CARIBBEAN COMMUNITY CLIMATE CHANGE CENTRE (CCCCC)

MAINSTREAMING ADAPTATION TO CLIMATE CHANGE

Coral Reef Monitoring for the Organization of Eastern Caribbean States and Tobago

Year 2

Status of the Coral Reefs







THE UNIVERSITY OF THE WEST INDIES
AT MONA, JAMAICA

Mainstreaming Adaptation to Climate Change (MACC) Project

Component 1: Build Capacity to Assess Vulnerability and Risks Associated with Climate Change

Sub-component (a) Strengthening the climate and coral reef monitoring network

Service Agreement No. 009/2008

Coral Reef Monitoring for the Organization of Eastern Caribbean States and Tobago Year 2

STATUS OF THE CORAL REEFS

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March 2009

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© and published by the Caribbean Community Climate Change Centre
Digital Edition (November 2010) ISBN 978-976-8236-22-7 (PDF)
http://www.caribbeanclimate.bz

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to acknowledge with gratitude the persons and organizations listed below for their assistance with the implementation of the coral reef monitoring programme in the OECS and Tobago –Year 2.

Grenada

- Omar Spence – Discovery Bay Marine Laboratory (Jamaica)
- Jerry Mitchell
- Paul Phillip (Fisheries Biologist)
- Crafton Isaac (Fisheries Assistant Biologist)

St Kitts and Nevis

- Peter Wilson-Kelly - Peter Wilson-Kelly & Associates (Jamaica)
- Graeme Browne – Department of Sustainable Development
- Lt. Lynn Wilkins – St. Kitts and Nevis Defence Force Coast Guard

Saint Lucia

- Peter Wilson-Kelly - - Peter Wilson Kelly & Associates (Jamaica)
- Claudia Lewis - Department of Life Sciences, UWI (Jamaica)
- Kia Wulf – Soufriere Marine Management Association Inc.
- Susanna Scott – Department of Fisheries
- Daniel Medar - Department of Fisheries
- Sarita Williams-Peter – Department of Fisheries

St Vincent and the Grenadines

- Hugh Small – Centre for Marine Sciences (Jamaica)
- Lucille Grant – Fisheries Division
- Kris Isaacs – Fisheries Division
- Earl Martindale – Independent Diver
- Lesliann James
- Bernard Soleyn (Boat Cover)

Tobago

- Addison Titus – Institute of Marine Affairs,
- Kirwin Sampson – Dept of Fisheries and Marine Resources, Tobago House of Assembly

Jamaica

- Nichole Sang – Centre for Marine Sciences, UWI
- Ivana Kenny – Department of Life Sciences, UWI
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- Loureene Jones Smith, NEPA
- Karlene Anderson - Centre for Marine Sciences, UWI
- Dale Webber - Centre for Marine Sciences, UWI

ACRONYMS AND ABBREVIATIONS

CARICOM	Caribbean Marine Productivity Programme
CCCCC	Caribbean Community Climate Change Centre
CCDC	Caribbean Coastal Data Centre
CMS	Centre for Marine Sciences
CPACC	Caribbean Planning For Adaptation to Global Climate Change
CPCe	Coral Point Count with Excel Extension
CREWS	Coral Reef Early Warning System
GEF	Global Environmental Facility
GPS	Global Positioning System
IMA	Institute of Marine Affairs
IPCC	Inter- governmental Panel on climate Change
MACC	Mainstreaming Adaptation to Climate Change
MOA	Memorandum of Agreement
NEPA	National Environment and Planning Agency
OECS	Organization of Eastern Caribbean States
RTLs	Roving Team Leaders
SMMA	Soufriere Marine Management Area
SSMR	Soufriere/Scott's Head Marine Reserve
UWI	University of the West Indies

CHAPTER 1

CORAL REEF MONITORING FOR THE OECS AND TOBAGO – YEAR 2

1.1 INTRODUCTION

The objective of the Coral Reef Monitoring for the Organization of Eastern Caribbean States (OECS) and Tobago project was to strengthen the coral reef monitoring network in the region and to conduct an assessment of the coral reefs in these participating countries. Under the Memorandum of Agreement (MOA) between the Caribbean Community Climate Change Centre (CCCCC), the executing agency for the Mainstreaming Adaptation to Climate Change (MACC) project, and the Centre for Marine Sciences (CMS), University of the West Indies (UWI), Mona, collaboration in the area of strengthening the coral reef monitoring network in the region was undertaken. Training (Creary, 2007) and monitoring (Creary, 2008) were conducted over the period September 2007 to April 2008. In a follow up MOA the CMS undertook the support of monitoring in the participating countries for a second year. This report presents the combined results from the first and second monitoring exercises.

1.2 BACKGROUND

The Caribbean: Planning for Adaptation to Global Climate Change (CPACC) project was established in 1998 to build capacity in the Caribbean region for the adaptation to climate change impacts, particularly sea level rise. Component 5 - *Coral Reef Monitoring for Climate Change Impacts* represented one of the nine components of the project and was intended to create a long term coral reef monitoring programme to show the effects of global warming factors on coral reefs. Component 5 was initially implemented in three pilot countries (The Bahamas, Belize and Jamaica) in 2000 with the intention of expanding the monitoring to the seven other CARICOM countries (Antigua & Barbuda, Dominica, Grenada, St Kitts & Nevis, Saint Lucia, St Vincent & the Grenadines and Trinidad & Tobago). Unfortunately, the CPACC project ended before the implementation of this component of the regional monitoring programme.

The Caribbean Community Climate Change Centre (CCCCC) was established by regional governments in 2002 in order to coordinate the regional response to climate change. The CCCCC is the executing agency for the Mainstreaming Adaptation to Climate Change (MACC) project, which started in 2003, with funding from the Global Environmental Facility (GEF) through the World Bank. The primary objective of the MACC project was to mainstream adaptation to climate change into national development planning through technical support and capacity building. Under Component 1 the MACC project aimed to build capacity to assess vulnerability and risks associated with climate change and climate variability. Part of this capacity building component involved the strengthening of the climate change and coral reef monitoring network in the region. To this end the MACC project supported the expansion of the coral reef monitoring network proposed under the CPACC project. The CMS, under a MOA with the CCCCC for the MACC project led and coordinated the expansion of the coral reef monitoring programme to the OECS and Tobago and provided technical support through training, monitoring, data analysis and report preparation.

1.3 Training and Coral Reef Monitoring in the OECS and Tobago (Year 1)

Training and coral reef monitoring in the OECS and Tobago was conduct in 2007/2008. A Regional Training Workshop was held in St Lucia during the period September 10-13, 2007 in association with the Sustainable Development & Environment Section (Ministry of Economic Affairs, Economic Planning & National Development), the Department of Fisheries (Ministry of Agriculture, Forestry & Fisheries) and the Soufriere Marine Management Association. A total of 16 participants from seven countries (Antigua & Barbuda, Dominica, Grenada, St Kitts & Nevis, Saint Lucia, St Vincent & the Grenadines and Trinidad & Tobago) were trained in site selection, video monitoring, data processing & analysis and report preparation, based on the CPACC site selection (Woodley, 1999) and video monitoring protocols (Miller, 2000; Miller & Roger, 2002). Lessons learnt during the pilot phase were also incorporated into the training workshop (Creary, 2007).

A core group of resource persons was formed to provide technical support to the participating countries and monitoring was conducted over the period September 2007 to April 2008. Each country selected sites for monitoring based on the guidelines outlined in the training workshop. The video monitoring protocol adapted for CPACC was employed and the resultant video tapes were processed and analyzed at the CMS who prepared the final report in collaboration with the participating countries (Creary 2008).

1.4 Coral Reef Monitoring in the OECS and Tobago – Year 2

1.4.1 Monitoring Schedule and Technical Support

Following the monitoring carried out in 2007/2208 funds were made available by the MAAC to the CMS to lead and implement the coral reef monitoring in the OECS and Tobago for a second year. Participating countries were requested to indicate their capacity to repeat the monitoring and to specify any support that they would require (A list of contact persons for each country and CMS personnel is provided in Appendix 1). In preparation for monitoring the countries were requested to provide the following information; names of local divers/assistants, the availability of dive equipment, the status of the camera equipment (housing, batteries, blank tapes etc), status of the data collected from the HOBO Temp meter, any equipment/supplies required for monitoring (and proposed cost), the availability of boat, status of the transects/markings and any other information that would be useful in planning the monitoring exercise. Based on responses received the monitoring schedule was developed as outlined in Table 1.1 below (further details are provided in Appendix 2). Tobago did not require assistance in monitoring and completed their monitoring in September 2008. Antigua indicated that they would conduct monitoring when the weather permitted; however, monitoring was not conducted up to the time of the writing of this report. St Kitts, St Lucia and Dominica made specific requests for supplementary training in data analysis and this was accommodated during the visits to these countries. Financial support was provided to Dominica, Grenada, St Kitts, St Lucia and St Vincent to facilitate the implementation of the Year 2 monitoring. Additional equipment and supplies such as video tapes, flagging tapes etc were made available to countries who requested it.

Table 1.1: Monitoring schedule for the coral reef monitoring programme in the OECS and Tobago - Year 2 (2008-2009) (RTL – Roving Team Leader)

Country	Monitoring Dates	Technical Support provided by CMS
Antigua & Barbuda	No monitoring conducted	No technical support requested
Dominica	Mar 1-7, 2009	RTL, financial (boat and equipment rental). Supplemental training is data analysis
Grenada	Feb 22-28, 2009	RTL, financial (boat and equipment rental)
St Kitts & Nevis	Feb 1-7, 2009	RTL, financial (airfare for L. Wilkin), supplementary training in data analysis
St Lucia	Feb 15-21, 2009	RTL, financial (boat and equipment rental). Supplemental training in data analysis
St Vincent & the Grenadines	Feb 22-28, 2009	RTL, financial (boat, private diver, and equipment rental)
Tobago	Sep 17-18, 2008	Monitoring conducted by in-country team, no assistance required from CMS

1.4.2 Site Section and Video Monitoring

Monitoring at all locations took place under the supervision of Roving Team Leaders (RTLs) from the CMS (Appendix 1) in collaboration with local personal and volunteers. The exception to this was Tobago where the staff of the Institute of Marine Affairs (IMA) conducted the monitoring without support from the CMS. Monitoring was conducted in the same Operational Area previously monitored in 2007. Attempts were made to relocate the permanent transects established in 2007 but at most monitoring sites it was not possible to relocate all the transects, therefore new transects had to be established. In addition, changes had to be made to the location of some of the specific monitoring sites due to sea conditions (St Vincent), reef area (Dominica, Grenada) and re-evaluation of the suitability of site for long term monitoring (Tobago).

The CPACC Video Monitoring Protocol, which utilizes a high resolution video camera to video tape the substrate was employed. Prior to filming, a slate containing information about the transect (site name, date depth, transect number and videographer) was recorded. Divers then videotaped while swimming slowly along the transect holding the camera perpendicular to the substratum at a height of 40 cm (guided by a 40cm wand attached to the camera housing) in order to provide a belt transect that was approximately 40 cm wide (Miller, 2000; Miller & Rogers, 2002). At the end of filming each transect recording was continued in a more horizontal view, making a 360^{o} rotation of the transect area and then a "swim back" along the transect tape at about 1-2 m above the bottom. The resultant videotapes were

viewed to ensure that clarity and resolution were satisfactory and then labeled and sent to the Caribbean Coastal Data Centre (CCDC) of the CMS for processing and analysis.

1.4.3 Data Processing, Analysis and Report Preparation

Video tapes were delivered to the CCDC where they were numbered, catalogued and the content of each tape logged. From the tapes non-overlapping adjacent images were captured using the Pinnacle Studio 9 software. The point count method, Coral Point Count with Excel extensions (CPCe), was used to analyze the images (Kohler & Gill, 2006). Using the CPCe software, 10 points were randomly overlaid on each image and the benthic species or substrate category lying under each point was identified using the standard coral/substrate code developed under CPACC (Miller, 2000; Chevannes Creary, 2001). Once identified the codes are entered directly into an associate Microsoft Excel Spreadsheet which automatically generated statistical parameter for each species/substrate category (mean, standard deviation, standard error). The report was prepared in collaboration with the RTL and includes the data from 2007/2008 for comparison.

CHAPTER 2

GRENADA - YEAR 2 CORAL REEF MONITORING

2.1 METHODOLOGY

2.1.1 SITE SELECTION AND DESCRIPTION

Monitoring was conducted in the Operational Area selected in 2007 (Figure 2.1). Prior to the second round of monitoring the status of the transects markings were not known. Locating the previously marked transects proved challenging as the RTL had to depend on the dive shop operator to assist in relocating the transects. Because of the topography, some transects were 10m instead of 20m as stated in the video monitoring protocol. Monitoring was repeated at Boss Reef, Middle Boss Reef, Lower (Bottom) Boss Reef and Northern Exposure. The following sites were added during this monitoring exercise; Whibble Reef, Flamingo Bay and Quarter Wreck (Figure 2.2). All the sites except Quarter Wreck were located in the Grenada National Marine Park and sloped from depths of 6 to 30 m.

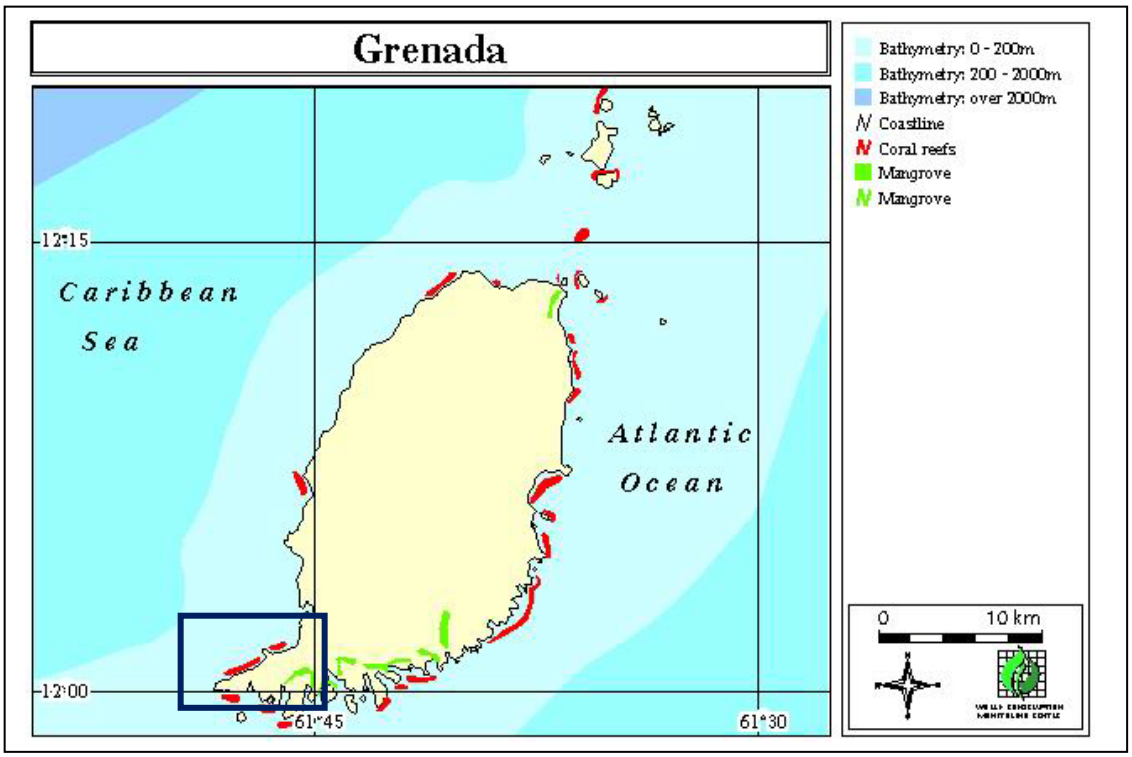

Figure 2.1: Outline map of Grenada showing the location of the coral reefs. The Operational Area within the Grand Anse reef system, which forms part of the Grenada National Marine Park is highlighted.

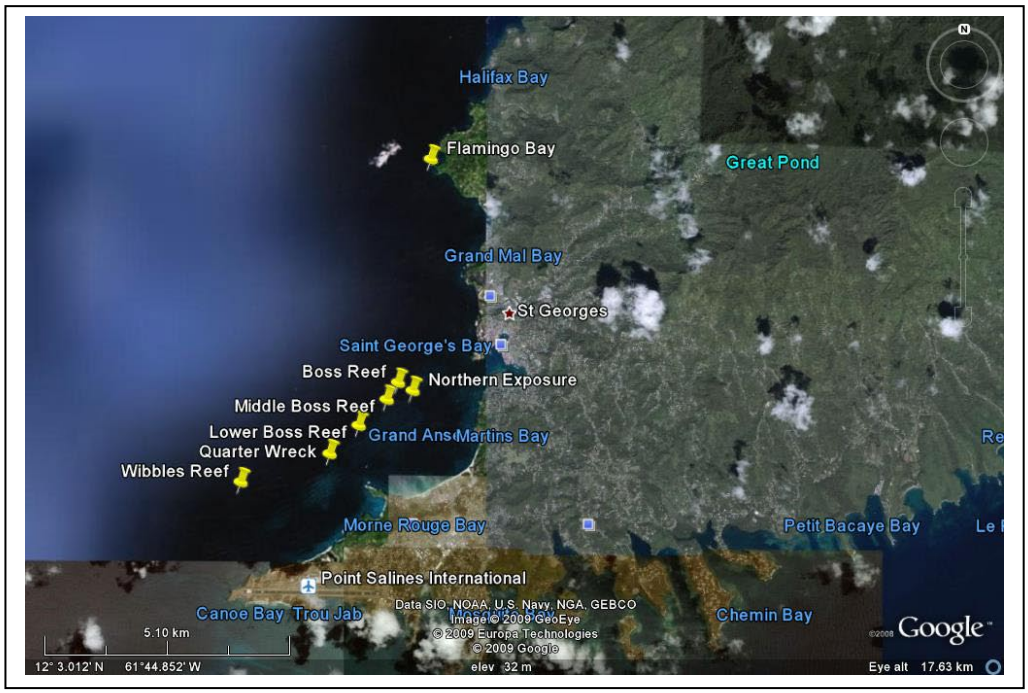

Figure 2.2: Map showing the location of the monitoring sites in the Grand Anse Reef System, Grenada

2.1.2 VIDEO MONITORING

Video monitoring was conducted during the period February 23-26 generally following the procedures outlined in Section 1.4.2. Figure 2.3 shows a diver participating in the monitoring exercise on the Grand Anse reef system.

Figure 2.3: Team members with transect tape in preparation for video monitoring in the Grand Anse Reef System, Grenada.

2.1.3 Data Processing and Analysis

Two video tapes containing twenty seven (27) 10m transects were delivered to the CCDC along with the metadata and the field report. A total of 830 images were captured from the video transects and analyses following the procedure outlined in Section 1.4.3. The tape catalogue is presented in Appendix 3.

2.2 Results

2.2.1 Benthic Substrate

The results of the monitoring conducted in 2009 showed that the sites in the Grand Anse Reef system were dominated by macroalgae (70.36%) which compares to the 41.78% observed in 2007. There was however also 42.46% of the benthic cover represented by dead coral and algae observed 2007. Hard coral cover was slightly higher in 2009 (12.84%) when compared to 2007 (10.09%). Gorgonians (2.38%) and sponges (1.84%) were also more abundant in 2009. The data showing the benthic cover of all the substrate categories for both 2007 and 2009 are presented in Table 2.1 and represented graphically in Figure 2.3. Images of the general appearance of the reef system in 2009 are presented in Figure 2.4.

Table 2.1: Summary of the mean percentage cover for the substrate category in the Grand Anse Reef system, Grenada in October 2007 and February 2009

MAJOR CATEGORY (% of transect)	October 2007			February 1009		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
CORAL	10.09	4.58	1.02	12.84	4.57	0.88
GORGONIANS	1.13	1.61	0.36	2.38	3.39	0.65
SPONGES	0.17	0.25	0.05	1.84	2.03	0.39
ZOANTHIDS	0.15	0.38	0.08	0.11	0.59	0.11
MACROALGAE	41.78	12.90	2.88	70.36	10.21	1.96
OTHER LIVE	0.14	0.25	0.06	0.21	0.61	0.12
DEAD CORAL WITH ALGAE	42.46	11.11	2.48	0.60	0.92	0.18
CORALLINE ALGAE	0.01	0.03	0.01	0.84	0.79	0.15
DISEASED CORALS	0.00	0.00	0.00	0.05	0.22	0.04
SAND, PAVEMENT, RUBBLE	4.04	2.98	0.67	9.19	5.89	1.13
UNKNOWNS	0.02	0.07	0.02	1.58	1.11	0.21
Sum (excluding tape+shadow+wand)	100.00			100.00		

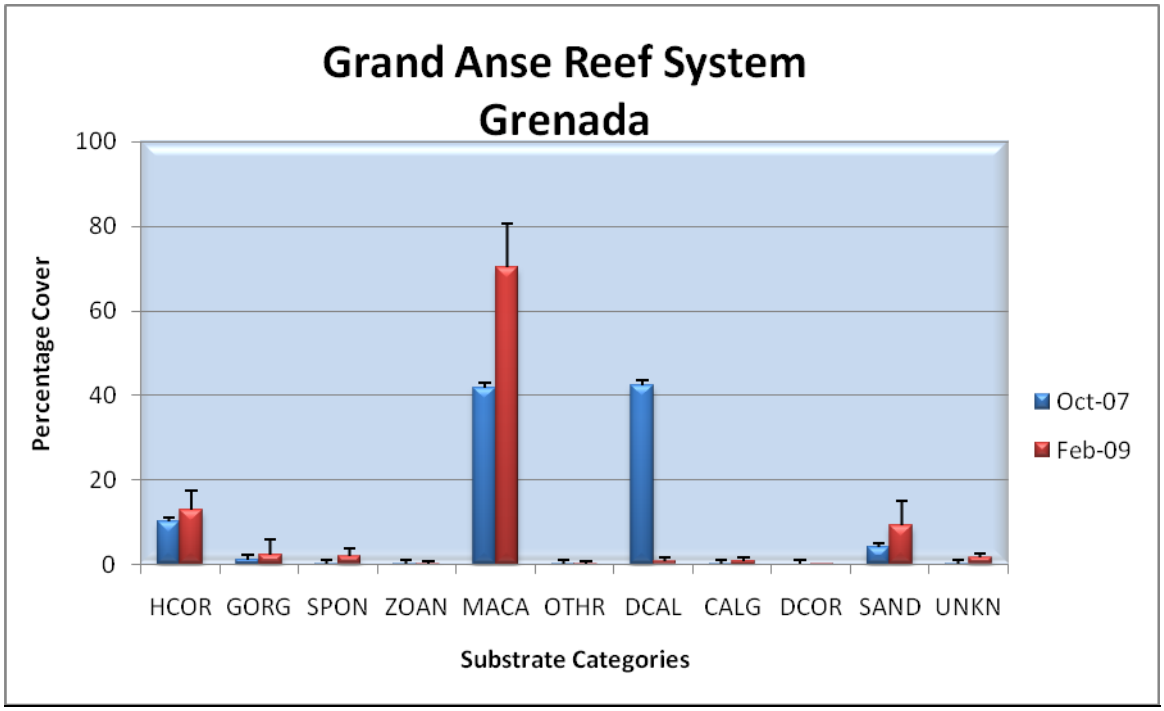

Figure 2.4: Graph illustrating the mean percentage cover of the different substrate categories found in the Grand Anse Reef System Grenada, October 2007 and February 2009. Error bars represent Standard Deviation (STD. DEV.). (Substrate categories: HCOR - Hard coral; GORG - Gorgonians; SPON – Sponge; ZOAN – Zoanthids; MACA– Macroalgae; OTHR – Other, live; DCAL - Dead coral with algae; CALG – Coralline algae; DCOR– Diseased coral; SAND – Sand, rubble, rock and boulder; UNKN – Unknown.)

Figure 2.5: Images showing the general appearance of the coral reefs in the Grand Anse Reef System.

2.2.2 HARD CORAL SPECIES

A total of twenty-two (22) hard coral species were identified during the monitoring assessment in 2009 which represented 12.84% of the benthic cover. This compares to fifteen (15) species identified in 2007 representing 10.09% of the benthic substrate. The most commonly occurring species were *Montastraea faveolata* (3.11%), *Porities asteroides* (1.96%), *Siderastrea siderea* (1.75%), *Porities porities* (1.69%) and *Madracis mirabilis* (1.37%). Table 2.2 provides a summary of the cover represented by the observed coral species in both 2007 and 2009.

Table 2.2: Hard coral species identified in the Grand Anse Reef System, Grenada during October 2007 and February 2009

HARD CORAL SPECIES	October 2007			February 2009		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
Agaricis lamarcki				0.07	0.35	0.07
Colpophyllia natans				0.07	0.33	0.06
Coral (general)				0.48	0.62	0.12
Dichocoenia stokesi				0.01	0.07	0.01
Diploria clivosa	0.03	0.12	0.03			
Diploria labyrinthiformis	0.03	0.10	0.02	0.03	0.10	0.02
Diploria strigosa	0.28	0.44	0.10	0.44	0.78	0.15
Eusmilia fastigiata				0.02	0.09	0.02
Madracis decactis				0.13	0.39	0.08
Madracis mirabilis				1.37	2.46	0.47
Meandrina meandrites	0.03	0.09	0.02	0.17	0.36	0.07
Millipora alcicornis	0.04	0.10	0.02	0.11	0.41	0.08
Millipora complanata	0.12	0.30	0.07	0.10	0.40	0.08
Millipora squarrosa						
Montastraea annularis	0.77	1.22	0.27	0.07	0.25	0.05
Montastraea cavernosa	0.59	0.81	0.18	0.71	0.88	0.17
Montastraea faveolata				3.11	2.82	0.54
Mycetophyllia aliciae	0.01	0.03	0.01			
Mycetophyllia ferox	0.01	0.04	0.01			
Oculina diffusa				0.01	0.07	0.01
Porites astreoides	2.59	1.36	0.30	1.96	1.56	0.30
Porites divaricata				0.40	0.72	0.14
Porites furcata	0.01	0.05	0.01	0.10	0.34	0.06
Porites porites	5.17	3.62	0.81	1.69	2.49	0.48
Siderastrea radians	0.09	0.29	0.07	0.03	0.12	0.02
Siderastrea siderea	0.32	0.42	0.09	1.75	2.53	0.49
Total % Coral Cover	**10.09**			**12.84**		
Number of Known Species	**15**			**22**		

CHAPTER 3

ST KITTS AND NEVIS- YEAR 2 CORAL REEF MONITORING

3.1 METHODOLOGY

3.1.1 SITE SELECTION AND DESCRIPTION

Monitoring was repeated in the Operational Area located at Sandy Point, northwest of the capital of Basseterre and this area is highlighted in Figure 3.1. The location of the monitoring site at Paradise Reef is shown in Figure 3.2. Prior to monitoring almost all 20 of the transect markers were located, with some difficulty however most were covered with silt and algal growth. The HOBOtemp was not deployed prior to this monitoring exercise hence no temperature data was available.

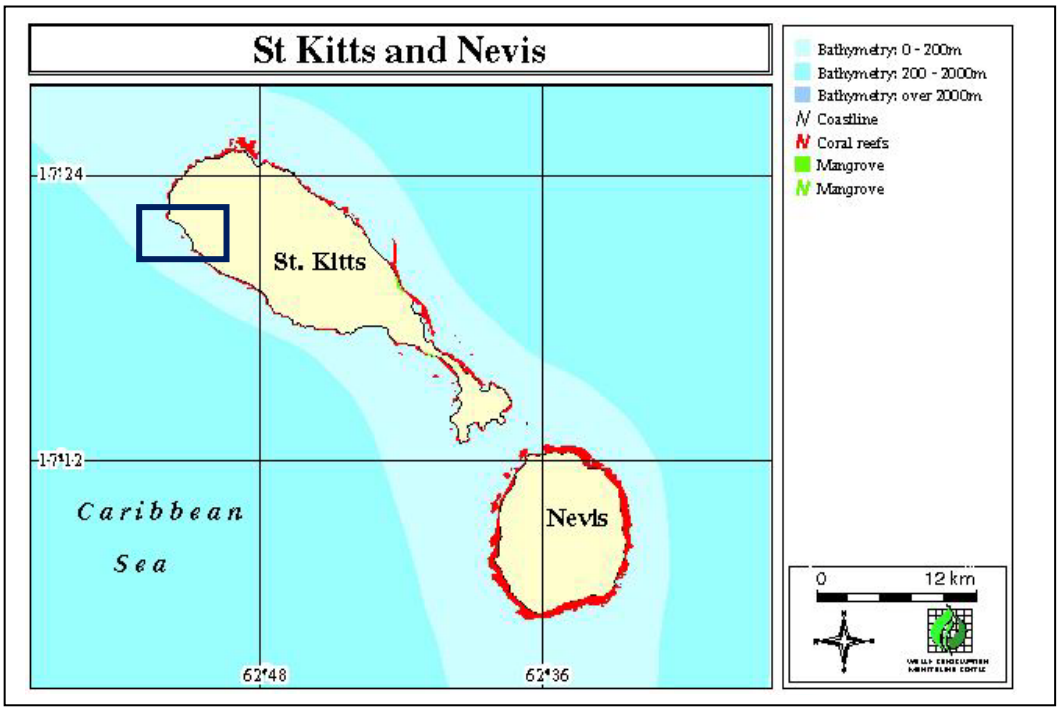

Figure 3.1: Outline map of St Kitts and Nevis showing the location of the coral reefs. The Operational Area at Sandy Point is highlighted.

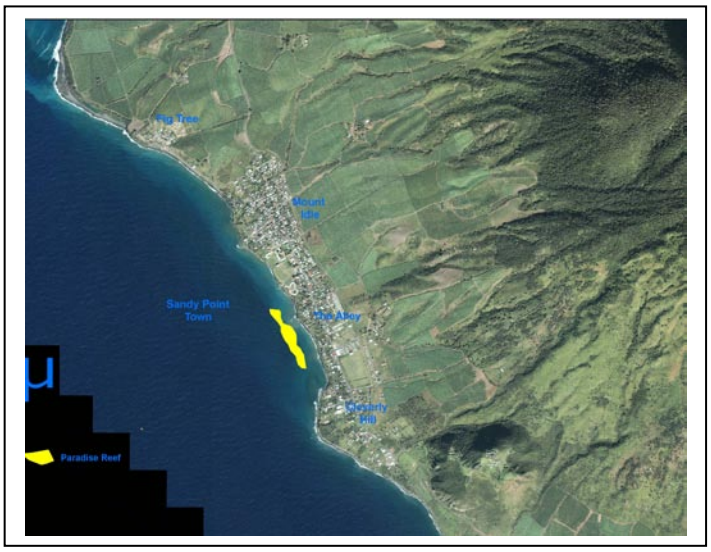

Figure 3.2: Satellite photograph showing the location of paradise Reef at Sandy Point along the northwest coast of St Kitts.

3.1.2 Video Monitoring

Video monitoring was conducted over the period February 2-5 generally following the procedures outlined in Section 1.4.2. Figure 3.3 shows divers carrying out coral reef monitoring on Paradise Reef

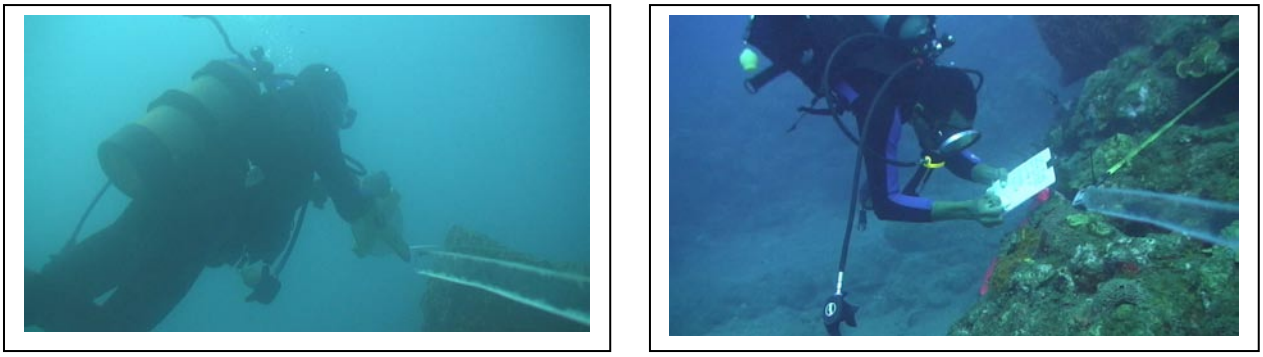

Figure 3.3: Divers participating in the coral reef monitoring exercise in St Kitts.

3.1.3 Data Processing and Analysis

Two videotapes containing 20 video transects were submitted to the CCDC for processing along with the tape metadata and field report. A total of 1522 images were captured from the video transects with processing and analysis generally following the procedure outlined in section 1.4.3. The tape catalogue is presented in Appendix 3.

3.2 RESULTS

3.2.1 BENTHIC SUBSTRATE

Paradise Reef in St Kitts was assessed for the second time during the period February 2-5, 2009 and was found to be once again dominated by macroaglae having a mean cover of 67.19% compared to 73.77% in November of 2007. Hard coral cover declined slightly accounting for 7.85% of cover compared to 10.25% in the previous monitoring exercise. There was also a decline in the amount of sponges observed with 3.06% recorded compared to 7.49% previously observed. Table 3.1 contains the results for all the substrates categories for both 2007 and 2009 and these results are illustrated in Figure 3.4. Images of the general appearance of Paradise Reef are provide in Figure 3.5

Table 3.1: Summary of mean percentage cover for the substrate categories at Paradise Reef, Sandy Point in St Kitts during November 2007 and February 2009

MAJOR CATEGORY (% of transect)	November 2007			February 2009		
	MEAN	**STD. DEV.**	**STD. ERROR**	**MEAN**	**STD. DEV.**	**STD. ERROR**
CORAL	10.25	4.31	1.01	7.85	4.50	1.01
GORGONIANS	1.02	1.25	0.03	0.09	0.14	0.03
SPONGES	7.49	2.97	0.63	3.06	2.80	0.63
ZOANTHIDS	0.09	0.16	0.04	0.06	0.18	0.04
MACROALGAE	73.77	6.50	2.28	67.19	10.19	2.28
OTHER LIVE	0.13	0.12	0.00	0.00	0.00	0.00
DEAD CORAL WITH ALGAE	2.25	1.99	1.46	6.21	6.55	1.46
CORALLINE ALGAE	0.05	0.10	0.00	0.00	0.00	0.00
DISEASED CORALS	0.04	0.08	0.00	0.00	0.00	0.00
SAND, PAVEMENT, RUBBLE	4.86	5.18	2.48	15.33	11.09	2.48
UNKNOWNS	0.06	0.14	0.08	0.21	0.35	0.08
Sum (excluding tape+shadow+wand)	100.00			100.00		

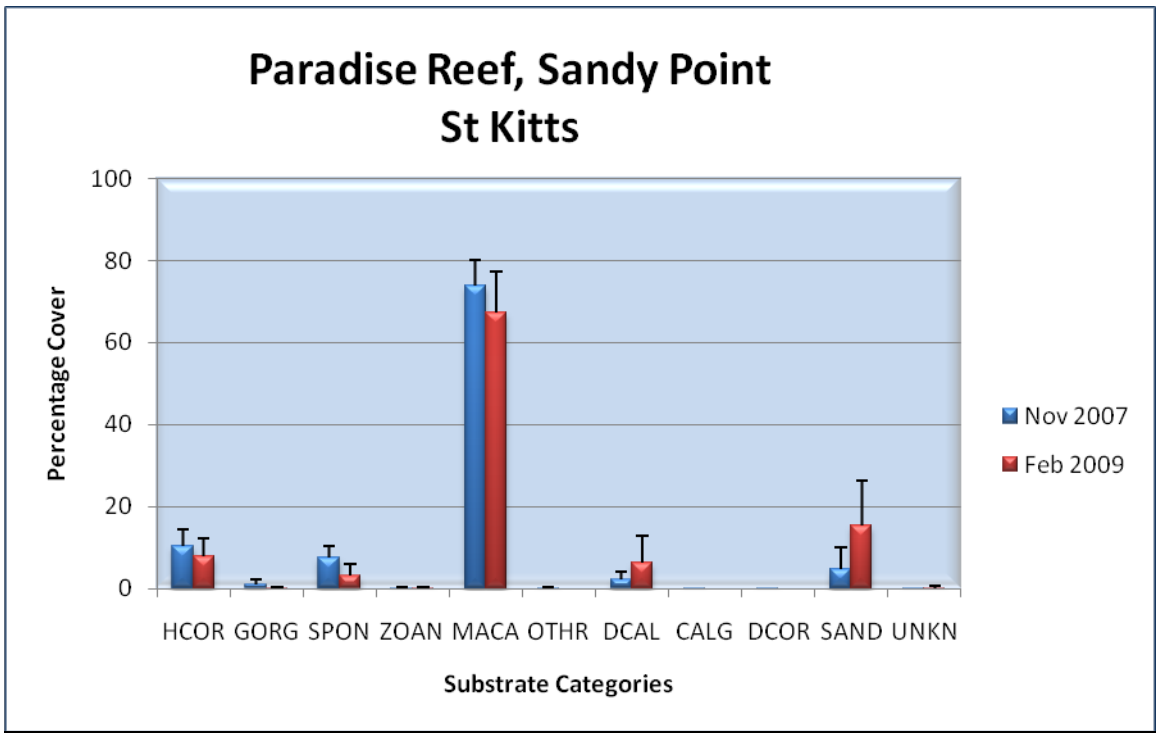

Figure 3.4: Graph illustrating the mean percentage cover of the different substrate categories found at Paradise Reef, Sandy Point in St Kitts, November 2007 and February 2009. Error bars represent Standard Deviation (STD. DEV.). (Substrate categories: HCOR - Hard coral; GORG - Gorgonians; SPON – Sponge; ZOAN – Zoanthids; MACA– Macroalgae; OTHR – Other, live; DCAL - Dead coral with algae; CALG – Coralline algae; DCOR– Diseased coral; SAND – Sand, rubble, rock and boulder; UNKN – Unknown.)

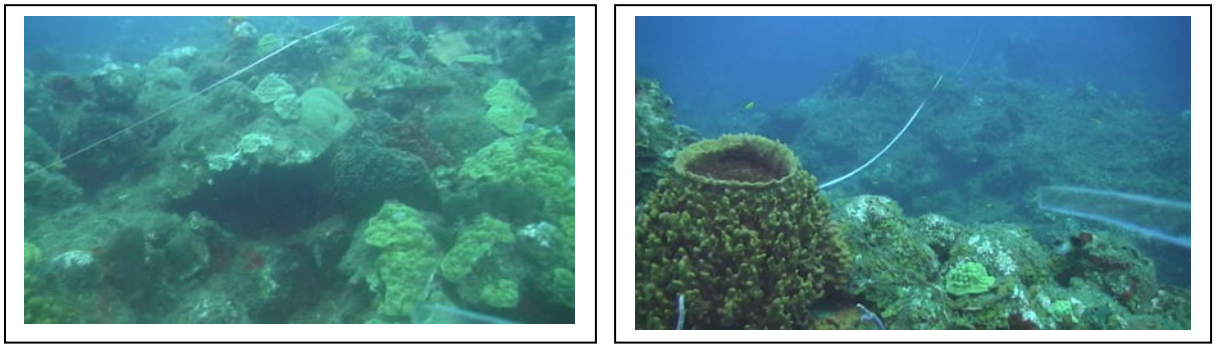

Figure 3.5 Images showing the appearance of the coral reef at Paradise Reef, Sandy Point, St Kitts.

3.2.2 Hard Coral Species

At total of sixteen (16) hard coral species were observed and these made up 7.85% of the total benthic cover. This compared to twenty-one (21) species observed in 2007 which made up 10.25% of the benthic substrate. *Porites astreoides* was the most commonly occurring species (5.09%). *Montastraea cavernosa*

(0.62%), *Siderastrea siderea* (0.53%), *Montastraea annularis* (0.48%) and *Montastrea faveolata* (0.33%) contributed to a lesser extent to the coral cover. In November 2007 the most dominant coral species at Paradise reef was also *Porites astreoides* (5.81%). Table 3.2 provides the summary of the percentage cover for the hard coral species occurring in November 2007 and February 2009.

Table 3.2: Coral species identified at Paradise Reef, Sandy Point in St Kitts, November 2007 and February 2009.

HARD CORAL SPECIES	November 2007			February 2009		
	MEAN	STD. DEV.	STD. ERR	MEAN	STD. DEV.	STD. ERR
Agaricia agaricites	0.04	0.13	0.03	0.08	0.14	0.03
Colpophyllia natans	0.12	0.29	0.07			
Dichocoenia stokesi	0.02	0.07	0.02			
Diploria labyrinthiformis	0.23	0.42	0.10	0.18	0.32	0.07
Diploria strigosa	0.06	0.17	0.04	0.13	0.29	0.07
Eusmilia fastigiata	0.10	0.19	0.04	0.02	0.07	0.02
Favia fragum	0.01	0.03	0.01	0.02	0.06	0.01
Madracis mirabilis	0.16	0.56	0.13	0.02	0.07	0.02
Massive corals	0.02	0.07	0.02			
Meandrina meandrites	0.30	0.39	0.09	0.14	0.24	0.05
Millipora alcicornis				0.01	0.03	0.01
Millipora complanata	0.01	0.02	0.01			
Millipora squarrosa	0.02	0.07	0.02			
Montastraea annularis	0.91	1.02	0.24	0.48	1.17	0.26
Montastraea cavernosa	0.38	0.47	0.11	0.62	0.88	0.20
Montastrea faveolata	1.15	2.23	0.53	0.33	0.82	0.18
Mycetophyllia ferox				0.01	0.04	0.01
Mycetophyllia lamarckiana	0.07	0.13	0.03			
Porites astreoides	5.81	2.24	0.53	5.09	3.05	0.68
Porites furcata	0.04	0.12	0.03			
Porites porites	0.05	0.14	0.03	0.18	0.21	0.05
Siderastrea radians	0.01	0.03	0.01	0.02	0.06	0.01
Siderastrea siderea	0.72	0.89	0.21	0.53	0.70	0.16
Solenastrea bournoni	0.03	0.11	0.03			
Total % Coral Cover	**10.25**			**7.85**		
Number of known species	**21**			**16**		

CHAPTER 4

SAINT LUCIA - YEAR 2 CORAL REEF MONITORING

4.1 METHODOLOGY

4.1.1 SITE SELECTION AND DESCRIPTION

Monitoring was conducted within the Operational Area established in the Soufriere Marine Management Area (SMMA) in 2007 (Figure 4.1). Monitoring was conducted at four of the five sites previously monitored in 2007 (Figure 4.2). These were Malgretoute, Grand Caille, Turtle Reef and Anse Chastanet. The reefs at Malgratoute, Grand Caille and Anse Chastanet were formed as a thin veneer on top of volcanic boulders of the Petit Pitons and the submerged island shelf. The reef formations were more extensive at Grand Caille and Anse Chastanet. The reef site at Anse Chantanet showed visible impacts of storms, disease, bleaching and the land based activities such as tourism and farming appear to be also impacting the reefs.

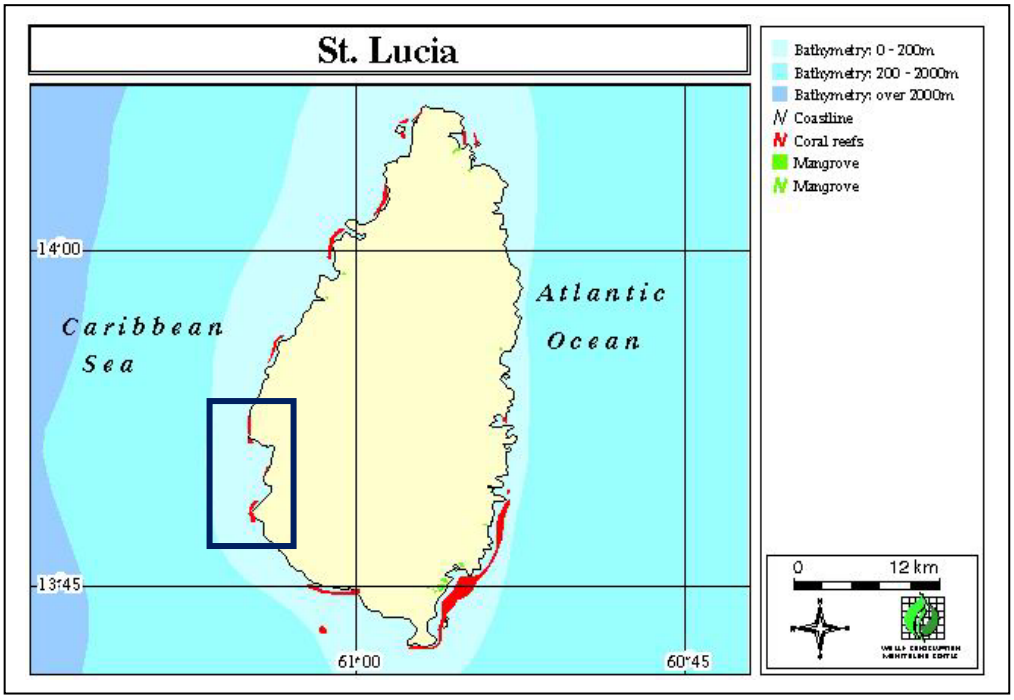

Figure 4.1: Outline map of Saint Lucia showing the location of the coral reefs. The Operational Area at the Soufriere Marine Management Area is highlighted.

Figure 4.2: Map showing the locations of the monitoring sites at Malgretoute, Grand Caille, Anse Chantanet and Turtle Reef within the Soufriere Marine Management Area, St Lucia.

4.1.2 VIDEO MONITORING

Four transects were videotaped at Malgretoute, five at Grande Caille, four at Anse Chastanet and three at Turtle Reef. The transects were generally laid out in one line, with a 5 meter separation existing between them. Some of the pre-existing transect markers from 2007 were not found so additional transects had to be established. The currents were particularly strong at Anse Chastanet and this made video monitoring rather challenging at this site. Figure 4.3 shows images of divers reestablishing some of the transect markers.

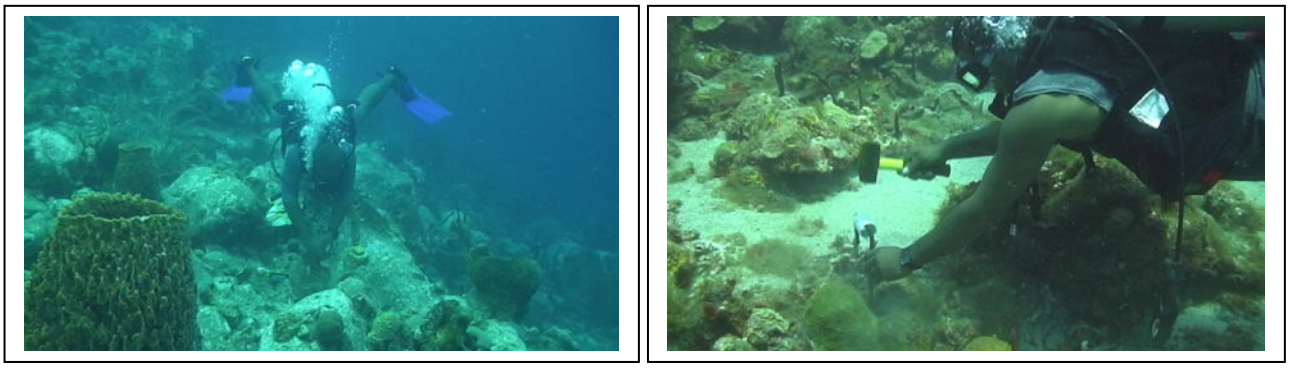

Figure 4.3 Divers re-establishing the transect markers in the Soufriere Marine Management Area, St Lucia.

4.1.3 Data Processing and Analysis

The CCDC received a total of four (4) video tapes containing sixteen (16) transects along with the tape metadata and field report. A total of 1490 images were captured from the video transects and analyzed following the procedure outlined in Section 1.4.3. The tape catalogue is found in Appendix 3.

Included in this visit was a training workshop in coral reef species identification and data processing & analysis as requested by the Department of Fisheries. The workshop schedule and participants list is provided in Appendix 4.

4.2 Results

4.2.1 Benthic Substrate

The sites in the SMMA were dominated by dead coral with algae (36.36%) and macroalgae (13.01%) in 2009 which differs significantly from the 44.11% macroalgae dominated reef observed in 2007. Hard coral cover remained relatively unchanged with 10.08% observed in 2009 compared to 9.53% in 2007. Sponges accounted for 6.41% of benthic cover compared to 7.07% in 2007. Gorgonian cover showed a slight declined from 1.35% in 2007 to 0.30% in 2009. No coralline corals were observed and a small amount of zooanthids (0.16%) and diseased corals (0.08%) was identified. Sand, pavement and rubble remained unchanged (33.26% in 2007 and 33.27% in 2009). These results are presented in Table 4.1 and illustrated in Figure 4.2.

Table 4.1 A Summary of mean percentage cover for the substrate categories for sites within the Soufriere Marine Management Area, St Lucia for September 2007 and February 2009

MAJOR CATEGORY (% of transect)	September 2007			February 2009		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
CORAL	9.53	6.19	1.38	10.08	5.19	1.30
GORGONIANS	1.35	3.23	0.72	0.30	0.36	0.09
SPONGES	7.07	3.83	0.86	6.41	3.54	0.89
ZOANTHIDS	0.00	0.00	0.00	0.16	0.29	0.07
MACROALGAE	44.11	15.37	3.44	13.01	11.85	2.96
OTHER LIVE	0.97	0.75	0.17	0.00	0.00	0.00
DEAD CORAL WITH ALGAE	0.25	0.32	0.07	36.46	23.36	5.84
CORALLINE ALGAE	0.90	1.24	0.28	0.00	0.00	0.00
DISEASED CORALS	0.00	0.00	0.00	0.08	0.28	0.07
SAND, PAVEMENT, RUBBLE	33.26	14.84	3.32	33.27	18.64	4.66
UNKNOWNS	2.56	1.50	0.33	0.24	0.40	0.10
Sum (excluding tape+shadow+wand)	100.00			100.00		

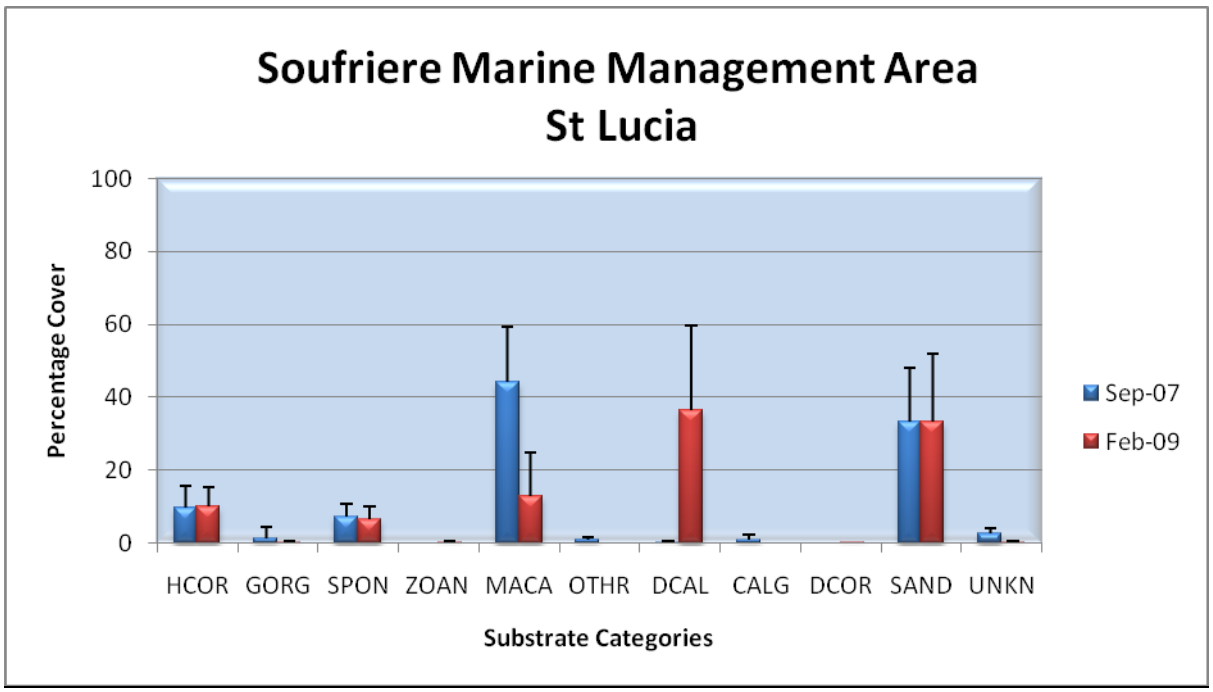

Figure 4.4: Graph illustrating the mean percentage cover of the different substrate categories found at sites within the Soufriere Marine Management Area, St Lucia in September 2007 and February 2009. Error bars represent Standard Deviation (STD. DEV.). (Substrate categories: HCOR - Hard coral; GORG - Gorgonians; SPON – Sponge; ZOAN – Zoanthids; MACA– Macroalgae; OTHR – Other, live; DCAL - Dead coral with algae; CALG – Coralline algae; DCOR– Diseased coral; SAND – Sand, rubble, rock and boulder; UNKN – Unknown.)

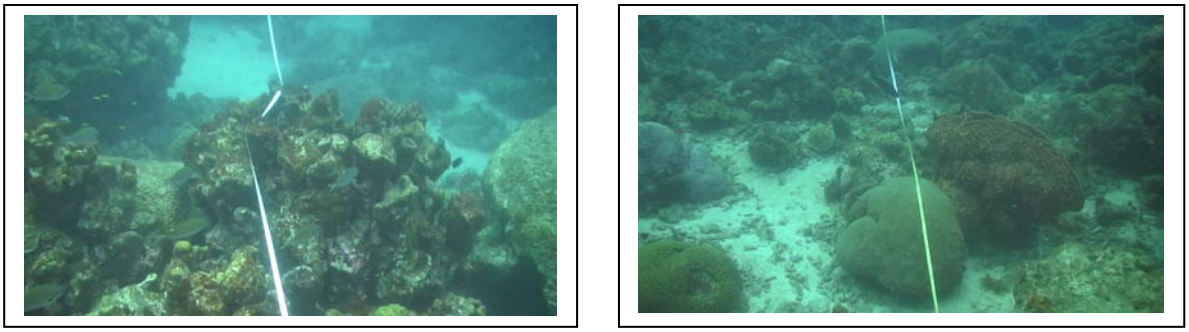

Figure 4.5: Images of the reefs in the SMMA. St Lucia

4.2.1 Hard Coral Species

Fifteen (15) hard coral species were identified during this second round of monitoring, representing 10.08% of benthic cover. This compares to twenty (20) observed during the first monitoring exercise which accounted for 9.53% of the benthic cover. The most commonly occurring hard coral species were *Porites astreoides* (2.57%), *Porites porites* (2.23%) and *Siderastrea siderea* (1.43%). Table 4.2 provides a list of the coral species observed in 2007 and 2009.

Table 4.2 Hard coral species identified at sites within the Soufriere Marine Management Area, St Lucia in September 2007 and February 2009.

HARD CORAL SPECIES	September 2007			February 2009		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
Acropora palmata	0.02	0.06	0.01			
Agaricia agaricites				0.03	0.05	0.01
Colpophyllia natans	0.52	0.9	0.20			
Coral (general)	0.42	0.32	0.07			
Diploria clivosa				0.09	0.17	0.04
Diploria labyrinthiformis	0.06	0.15	0.03	0.30	0.55	0.14
Diploria strigosa	1.13	2.19	0.49	0.84	0.97	0.24
Eusmilia fastigiata	0.08	0.20	0.05	0.10	0.24	0.06
Madracis decactis	0.02	0.07	0.02			
Madracis mirabilis	0.80	1.38	0.31	0.16	0.44	0.11
Meandrina meandrites	0.63	0.82	0.18	0.96	1.01	0.25
Millipora alcicornis	0.04	0.19	0.04			
Millipora complanata	0.26	0.61	0.14	0.01	0.04	0.01
Montastraea annularis	0.32	0.53	0.12	0.08	0.14	0.04
Montastraea cavernosa	0.17	0.27	0.06	0.42	0.64	0.16
Montastrea faveolata	0.41	0.70	0.16	0.54	0.67	0.17
Montastrea franksi	0.05	0.19	0.04			
Mycetophyllia aliciae	0.03	0.09	0.02			
Porites astreoides	1.97	1.39	0.31	2.57	1.55	0.39
Porites furcata	0.01	0.07	0.01	0.33	0.70	0.17
Porites porites	1.87	3.10	0.69	2.23	3.17	0.79
Siderastrea siderea	0.70	0.81	0.18	1.43	2.01	0.50
Total % Coral Cover	**9.53**			**10.08**		
Number of Known Species	**20**			**15**		

CHAPTER 5

ST VINCENT AND THE GRENADINES - YEAR 2 CORAL REEF MONITORING

5.1 METHODOLOGY

5.1.1 SITE SELECTION AND DESCRIPTION

Monitoring was repeated in the Operational Area established in Kingstown in 2007 (Figure 5.1). Two sites at Castle Bay (Figure 5.2) had previously been selected and these appeared pristine with little visible storm impact. There was also no evidence of coral disease but a small amount of coral bleaching was observed. This area has been generally impacted by freshwater runoff from Kingstown via storm and regular drains. During the monitoring large amounts of juvenile fishes and numerous *Diademia antillarium* were observed. None of the transect markers previously installed in 2007 were located and new transects had to be established.

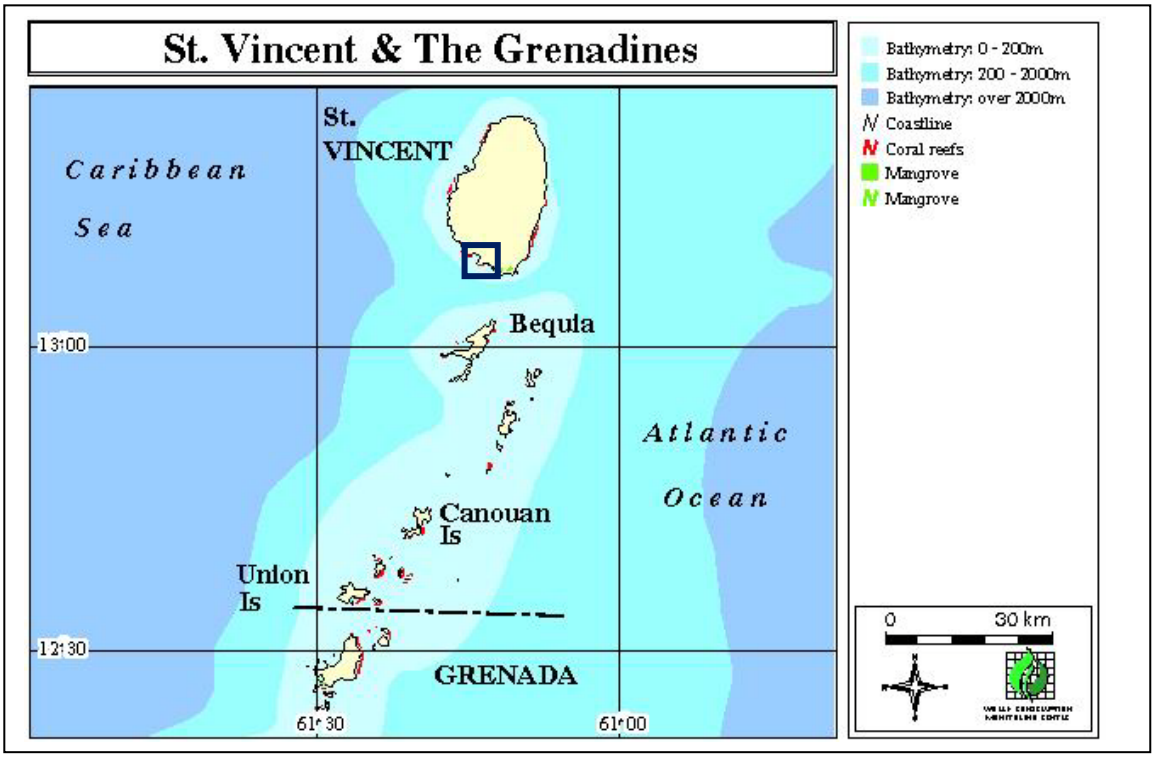

Figure 5.1: Outline map of St Vincent and the Grenadines showing the location of the coral reefs. The Operational Area in Kingstown is highlighted.

Figure 5.2 Map showing the location of the Castle Bay monitoring sites in Kingstown, St Vincent

5.1.2 VIDEO MONITORING

Monitoring was repeated at one of the two sites previously monitored in Castle Bay during the period February 23-25, 2009 The second site was not used due to strong currents at the time of the monitoring and only a total of fifteen (15) transects were monitored. The HOBO Temp deployed during the previous monitoring exercise was washed away, possibly during a storm event and this was replaced by one provided by the CMS and programmed to log temperature every 30 minutes for 74 days. Figure 5.3 shows images of the members of the dive team on shore and monitoring on the reef.

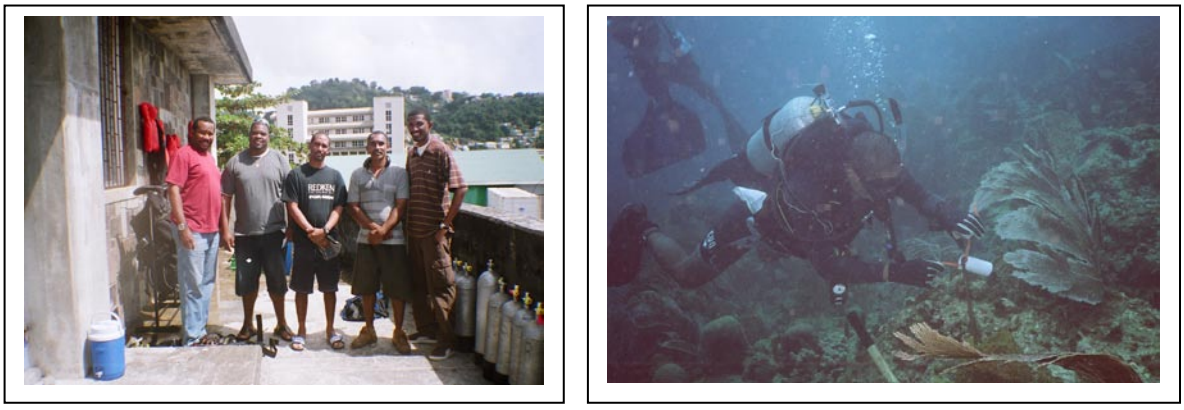

Figure 5.3: Members of the St Vincent monitoring team (L – R: Earl Martindale, Lesliann James, Hugh Small, Bernard Soleyn (boat cover), Kris Isaacs) prior to dive and team member (Hugh Small) marking out transects.

5.1.3 Data Processing and Analysis

The CCDC received a total of three video tapes containing fifteen (15) transects along with the tape metadata and field report. A total of 938 images were captured for the video transects and analyzed following the procedure outlined in Section 1.4.3. The tape catalogue is presented in Appendix 3

5.2 Results

5.2.1 Benthic Substrate

As observed during the monitoring in October 2007 hard coral (24.88%) and macroalgae (37.91%) dominated the benthic substrate. These substrate categories represented 29.28% and 26.51% of the benthic substrate respectively in 2007. There was a decline in the abundance of sponges to 5.53% from 12.07% in 2007 with the gorgonians remaining about the same (3.34% in 2009 compared to 3.56% in 2007). As in the previous monitoring exercise there were limited amounts of dead coral and algae (4.06%), and a small proportion of diseased corals (1.09%). No coralline algae were observed. The non living portion of the substrate, comprised of sand, pavement and rubble increased from 14.34% to 20.97%. These results are summarized in Table 5.1 and illustrated in Figure 5.4. Images of the general appearance of the reef are provided in Figure 5.5.

Table 5.1: Summary of mean percentage cover for the substrate categories at Castle Bay, Kingstown, St Vincent during October 2007 and February 2009.

MAJOR CATEGORY (% of transect)	October 2007			February 2009		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
CORAL	29.18	15.74	3.71	24.88	14.95	3.86
GORGONIANS	3.56	4.44	1.05	3.45	4.66	1.20
SPONGES	12.07	6.33	1.49	5.53	5.35	1.38
ZOANTHIDS	0.00	0.00	0.00	0.20	0.42	0.11
MACROALGAE	36.51	9.30	2.19	37.91	11.32	2.92
OTHER LIVE	0.99	0.59	0.14	1.62	1.36	0.35
DEAD CORAL WITH ALGAE	3.06	1.55	0.37	4.06	11.96	3.09
CORALLINE ALGAE	0.00	0.00	0.00	0.00	0.00	0.00
DISEASED CORALS	0.13	0.21	0.05	1.09	2.78	0.72
SAND, PAVEMENT, RUBBLE	14.34	9.02	2.13	20.97	13.92	3.59
UNKNOWNS	0.15	0.38	0.09	0.28	0.36	0.09
Sum (excluding tape+shadow+wand)	100.00			100.00		

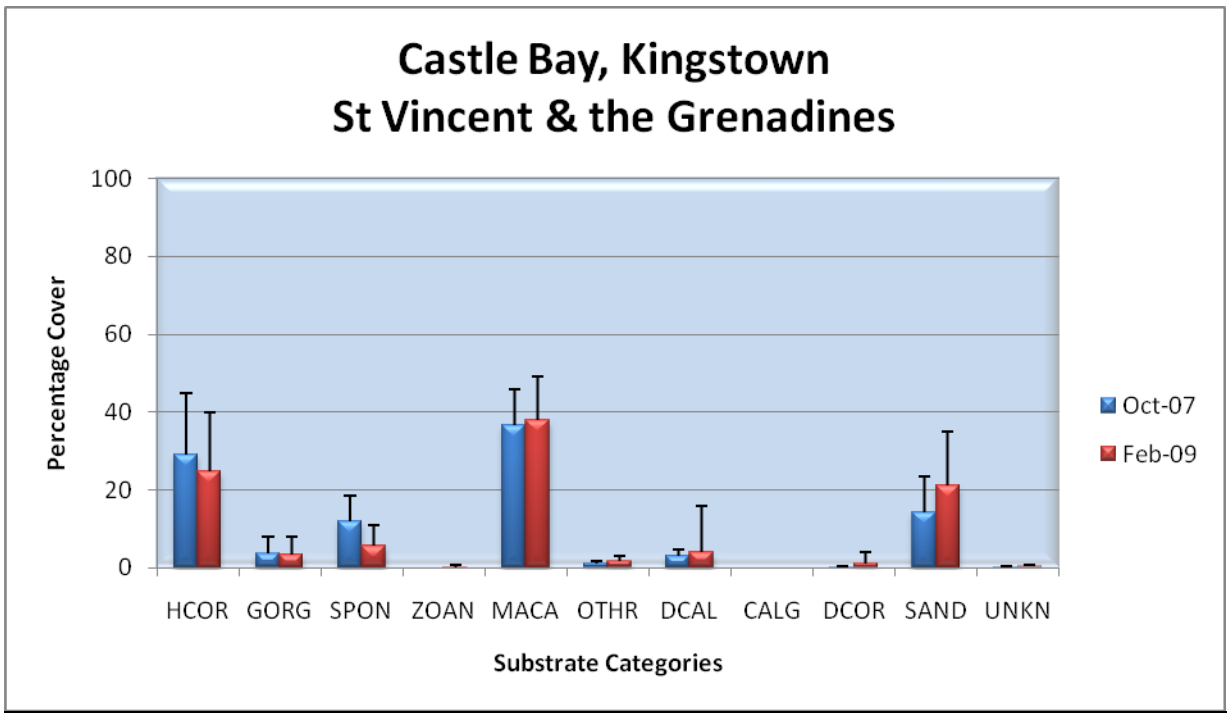

Figure 5.4: Graph illustrating the mean percentage cover of the different substrate categories found at sites around Castle Bay, Kingstown, St Vincent, October 2007 and February 2009. Error bars represent Standard Deviation (STD. DEV.). (Substrate categories: HCOR - Hard coral; GORG - Gorgonians; SPON – Sponge; ZOAN – Zoanthids; MACA– Macroalgae; OTHR – Other, live; DCAL - Dead coral with algae; CALG – Coralline algae; DCOR– Diseased coral; SAND – Sand, rubble, rock and boulder; UNKN – Unknown.)

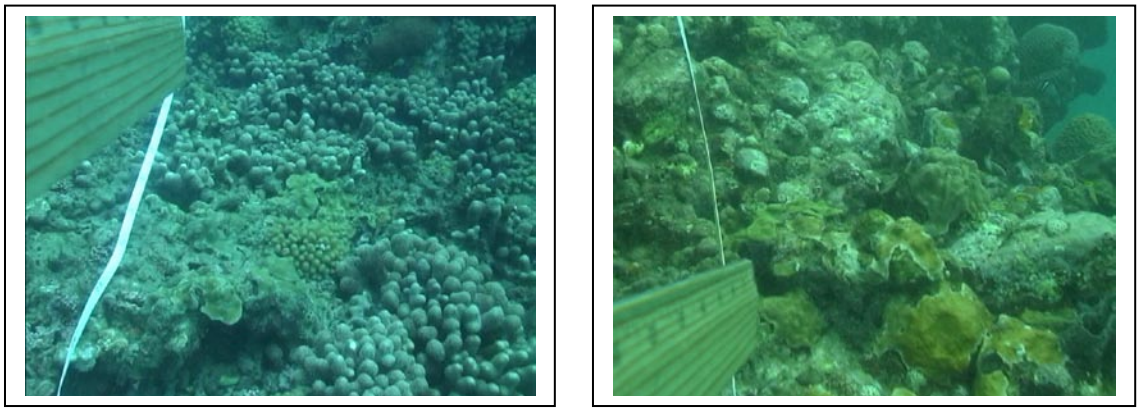

Figure 5.5 Images of the general appearance of the reefs at Castle Bay, Kingstown, St Vincent

5.2.2. Hard Coral Species

Twenty-four (24) hard coral species were observed which accounted for 24.88% of the benthic substrate cover, this compares to thirty-one (31) species observed in 2007. As in 2007 the most commonly occurring coral species were *Porites astreoides* (7.67%), *Montastraea annularis* (6.38%) and *Siderastrea*

siderea (4.64%) and to a much lesser extent *Diploria strigosa* (1.36%) and *Porites porities* (1.46%). Table 5.2 provides as summary of the percentage cover of the coral species occurring at Castle Bay in October 2007 and February 2009.

Table 5.2: Hard Coral species identified at sites within the Castle Bay, Kingstown, St Vincent during October 2007 and February 2009.

HARD CORAL SPECIES	October 2007			February 2009		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
Acropora cervicornis	0.04	0.12	0.03			
Agaricia agaricites	0.86	0.57	0.14	0.30	0.31	0.08
Colpophyllia breviserialis	0.01	0.03	0.01	0.00	0.00	0.00
Colpophyllia natans	0.38	0.87	0.20	0.37	1.04	0.27
Coral juvenile	0.01	0.03	0.01			
Dendrogyra cylindrus	0.17	0.65	0.15	0.05	0.19	0.05
Dichocoenia stokesi	0.37	0.44	0.10	0.18	0.49	0.13
Diploria clivosa	0.14	0.23	0.06	0.01	0.05	0.01
Diploria labyrinthiformis	0.02	0.08	0.02	0.12	0.42	0.11
Diploria strigosa	1.79	1.37	0.32	1.36	1.38	0.36
Eusmilia fastigiata	0.16	0.35	0.08			
Favia fragum	0.10	0.25	0.06	0.09	0.16	0.04
Isophyllia sinuosa	0.01	0.03	0.01	0.00	0.00	0.00
Madracis mirabilis	0.76	1.30	0.31	0.17	0.36	0.09
Manicina areolata	0.02	0.10	0.02			
Massive corals	0.04	0.08	0.02	0.02	0.05	0.01
Meandrina meandrites	1.56	1.11	0.26	0.67	1.52	0.39
Millipora alcicornis	0.07	0.18	0.04	0.10	0.16	0.04
Millipora complanata	0.01	0.03	0.01	0.42	0.67	0.17
Millipora squarrosa	0.39	0.43	0.10	0.05	0.21	0.05
Montastraea annularis	5.55	8.50	2.00	6.39	7.70	1.99
Montastraea cavernosa	1.29	1.51	0.36	0.48	0.61	0.16
Montastrea faveolata	0.03	0.07	0.02			
Montastrea franksi				0.20	0.76	0.20
Mycetophyllia lamarckiana	0.03	0.09	0.02	0.00	0.00	0.00
Porites astreoides	8.07	4.51	1.06	7.67	5.79	1.49
Porites branneri				0.02	0.10	0.02
Porites divaricata	0.01	0.03	0.01	0.07	0.27	0.07
Porites furcata	0.26	0.47	0.11	0.06	0.14	0.04
Porites porites	0.35	0.67	0.16	1.45	2.30	0.59
Siderastrea radians	0.02	0.07	0.02	0.01	0.04	0.01
Siderastrea siderea	6.57	4.77	1.13	4.64	3.64	0.94
Solenastrea bournoni	0.12	0.19	0.04			
Total % Coral Cover	29.18			24.88		
Number of Known Species	31			24		

CHAPTER 6

TRINIDAD AND TOBAGO - YEAR 2 CORAL REEF MONITORING

6.1 METHODOLOGY

6.1.1 SITE SELECTION AND DESCRIPTION

Monitoring was conducted in the Operational Area established at Speyside in 2007 (Figure 6.1). The specific monitoring sites, however, were changed from Angel Reef and Japanese Garden to Black Jack Hole (Figure 6.2) as the previous sites were heavily used by dive tourists. This new site consists of a 100m sloping ridge located to the south east of the Little Tobago Island. The site is named after the multitude of black jacks (deep water relative of horse eye jacks) commonly observed there.

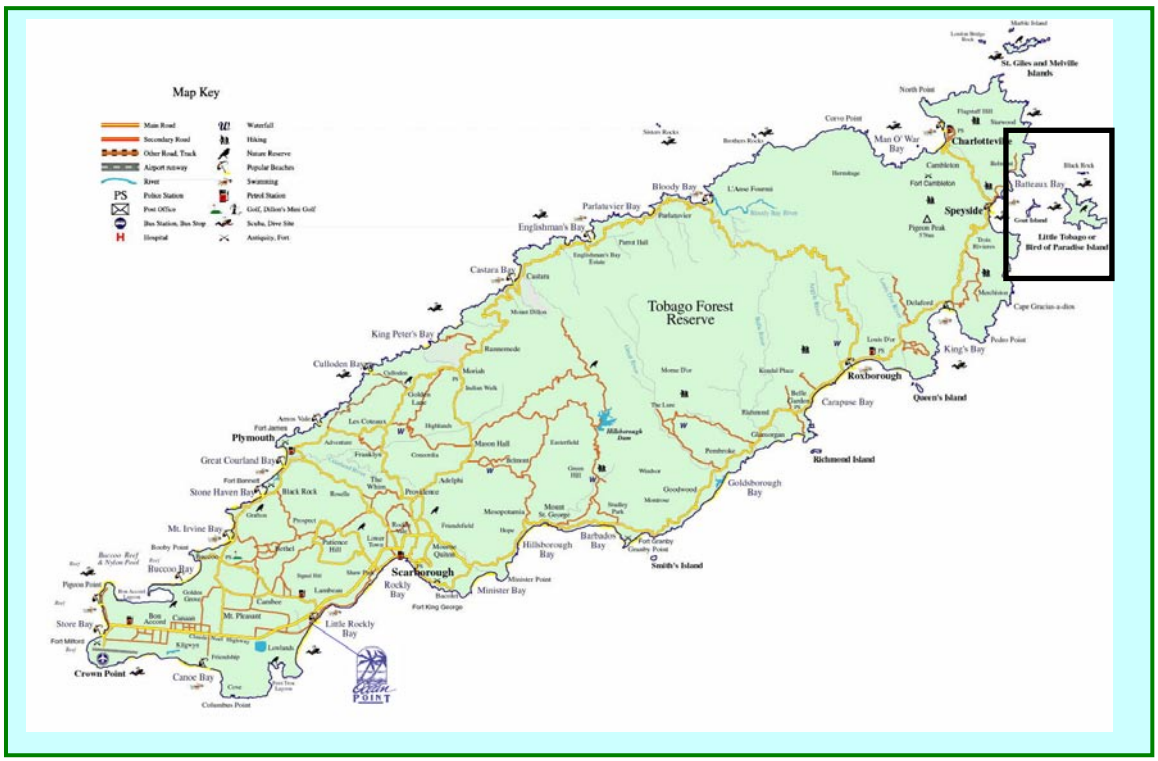

Figure 6.1: Map of Tobago showing the Operational Area at Speyside

Figure 6.2: Map of northeast Tobago showing Speyside and the location of the monitoring sites at Black Jack Hole.

6.1.2 Video Monitoring

Monitoring was conducted in during the period September 18-18, 2008 under the supervision of the Institute of Marine Affairs (IMA).

6.1.3 Data Processing and Analysis

The CCDC received two (2) video tapes containing twenty (20) transects. At total of 2100 images were captured from the video transects and analyzed following the procedures outlined in Section 1.4.3. The tape catalogue is presented in Appendix 3.

6.2 Results

6.2.1 Benthic Substrate Cover

The Black Jack Hole site was dominated by dead coral with algae which accounted for 29.39% of the benthic cover (compared to 0.48% at Angel Reef and Japanese Garden in 2007), however macroalgal cover was relatively low accounting for only 12.18% when compare the 25.44% observed at the previous sites. Other significant compositions of this benthic substrate were hard coral (11.25%), gorgonians (5.56%), and sponges (13.32%). Sand pavement and rubble made up 24.05% on the benthic substrate. These results are presented in Table 6.1 below which includes data from 2007 and 2008. The results are graphically illustrated in Figure 6.3. Images of the general appearance of the reef at the Black Jack Hole site are provided in Figure 6.4.

Table 6.1: Summary of mean percentage cover for the substrate categories at Black Jack Hole, Speyside, Tobago during the months October 2007 and September 2008.

MAJOR CATEGORY (% of transect)	October 2007			September 2008		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
HARD CORAL	15.88	17.76	3.97	11.25	6.26	6.26
GORGONIANS	16.8	9.23	2.06	5.56	2.67	2.67
SPONGES	21.15	11.45	2.56	13.32	5.11	5.11
ZOANTHIDS	0.93	1.23	0.27	0.06	0.08	0.08
MACROALGAE	25.44	10.87	2.43	12.18	8.65	8.65
OTHER LIVE	0.01	0.03	0.01	0.42	0.30	0.30
DEAD CORAL WITH ALGAE	0.48	0.76	0.17	29.39	11.34	11.34
CORALLINE ALGAE	2.13	2.27	0.51	2.53	2.62	2.62
DISEASED CORALS	0	0	0	1.22	1.08	1.08
SAND, PAVEMENT, RUBBLE	13.57	6.16	1.38	24.05	12.59	12.59
UNKNOWNS	3.61	3.08	0.69	0.01	0.03	0.03
Sum (excluding tape+shadow+wand)	100.00			100.00		

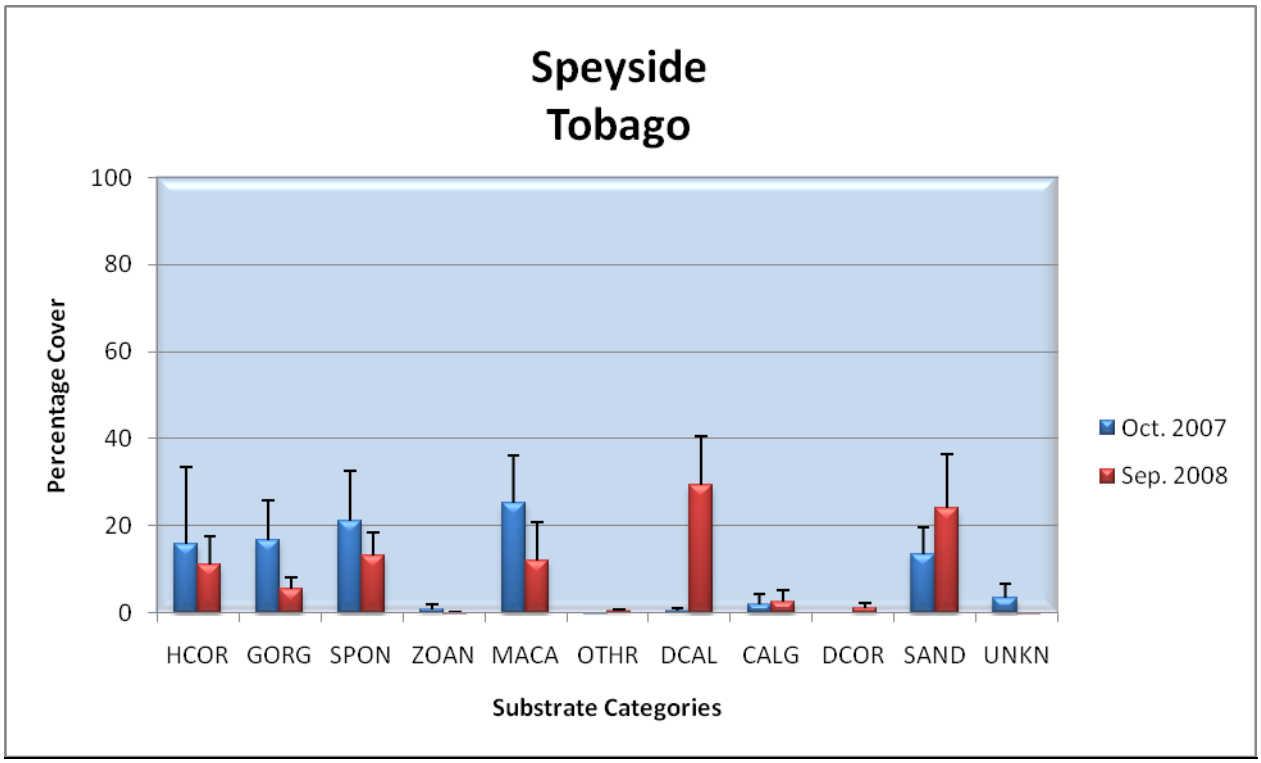

Figure 6.3: Graph illustrating the mean percentage cover of the different substrate categories found at Black Jack Hole, Speyside, Tobago October 2007 and September 2008. Error bars represent Standard Deviation (STD. DEV.). (Substrate categories: HCOR - Hard coral; GORG - Gorgonians; SPON – Sponge; ZOAN – Zoanthids; MACA– Macroalgae; OTHR – Other, live; DCAL - Dead coral with algae; CALG – Coralline algae; DCOR– Diseased coral; SAND – Sand, rubble, rock and boulder; UNKN – Unknown.)

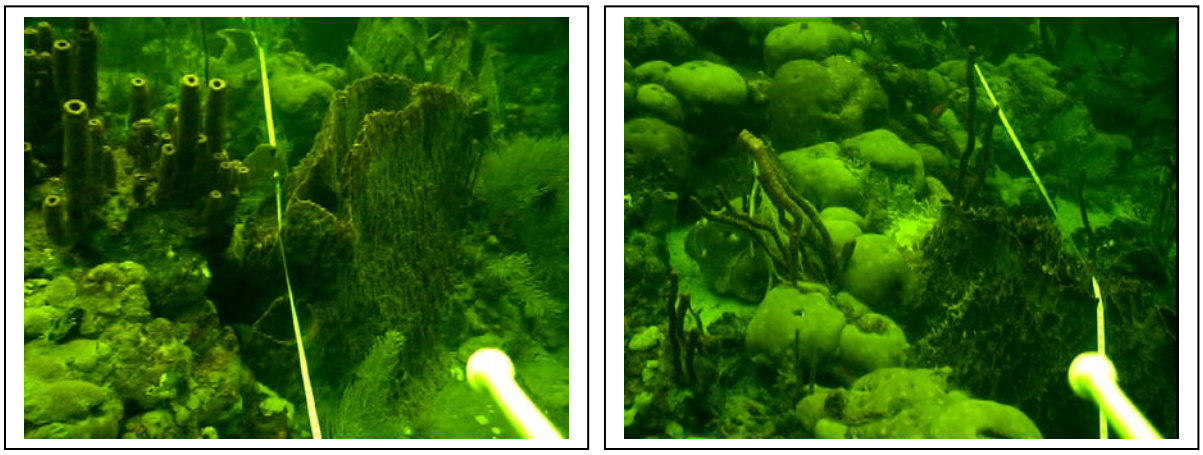

Figure 6.4: Images of the coral reef at Black Jack Hole monitoring site near Speyside, Tobago.

6.2.2 HARD CORAL SPECIES

A total of twenty (20) hard coral species were observed during the monitoring exercise at Black Jack Hole which compared to nineteen (19) species observed in 2007. The most commonalty occurring species were *Siderastrea siderea* (3.05%), *Millipora alcicornis* (1.47%), *Porites porites* (1.18%) and *Madracis mirabilis* (1.18%). Table 6.2 provides a summary of the percentage cover for all coral species observed in 2008 and includes the percentage cover for species occurring at Angel Reef and Japanese Garden in 2007.

Table 6.2: Hard Coral species identified within the Speyside area, Tobago during October 2007 and September 2008.

CORAL SPECIES	October 2007			September 2008		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
Acropora palmata	0.01	0.03	0.01			
Agaricia agaricites	0.24	0.40	0.09	0.06	0.25	0.06
Agaricia undata	0.01	0.03	0.01			
Colpophyllia natans	0.06	0.26	0.06			
Coral (general)	0.37	0.39	0.09	0.57	1.29	0.29
Dichocoenia stokesi				0.71	1.44	0.32
Diploria labyrinthiformis				0.11	0.43	0.1
Diploria strigosa	0.77	1.91	0.43	0.36	0.58	0.13
Eusmilia fastigiata				0.10	0.32	0.07
Favia fragum	0.02	0.08	0.02	0.01	0.05	0.01
Leptoseris cucullata	0.06	0.15	0.03			
Madracis mirabilis	9.54	18.62	4.16	1.18	3.97	0.89
Meandrina meandrites	0.22	0.45	0.10	0.18	0.66	0.15
Millipora alcicornis	0.33	0.51	0.11	1.47	1.41	0.31
Millipora complanata	0.70	1.36	0.3			
Montastraea annularis	0.25	1.03	0.23	0.35	1.06	0.24
Montastraea cavernosa	0.25	0.39	0.09	0.24	0.52	0.12
Montastraea faveolata	1.61	5.02	1.12	0.01	0.05	0.01
Montastrea franksi				0.19	0.46	0.10
Mycetophyllia aliciae	0.04	0.18	0.04			
Mycetophyllia lamarckiana				0.03	0.08	0.02
Porites astreoides	0.43	0.45	0.10	0.86	1.39	0.31
Porites porites				1.18	3.72	0.83
Porites furcata	0.04	0.10	0.02			
Siderastrea radians				0.54	0.99	0.22
Siderastrea siderea	0.91	0.81	0.18	3.05	2.18	0.49
Solenastrea hyades	0.01	0.05	0.01			
Stephanocoenia michelinii				0.06	0.25	0.05
Total % Coral Cover	15.88			11.25		
Number of known species	19			20		

CHAPTER 7

DOMINICA - YEAR 2 CORAL REEF MONITORING

7.1 METHODOLOGY

7.1.1 SITE SELECTION AND DESCRIPTION

Coral reef monitoring was repeated in the Operational Area established within the Soufriere/Scott's Head Marine Reserve (SSMR) in 2007 (Figure 7.1). Monitoring was conducted at two (Point Guignard and Soufriere Pinnacle) of four sites previously used as well as at two new sites (La Bim 1 and La Bim 2). The location of these sites is indicated in Figure 7.2. In addition difficulty was experienced in relocating the previously established transects hence new transects had to be laid out.

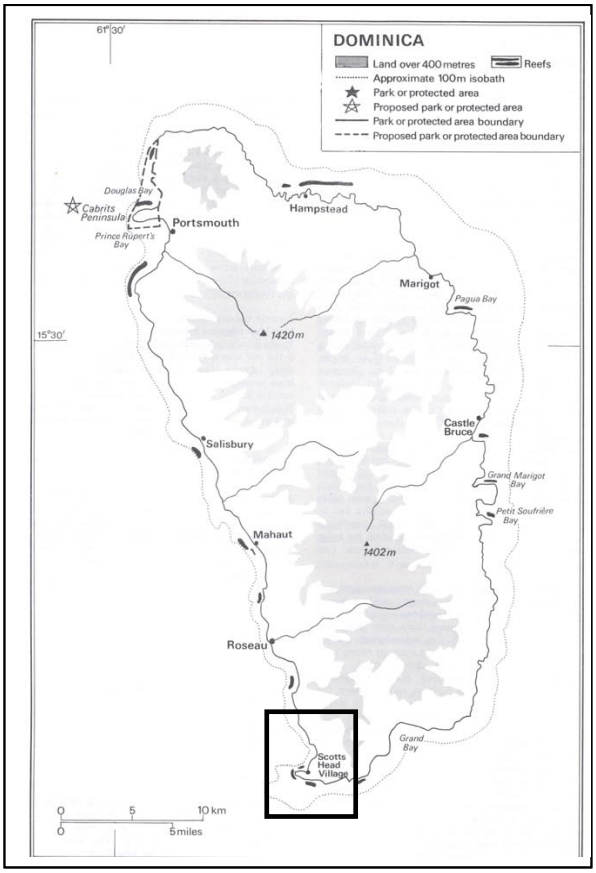

Figure 7.1: Outline map of Dominica showing the existing and proposed marine park boundaries. The Operational Area located at the Soufriere/Scott's Head Marine Reserve is highlighted.

Figure 7.2 Satellite photograph showing the location of the monitoring sites within the Soufriere/Scott's Head Marine Reserve

7.1.2 Video Monitoring

Video monitoring was conducted over the period March 2-5, 2009 and generally followed the procedures outlined in Section 1.4.2. Figure 7.3 shows divers taking part in the coral reef monitoring exercise within the Soufriere/Scott's Head Marine Reserve

Figure 7.3 Divers taking part in the coral reef monitoring exercise within the Soufriere/Scott's Head Marine Reserve

7.1.3 Data Processing and Analysis

Three (3) video tapes containing a total of 29 transects were submitted to the CCDC for processing and analysis along with 1857 captured images. The images were analyzed following the procedure outlined in Section 1.4.3. The taped catalogue is presented in Appendix 3.

7.2 RESULTS

7.2.1 BENTHIC SUBSTRATE

Four sites within the SSMR were assessed in early March 2009. The area monitored was, as in 2007, dominated (41.80%) by dead coral with algae and to a lesser extent macroalgae (11.73%). This compares to 54.91% dead coral and algae and 11.64% macroalgae observed in 2007. Hard coral cover showed a slight decline in values accounting for 9.01% cover in 2009 compared to 11.40% observed in 2007. There was a slight increase in the observed cover of sponges of 4.21% in 2009 compared to 3.68% in 2007. Table 7.1 below contains the results of the all the substrate category assessed in 2007 and 2009 and these results are illustrated in Figure 7.4. Selected images showing the general appearance of the reef ecosystems are provided in Figure 7.5

Table 7.1 Summary of percentage cover for the substrate category for sites within the Soufriere/Scott's Head Marine Reserve, Dominica for November 2007 and March 2009

MAJOR CATEGORY (% of transect)	November 2007			March 2009		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
CORAL	11.40	4.44	0.97	9.01	4.89	1.02
GORGONIANS	0.97	1.21	0.26	0.67	0.96	0.20
SPONGES	3.68	3.62	0.79	4.21	4.33	0.90
ZOANTHIDS	0.04	0.18	0.04	0.07	0.19	0.04
MACROALGAE	11.64	12.18	2.66	11.73	17.22	3.59
OTHER LIVE	0.71	0.88	0.19	0.01	0.05	0.01
DEAD CORAL WITH ALGAE	54.91	12.84	2.80	41.80	24.85	5.18
CORALLINE ALGAE	0.09	0.20	0.04	0.00	0.00	0.00
DISEASED CORALS	0.04	0.10	0.02	0.23	0.40	0.08
SAND, PAVEMENT, RUBBLE	16.27	7.63	1.66	19.11	13.17	2.75
UNKNOWNS	0.25	0.42	0.09	13.16	11.06	2.31
Sum (excluding tape+shadow+wand)	100.00			100.00		

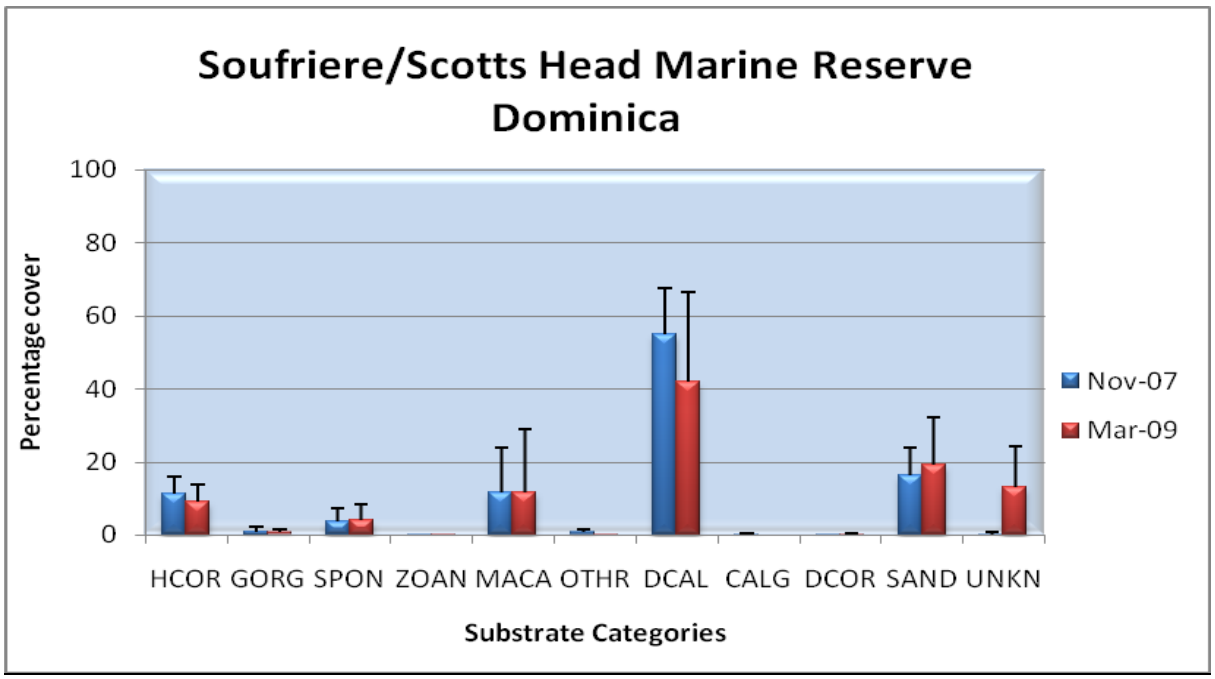

Figure 7.4: Graph illustrating the mean percentage cover of the different substrate categories found at sites within the Soufriere/Scott's Head Marine Reserve, Dominica for November 2007 and March 2009. Error bars represent Standard Deviation (STD. DEV.). (Substrate categories: HCOR - Hard coral; GORG - Gorgonians; SPON – Sponge; ZOAN – Zoanthids; MACA– Macroalgae; OTHR – Other, live; DCAL - Dead coral with algae; CALG – Coralline algae; DCOR– Diseased coral; SAND – Sand, rubble, rock and boulder; UNKN – Unknown.)

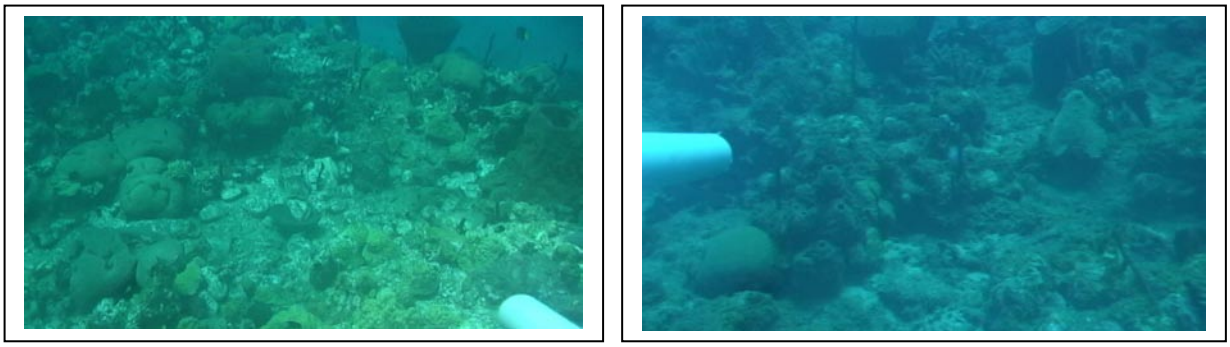

Figure 7.5: Selected images showing the general appearance of the reef ecosystems at sites within the Soufriere/Scott's Head Marine Reserve

7.2.2 Hard Coral Species

A total of nineteen (17) hard coral species were identified from the sites monitored in the SSMR and these accounted for 9.01% of the benthic substrate cover. This compares to 22 species identified in 2007 which represented 11.40% of the benthic substrate. The coral species *Porites astreoides* (2.61%) and *Siderastrea siderea* (2.39%) occurred most commonly at these sites accounting for just over half of the coral cover.

Table 7.2 below provides a summary of the relative abundance of the hard coral species observed in 2007 and 2009.

Table 7.2: Hard coral species identified at sites within the Soufriere/Scott's Head Marine Reserve, Dominica for November 2007 and March 2009

HARD CORAL SPECIES	November 2007			March 2009		
	MEAN	STD. DEV.	STD. ERROR	MEAN	STD. DEV.	STD. ERROR
Agaricia agaricites	0.12	0.26	0.06	0.17	0.29	0.06
Agaricia fragilis	0.02	0.08	0.02			
Agaricia grahamae	0.11	0.27	0.06			
Colpophyllia natans	0.09	0.41	0.09			
Diploria clivosa	0.02	0.06	0.01	0.02	0.11	0.02
Diploria labyrinthiformis				0.33	0.70	0.15
Diploria strigosa	0.31	0.79	0.17	0.15	0.57	0.12
Eusmilia fastigiata				0.01	0.05	0.01
Favia fragum	0.03	0.09	0.02			
Madracis mirabilis				0.16	0.56	0.12
Manicina areolata	0.07	0.22	0.05			
Massive corals	0.01	0.06	0.01			
Meandrina meandrites	1.41	1.20	0.26	0.94	0.91	0.19
Millipora complanata	0.15	0.48	0.10	0.76	2.14	0.45
Montastraea annularis	0.61	0.92	0.20	0.65	1.48	0.31
Montastraea cavernosa	0.87	1.47	0.32	0.11	0.35	0.07
Montastrea faveolata				0.18	0.61	0.13
Mussa angulosa	0.06	0.28	0.06			
Mycetophyllia ferox	0.02	0.05	0.01			
Porites astreoides	3.04	2.13	0.46	2.61	1.85	0.39
Porites divaricata				0.03	0.13	0.03
Porites furcata				0.02	0.08	0.02
Porites porites	1.41	2.82	0.62	0.42	0.76	0.16
Scolymia lacera	0.04	0.17	0.04			
Siderastrea radians	0.38	0.69	0.15	0.07	0.21	0.04
Siderastrea siderea	1.80	2.30	0.50	2.39	2.64	0.55
Solenastrea bournoni	0.05	0.24	0.05			
Solenastrea hyades	0.78	2.63	0.57			
Total % Coral Cover	**11.40**			**9.01**		
Number of Known Species	**22**			**17**		

CHAPTER 8

SUMMARY OF CORAL REEF MONITORING RESULTS - YEAR 2

The overall objective of establishing a coral reef monitoring programme in the Eastern Caribbean was to strengthen the coral reef monitoring network in the region and to build capacity to conduct reef assessments in the participating countries. In 2007 participants were trained in the CPACC video monitoring protocol and technical support was provided by the Centre for Marine Sciences to the countries to carry out reef assessments. Technical support was also provided to conduct reef assessment for a second year as part of the long term coral reef monitoring programme in the OECS and Tobago. Six countries participated in this second round of monitoring.

As observed in 2007 the reefs were dominated by macroalgae and dead coral with algae. When combined these two categories represent a significant portion of the benthic substrate. St Kitts had the highest combined value of 73.40% followed closely by Grenada with a combined value of 70.97%. Dominica had a combined value of 53.13%, St Lucia 49.47%, St Vincent 41.57% and Tobago 41.57%. The levels of hard coral cover reflected to a large extent those obtained in the previous study (Creary, 2008). Dominica, Grenada, St Kitts, St Lucia and Tobago had coral cover between 7%and 13% while St Vincent had the highest coral cover of approximately 25%.

Gorgonians were not very abundant in all the islands ranging from 0.09% to 5.56%. Sponges were most abundant in Tobago (13.32%) with the remaining countries having cover ranging from between 1.84% to 6.42%. The zoanthids represented a very small proportion of the benthic cover in all the countries ranging from 0.06% to 0.2%. Also not well represented were the coralline algae which were not observed in Dominica, St Kitts, St Lucia and St Vincent and ranged from 0.84% to 2.5% for Grenada and Tobago. Disease corals were observed in small amounts at all locations except St Kitts. The mean percentages cover for the different substrate categories for each of the countries monitored on 2008/2009 is presented in Table 8.1 below. These results are illustrated in Figure 8.1.

During the monitoirng exercise a total of thirty (30) identified coral species werer observed in addition to other unidentified coral species. The most abundant and widely distributed species were *Porites astreoides,* (0.86 – 7.76%), *Montastraea annularis* (0.07 - 6.39%) and *Siderastrea sidereal* (0.53 – 4.65%) which were observed in all countries. Also observed in all countries were *Agaricia agaricites* (0.03 – 0.17%)*, Dilporia labyrinthiformis* (0.03 – 0.33%), *Diploria strigosa* (0.13 – 1.35%)*, Madricis mirablis* 0.02 – 1.18%)*, Meandrina meandrites* (0.14 – 0.96%)*, Montastraea cavernosa* (0.11 – 0.71%)*, Porities porities* (0.18 2.23%). These results are presented in Table 8.2 below. Figure 8.2 compares the coral cover for countries over the two monitoirng occassions.

Table 8.1: Combined summary of the mean percentage cover for the substrate categories at the coral reef sites in Dominica, Grenada, St Kitts, Saint Lucia, St Vincent and Tobago monitored over the period September 2008 to March 2009.

MAJOR CATEGORY (% of transect)	Mean Percentage Cover					
	Dominica	Grenada	St Kitts	St Lucia	St Vincent	Tobago
HARD CORAL	9.01	12.84	7.85	10.08	24.88	11.25
GORGONIANS	0.67	2.38	0.09	0.30	3.45	5.56
SPONGES	4.21	1.84	3.06	6.41	5.53	13.32
ZOANTHIDS	0.07	0.11	0.06	0.16	0.20	0.06
MACROALGAE	11.73	70.36	67.19	13.01	37.91	12.18
OTHER LIVE	0.01	0.21	0	0	1.62	0.42
DEAD CORAL WITH ALGAE	41.80	0.60	6.21	36.46	4.06	29.39
CORALLINE ALGAE	0	0.84	0	0	0	2.53
DISEASED CORALS	0.23	0.05	0	0.08	1.09	1.22
SAND, PAVEMENT, RUBBLE	19.11	9.19	15.33	33.27	20.97	24.05
UNKNOWNS	13.16	1.58	0.21	0.24	0.28	0.01
Total	100	100	100	100	100	100

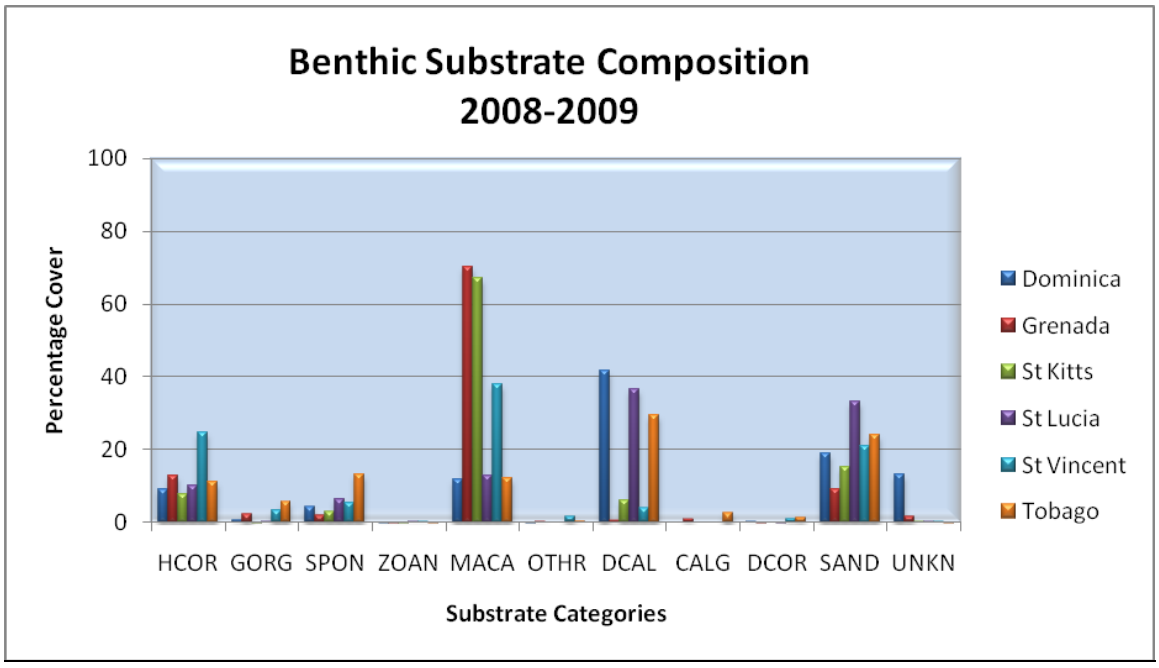

Figure 8.1 Graph illustrating the mean percentage cover for the different substrate categories found at the coral reefs sites in Dominica, Grenada, St Kitts, Saint Lucia, St Vincent and Tobago monitored September 2008 to March 2009. (Substrate categories: HCOR - Hard coral; GORG - Gorgonians; SPON – Sponge; ZOAN – Zoanthids; MACA– Macroalgae; OTHR – Other, live; DCAL - Dead coral with algae; CALG – Coralline algae; DCOR– Diseased coral; SAND – Sand, rubble, rock and boulder; UNKN – Unknown.)

Table 8.2: Hard Coral species identified at the coral reef sites in Dominica, Grenada, St Kitts, Saint Lucia, St Vincent and Tobago monitored during the period September 2008 to February 2009.

Hard Coral Species	Dominica	Grenada	St Kitts	St Lucia	St Vincent	Tobago
Agaricia agaricites	0.17	0.07	0.08	0.03	0.30	0.06
Colpophyllia natans		0.07			0.37	
Coral (general)		0.48				0.57
Dendrogyra cylindrus					0.05	
Dichocoenia stokesi		0.01			0.18	
Diploria clivosa	0.02			0.09	0.01	0.71
Diploria labyrinthiformis	0.33	0.03	0.18	0.30	0.12	0.11
Diploria strigosa	0.15	0.44	0.13	0.84	1.36	0.36
Eusmilia fastigiata	0.01	0.02	0.02	0.10		0.10
Favia fragum			0.02		0.09	0.01
Madracis decactis		0.13				
Madracis mirabilis	0.16	1.37	0.02	0.16	0.17	1.18
Massive corals					0.02	
Meandrina meandrites	0.94	0.17	0.14	0.96	0.67	0.18
Millipora alcicornis		0.11	0.01		0.10	1.47
Millipora squarrosa					0.05	
Millipora complanata	0.76	0.10		0.01	0.42	
Montastraea annularis	0.65	0.07	0.48	0.08	6.39	0.35
Montastraea cavernosa	0.11	0.71	0.62	0.42	0.48	0.24
Montastrea faveolata	0.18	3.11	0.33	0.54		0.01
Montastrea franksi					0.20	0.19
Oculina diffusa		0.01				
Mycetophyllia ferox			0.01			
Mycetophyllia lamarckiana						0.03
Porites astreoides	2.61	1.96	5.09	2.57	7.67	0.86
Porities branneri					0.02	
Porities divaricata	0.03	0.40			0.07	
Porites furcata	0.02	0.10		0.33	0.06	
Porites porites	0.42	1.69	0.18	2.23	1.45	1.18
Siderastrea radians	0.07	0.03	0.02		0.01	0.54
Siderastrea siderea	2.39	1.75	0.53	1.43	4.64	3.05
Stephanocoenia michelinii						0.06
Total % Coral Cover	9.01	12.84	7.85	10.08	24.88	11.25
Number of known species	17	22	16	15	24	20

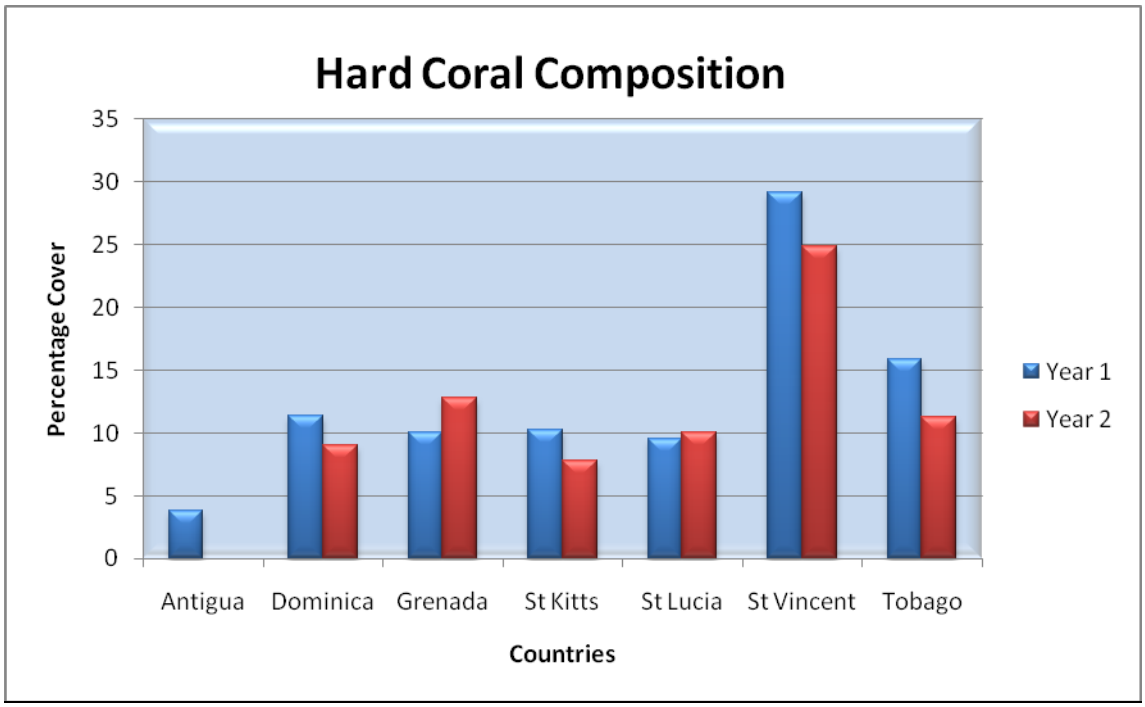

Figure 8.2 Graph summarising the hard coral cover at the monitoring sites in Antigua, Dominica, Grenada, St Kitts, Saint Lucia, St Vincent and Tobago monitored during the period 2007 and 2009 (Year 1 – 2007/2008; Year 2 – 2008/2009).

CHAPTER 9

DISCUSSION

The reefs in the Eastern Caribbean have been exposed to a variety of local (eg pollution and sedimentation from run offs) and regional (eg increase sea surface temperatures) threats, the impacts of which are different for each country. For all the islands macroalgae and dead coral with algae were the largest components of the reef ecosystems, followed by hard corals. Hard coral cover ranged from 4-29% with most countries having values around 10%. Gardener *et al* (2003) reviewed over 200 locations around the Caribbean and reported a region-wide decline of corals across the entire Caribbean basin, with the average hard coral cover on reefs being reduced by 80%, from about 50% to 10% cover over the last three decades. Studies have also shown that the Caribbean has the largest proportion of corals in the high extinction risk categories with the proportion of corals threatened with extinction increasing dramatically in recent decades and now thought to exceed that of most terrestrial groups (Carpenter *et al*, 2008).

So when we look at the results of the monitoring programme we find that in Antigua colonies of *Acropora palmata* beds that were previously reported to be extensive at Little Bird Island were not observed during this assessment and the that area appeared to have experienced significant disturbance. This supports the observations of Bouchon *et al* (2004) particularly with respect to the low hard coral (4%) and high algal cover. In the case of Dominica, it was felt that the 11.6% coral cover observed in 2007 and 9.01% in 2009 were not indicative of the full coral biodiversity expected within the SSMR (per com Fisheries Department Representative). Bouchon *et al* (2004) described the reefs in Dominica as having "high hard and soft coral abundance, very low algal cover, no observable disease, no bleaching". The results from the sites monitored did not reflect this therefore work needs to be done to get a more accurate assessment of reef health in Dominica.

The Fisheries Department of Granada has proposed a system of marine protected areas for Grenada (Burke & Maidens, 2004) and it is expected that the results from this monitoring exercise will be used in conjunction with the previously collected data to support this proposal. Other studies conducted (Wilkinson, 2008) along the south west coast of Grenada showed a range of 6-20% hard coral cover which is in line with the 10-13% observed at the sites monitored in this programme. Paradise Reefs, the monitoring site selected in St Kitts is located within the designated National Marine Park at Sandy Point and features giant basket sponges as part of the coral assemblage. Although this area is well used by divers, its designation as a protected area prevents boats from anchoring and damaging the reefs. Despite this protection this reef exhibited a high occurrence of macroalgae (67.19%) accompanied by relatively low coral cover (7.85%).

The fringing reef communities along parts of the west coast of St Lucia are under pressure from tourism and coastal development (Burke & Maidens, 2004). The SMMA has a comprehensive monitoring programme which provides data on a variety of coastal and marine parameters and the data collected from this monitoring exercise will be incorporated into their database. For St Vincent & the Grenadines the monitoring site selected at Castle Bay had the highest coral cover and highest species diversity as represented by the number of coral species, despite its close proximity to the capital, Kingstown, and the impacts of runoff and discharges from the nearby rivers.

For Tobago it was felt that the results of the monitoring did not reflected the results of previous studies using photo quadrat surveys carried out in the area by Laydoo (1985) (per com IMA Representative). The main difference cited were the number of coral species found and the actual species identified. A more detailed evaluation of the studies, along with any other additional data that might be available, needs to be carried out before a conclusion can be drawn about these results. Because of heavy diving traffic on the previously selected sites (Angel Reef and Japanese Gardens) monitoring was moved to Black Jack Hole which showed less coral cover (25%) than observed at the previous sites (29%).

Against this background of increasing anthropogenic threats to the coral reefs of the Easter Caribbean are the challenges faced in the implementation of a regional monitoring programme. The most significant challenge was that of having sufficient personnel to carry out the in-country preparatory work (site selection, marking of transects), monitoring and data analysis. This was partially overcome by having resources persons from the CMS leading the monitoring in each country and having the videotapes processed and analyzed by the CMS. The trained participants did not transfer their training to in-country personnel, which resulted in additional difficulties in the second round of monitoring as some of the original trainees and personnel who assisted in the Year 1 monitoring were not available. In addition, the monitoring protocol was not strictly adhered to and the metadata and field report in support of the video tapes were not always provided as specified. No temperature data was retrieved as the HOBO Temp meters provided were either not deployed or deployed and loss due to rough sea conditions.

In retrospect more time was required for the initial training of the participants especially with respect to the data processing and analysis to allow this activity to be conducted in-country. This additional training was provided to St Lucia, Dominica and St Kitts during the second round of monitoring. There were also some logistical (eg boat availability, access to sites) and equipments problems (eg fogging and flooding of camera housings) and the issue of weather and sea conditions. Financial support for boat rental, equipment purchase and contracting independent divers was provided to those countries that made the request. Communication with the countries was difficult at times and it did not appear that (with the exception of Tobago) that the monitoring programme had been institutionalized and incorporated into the work programme of the respective responsible authories.

Despite the challenges the coral reef monitoring programme was implemented with a high degrees of success in seven countries in the Eastern Caribbean during the period 2007-2009 and has provide the basis for establishing a programme to assess changes in reef health over the long term. For some countries this monitoring programme forms the basis for long term reef health assessment while for others the data provided supports existing programmes. The programme needs to continue to further build capacity in the countries and to provide data sets to model and predict further reef status as well as provide evidence of reef conditions to the policy makers. As a region which is highly dependent on tourism and reef fisheries the cost of reducing vulnerability is likely to be high (Vergara, *et al*, 2008) but the underlying data and tools required to conduct economic valuation of coral reefs have not been sufficiently developed and hence this cost remains unassessed.

CHAPTER 10

RECOMMENDATIONS

In the Inter- governmental Panel on climate Change (IPCC) Technical Report V which speaks to the subject of climate change and biodiversity the conclusion is drawn that sea surface temperatures have adversely affected coral reefs through widespread bleaching and the increased incidences of coral diseases. This report predicts that coral bleaching is likely to become more widespread by 2010 as sea surface temperatures are projected to increase by at least 1-2^{o}C. This is expect to result in extensive mortality of corals, reduced species diversity, more frequent outbreaks of pest and disease and an overall reduction in productivity of the reef ecosystems (Gitay *et al*, 2002). Given these predictions of the future state of Caribbean Reefs it is very important to expand the monitoring of reef health, to better understand the specific causes in order to formulate informed solutions. Wilkinson and Souter (2008) have concluded that local management actions are unlikely to prevent coral bleaching as a result of climate change, however, effective management can reduce damage resulting from direct human pressures and facilitate natural adaptation mechanisms and more rapid recovery.

The recommendations presented below were first provide in the report on the monitoring conducted in 2007 (Creary, 2008) and have now been modified based on the experience and lessons learnt during the second monitoring exercise. These recommendations should be seriously considered for incorporation into further plans for continuation of the monitoring programme in the region to ensure that the human and financial effort expended and the data collected is useful to the participating countries.

10.1 REGIONAL CORAL REEF MONITORING FRAMEWORK

- A Technical Review Workshop should be held to include all the participating and institutions to conduct a thorough review of the monitoring protocol and the data collected. Challenges and technical/logistical difficulties should be discussed and resolved with proposed solutions incorporated into the programme for future monitoring.

- The Technical Review Workshop should provide the forum for the establishment of a **Regional Coral Reef Monitoring Framework** which would serve to outline the roles and responsibilities of all the participating entities including the country agencies responsible for coral reef monitoring and protection (in most cases the Fisheries Departments) , the Centre for Marine Sciences (through the University of the West Indies) the Caribbean Community Climate Change Centre and any other participating organization.

10.2 TRAINING

- A review of the training should be carried out with the relevant person in the participating countries to ensure understanding and adherence to the monitoring protocol. Strict adherence to the video monitoring protocol has emerged as an issue that requires particular attention for future monitoring exercises. Refresher training should be held periodically.

- A data processing and analysis workshop should be held to build capacity in the participating countries.

- Training should be provided to additional persons in the countries to further build capacity to ensure that staff changes do not result in the loss of monitoring capacity.

10.3 Coral Reef Monitoring Protocol

10.3.1 Site Selection

- Each country should review the site selected to ensure that these sites are representative of the area being studied and are suitable for the long term monitoring.

- Additional sites should be added were feasible.

- The question of the establishment of permanent transects needs to be revisited and reviewed given the fact that a large number of the transect markers could not be relocated after a year, for a number of reasons (algal overgrowth, rough seas and storms).

10.3.2 Monitoring

- Persons involved in the actual videotaping should endeavour to adhere to the protocol. The protocol, which been developed and field tested over a number of years, provides data that is statistically rigorous if executed as designed.

- Preparation is absolutely essential prior to going into the field to monitor. The protocol should be reviewed, equipment and materials acquired, dive team assembled and responsibilities assigned. Preparation on land reduces the incidence of errors in the field and greatly facilitates adherence to the monitoring protocol.

- Field checking of the camera equipment is recommended prior to monitoring to ensure full functionality. Problems were experienced with leaking camera housings and fogging lens. These problems could have been addressed if camera equipment were checked prior to monitoring.

- The video monitoring exercise should always include the filming of additional footage, particularly panoramic views of the reefs. These additional footages are particularly useful for illustrating the condition of the reefs in reports (such as this one) and presentations.

- Tapes should be reviewed at the end of the day to ensure good quality footage. The taping should be repeated if the footage is not of an acceptable quality.

- It is very important that a field report and metadata accompany all tapes whether they are processed and analyzed in-country or sent to the CMS. This information is invaluable in interpreting the information that is on the tapes, for review at a later date and for archiving puoposes.

- Each country should ensure that temperature readings are available for each of the Operational Areas through the deployment of the HoboTemp meters. This will allow *in situ* temperatures to be correlated to coral health.

10.3.3 Data Processing and Analysis

- There should be an increased focus on in country coral species identification and data analysis particularly by the persons knowledgeable about the specific monitoring sites.

10.4 Supplementary Studies and Research

- Provision in the programme should be made to monitoring during coral bleaching events to determine the extent of bleaching and the rate and nature of recovery. The CREWS network in the Caribbean provides the information which allows predictions of potential bleaching events.

- Closely associated to coral bleaching are the increase incidences of coral diseases which are now being linked indirectly to increased sea surface temperatures. Provision should also be made to include the monitoring of carol diseases if they occur.

- Where possible, other indicators for assessing and monitoring coral reef status should be undertaken such as, but not limited to, coral recruitment, coral size distribution, fish species and abundance, abundance of herbivores and physical parameters.

- Each country should gather all other relevant data associated with the sites selected for monitoring, related to anthropogenic issues such as pollution, over-fishing, sedimentation, turbidity and physical damage, which interact with climate factors and affect the status of the coral reefs.

- Research should be conducted to determine suitable coral reef restoration and regeneration methodologies (eg coral gardening, identification of temperature resistant/adaptive species) to promoting the re-establishment of degraded reef sites in order to improve the reef structure and increase species diversity.

- Appropriate tools to carry out economic valuation of coral reefs need to be developed and implemented to more accurately determine direct and indirect costs of coral loss.

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Sources of Maps

- Location of Coral Reefs maps - UNEP-WCMC www.reefbase.org
- Location of Operational Areas and monitoring sites - www.google - earth
- Maps of Tobago - Institute of Marine Affairs, Trinidad and Tobago
- Map of Speyside (www.myTobago.info)

APPENDIX 1 – CONTACT PERSONS

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APPENDIX 2: MONITORING SCHEDULE AND SITES

Country	Dates	Operational Area	Monitoring Site(s)	Dive Teams
Dominica	Mar 2-5, 2009	Soufriere/Scott's Head Marine Reserve	Soufriere Pinnacle (15°13.987N - 061°21.891W), Point Guignard (15°14.488N – 061°22.370W) La Bim 1, La Bim 2 Coral Gardens	Peter Gayle Derrick Theophile
Grenada	Feb 23-26, 2009	Grand Anse reef system	Boss Reef (12°02.463'N – 061°46.240'W) Middle Boss Reef (12°02.272'N – 061°46.369'W) Lower Boss Reef (12°01.982'N – 061°46.689'W) Northern Exposure (12°02.372'N – 061°46.073W) Wibbles Reef (12°01.345'N - 061°48.038'W) Famingo Bay (12°04.961'N - 061°45.872'W) Quarter Wreck (12°01.664'N - 061°47.021'W)	Omar Spence, Paul Phillip, Crafton Isaac, Adrian Blackman
St Kitts & Nevis	Feb 2-5, 2009	Sandy Point	Paradise Reef	Peter Wilson Kelly, Lynn Wilkin, Graeme Brown
St Lucia	Feb 16-18, 2009	Soufriere Marine Management Area	Anse Chastanet: 13`51.851'N 61`04.767'W Turtle Reef: 13`51.946'N 61`04.784'W Malgretoute: 13`50.361'N 61`03.921'W Grand Caille: 13`51.696'N 61`04.575'W	Peter Wilson-Kelly, Luthuli Fontenelle , Kia Wulf, Daniel Medar
St Vincent & the Grenadines	Feb 23-25, 2009	Kingstown	Castle Bay - 13° 09.369N, 61° 14.304W	Hugh Small, Lucille Grant, Kris Isaacs, Earl Martindale, Lesliann James, Bernard Soleyn (boat cover)
Trinidad & Tobago	Sep 17-18, 2008	Speyside, Tobago	Black Jack Hole	Addison Titus

APPENDIX 3: CATALOGUE OF VIDEO TAPES

Country	Tape #	Date	Site	Transect #s	# Transects	# Images Captured
Dominica	DM05	03-Mar-09	La Bim 1, Point Guinard	Transect 1-12		
	DM06	04-Mar-09	La Bim 2, Soufriere Pinnacle	Transects 13-21		
	DM07	05-Mar-09	Coral Gardens	Transects 22 -29	29	1857
Grenada	GD1	24-Feb-09	Flamingo Bay, Whibble, Quarter Wreck, Middle Boss, Lower Boss	Transects 1-13		
	GD2	25-Feb-09	Boss, Northern Exposure, Flamingo Bay	Transects 14-27		
	CD2	26-Feb-09	General Images		27	830
St Kitts	KN04	16-Feb-09	Paradise Reef, Sandy Point	Transects 1		
	KN05	17-Feb-09	Paradise Reef	Transects 2-10		
	KN06	18-Feb-09	Paradise Reef	Transects 11-20	20	1522
St Lucia	LC05	16-Feb-09	Margretoute	Transects 1, 3, 4		
	LC06	17-Feb-09	Anse Chastenet	Transects 2-4		
		17-Feb-09	Turtle Reef,	Transects 1-3		
	LC07	18-Feb-09	Grand Caille	Transects 1-5		
		18-Feb-09	Margretoute	Transects 2		
		18-Feb-09	Anse Chastenet	Transects 1	16	1490
St Vincent	VG03	24 Feb 09	Castle Bay , Kingstown	Transects 1-10		
	VG04	25 Feb 09	Castle Bay , Kingstown	Transects 11-20	15	938
Tobago	TT03	18-Sep-08	Speyside, Black Hole Jack	Transects 1-9		
	TT04	19-Sep-08	Speyside, Black Hole Jack	Transects 10-20	20	2100

APPENDIX 4: ST LUCIA TRAINING WORKSHOP

AGENDA

CORAL REEF MONITORING - DATA ANALYSIS AND PROCESSING WORKSHOP

DAY 1

9:00 am - 9 :10 am	Workshop overview, and Introduction of Trainers and Participants	
9:10 am – 9 : 30am	Introduction to the biology and ecology of coral reefs	Sarita Williams-Peter
9:30 am - 9: 50 am	Coral species identification	Susanna Scott
9: 50 am – 10: 05 am	Threats to coral reefs	Sarita Williams-Peter
10 : 05am – 10: 30am	Computer Hardware and Software Requirements / Software set up	Claudia Lewis
10 : 30 am – 10 : 50am	**BREAK**	
10: 50 am – 12: 30pm	Review of video monitoring field activities	Peter Wilson Kelly
12 :30pm – 1: 30pm	**LUNCH**	
1:30 pm – 1:45 pm	Overview of Data Processing and Analysis	Claudia Lewis
1:45 pm – 4:00 pm	Image capture, CPCe data analysis, species identification etc.	Participants, Claudia Lewis, Susanna Scott
	END OF DAY ONE	

DAY 2

9: 30 am - 10: 00 am	Review of data processing and analysis	Claudia Lewis
10: 00 am - 10: 15 am	**BREAK**	
10: 15 – 12: 30 pm	Image Capture, CPCe data analysis, species identification etc.	Participants, Claudia Lewis
12: 30pm – 1: 30pm	**LUNCH**	
1 :30pm - 3: 30pm	Data Interpretation	Peter Wilson Kelly, Participants
3: 30pm – 3: 40 pm	Closing Remarks	Sarita Williams-Peter, Peter Wilson Kelly
3: 40pm – 4:00pm	Workshop wrap up	Participants

St Lucia Training Workshop Participants

Coral Reef Monitoring Programme The OECS and Tobago - Year 2
Monitoring and Training in St Lucia Feb 18-20, 2009

Name	**Organization**	Day 1	Day 2
Daniel Medar	Department of Fisheries		
Luthuli Fontenelle	Department of Fisheries		
Sarita Williams-Peter	Department of Fisheries		
Allena Joseph	Department of Fisheries		
Kai Wulf	SMMA		
Yvonne Edwin	Department of Fisheries		
Patricia Hubert Medar	Department of Fisheries		
Hardin Jn Piere	Department of Fisheries		
Petra Polius	Department of Fisheries		
Sonia Cazaubon	SMMA		
Ferrari			
Peter Wilson Kelly	CMS		
Claudia Lewis	CMS		
Number of Persons		9	10