Caribbean Conservation Association
One Caribbean, One Vision

NCC
NATIONAL CONSERVATION COMMISSION

Folkestone Marine Reserve, St. James Barbados

Centre for Resource Management and Environmental Studies

CERMES

University of the West Indies Barbados

Funded by

GEF
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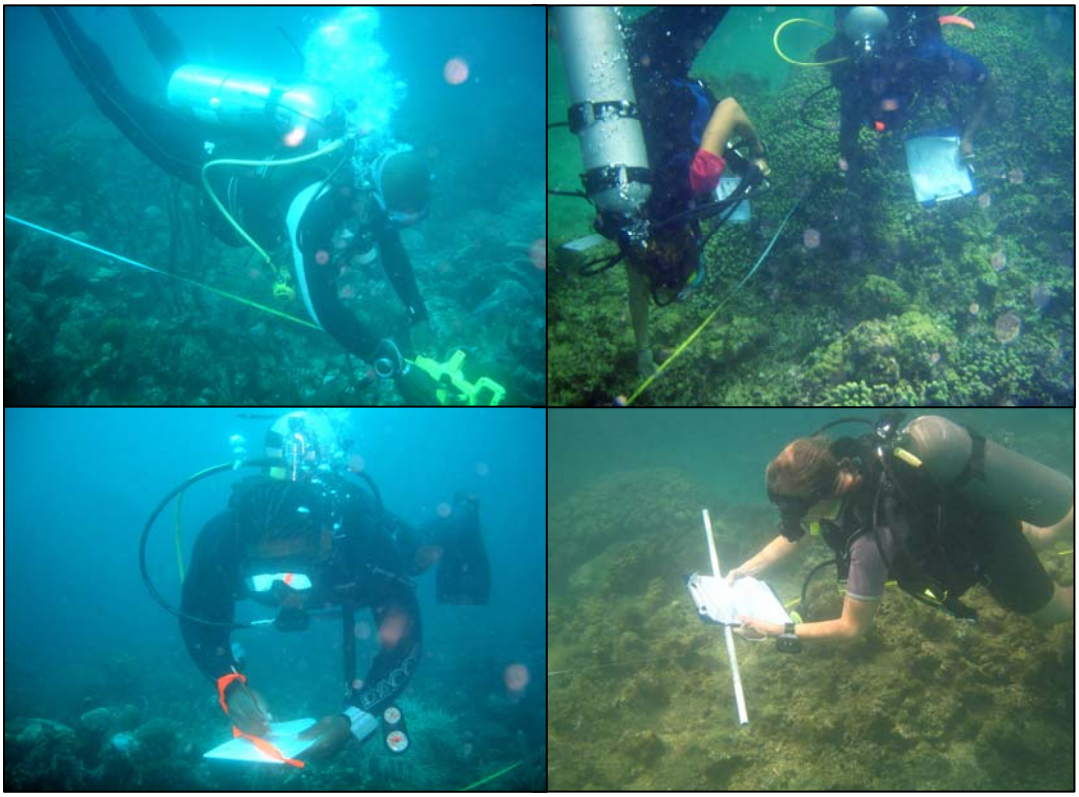
Community-Based Coral Reef Monitoring And Management

Baseline survey of coral reefs within the Folkestone Marine Reserve, St. James, Barbados



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ABSTRACT

This paper seeks to provide information on the status of the nearshore and bank reefs within the Folkestone Marine Reserve in Barbados in efforts to develop a coral reef monitoring database to assist with long term monitoring of the reefs at the Folkestone Park and Marine Reserve Office.

The coral reef monitoring programme - Reef Watchers - primarily focused on engaging the local dive community to monitor the reefs. Through training sessions, nineteen volunteers were trained to use the Reef Watchers protocol which was modified from the Reef Check methodology. A total of six reefs within the Folkestone Marine Reserve were surveyed from June 2008 to August 2009.

Results of the surveys indicate that the reefs are in fairly good condition with a wide variety of fish and hard corals species observed across the bank and fringing reefs. Anthropogenic activities are still having a negative impact on the reefs within the reserve. The lessons learnt from the Reef Watchers programme focused on the importance of engaging the community in coral reef monitoring, ensuring sustainability of the programme and efficient data collection by volunteers.

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1 INTRODUCTION

1.1 About the project

The Community-based Coral Reef Monitoring and Management Project was implemented by Caribbean Conservation Association, in collaboration with National Conservation Commission (Folkestone Marine Reserve) and Centre for Resource Management and Environmental Studies (CERMES), UWI and is funded by SGP/GEF/UNDP. The project seeks to build capacity at the community level to support identification and analysis of the problems facing coral reefs within the Folkestone Marine Reserve and the development and implementation of community-level strategies to combat the existing impacts. This is hoped to be achieved by:

- The establishment of a local network of stakeholders for collaboration and information exchange; and
- Providing the necessary training to community groups in coral reef education and awareness, management planning, and long-term financing and sustainability.

The objectives of the project are:

1. To improve information and resource sharing among managers, scientists, communities and youths, for increased participation in decision-making regarding coral reef management.
2. To build capacity of youths for advocacy, and incorporate coral reef biodiversity conservation and management into the primary schools curricula.
3. To strengthen community and stakeholder participation in management planning and monitoring of coral reefs and associated biodiversity.
4. To assist in mobilizing financial resources for conservation and management of coral reefs in the long-term.

1.2 About Reef Watchers

The Reef Watchers' programme evolved from objective three of the project. The programme is a community-based coral reef monitoring regime conducted by volunteers from the community, and will thus be a useful tool in building public support for government and NGO coral reef conservation efforts. The programme is coordinated by CERMES and the local dive operator located adjacent to the Folkestone Marine Reserve: Hightide Watersports. The regime provides an opportunity for local divers to move beyond awareness and play an active role in reef research and conservation.

The Reef Watchers programme is intended to be a long term programme with the following key objectives:

- to educate the local public about local (and global) coral reef status;

• to create a local network of volunteers which regularly monitor and report on reef health within and around the Folkestone Marine Reserve;
• to stimulate local community action to protect remaining reefs and rehabilitate damaged reefs using ecologically sound and economically sustainable solutions (CERMES, 2008).

1.3 Objectives of report

The objectives of this paper are to:

1. identify the status of the fringing, patch and bank reefs located within the Folkestone Marine Reserve,
2. identify impacts affecting the coral reefs, and
3. indicate lessons learnt from community-based coral reef monitoring.

This paper provides baseline coral reef information on the Folkestone Marine Reserve and allows reserve management to develop a database to monitor the state of the reefs in the long-term, and to share accurate information on the reefs without relying on external entities. The paper is also the first step to community-based monitoring in the Folkestone Marine Reserve and its results will provide the local community with a strong feeling of stewardship. Moreover it will be seen as a model for other marine protected areas seeking to involve the community in their monitoring efforts.

2 BACKGROUND

2.1 The Folkestone Marine Reserve

The Folkestone Marine Reserve located on the west coast is the only legislated marine protected area on the island. It is a 2.2 sq km no-take zoned marine reserve lying on one of the most heavily used areas of marine space in Barbados. The area is comprised of unique marine habitats including fringing and patch reefs, endangered hawksbill turtle nesting sites and remnants of rare mangrove ecosystems (AXYS Environmental Consulting (Barbados) Inc., 2000).

The coral reefs in the reserve have been impacted mainly by eutrophication and suspended particulate matter in the water column (Cotter 1982), reduction of grazing pressure due to decreases in herbivorous sea urchins and low abundance of herbivorous reef fish resulted in increased algal abundance which then resulted in coral diseases (Hunte *et al*., 1986; Oxenford *et al*., 1993). The low abundance of reef fishes and the decrease in sea urchins was attributed to over fishing and disease–induced mortality respectively.

2.2 Reef monitoring in Folkestone Marine Reserve

Currently there are no studies available that focus on monitoring all the reefs within the Folkestone Marine Reserve. However data can be obtained from various monitoring activities across the island. A long-term monitoring programme has been established since 1982 - the Barbados Reef Surveys. These surveys are sponsored by the Government through the Coastal Zone Management Unit (CZMU), with the field work being done through the Office of Research and CERMES, UWI. The health of 43 reefs along the west and south coasts of the island are monitored at five-year intervals. Two of the 43 reefs are located within the Folkestone Marine Reserve (Hunte and Allard 1994; Hunte et al., 1998).

Historical data for reefs such as North and South Bellairs are also available from the Caribbean Coastal Marine Productivity (CARICOMP) Programme. CARICOMP is a Caribbean-wide initiative which focuses on monitoring productivity of mangroves and sea grasses, and coral reef community composition.

Data from the North Sandy Lane Fringing Reef (Vauxhall reef) and South Sandy Lane Fringing reef have been collected through the Marine Monitoring Program of Sandy Lane Desalination Plant (Brine Disposal). The objective of the programme was to monitor the characteristics of selected coral reefs in the coastal zone off the Sandy Lane Desalination Plant in an effort to determine whether negative impacts are occurring and whether these may be attributable to brine release from the Desalination Plant (Sarafinchin Associates Ltd., 2001).

3 METHODOLOGY

3.1 Reef Watchers' training

A total of nineteen volunteers have been trained in the Reef Watchers methodology which was modified from Reef Check protocol. The first training workshop was held in June 2008 at the Folkestone Park and Marine Reserve Office (Figure 3.1). The workshop consisted of a theory session and a practical session. Participants were introduced to the Reef Watchers protocol during the theory session. Slideshows were used to assist the volunteers with identifying fish, invertebrates and benthic substrates before they performed the surveys. The participants were provided with an underwater guide as part of their package to assist them in identifying organisms while underwater. The practical sessions took place at North Bellairs Fringing Reef and Sandy Lane Bank Reef. At the end of the practical sessions, volunteers returned to the classroom for the data entry session.

The second training workshop was held on January 24th 2009 at the CERMES located at the University of the West Indies. The procedure for the workshop was similar to the first. However for the practical session, participants surveyed the South Bellairs Fringing Reef.

Due to lack of time, participants were not given the opportunity to take part in the data entry session but were allowed to take home their data to enter on their own. At the end of this workshop, each participant was given a Reef Watchers Instructional DVD to assist them with future dives.

Figure 3.1: Reef Watcher volunteers during practical session of first workshop

3.2 Reef monitoring

Seven reefs were selected for monitoring in the Folkestone Marine Reserve. These reefs were North Bellairs Fringing Reef, South Bellairs Fringing Reef, Fisherman's Bank Reef, Dottins Bank Reef, Sandy Lane Bank Reef, Sandy Lane Patch Reef and Sandy Lane Fringing Reef (Figure 3.2 and Table 3.1). These reefs were surveyed between June 2008- August 2009. Unfortunately due to weather condition data was not collected for the Sandy Lane Patch Reef for this report.

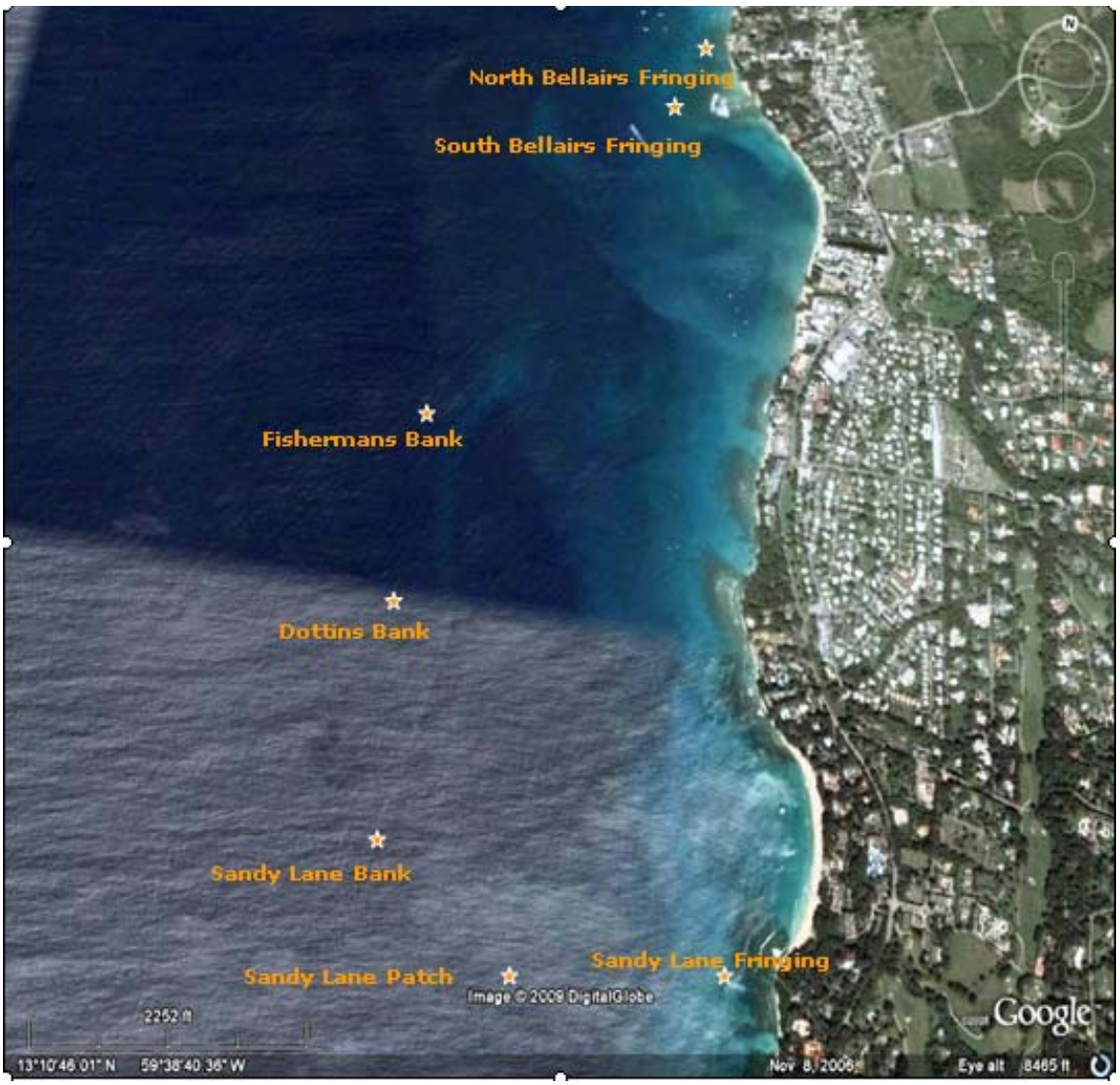

Figure 3.2: Location of the seven reefs within the Folkestone Marine Reserve (Modified from Google Earth Maps 2009)

Table 3.1: Dive dates and depth of the seven sites for the Reef Watchers programme

Reef Site/ Code	Depth (ft)	Dive dates
North Bellairs [NB]	13	June 2008
South Bellairs [SB]	12-20	January 2009
Sandy Lane Bank reef [SLB]	70	June 2008
Sandy Lane Fringing reef [SLF]	2-12	August 2009
Fisherman's Bank reef [FB]	35-50	November 2008
Dottins Bank reef [DB]	45-70	March 2009

In this monitoring regime, four types of data were collected from each reef site: site description, fish surveys, invertebrate surveys and benthic surveys.

3.2.1 Site Description

Site description data were collected at each reef site before the dive. The description was based on measure of environmental conditions and ratings of human impacts. Anecdotal, observational, historical, geographical data were also recorded on the data sheets (Appendix 7.1.1).

3.2.2 Fish belt transect

A one metre length of PVC pipe was used to help estimate the 2m belt transect width for the fish survey (Figure 3.3). Four 2 m wide (centered on the transect line) by 20 m long segments were sampled for fish species typically targeted by fishermen, aquarium collectors and others. Fish seen up to 5 m above the reef were counted. The indicator fish that were used for this project were: butterflyfish, grunts/margates, snapper, parrotfish, moray eel, blue tangs/surgeonfish and the groupers/coneys/hinds (Appendix 7.1.2). These fish were selected because they are typically fished off the reefs by spearfishing or fish pots, or caught using hand-lines.

Figure 3.3: Reef Watcher conducting fish survey at North Bellairs Fringing Reef

3.2.3 Invertebrate belt transect

The same four 2 m wide (centered on the transect line) by 20 m long segments as in the fish belt transect were sampled for invertebrate species (those targeted as food species or those that impact the health of the reef). These invertebrates included: the banded coral shrimp (*Stenopus hispidus*), the long spined sea urchin (*Diadema antillarum)*, pencil urchins (*Eucidaris tribuloides*), sea eggs (*Tripneustes ventricosus),* flamingo tongue snail (*Cyphoma gibbosum*), sea fans and sea whips (Gorgonia sp.) and lobsters (*Panulirius sp.*). During the survey, information about the impacts on corals was also collected, including coral damage, coral diseases and coral bleaching (Appendix 7.1.3).

3.2.4 Substrate line transect

The same transect line as the fish and invertebrate belt transects were used for the substrate survey but this time, points sampled at 0.5 m intervals along the tape were used to determine the substrate types on the reef, including live and dead coral (Figure 3.4). The substrate types used were live hard coral, soft coral, sponge, nutrient indicator algae, sand, silt/clay, rubble, rock and recently killed coral (Appendix 7.1.4).

Figure 3.4: Reef Watcher conducting substrate survey at North Bellairs Fringing Reef

3.3 Data analysis

The data were transferred from the underwater slates to the electronic datasheet in Excel for descriptive analysis. Data were analysed for mean abundance of fish, invertebrate, mean percentage cover of substrate, incidences of coral impacts and percentage coral colony and coral populations affected by bleaching.

4 RESULTS/DISCUSSION

The data from these preliminary surveys will provide the baseline data required for future coral reef monitoring analysis.

4.1 Bank Reefs

4.1.1 Fish counts

Fisherman's Bank Reef had the lowest mean density of fish compared to the other bank reefs. Dottins and Sandy Lane Bank Reefs have fish densities twice as much as Fisherman's Bank Reef. Figure 4.1 illustrates the mean abundance of indicator fish found at the bank reef sites adjacent to the Folkestone Marine Reserve. The Sandy Lane Bank Reef has the highest mean abundance of fish families. Parrotfish were observed as the most abundant species on Fisherman's Bank Reef and Sandy Lane Bank Reef while the butterflyfish were more abundant at Dottins Bank Reef. A greater diversity of fish species has been spotted on Dottins Bank Reef. Moray eels and snappers were limited at the sites. These species may be considered as rare in the Folkestone Marine Reserve.

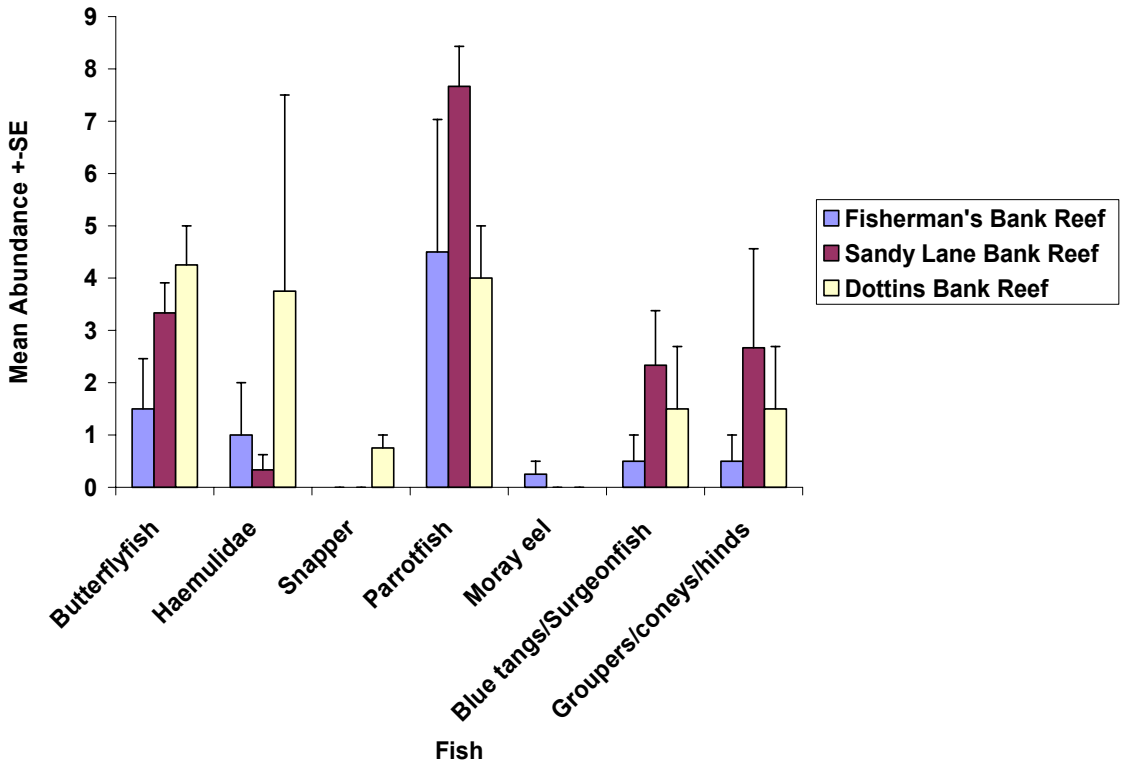

Figure 4.1: Mean fish abundance for bank reefs adjacent to Folkestone Marine Reserve

4.1.2 Invertebrates

The highest overall density of invertebrates was found at the Sandy Lane Bank Reef. Gorgonians (sea fans and sea whips) were the most prevalent invertebrate species on the bank reefs (Figure 4.2). The highest mean abundance of gorgonians was found at Sandy Lane Bank Reef. Gorgonians were the only benthic fauna observed at the Fisherman's Bank Reef. All other invertebrate species (*Diadema*, *Tripneustes* [sea egg], lobster) were either not seen or observed at any of the bank reef sites as they usually reside in shallower waters.

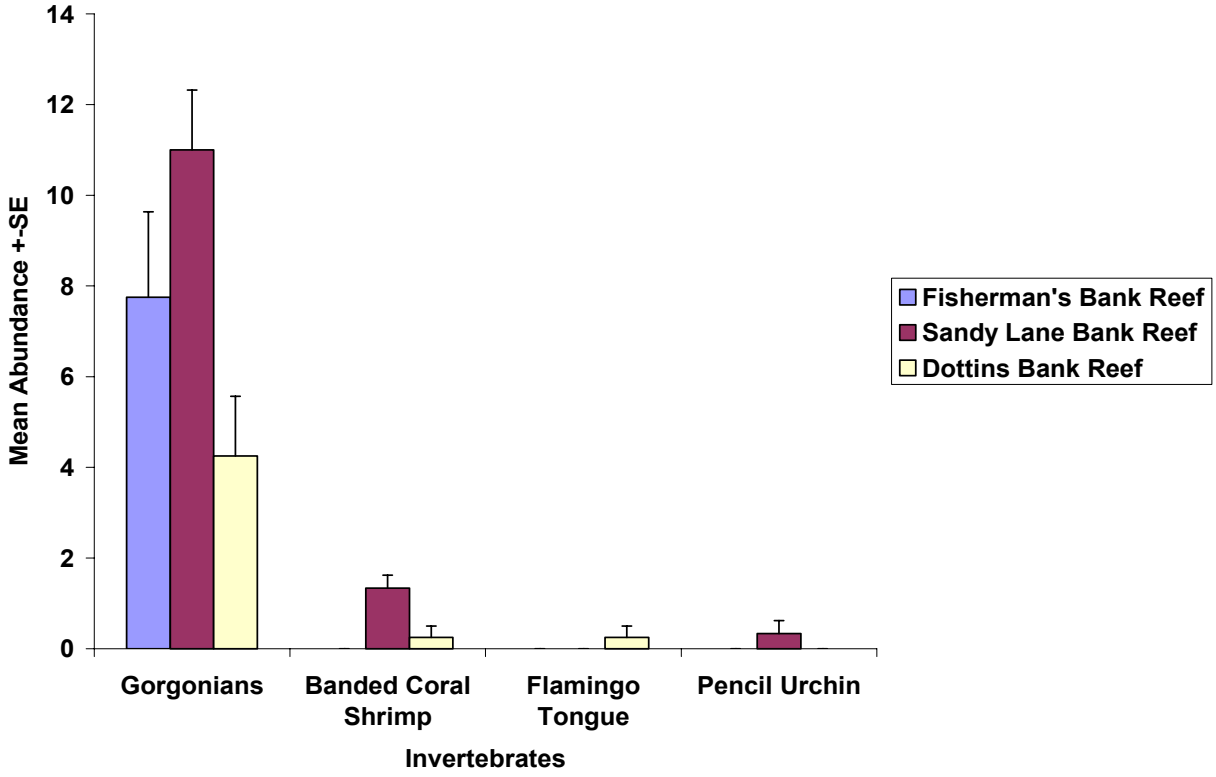

Figure 4.2: Mean invertebrate abundance for bank reefs adjacent to Folkestone Marine Reserve

4.1.3 Substrate type

The major substrate composition of the surveyed reef sites is predominantly hard coral. At Sandy Lane Bank Reef, 57.5% of the substrate was hard coral; at Dottins Bank Reef 37.5% was hard coral, and at Fisherman's Bank Reef 33.1% was hard coral (Figure 4.3).

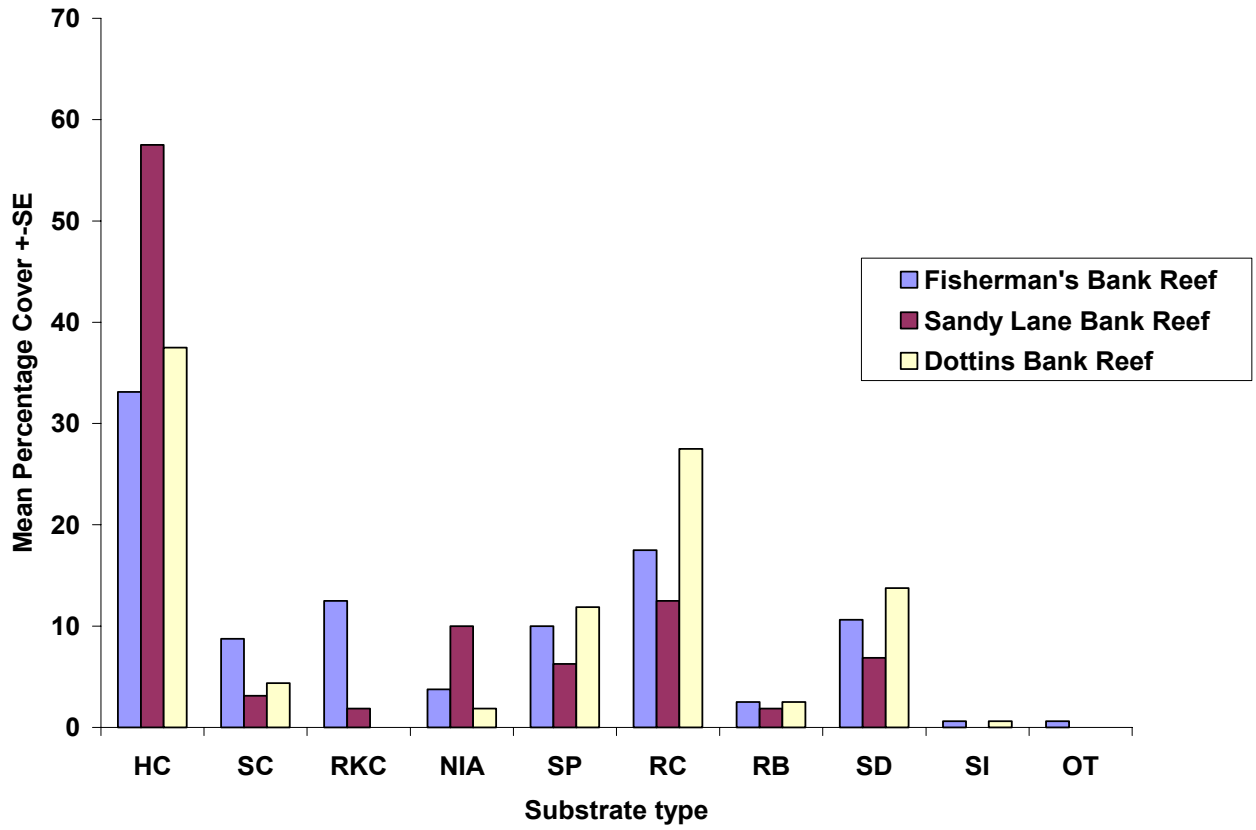

Figure 4.3: Mean percentage cover of substrate for the bank reefs
[HC- Hard coral, SC-soft coral, RKC- recently killed coral, NIA- nutrient indicator algae, SP-sponge, RC-rock, RB- rubble, SD- sand, SL-silt, OT-other]

4.1.4 Impacts

The Reefs at Risk analysis reports that all the reefs around Barbados are threatened by human activities (Burke and Maidens, 2003). This is evident as the reef adjacent to the reserve shows coral damage from human impacts ranging from boat/anchor damage, trash and other coral damage (Figure 4.4). There were no recordings of coral damage on Fisherman's Bank Reef. Dottin's and Sandy Lane Bank Reefs which are both popular dive sites have exhibited signs of boat/anchor damage. Other signs of coral damage were observed at Sandy Lane Bank Reef while only trash was observed at Dottin's Bank Reef. Fortunately dynamite and fish nets have not been observed at any of the sites, indicating that the local community respects the park as a no-take fishing reserve.

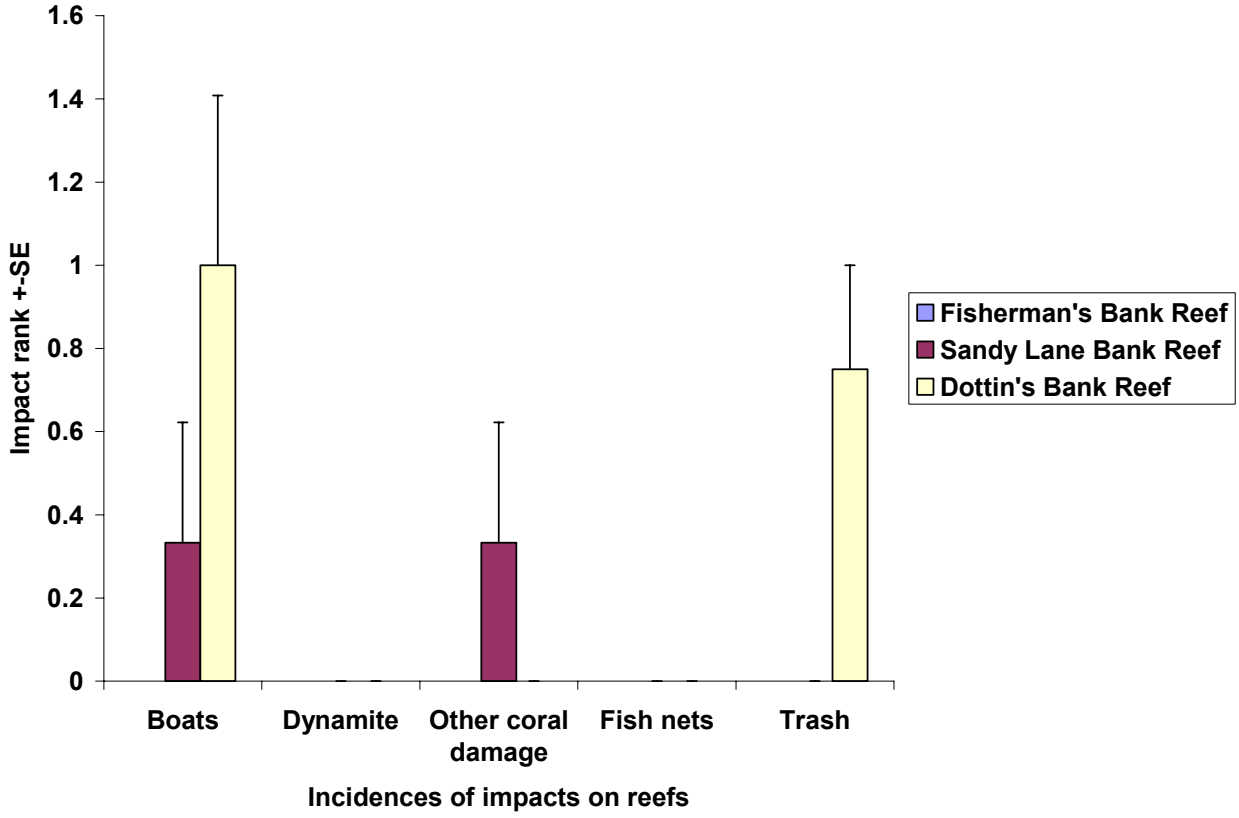

Figure 4.4: Incidences of impacts on bank reefs adjacent to the Folkestone Marine Reserve

4.1.5 Coral bleaching

Coral bleaching impacts were limited to Sandy Lane Bank Reef and Dottins Bank Reef. Some coral populations showed 4% and 6% coral bleaching (Table 4.1). Three percent of the individual coral colonies exhibited bleaching at Dottins Bank Reef and one third (33%) of the individual coral colonies on the Sandy Lane Bank Reef showed some coral bleaching (Table 4.2). There were no signs of bleaching at Fisherman's Bank Reef. Most of the bleaching that occurred on the two bank reefs is residual bleaching from the regional mass bleaching event occurring during 2005-2006. This event affected all reef habitats on the sheltered west coast and exposed southwest coast of the island where an average of 70.6% of all colonies were bleaching (Oxenford *et al*., 2008). Coral diseases were not observed on any of the bank reefs.

Table 4.1: Estimated percentage of coral population affected by bleaching

	% of coral population affected by bleaching	% of coral population not affected by bleaching
Fisherman's Bank Reef	0	100
Sandy Lane Bank Reef	4	96
Dottins Bank Reef	6	94

Table 4.2: Estimated percentage of coral colony affected by bleaching

	% of individual coral colony affected by bleaching	% of individual coral colony not affected by bleaching
Fisherman's Bank Reef	0	100
Sandy Lane Bank Reef	33	67
Dottins Bank Reef	3	97

4.2 Fringing reefs

4.2.1 Fish counts

The fringing reefs had a wide diversity of fish species. Six of the seven indicator fish species were found on each reef. The highest overall density of indicator fish species were seen at North Bellairs Fringing reef. Figure 4.5 illustrates the mean abundance of indicator fish species found on the fringing reefs of the marine reserve. On average the Haemulidae family were observed as the most abundant species on the fringing reefs and was most common on the North Bellairs reef. Parrotfish were the second most abundant invertebrate across all three reefs. While butterflyfish, snappers and moray eels were found on the Bellairs Reefs, they were not present on the Sandy Lane reef. Groupers were not observed on any of the fringing reefs.

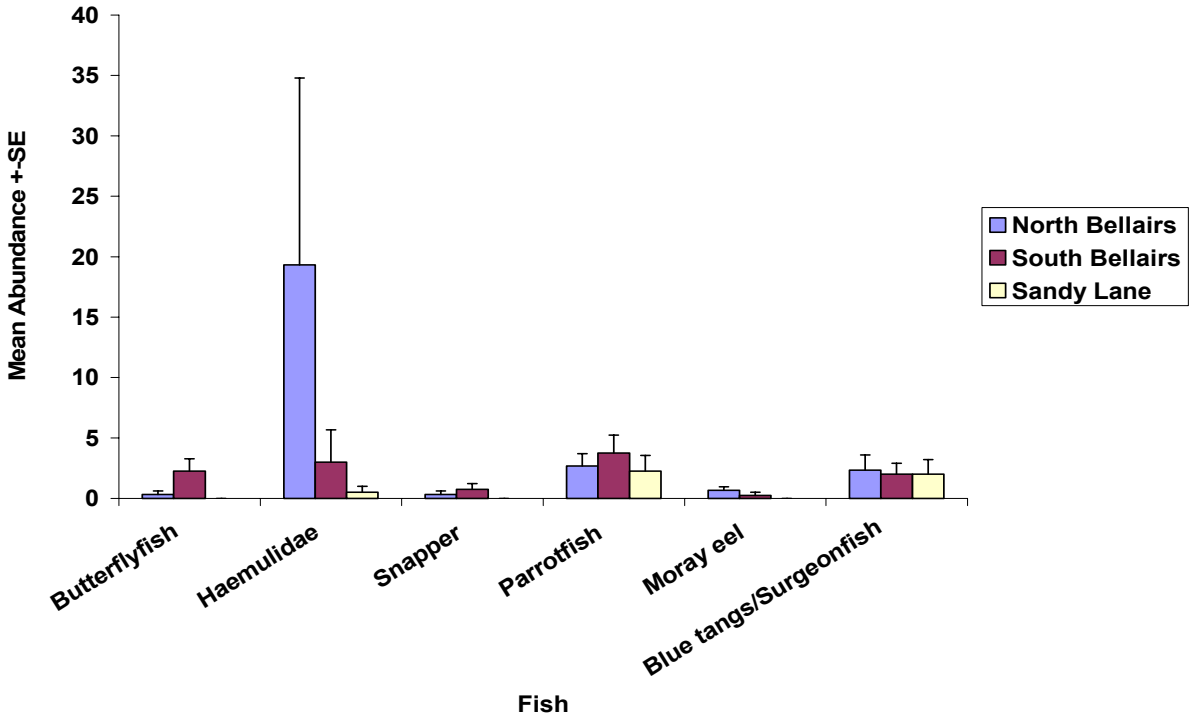

Figure 4.5: Mean fish abundance for fringing reefs adjacent to Folkestone Marine Reserve

4.2.2 Invertebrates counts

Only three invertebrate species were found on the fringing reefs. Diadema were observed as the most abundant invertebrate on the fringing reef with the highest overall density of Diadema seen at South Bellairs Fringing reef. However it was not found on the Sandy Lane Fringing Reef. Like on the bank reefs, Gorgonians were prevalent on all the fringing reefs but were most common on the South Bellairs Reef. Pencil urchins were also observed at the North Bellairs and Sandy Lane Reef. All other invertebrate species such as flamingo tongue, lobsters, banded coral shrimp and sea eggs were either not seen or were in limited densities on the fringing reefs.

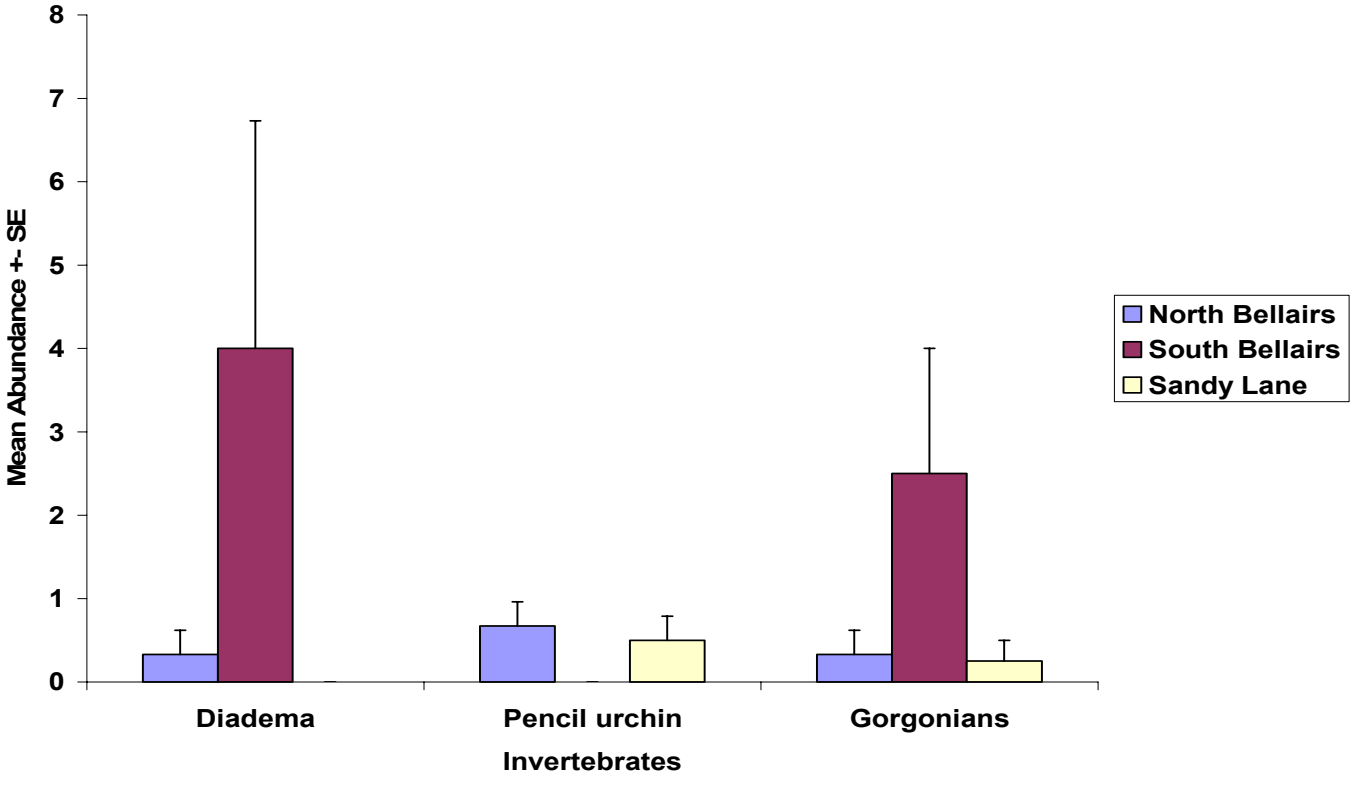

Figure 4.6: Mean invertebrate abundance for fringing reefs adjacent to Folkestone Marine Reserve

4.2.3 Substrate type

The major substrate composition of the surveyed reef sites is predominantly rock. At North Bellairs Reef, most of the substrate was rock (46.67%) at South Bellairs (50%) of the substrate was rock while at Sandy Lane (48.75%) was nutrient indicator algae; (Figure 4.7). The high level of algae found on the Sandy Lane Fringing Reef may be attributed to many factors such as the weather conditions as this survey was conducted during the hurricane season unlike the other fringing reefs and it may also be due to increase sediment load from the construction of the boardwalk along Holetown's beaches

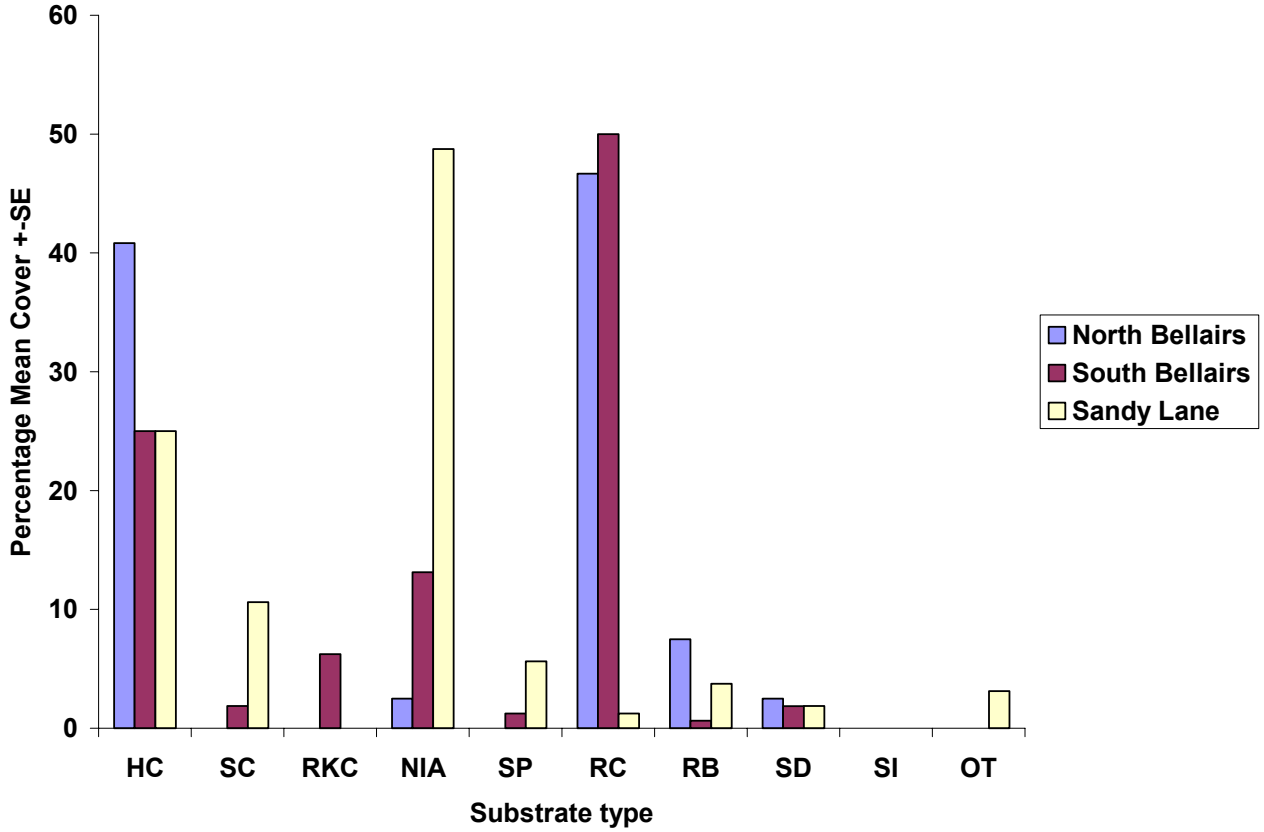

Figure 4.7: Mean percentage cover of substrate for the fringing reefs
[HC- Hard coral, SC-soft coral, RKC- recently killed coral, NIA- nutrient indicator algae, SP-sponge, RC-rock, RB- rubble, SD- sand, SL-silt, OT-other]

4.2.4 Impacts

Coral damage on the fringing reefs included boat damage, trash and other types of damage (Figure 4.8). Most of the coral damage is attributed to other coral damage activities which were not listed. Boat damage occurred on the North Bellairs and Sandy Lane Reef. South Bellairs Reef was the only site where trash was observed on the reef. Fortunately dynamite and fish nets have not been observed at any of the sites.

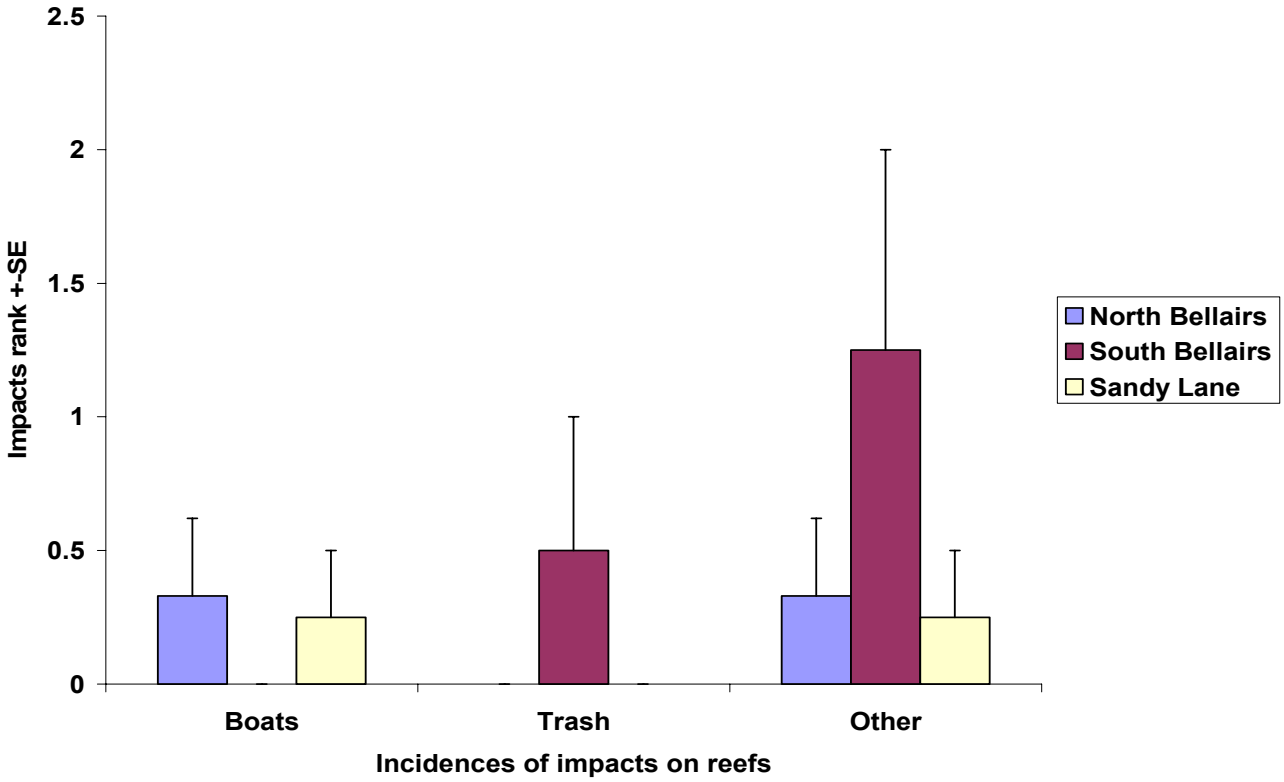

Figure 4.8: Incidences of impacts on fringing reefs adjacent to the Folkestone Marine Reserve

4.2.5 Coral bleaching

Coral bleaching was considered to be low at the fringing reef sites (Table 4.3 and 4.4). While coral bleaching impacts were minor, they were limited to North and South Bellairs Reefs with the South Bellairs reefs exhibiting more bleaching.

Incidences of disease on the reefs are extremely low to non-existent. At South Bellairs Fringing Reef, 2.75% of the corals exhibited coral disease (Table 4.5). The type of disease is unknown. However a report by Hoetjes *et al*.,2001 indicated the Dark Spot disease was most abundant on the Bellairs reefs during the 2001 period and so there is a possibility that this same disease could be affecting some coral colonies of the South Bellairs Reef.

Table 4.3: Estimated percentage of coral population affected by bleaching on the fringing reef

	% of coral population affected by bleaching	% of coral population not affected by bleaching
North Bellairs Fringing Reef	0.03	99.97
South Bellairs Fringing Reef	1.75	98.25
Sandy Lane Fringing Reef	0	100

Table 4.4: Estimated percentage of coral colony affected by bleaching on the fringing reef

	% of coral colony affected by bleaching	% of coral colony not affected by bleaching
North Bellairs Fringing Reef	0.08	99.91
South Bellairs Fringing Reef	5	95
Sandy Lane Fringing Reef	0	100

Table 4.5: Estimated percentage of coral affected by coral disease on the fringing reef

	% of coral affected by coral disease	% of coral not affected by coral disease
North Bellairs Fringing Reef	0	100
South Bellairs Fringing Reef	2.75	97.25
Sandy Lane Fringing Reef	0	100

5 CONCLUSION

This paper illustrates that the reefs in the reserve are in a fairly good condition. There a wide variety of coral and fish species found across the bank and fringing reefs of the Folkestone Marine Reserve. Most of the most substrate composition for the bank reefs is hard coral cover while on the fringing reefs the majority of cover is coral rock and, in some instances hard coral species. Anthropogenic activities continue to have a negative impact on coral reefs along this heavily populated section of the West coast, resulting in some boat and anchor damage and trash on the reefs. There are still a few signs of residual coral bleaching from the mass coral bleaching event in 2005-2006; however incidences of disease on the reefs are very low with signs of disease being found only on the South Bellairs Reef. These are issues that should be continually addressed by the Folkestone Park Marine Reserve through educating stakeholders, public education using various media and implementing monitoring programmes, and informing scientists of any new signs of bleaching or disease.

The Reef Watchers programme is the beginning of a solution to protect reefs within the Folkestone Marine Reserve. However from the baseline survey of the programme, a number of lessons learnt have evolved. Community involvement in coral reef monitoring can support the capacity of reserve management if reserve management lacks both financial and human resources. Community involvement can be considered a cost-effective way of basic reef monitoring as it uses volunteerism and sponsorship instead of a paid programme. Community-based monitoring is also a form of promoting ecotourism, as tourists have actively assisted local divers in the survey. For the community, participating in such a programme empowers the volunteers as they realise that they are making a difference.

Continuous training of volunteers is important for such a programme. Conducting annual workshops will train new volunteers and help retrain past volunteers and allow persons to share and discuss problems experienced using the protocol. Also, volunteers need to have access to resources (e.g. videos, charts, books) to assist with the dive protocols and accurately identifying species. However, funding is required to provide training and resources to ensure that the programme is sustainable in the long term.

Data should be collected in a timely manner. Data collected should be accurate and conducted during similar weather conditions and at the same time of the year, as this can impact on the quality of the data. Volunteers should practice the methodology in the water before conducting the official survey. The methodology can be revised if needed in order to make surveying easier underwater. Also, each team of divers should not consist of only novice divers, as they will focus on diving and not data collection; a good mix of novice and seasoned divers is always better for survey work. Volunteers should ensure to collect all of the data for each transect, and to survey a total of four transects per reef site. Problems with

insufficient data have been encountered during the baseline surveys, so it is important to impress upon the volunteers that they must take the time to fill in the forms correctly, both before going in the sea, and while surveying the reef sites.

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7 APPENDICES

7.1 Appendix 1: Data sheets

7.1.1 Site description sheet

Site name: _____

BASIC INFORMATION

Country: _____ Parish: _____ City/town: _____

Date: _____ Time: Start of survey: _____ End of survey: _____

Latitude (deg. min. sec): _____ Longitude (deg. min. sec): _____

From chart or by GPS? (If GPS, indicate units): Chart: _____ GPS: _____ GPS units: _____

Orientation of transect: N-S: _____ E-W: _____ NE-SW: _____ SE-NW: _____

Temperature (°C): Air: _____ surface: _____ at 3m: _____ at 10m: _____

Distance from shore (m): _____ from nearest river (km): _____

River mouth width: <10 m _____ 11-50 m _____

Distance to nearest population center (km): _____ Population size (x1000): _____

Weather: sunny: _____ cloudy: _____ raining: _____

Visibility (m) : _____

Why was this site selected: _____ Is this best reef in the area? Yes: _____ No : _____

IMPACTS:

Is this site sheltered?: Always: _____ Sometimes: _____ Exposed: _____

Major coral damaging storms: Yes: _____ No: _____ If yes, when was last storm: _____

Overall anthropogenic impact: None: _____ Low: _____ Med: _____ High: _____

Is siltation a problem: Never: _____ Occasionally: _____ Often: _____ Always: _____

Aquarium fishing: None: _____ Low: _____ Med: _____ High: _____

Harvest inverts for food: None: _____ Low: _____ Med: _____ High: _____

Harvest inverts for curio sales: None: _____ Low: _____ Med: _____ High: _____

Tourist diving/snorkeling: None: _____ Low: _____ Med: _____ High: _____

Sewage pollution (outfall or boat): None: _____ Low: _____ Med: _____ High: _____

Industrial pollution	None:		Low:		Med:		High:	
Commercial fishing (fish caught to sell for food)	None:		Low:		Med:		High:	
Live food fish trade	None:		Low:		Med:		High:	
Artisinal/recreational (personal consumption)	None:		Low:		Med:		High:	
How many yachts are typically present within 1km of this site	None:		Few (1-2):		Med (3-5):		Many (>5):	

Other impacts: _____

PROTECTION:

Any protection (legal or other) at this site?	Yes:		No:		If yes, answer questions below			
Is protection enforced	Yes:		No:					
What is the level of poaching in protected area?	None:		Low:		Med:		High	

Check which activities are banned:	Spearfishing	
	Commercial fishing	
	Recreational fishing	
	Invertebrate or shell collecting	
	Anchoring	
	Diving	
	Other (please specify)	

Other comments: _____

TEAM INFORMATION

Submitted by:		
	Team Leader:	
	Team Scientist:	
	Team Members:	

7.1.2 Fish data sheet

Site Name: _____ Island: _____

Depth: _____ Team Leader: _____

Date: _____ Time: _____

Fish

Data recorded by:

	T1	T2	T3	T4
	0-20m	20-40m	40-60m	60-80m
Butterflyfish (Chaetodontidae)				
Grunts/Margates (Haemulidae)				
Snapper (Lutjanidae)				
Parrotfish (Scaridae)				
Moray Eel				
Blue tangs/Surgeonfish				
Groupers/coneys/hinds				
Rare animals sighted (type/#)				

Comments:

7.1.3 Invertebrate data sheet

Site Name: _____		Island: _____		
Depth: _____		Team Leader: _____		
Date: _____		Time: _____		
Data recorded by:				
	T1	T2	T3	T4
Invertebrates	0-20m	20-40m	40-60m	60-80m
Banded coral shrimp (*Stenopus hispidus*)				
Diadema urchins				
Pencil urchin (*Eucidaris* spp.)				
Sea egg (*Tripneustes* sp.)				
Flamingo tongue (*Cyphoma gibbosum*)				
Gorgonian (sea fan, sea whip)				
Lobster (Palinuridae)				
Impacts: Coral Disease/ Bleaching/Trash/Other	*0 = none, 1 = low, 2 = medium and 3 = high*			
	0-20m	20-40m	40-60m	60-80m
Coral damage: Boat/Anchor				
Coral damage: Dynamite				
Coral damage: Other				
Trash: Fish nets				
Trash: General				
Bleaching (% of coral population)				
Bleaching (% of colony)				
Coral Disease (% of coral affected if yes)				
Rare animals sighted (type/#)				
Comments:				

7.1.4 Benthic data sheet

Site name:						**Island:**									
Depth:						**Date:**									
						Data recorded by:									
Time:															

Substrate Code

HC hard coral	**SC** soft coral	**RKC** recently killed coral
NIA nutrient indicator algae	**SP** sponge	**RC** rock
RB rubble	**SD** sand	**SI** silt/clay
OT other		

(For first transect, if start point is 0 m, last point is 19.5 m)

T 1				T 2				T 3				T 4			
0 - 20 m				20 - 40 m				40 - 60 m				60 - 80 m			
0		10		20		30		40		50		60		70	
0.5		10.5		20.5		30.5		40.5		50.5		60.5		70.5	
1		11		21		31		41		51		61		71	
1.5		11.5		21.5		31.5		41.5		51.5		61.5		71.5	
2		12		22		32		42		52		62		72	
2.5		12.5		22.5		32.5		42.5		52.5		62.5		72.5	
3		13		23		33		43		53		63		73	
3.5		13.5		23.5		33.5		43.5		53.5		63.5		73.5	
4		14		24		34		44		54		64		74	
4.5		14.5		24.5		34.5		44.5		54.5		64.5		74.5	
5		15		25		35		45		55		65		75	
5.5		15.5		25.5		35.5		45.5		55.5		65.5		75.5	
6		16		26		36		46		56		66		76	
6.5		16.5		26.5		36.5		46.5		56.5		66.5		76.5	
7		17		27		37		47		57		67		77	
7.5		17.5		27.5		37.5		47.5		57.5		67.5		77.5	
8		18		28		38		48		58		68		78	
8.5		18.5		28.5		38.5		48.5		58.5		68.5		78.5	
9		19		29		39		49		59		69		79	
9.5		19.5		29.5		39.5		49.5		59.5		69.5		79.5	

What percentage of recorded RKC is a result of bleaching?

Comments: