site	Depth (m)	Hard Coral	Recently Killed Coral	Nutrient Indicator Algae	Sponge	Soft Coral	Rubble	Rock	Silt/Clay	Other
St. Vincent	Young Island Cut	7	4.75 (2.6)	0	2.75 (1.5)	3.00 (0.8)	0	4.25 (2.5)	6.25 (2.5)	0	4.75 (1.0)
	The Gardens	13	2.50 (3.7)	0	10.00 (3.2)	13.00 (2.2)	0	3.50 (1.7)	4.25 (2.8)	0	0.25 (0.5)
Bequia	Moon-hole	12	15.75 (0.5)	0.75 (1.0)	10.50 (3.9)	2.50 (2.4)	2.00 (0.8)	1.00 (0.8)	4.75 (2.8)	0	0.25 (0.5)
Mustique	Plantain	9	17.25 (5.3)	0.25 (0.5)	6.75 (4.27)	0	5.25 (2.5)	0	4.25 (1.3)	0	0.75 (0.5)
	Horseshoe Back Reef	2	9.75 (3.1)	0	2.25 (1.0)	0.75 (1.0)	0.5 (1.0)	2.50 (2.9)	15.75 (2.6)	0	0
Tobago Cays	Petite Tabac	3	4.00 (1.6)	0	8.25 (1.9)	0	0.75 (0.5)	0	23.25 (3.9)	1.00 (1.4)	0.50 (1.0)
	Petite Bateau	2	5.50 (5.0)	0	16.25 (6.8)	0.50 (0.6)	0	1.25 (2.5)	9.75 (3.9)	0	0

Table 3. Mean density of fish and invertebrates per 400 m² transect during Reef Check surveys in St. Vincent and the Grenadines from January - April 2005.

Indicator Fish Families	St. Vincent		Bequia	Mustique	Tobago Cays Marine Park		
	Young Island Cut	The Gardens	Moonhole	Plantain	Horseshoe Back Reef	Petite Tabac	Petite Bateau
Butterflyfish	4.75 (0.5)	1.25 (1.5)	6.25 (2.6)	5.25 (2.4)	8.25 (2.2)	0.25 (0.5)	2.50 (2.1)
Grunts	50.50 (67.6)	4.00 (2.9)	12.00 (6.2)	7.25 (2.4)	0.50 (0.6)	4.25 (2.2)	57.25 (97.9)
Parrotfish	1.50 (1.3)	5.25 (4.6)	0.75 (1.0)	5.25 (2.5)	2.00 (0.8)	3.00 (2.2)	2.25 (1.7)
Snappers	0	0	1.50 (1.9)	8.25 (6.4)	0	0.25 (0.5)	1.25 (1.5)
Nassau Groupers	0	0	0	0	0	0	0
Other Groupers	1.00 (0.8)	0.25 (0.5)	0	4.50 (1.3)	0	0	0
Moray Eels	0.50 (1.0)	1.25 (1.9)	0.25 (0.5)	0	0	0	0
Indicator Invertebrates							
Gorgonians	4.50 (3.1)	13.00 (5.0)	31.00 (5.6)	43.25 (18.3)	35.00 (10.9)	46.25 (16.8)	26.00 (20.6)
Flamingo Tongue	1.25 (1.5)	0.25 (0.5)	5.50 (4.8)	0.75 (1.0)	1.00 (2.0)	1.75 (2.4)	0.50 (1.0)
Diadema antillarum	60.00 (30.1)	26.25 (14.0)	0.50 (0.6)	16.75 (14.9)	9.75 (8.1)	15.25 (9.2)	3 (4.7)
Pencil Urchin	0	0	1.25 (1.0)	0.75 (1.0)	0.50 (1.0)	0	2 (4)
West Indian Sea Egg	0.50 (1.0)	0	0	0.25 (0.5)	0	0.50 (0.6)	0.75 (1.5)
Bristle Worm	0	1.50 (1.0)	0	0.5 (1.0)	0	0	0
Spiny Lobster	0	0	0	0	0.50 (1.0)	0.50 (1.0)	0
Queen Conch	0.25 (0.5)	0	0	0	0	0	0
Banded Coral Shrimp	0	0.25 (0.5)	0.75 (1.0)	0	0	0	0.50 (1.0)
Triton	0	0	0	0	0	0	0

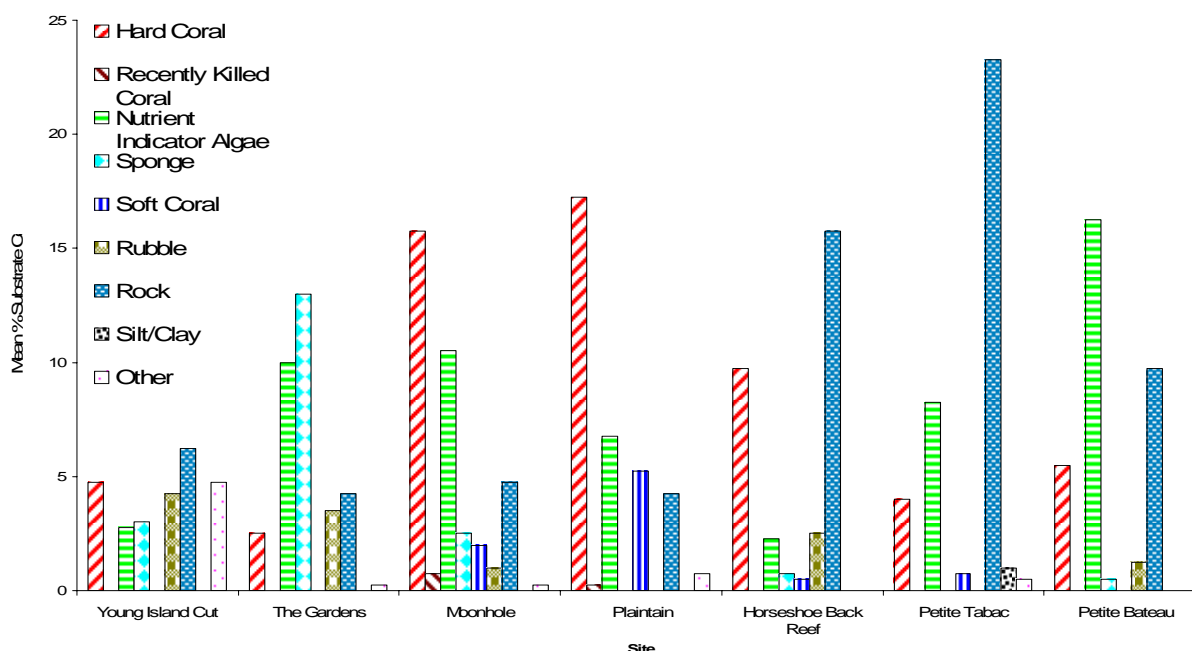


Figure 1. Mean abundance (% cover) of benthic substrate types by survey sites in St. Vincent and the Grenadines surveyed from January - April 2005.

Gorgonian (sea fan) densities ranged from a mean low of 4.5 individuals per 400 m² at Young Island Cut to a high of 46.25 individuals per 400 m² at Petite Tabac and 43.25 individuals per 400 m² at Plantain sites (Table 3). *Diadema antillarum* densities varied widely across all sites. The highest mean densities were found at sites on St. Vincent with a high of 60 individuals per 400 m² found at Young Island Cut and a mean of 26.25 per 200 m² at the Gardens site. *D. antillarum* densities were less than 1 (0.5 individuals per 400 m²) at the Moonhole site. This may account for the exceptionally low abundance of NIA (2.75 %) at the Young Island Cut site versus the (10.50 %) NIA abundance found at the Moonhole site, reinforcing the role of *D. antillarum* as one of the controllers of the amount of fleshy macroalgae covering a reef. Petite Bateau also possessed low densities of *D. antillarum* (3 individuals per 400 m²) and the highest measure of NIA percent cover at a site, averaging 16.25% per transect.

All other invertebrate species (flamingo tongue snail, pencil urchin, West Indian sea egg, bristle worms, spiny lobster, queen conch, banded coral shrimp and triton snail) were either not seen or found at minimal densities across all sites, indicating that these invertebrate resources are presently rare in St. Vincent and the Grenadines (Table 3).

Coral bleaching was considered to be low at all sites except for Petite Bateau, where several colonies showed up to 40 % coral bleaching (Table 4). Diseases found on corals during the surveys include white plague, black band and aspergilliosis. Coral damage from human impacts ranged from high (trash and heavy anchor damage) at the

Young Island Cut site, to medium (snorkelling damage) at the Petite Bateau site, and low at the Moonhole site.

RECOMMENDATIONS

Further collaboration between the St. Vincent and the Grenadines Fisheries Division, the Sustainable Grenadines Project, the various Reef Check Coordinators and local teams are essential for the successful implementation of this long-term monitoring programme. Reef Check Coordinators (both governmental and NGO) should work together to organize and promote subsequent annual surveys, train new teams, and implement additional sites for monitoring. They are jointly responsible for properly managing the data collected, disseminating information to government and communities in order to aid in education and co-management.

A healthy marine environment is essential not only for the conservation of marine biodiversity, but to ensure the sustainable livelihoods of local communities and the long-term success of tourism and fishing on the Grenadine Bank. Results from these initial Reef Check surveys reflect the effects that human impacts such as coastal development, pollution (marine and land based) and over-fishing are presently having on the marine environment. Implementing the Reef Check survey program is a first step in the monitoring and conservation the marine environment in St. Vincent and the Grenadines.

It is recommended that the St. Vincent and the Grenadines Fisheries Division utilize and integrate this community-based monitoring program as a part of a

Table 4. Coral diseases, bleaching, damage and trash recorded during Reef Check surveys in St. Vincent and the Grenadines from January - April 2005.

Island	Site	Coral Bleaching	Diseases	Coral Damage	Trash	Other Comments
St. Vincent	Young Island Cut	Low	White Plague	High (anchor damage)	High	A lot of macroalgae in area
	The Gardens	Low	Aspergilliosis	Low (anchor damage)	Low	Popular shallow dive site near industrial area
Bequia	Moonhole	Low	None	None	Low (fish nets)	High coral abundance & diversity at site
Mustique	Plantain	Low	Black Band & Aspergilliosis	Medium (anchor damage)	Low (fishing line)	Water sports and beach bar/restaurant in bay
Tobago Cays	Horseshoe Back Reef	Low	Black Band & Aspergilliosis	Medium (wave damage)	None	Generally healthy reef
	Petite Tabac	Low	White Plague	Medium (wave damage)	None	Fish bite marks seen in some hard corals
	Petite Bateau	Medium	Black Band	High (snorkelling damage)	Low	A lot of black band disease & coral rubble in area

national two level 'design framework' to support decision-making in coral reef management. Ideally, Reef Check should be conducted quarterly by volunteer teams at many sites, and used in combination with a more scientific high-resolution monitoring program (such as AGRRA) conducted at fewer sites less frequently (every five years). This monitoring framework would provide government with a cost-efficient, early-warning indicator system for detecting major changes in the marine environment. Furthermore, involving marine resource users should facilitate community support for marine management in an area, thereby decreasing the cost of enforcing management regulations.

Institutionally, specific management objectives and corresponding action plans must be developed in advance in order to assist managers in determining which levels of change are considered ecologically significant, giving managers a clear idea of their responsibilities in pursuing action. A decision tree action plan should be developed to assist government and managers in order to efficiently determine the causes of change as well as the appropriate response to be taken (whether it is increasing frequency and number of sites monitored or the alerting of a team of specialists to investigate these changes). By formally deciding what changes are important and which methods are to be employed in advance, a response can be quickly assembled after negative impacts are detected from a monitoring program and major anthropogenic changes can possibly be mitigated.

Considering the limited resources (time, personnel, and finances) of most government agencies, it is recommended that the St. Vincent and the Grenadines Fisheries Division encourage this type of community-based monitoring program. Moreover, collaboration with large NGOs (such as the Nature Conservancy) in order to receive assistance in capacity building of government agencies in the logistics needed for policy development, funding opportunities, educational initiatives, and training of both government and communities is recommended so that a management plan and a marine monitoring system can be established across the Grenadine Bank.

Marine resources are of vital importance to the people of St. Vincent and the Grenadines, and a greater understanding of the abundance and distribution of key marine resources is needed. This would also include the type and location marine resource uses, the intensity of the various users as well as the areas of user conflict. This information in combination with marine surveys can provide baseline information needed to support a broader goal of a marine space-use plan for the Grenadine Bank including a system of protected areas.

ACKNOWLEDGEMENTS

Many thanks to the various communities, schools and private sector organisations in St. Vincent and the Grenadines who were involved in the implementation of this

project. Their donations of time, local information, and resources were invaluable; especially the many dive shops and divers who volunteered for the Reef Check training sessions and surveys. Thanks to the St. Vincent and the Grenadines Fisheries Division for supporting this project by providing staff, boats, dive gear, and fuel to perform surveys in the islands of St. Vincent and the Tobago Cays Marine Park. Special thanks to the Sustainable Grenadines Project and Robin Mahon: without your support and facilitation locating relevant contacts within the St. Vincent government and various communities of the Grenadines, the project would not have been so readily welcomed and trusted by the local communities. This project was funded by a PADI Project AWARE grant, as well as generous donations from Rite in the Rain paper products. Last but definitely not least, to the crew and scientific staff of *Amadis* for volunteering four months of their lives to this Project; Ben Loughran, Paul Kingston, Anne Gallagher and Lily Kozmian-Ledward - it wouldn't have happened without you all!

LITERATURE CITED

- Burke L. and J. Maidens. 2004. *Reefs at Risk in the Caribbean*. World Resources Institute, Washington D.C. USA. 80 pp.
- Hodgson, G. 1998. What is the Purpose of Monitoring Coral Reefs in Hawaii? Proceedings of the Hawaii Coral Reef Monitoring Workshop - A tool for management. June 9-11, 1998. East-West Center, Honolulu, Hawaii USA.
- Hodgson, G. and C.M. Stepath. 1998. Using Reef Check for long-term coral reef monitoring in Hawaii. Proceedings of the Hawaii Coral Reef Monitoring Workshop - A tool for management. June 9-11, 1998. East-West Center, Honolulu, Hawaii USA.
- Hodgson, G. 1999. *A Global Assessment of Human Effects on Coral Reefs*. *Marine Pollution Bulletin* **38**(5):345-355.
- Raymundo, L.J. and M. Ross. [2001]. *Reef Check Philippines: Building Capacity for Community-Based Monitoring*. Presented at ICRI Regional Workshop for East Asia. Unpubl. Report.