

Speyside Marine Area Community-based Management Project (SMACMP)

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Final Report



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Executive Summary

Tobago's coral reefs are being adversely affected by both natural and anthropogenic factors including overfishing, habitat degradation, land-based pollution stresses and climate change induced events. The addition of nutrients from land-based agricultural runoff and/or untreated sewage discharge are creating situations which promote the growth of phytoplankton and seaweeds (macroalgae), the latter of which can out-compete corals for space and light. The widespread overfishing of reefs has removed many of the herbivorous fish that keep algae in check, upsetting the competitive balance between corals and seaweeds, often leading to a fundamental change in the community. The large-scale bleaching event of 2005 as a result of thermal stress affected 85% of coral colonies around the island with many now exhibiting signs of disease.

The coastal marine ecosystems of Speyside on the northeast end of the island of Tobago (Trinidad & Tobago) despite these threats remain robust and healthy with the Speyside reefs offering some of the best recreational scuba diving opportunities in Tobago and the wider Caribbean. There exists a strong community-managed, tourism-related economic opportunity and incentive for sustainable development of this area. The Speyside Marine Area Community-based Management Project (SMACMP) aimed to seize this opportunity through promotion of effective community-led management and capacity-building initiatives for the Speyside Marine Area.

The SMACMP project objectives were:

1. To facilitate and promote community participation in the review and execution of the Management Plan for Speyside Reefs Marine Park, which will offer an integrated approach to coastal zone management and long-term viable and sustainable community livelihoods for the Speyside community;
2. To build local capacity to support livelihood needs, aspirations and opportunities, through relevant community training scholarship programmes;
3. To enhance community awareness of marine ecology and coastal zone management through a broad range of educational activities, public events and participatory GIS; and
4. To develop a database of the natural resources of the Speyside Marine Area to facilitate local and national management needs.

Over the course of one year, the SMACMP was able to achieve the following:

- All area schools were exposed to marine education through school visits and coordinated field activities.
- Approximately 200 students were touched in some way through the various awareness activities that were implemented and many of them have shown a keen interest in wanting to learn more about the marine environment and are considering the option of having a marine-related career.

- A Coral Reef Education Package was created in collaboration with teachers of the Speyside High School as a resource for delivering marine related content within the Caribbean Examination Council's various science syllabi.
- 9 community members were trained in the 2 week and flexible dive scholarship programmes
- 6 tour guides and 18 students enhanced their knowledge of the area's rich biodiversity
- Approximately 20 individuals, many in the 18-30 year age group, expressed interest in getting more involved in the project's overall objectives.
- Successful partnerships were forged with government departments, and local and national businesses and corporations. These partners generously provided financial and in-kind support that went a long way to ensuring that the awareness and capacity building activities were achieved.

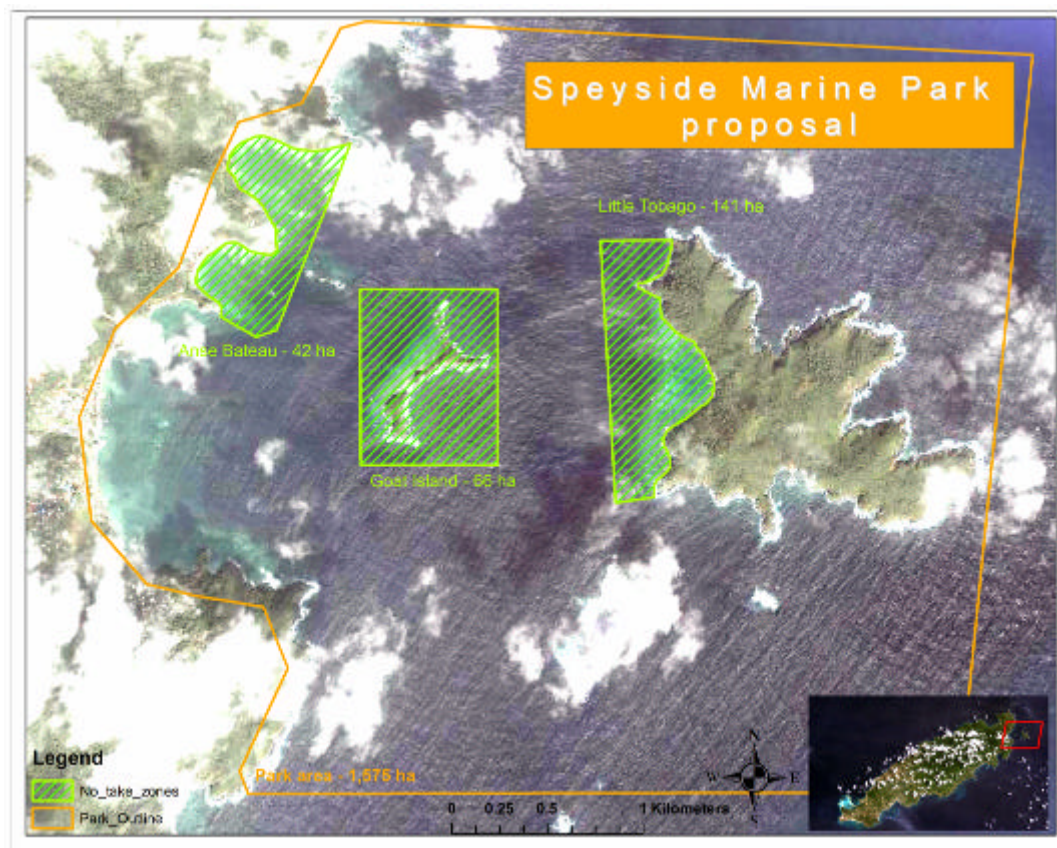
Additionally, a comprehensive database comprising benthic cover, coral cover, reef fish diversity, invertebrate composition, coral disease and associated oceanographic conditions and anthropogenic impacts and activities was developed. Further analysis of this data showed that the Speyside reefs had consistently high conservation management values (CMV) thereby strengthening the case for instituting a management regime for the area. The proposed recommendations, which include identifying a park boundary and no-take zone options, are presented as follows:

- Implement a management plan for a **Speyside Marine Park** that includes:
 - o Regular scientific monitoring along permanent transects within the park
 - o Several reef sites where fishing is restricted in order to encourage a recovery of fish stocks and conserve important coral reef health and biodiversity
 - o Installing a mooring buoy system for the marine park
 - o Implementing a user fee for recreation within the marine park
 - o Banning destructive fishing methods and extraction of endangered species from the park and developing fishing and harvesting guidelines
- Develop and implement a **Speyside Marine Park Authority** who is responsible for the management of the park, including:
 - o Maintaining mooring buoys
 - o Allowing use of the park through non-destructive activities
 - o Organising meetings between stakeholders (dive shops, fishermen, tour boats, THA)
 - o Updating and reporting to the THA and public
 - o Ensuring user derived income is used for the management of the park
- Train and hire several **Marine Park Rangers**, empowered with special policing authority to:
 - o Patrol on a daily basis to ensure rules and regulations are upheld
 - o Issue fines if needed
 - o Educate the public and inform visitors about responsible recreation within the park
 - o Conduct fish catch monitoring
- Establish a **Speyside Marine Park Visitors Centre** to:
 - o Inform tourists
 - o Receive diver and user fees

- o Educate children about their marine environment
- o Run research and monitoring programmes
- o Organise community outreach and education events
- Implement several **replanting schemes** in order to encourage reef rehabilitation and boost local fish and invertebrates stocks
 - o Elkhorn coral (*Acropora Palmata*) replanting
 - o Mangrove replanting
 - o Seagrass planting

A well-managed and protected marine park will produce the following benefits:

- ❖ **Protect** the precious marine environment on which we all rely
- ❖ **Increase tourism** to the area
- ❖ **Provide income** through recreational user fees and boat mooring fees
- ❖ Provide **more employment** to Speyside residents through park rangers, tour guides and boat drivers
- ❖ **Improve fishing**, with bigger and better fish and lobster catches through a well managed (zonal) fishing plan
- ❖ Provide **additional funding** and **external support** for park management and associated initiatives
- ❖ Secure a **vital source of fish and coral** larvae to the rest of Tobago and the Lesser Antilles, acting as a **future lifeline** in the face of climate change.



Conclusion

Healthy coral reefs are an essential part of Speyside's economy and efforts must be made to ensure that reef health is improved. Additionally, time must be spent engaging and

encouraging the community to take ownership and play a leading role in improving and maintaining their natural environment. Resources must be dedicated to support the necessary training and capacity building programmes that would equip the stakeholders with knowledge and technical skills; and empower them to manage their coastal resources sustainably.

The SMACMP started this process and the momentum continues with five individuals who are forming a community based organisation to realise the establishment and management of the Speyside Marine Park.

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The establishment and success of the SMACMP project would not have been possible without: the vision and leadership provided by the Speyside Community, and the Speyside Village Council in particular; the generous hospitality of Pat Turpin and Man-O-War Bay Cottages; and the guidance, encouragement and generous support provided by the following project partners and supporters (listed in alphabetical order):

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1 Introduction

The World Resources Institute in *Reefs at Risk in the Caribbean* (Burke *et al.*, 2008) identified that two thirds of the Caribbean's coral reefs are at high risk from anthropogenic threats such as sedimentation from deforestation, coastal development, dredging, pollution from agricultural and industrial development, untreated wastewater discharge, fishing related activities and climate change.

Threats to reef health in Tobago caused by both natural and anthropogenic factors include overfishing, habitat degradation, land-based pollution stresses and climate change induced events. The impact of natural threats has been illustrated most recently with the destructive force of Hurricane Ivan, which caused considerable damage to coastal areas and the shallow marine environment in 2004. A major climate change induced event that has significantly affected the coral reefs around Tobago was the large-scale bleaching event of 2005. In this event approximately 85% of coral colonies around the island lost their symbiotic algae (zooxanthellae) due to thermal stress (O'Farrell and Day, 2006). The absence of zooxanthellae caused the colonies to appear white. The zooxanthellae are photosynthetic and provide the bulk of the coral's nutrition. If a coral colony is not able to regain its population of symbiotic algae, it will energetically starve and eventually die. Most of Tobago's bleached coral colonies recovered but many exhibited signs of disease. Disease outbreaks and subsequent mortality among corals and other reef organisms have been a major cause of the recent increase in coral reef degradation (Buddemeier *et al.*, 2004) and coral disease frequency has been linked to thermal stress (Bruno *et al.*, 2007). There is a lack of knowledge about the causative agents of many diseases affecting corals but studies have shown that microbial pathogens are a potential source that have been linked to sewage and agricultural outputs (Voss *et al.*, 2006, Smith *et al.*, 1996) providing strong evidence for the effectiveness of proper waste management schemes in order to minimise disease impacts on coral reefs.

Other anthropogenic threats to Tobago's reefs include the addition of nutrients from land-based agricultural runoff and/or untreated sewage discharge that create a situation which promotes the growth of phytoplankton and seaweeds (macroalgae), the latter of which can out-compete corals for space and light. High levels of sediment from land-based sources such as vegetation removal and coastal construction are also of major concern for Tobago's reefs.

The unsustainable fishing or collection of marine resources, and with them, the ecosystem functions they perform, is a global problem with a long history of impacts across the entire marine ecosystem (Jackson *et al.*, 2001). In parts of the Caribbean, widespread overfishing of reefs has removed many of the herbivorous fish that keep algae in check, upsetting the competitive balance between corals and seaweeds, often leading to a fundamental change in the community. Consequently, management of fish stocks is a key component in preventing phase shifts and managing reef resilience (Hughes *et al.*, 2007).

Local stewardship of fisheries, under guidance of management experts, can be an effective means for conservation of reefs and improved local fish stocks. Recommendations, including implementing and enforcing permanent closures, seasonal protection of spawning sites, fishing gear restrictions and catch limits can all guide effective conservation and management of nearshore fisheries.

The coastal marine ecosystems of Speyside on the northeast end of the island of Tobago (Trinidad & Tobago) despite these threats, remain robust and healthy, and offer hope that through continued community-led ‘reef guardianship’, these reefs will not only serve the socio-economic needs of the Speyside community, but also potentially act as an important trans-boundary corridor for reef connectivity and rejuvenation in the eastern Caribbean.

1.1. Project Background

Following the Caribbean-wide coral bleaching event in late 2005, the Buccoo Reef Trust (BRT), Tobago House of Assembly (THA) and Coral Cay Conservation (CCC) undertook a rapid assessment of the extent of this bleaching event on the coral reefs of Tobago. As a result of this highly successful collaboration, in April 2007 BRT, THA and CCC with assistance from UNDP GEF/SGP, began implementation of the Tobago Coastal Ecosystem Mapping Project (TCEMP). This two-year project gathered baseline and monitoring data on the current status of the coral reef, mangrove and seagrass ecosystems of Tobago. This information fed into the Global Environment Facility Integrating Watershed and Coastal Area Management (GEF-IWCAM) project, which is providing the THA with the appropriate monitoring, management and decision-making tools to deliver an enhanced management regime for the marine ecosystem and in particular to support a more integrated approach to coastal zone management. Based on the data collected there is now strong evidence that coral diseases are becoming increasingly prevalent on Tobago’s reefs (van Bochove *et al.*, 2008).

In 2005, the reefs around Speyside were not as severely affected by coral bleaching, suggesting that they are more robust and resilient (O’Farrell *et al.*, 2006). Within the next 20 years, it is predicted that the majority of the Caribbean will experience conditions that currently lead to coral bleaching every two years or more (Wilkinson and Souter, 2008). In preparation for these predicted climate change induced events, Speyside’s reefs with their associated strong currents and limited coastal zone development, may well prove to be the last remaining and thus most important location in Tobago where coral reefs are most robust and thus most tolerant to climate change-induced coral bleaching. Through effective management, the value of Speyside’s reefs in terms of an important trans-boundary corridor for reef larval connectivity for the eastern Caribbean island chain is likely to increase exponentially over the coming years as adverse climate change impacts to Caribbean reefs become ever more severe.

Speyside reefs offer some of the best recreational scuba diving opportunities in Tobago and the wider Caribbean, and thus there exists a strong community-managed tourism-related economic opportunity and incentive for sustainable development of this area. Despite the obvious ecological and economic value of the Speyside reefs, there has been little effort to involve the community in effective management of the resources. Increasing pressures from tourism, fishing and coastal developments are rapidly undermining the integrity of the ecosystems. The rising value of fish and shellfish has led to an increase in fishing effort on the Speyside reefs. The lack of adequate infrastructure to treat increasing volumes of waste water, from both residential and commercial buildings, is also a major cause for concern. Recent proposals for large villa developments above Bateaux Bay and Starwood Bay, accentuate the need for greater management and conservation.

In addition to these growing threats, there has been little effort to follow-through on many of the studies and consultations that have taken place in the Speyside area and which have

acknowledged many of these concerns. There is a need to facilitate and promote greater community-led management of the resource, and to educate stakeholders about the economic and social benefits that could be derived from effective marine area management.

In 1985, recommendations were made by the THA to have the Speyside Marine Area designated a restricted area and subsequently a marine park. The Institute of Marine Affairs (IMA) then formulated a Management Plan for the Speyside Reefs Marine Park in 2002 (IMA, 2002), but this plan has not been implemented to date. The North East Tobago Management Plan (NETMP) produced for the THA in 2003, also acknowledged conservation of the marine ecosystems of North East Tobago as an essential part of the long-term economic development strategy for the area, and necessary for ensuring the sustainability of the diverse marine communities of living organisms, that together protect the shore, provide livelihoods for fishermen and create spectacles for divers and other tourists (Kaira Consultants, 2003). The Plan also identified the absence of baseline data as a key environmental management issue that needed to be addressed if management was to be effective and sustainable.



Figure 1 Map of Speyside (taken from North East Tobago Management Plan).

1.2 Objectives

The overall objectives of the SMACMP addressed key environmental management issues identified in the NETMP. They also complemented the overall aims of the NETMP's development strategy, which are to enable the communities to achieve a better quality of life through expansion of economic opportunity while ensuring that environmental health and sustainability are not compromised and the natural and cultural resources are not endangered. Additionally, the SMACMP aimed to promote the adoption and implementation of some of the recommendations presented in the Management Plan developed by the IMA.

The SMACMP project objectives were:

1. To facilitate and promote community participation in the review and execution of the Management Plan for Speyside Reefs Marine Park, which will offer an integrated

approach to coastal zone management and long-term viable and sustainable community livelihoods for the Speyside community;

2. To build local capacity to support livelihood needs, aspirations and opportunities, through relevant community training scholarship programmes;
3. To enhance community awareness of marine ecology and coastal zone management through a broad range of educational activities, public events and participatory GIS; and
4. To develop a database of the natural resources of the Speyside Marine Area to facilitate local and national management needs.

2. Accomplishing Project Objectives

The following sections highlight how the project objectives were achieved:

2.1 *Facilitating community participation*

Speyside is a small, close-knit community whose warmth and friendliness envelopes all who venture into their space. The people are unassuming, genuine, astute and very conscious of their surroundings. At the beginning, the project concept was presented to the village council who extended a warm welcome to the project implementers and pledged their support for the project. The SMACMP was officially launched in December 2008, but the community did not readily embrace the project. Many likened the project to previous initiatives which consulted the community on protecting their marine space but failed to follow up and realise any concrete results.

The Buccoo Reef Trust and Coral Cay Conservation therefore had to set about forging relationships and building community confidence in the two organisations and the project as a whole. A project board, comprising members from various sectors in the community, was established to guide project implementation and ensure the proposed activities were meeting the community's needs and the project's objectives. Board meetings were conducted on a monthly basis and more frequently as needed to plan events. A fun day was initiated shortly after the launch, which allowed the community to tour the marine area via glass-bottom boats and engage in marine oriented games and a beach clean up exercise. Midway through the project approximately 50 community members (adults and children) led an awareness march through the streets of Speyside expressing the sentiments of and soliciting support for the protection of the marine environment under the theme "With care and pride, we protect the reefs of Speyside!"

2.2 *Building local capacity to support livelihood needs*

The Speyside marine area offers some of the best recreational diving in Tobago and has great potential to support the socioeconomic needs of the community. To ensure that the community was equipped to capitalise on these potential opportunities, the project implementers carried out the following initiatives:

CCC Scholarship Programme

Three main types of scholarships were offered to community members, Tobago residents and nationals of Trinidad and Tobago.

- Coastal Zone Management Workshop (CZM): A one-day course in which participants were trained in snorkelling, identification of reef invertebrates, major fish and coral groups; as well as discussed coral reef ecology, threats to the marine environment and potential management options through a series of lectures and case studies.
- Reef Check Scuba Award: A two-week award in which participants were certified to PADI Advanced Open Water Diver, trained in the identification of target marine life forms and trained in Reef Check survey techniques.
- Reef Conservation Scuba Award: An intensive four-weeks in which participants were certified to PADI Advanced Open Water Diver, trained in the identification of over

300 marine life forms and in the methods for scientific surveying of coral reef ecosystems.

Under the project 15 Reef Conservation Scholars, 7 Reef Check Scholars and 27 Coastal Zone Management Scholars were trained (Table 1). Approximately one quarter of the scholars came from the Speyside/Charlotteville area, and the rest from Trinidad and other parts of Tobago. See Appendix I for a list of scholars.

Table 1 Summary of CCC Scholarship Programmes as part of the SMACMP

Scholarship	Duration	PADI SCUBA Training	Science and surveying	Participants
Costal Zone Management Workshop (CZM)	1 Day	Introduction to Snorkelling	Identification: reef invertebrates, major fish and coral groups Discussion: reef ecology, threats and potential management of options	27
Reef Check Scuba Award	2 Weeks	PADI Advanced Open Water	Reef Check certification (Identification of marine life and surveying techniques)	7
Reef Conservation Scuba Award	4 Weeks		Reef Check certification Identification: over 300 marine life forms Scientific surveying of coral reef	15

Although the scholarship programme was able to successfully benefit a number of Trinidad and Tobago nationals, it was not flexible enough to accommodate Speyside/Charlotteville residents. As a result a pilot “Flexible” scholarship programme was developed, which allowed scholars to complete the equivalent of two weeks of training at times of their convenience over an unlimited period of time. Five community members benefited from this scholarship programme and successfully completed their PADI Open Water certifications.

Biodiversity workshops with tour guides and students

The Speyside environment has a rich diversity of terrestrial and marine fauna and flora. The Speyside community is nestled at the foothills of the Main Ridge Forest Reserve, the oldest forest reserve in the western hemisphere. The offshore island of Little Tobago, a well known bird sanctuary, lies within the Speyside Marine Area. Following consultations with community members involved in tour guiding and the UNESCO Club located in the Speyside High School, the SMACMP project worked alongside the Tobago House of Assembly’s Department of Natural Resources and the Environment to develop and implement a biodiversity workshop. This workshop introduced participants to the biodiversity laws of Trinidad and Tobago, identification of the flora and fauna of the area and incorporated a field trip to allow participants to fully appreciate nature’s biodiversity. A total of 6 tour guides and 18 students benefited from this training, whose overall aim was to provide information that would enhance the tours given by the participants and support the development of a Speyside biodiversity guide that the UNESCO club members were interested in creating.

Water quality and coastal monitoring training

The project area is surrounded by fringing and contiguous reefs; however, it is located on the eastern-most end of Tobago and thus subject to violent tropical storms whose high winds and heavy rainfall can cause considerable erosion and destruction to hillsides and coastal areas. Coupled with ubiquitous hillside development and a now deforested wetland, the reefs surrounding Speyside are subject to heavy sedimentation. Further, the lack of an efficient sewerage treatment system in the area has resulted in the frequent practise of household waste water and agricultural wastes draining directly into the main waterways feeding into the sea, and by extension onto Speyside's reefs.

For these reasons the project facilitated the development of a relationship with the Department of Natural Resources and the Environment (DNRE) who will train members of a local environmental group, the UNESCO Club and Speyside High School students to monitor changes in the coastline and water quality entering the sea. The data that is collected would contribute to the national coastline monitoring project and "ridge to reef" environmental management policy.

Reef Check

Reef Check is a global coral reef monitoring programme that was developed to rapidly assess the health of coral reefs using simple, easily identifiable marine species as indicators. The Coastal and Marine Management and Education in the South Eastern Caribbean project run by the Buccoo Reef Trust facilitated a Reef Check EcoDiver Training and Coral Reef Monitoring programme for staff of the Tobago House of Assembly's Department of Marine Resources and Fisheries and local dive operators. The Reef Check EcoDiver Training was specifically designed to teach participants to train clients and interested persons to conduct the Reef Check monitoring protocol. The Coral Reef Monitoring programme allowed participants to establish a long term monitoring programme for Tobago. The added benefit of this training to the local dive operators was that they were provided with an additional package that they could offer to interested clients while actively contributing to the management of their marine environment. One operator from the Speyside area and CCC's project scientist were able to participate in this training and CCC, by extension, were able to train the scholars in carrying out this valuable monitoring technique.

2.3 *Creating community awareness*

A key aspect of the SMACMP was increasing community awareness and knowledge of the marine environment in general. Many different mechanisms and all available fora e.g. school and community events were used to impart information to all levels within the community. Some of the initiatives that were executed include:

- A Speyside Awareness Week, which was developed around the theme “With care and pride, protect the reefs of Speyside”. The week incorporated an art competition in which all area schools participated; a beach and underwater clean-up that resulted in four bin bags of rubbish and a substantial number of boat parts; marine-based lectures, and a family fun day
- Marine science lectures which were delivered during the evenings at the Speyside community centre and to guests staying at local hotels and regular visits were made to area schools where general marine information was presented in innovative ways e.g. puppet show
- A four-day Sea, Sun and Science: A Marine Science Experience program which was held over the Easter vacation for high school students living within the project area. Approximately eighteen teenagers were exposed to the marine sciences through snorkelling, field trips to the Speyside and Buccoo Reefs, and lectures covering fish anatomy, coral reef ecology and aquaculture. As a follow up, seven of these students were able to participate in a two week version of the programme held at the BRT offices in July
- The Summer Science Seminar was a day camp run by CCC during July and August for children aged 5-12 years. Children had fun learning about and interacting with the marine environment through swimming, snorkelling and marine organism identification
- A Coral Reef Education Package was created in collaboration with teachers of the Speyside High School as a resource for delivering marine related content within the Caribbean Examination Council’s various science syllabi.



Figure 2 An impression of community activities undertaken as part of SMACMP

2.4 *Develop a database of Speyside's natural resources*

Prior to the start of the project there was limited data on the marine composition of the Speyside marine area. As such, CCC conducted a quantitative baseline survey of the marine area using a technique that was designed to provide a comprehensive assessment of shallow coastal ecosystems quickly and effectively. The map below shows the areas within the Speyside Marine area that were surveyed during the project.

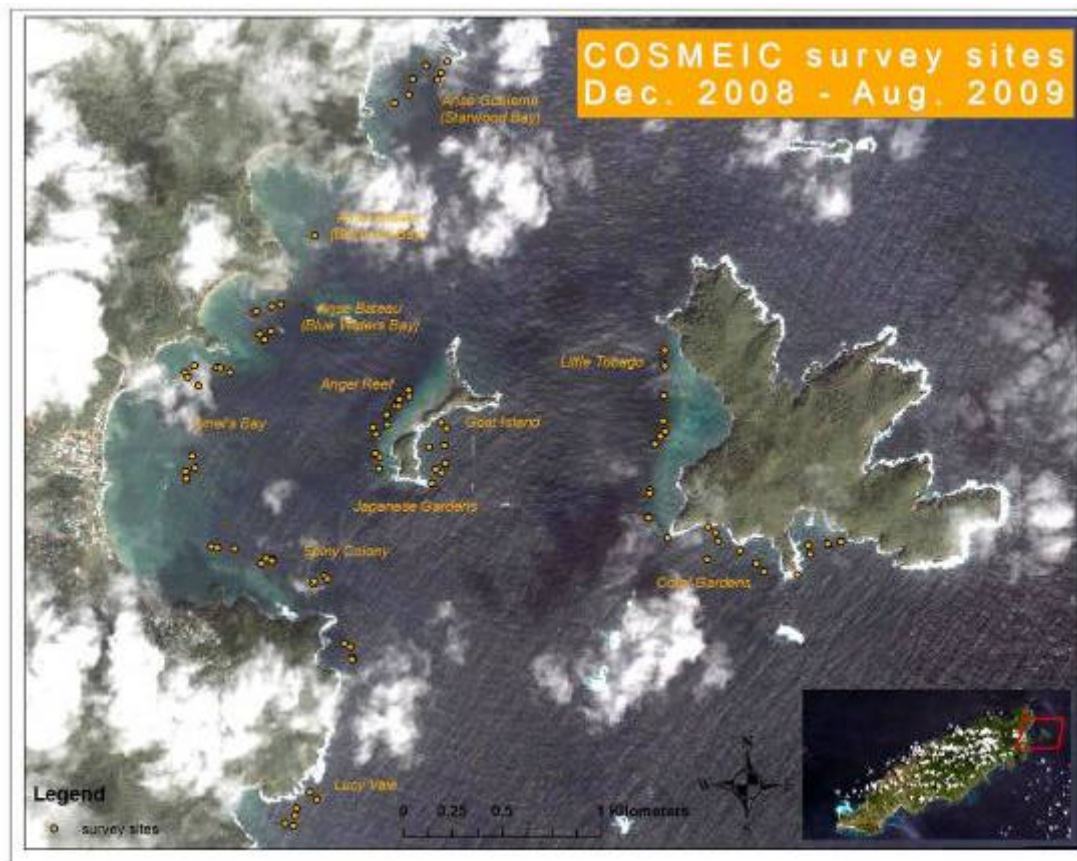


Figure 3 Baseline survey locations at 7 and 12 metres depth (orange dots), conducted around Speyside between December 2008 and August 2009. Inset – Tobago Island with the Speyside area highlighted in red.

By August 2009, a comprehensive database comprising benthic cover, coral cover, reef fish diversity, invertebrate composition, coral disease and associated oceanographic conditions and anthropogenic impacts and activities was developed. All data collected was geo-referenced using handheld GPS units allowing for the creation of distribution maps seen below i.e. Figures 4-7.

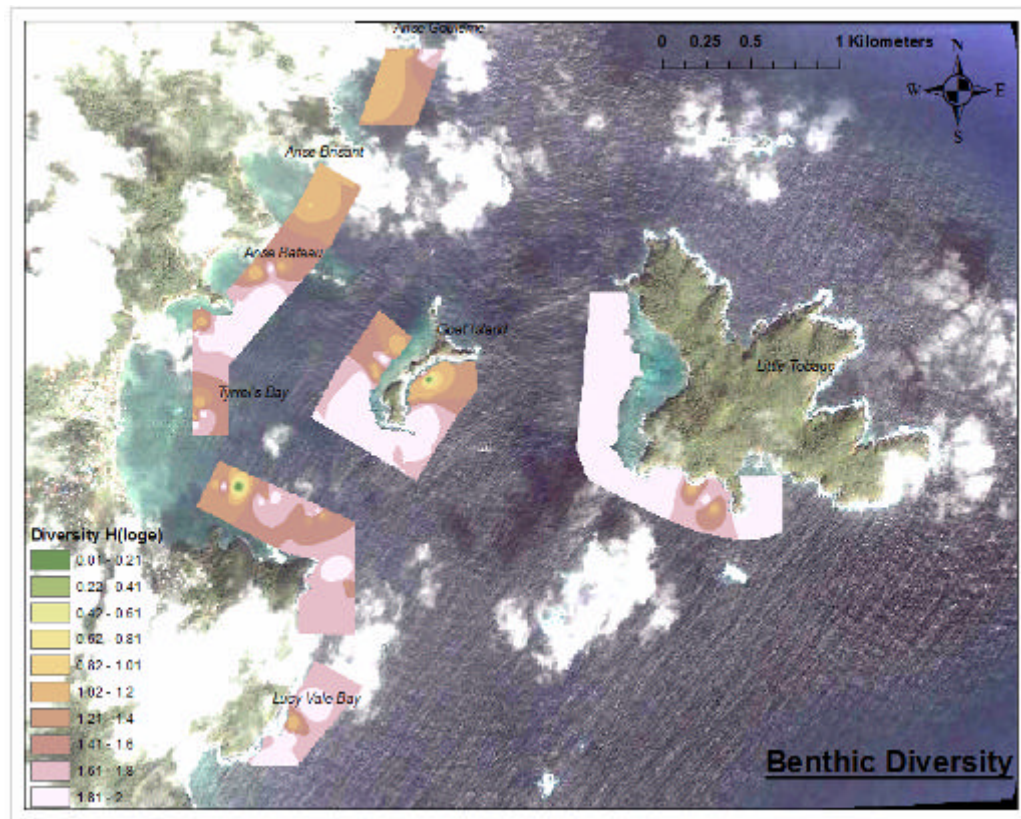


Figure 4 Contour map of the diversity of benthic species (Shannon diversity index (H)) for the fringing reefs surveyed around Speyside. Excludes macro-algae species.

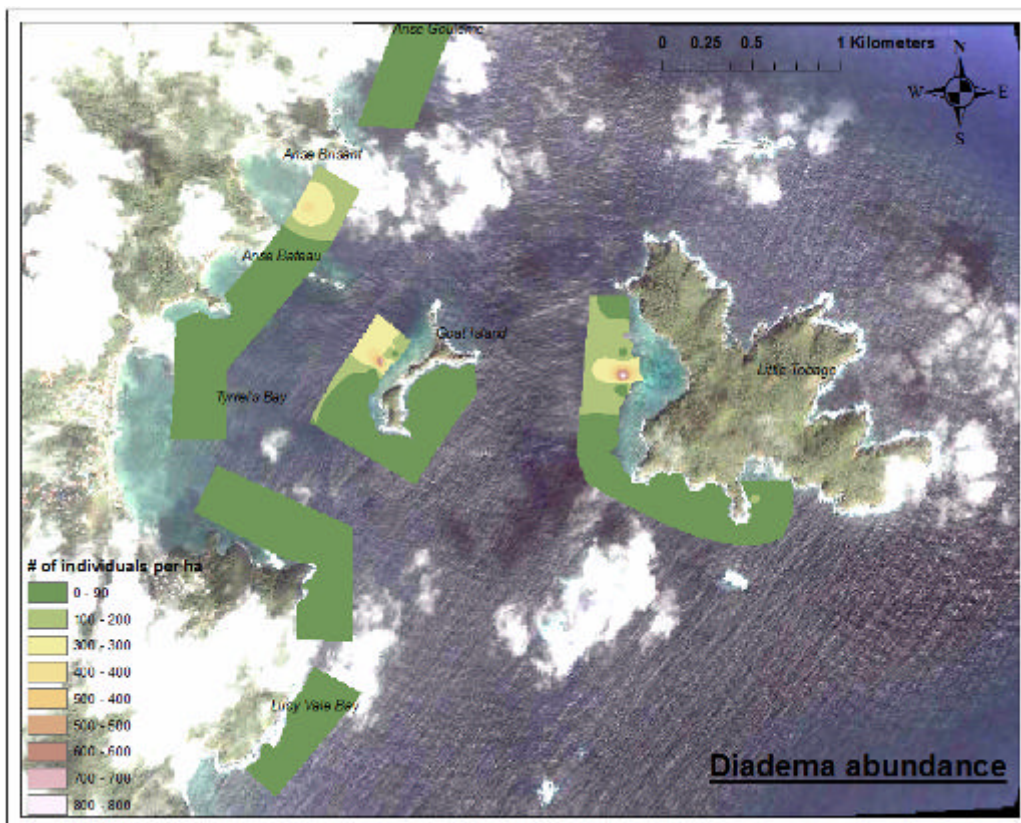


Figure 5 Colour contour map of the abundance of *diadema* sea urchins (individuals/ha) for the fringing reefs surveyed around Speyside.

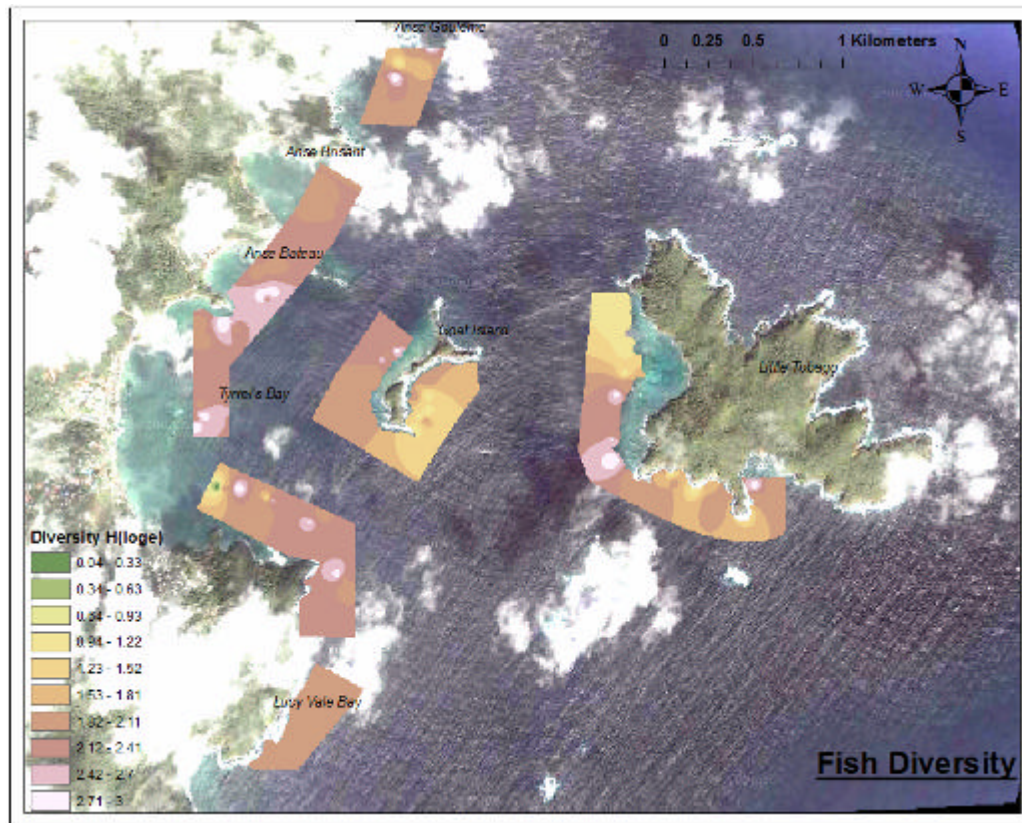


Figure 6 Contour map of the diversity of fish species (Shannon diversity index (H)) for the fringing reefs surveyed around Speyside.

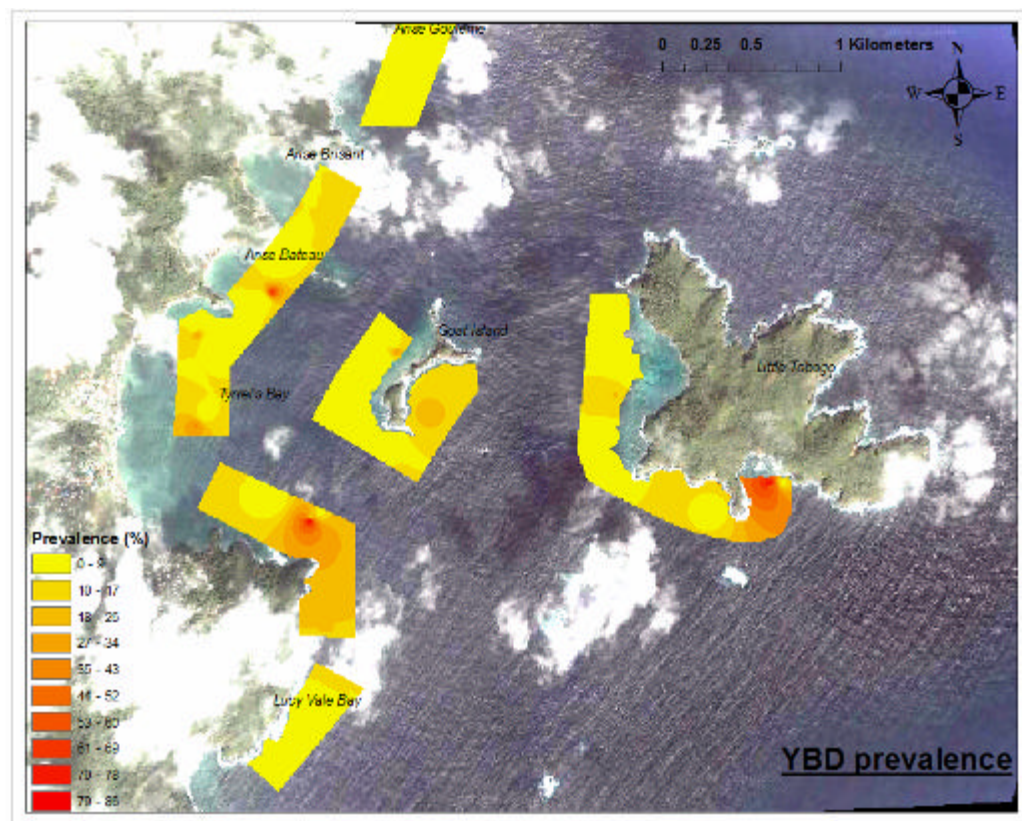


Figure 7 Colour contour map of the prevalence of yellow band disease for the fringing reefs surveyed around Speyside. Prevalence is given as a percentage of *Montastrea* spp. colonies infected.

The data was further analysed to determine Conservation Management Value (CMV) for the Speyside area. The CMV is the ecological value of each survey site relative to the other sites within a geographic region.

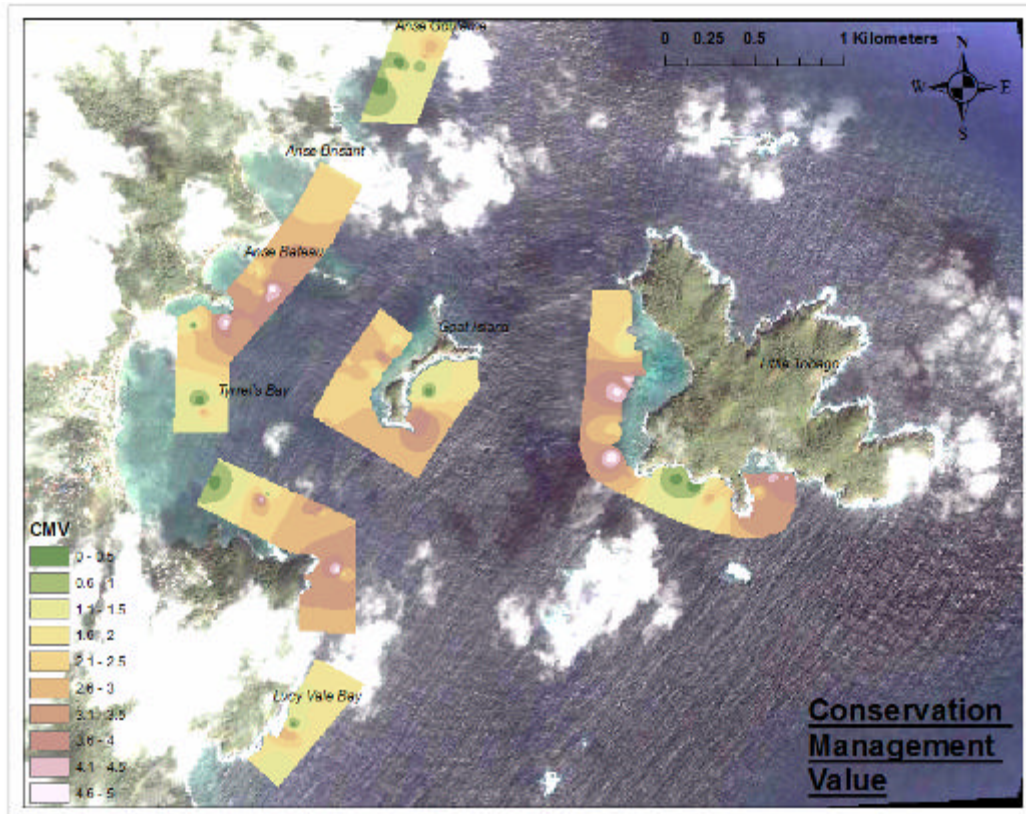


Figure 8 Conservation Management Values for coral reef habitats for the fringing reefs surveyed around Speyside.

The map above shows that high Conservation Management Values were found throughout the Speyside region. Consistently high values were found along the fringing reef on the western side of Little Tobago, and north and south of Tyrrel's Bay and Anse Bateau.

The complete scientific report for the Speyside marine area can be found in Appendix II.

3. Achievements

The SMACMP made giant strides in achieving the overall objectives of the project. All area schools were exposed to marine education through school visits and coordinated activities. Approximately 200 students were touched in some way through the various awareness activities that were implemented. Many of them have shown a keen interest in wanting to learn more about the marine environment and are considering the option of having a marine-related career.

The impact of the project on the adult community was more difficult to assess because of their reserved participation in project activities. However, verbal communication suggested that all were aware of the project and what it aimed to achieve. Further confirmation of this was received through a targeted walk around which was done over the course of three days with the assistance of a local community activist and avid supporter of the project. Approximately 20 individuals, many in the 18-30 year age group, expressed interest in getting more involved in the project's overall objectives.

BRT and CCC were able to forge successful partnerships with government departments and local and national businesses and corporations. These partners generously provided financial and in-kind support that went a long way to ensuring that the awareness and capacity building activities were achieved.

The scholarship programme was successful in training six persons from Tobago with 5 of those scholars coming from within the project area (Figure 9). An additional five persons from the Speyside community were able to Scuba certified under the "Flexible" scholarship scheme. See Appendix I for the list of scholarship recipients.

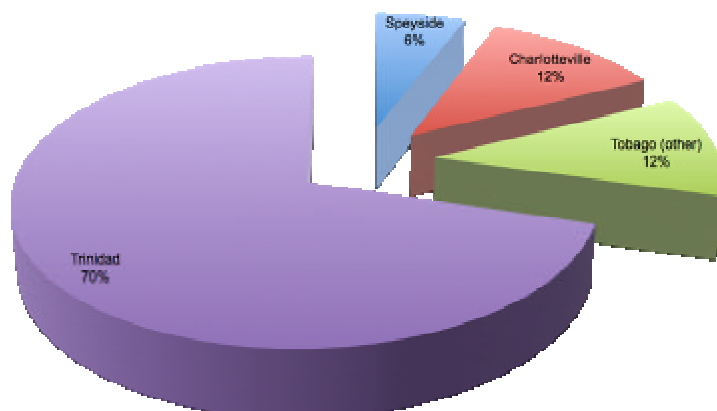


Figure 9 Chart showing the origin of scholarship recipients

The population of the database was a major achievement as the data collection process was almost derailed by unforeseen technical challenges outlined in section 4. The analysis of and subsequent outputs from the database facilitated the generation of initial management recommendations aimed at protecting the Speyside area from many of the local threats, while providing significant benefits to the Speyside community. The recommendations were based loosely on successful implementation of similar initiatives in Bonaire National Park, Dutch Antilles, and include a proposed park boundary and no-take zones (Figure 10). These recommendations are a useful supplement to the management recommendations made by the

Institute of Marine Affairs in their development of a management plan for the Speyside Marine Area in 2004. The recommendations are:

- Implement a management plan for a **Speyside Marine Park** that includes:
 - Regular scientific monitoring along permanent transects within the park
 - Several reef sites where fishing is restricted in order to encourage a recovery of fish stocks and conserve important coral reef health and biodiversity
 - Installing a mooring buoy system for the marine park
 - Implementing a user fee for recreation within the marine park
 - Banning destructive fishing methods and extraction of endangered species from the park and developing fishing and harvesting guidelines
- Develop and implement a **Speyside Marine Park Authority** who is responsible for the management of the park, including:
 - Maintaining mooring buoys
 - Allowing use of the park through non-destructive activities
 - Organising meetings between stakeholders (dive shops, fishermen, tour boats, THA)
 - Updating and reporting to the THA and public
 - Ensuring user derived income is used for the management of the park
- Train and hire several **Marine Park Rangers**, empowered with special policing authority to:
 - Patrol on a daily basis to ensure rules and regulations are upheld
 - Issue fines if needed
 - Educate the public and inform visitors about responsible recreation within the park
 - Conduct fish catch monitoring
- Establish a **Speyside Marine Park Visitors Centre** to:
 - Inform tourists
 - Receive diver and user fees
 - Educate children about their marine environment
 - Run research and monitoring programmes
 - Organise community outreach and education events
- Implement several **replanting schemes** in order to encourage reef rehabilitation and boost local fish and invertebrates stocks
 - Elkhorn coral (*Acropora Palmata*) replanting
 - Mangrove replanting
 - Seagrass planting

A well-managed and protected marine park will produce the following benefits:

- ❖ **Protect** the precious marine environment on which we all rely
- ❖ **Increase tourism** to the area
- ❖ **Provide income** through recreational user fees and boat mooring fees
- ❖ Provide **more employment** to Speyside residents through park rangers, tour guides and boat drivers
- ❖ **Improve fishing**, with bigger and better fish and lobster catches through a well managed (zonal) fishing plan

- ❖ Provide **additional funding** and **external support** for park management and associated initiatives
- ❖ Secure a **vital source of fish and coral** larvae to the rest of Tobago and the Lesser Antilles, acting as a **future lifeline** in the face of climate change.

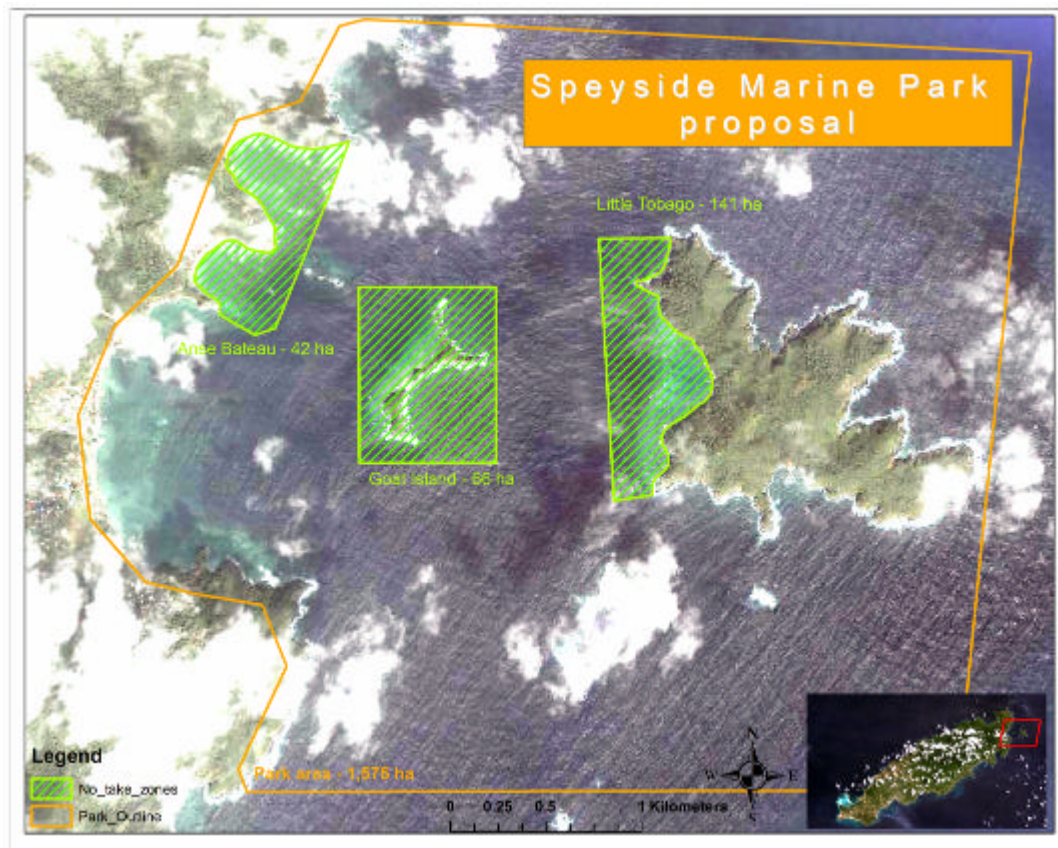


Figure 10 Proposed Speyside Marine Park outline (in orange) and no-take zones (in green). Inset – Tobago Island with the Speyside area highlighted in red.

The full impact of the project was realised at the highly successful project evaluation held in October. This session was attended by approximately 50 persons from the Speyside/Charlotteville, local NGO, government, and national, regional and international communities. The feedback was very positive and has resulted in the Minister of Tourism for Trinidad and Tobago being made aware of the strong potential for Speyside Marine area to be a model for promoting eco-tourism strategies for the country. Additionally, five community members have expressed strong interest in continuing the work started by the project and are in the process of forming a Community Based Organisation to facilitate this desire. A full list of participants is available in Appendix IV along with excerpts of testimonials.

4. Challenges

Implementation of project activities is never a smooth process as obstacles and challenges always crop up that can adversely affect the achievement of project outputs. The SMACMP was not immune to this aspect of project implementation. The main challenges that affected the project are identified below.

4.1 *Engaging and sustaining community participation*

At the onset of the SMACMP there was the general lack of community support and participation. There was great apathy within the community towards the overall project objectives as there were previous projects that promised similar benefits that were never realised. There was also a lack of understanding as to how the project objectives could be beneficial to the lives and livelihoods of individuals and the wider community. BRT and CCC ensured that the approach taken towards project implementation was one that involved the community at every stage. Every initiative undertaken in this project had increasing and sustaining community participation at its core, and although there has been considerable increase in support and awareness, the vast majority of community members and stakeholders still require further demonstration of the potential of the project.

4.2 *Constant local presence*

A hindrance to engaging the community in the project work was the absence of a dedicated presence by both BRT and CCC. The BRT's main office is located on the south-western end of the island, one hour away from the project site, and there were two staff members working on this project. However, this was not the only project that these members were involved in and as a result it took a longer time for them to connect with the community and advance the objectives of the project. CCC were geographically closer, being based in Charlotteville, however, the absence of dedicated transportation reduced their ability to be constantly present within the community.

4.3 *Project Duration*

The BRT and CCC had one year to effectively execute and implement the SMACMP. This time frame was too short to facilitate complete engagement of community members. In fact, it took at least six months for BRT and CCC to fully understand the community culture and dynamic that would allow for maximum participation by community members. For example, religion is an important aspect of the community and as such it was difficult to conduct workshops or programmes on weekends without excluding a major part of the demographic. Further most community members either worked or attended an education institution, which limited when during the week community members were available to participate in project initiatives. Constant advice from and consultation with community members was required which helped build tangible relationships and community trust. There was also greater community interest in project activities by the end of the project but there was no more time left to facilitate full and effective community participation in all activities.

4.4 *Financial and technical constraints*

The mechanism for disbursing project funds was not very efficient resulting in delays in release of the funds. This delay hampered project implementation such that activities had to be rescheduled or cancelled in order for the project implementation to remain on schedule. The cancellation of activities however, was done in such a way as to not reduce the intended overall impact of the activity. Nature had an adverse effect on the project as unanticipated heavy swells destroyed the survey vessel crippling the collection of marine data. Guidance and advice was sought from the GEF-SGP National Coordinator and readjustments were made to the project budget that allowed the marine surveying to resume and be completed on schedule without adversely affecting community awareness and capacity building aspects of the project.

5. Lessons Learned

5.1 *Open communication and networking*

The building and maintaining of relationships with key members of the community was critical to the successes achieved. In order to facilitate these relationships, staff from both implementing agencies had to make a concerted effort to frequently liaise with community groups e.g. village council, hoteliers, dive and reef tour operators, etc, in order to meet project objectives while simultaneously meeting community needs. This frequent interaction was deemed necessary to initiate and coordinate project initiatives, to reinforce the dedication of the implementers to the needs of the community in the context of the SMACMP, and most importantly to gain the trust of the community. A sustained presence within the community, either physical or through print media also facilitated frequent communication with community members, thus spreading awareness and increasing support. A direct result of the trust gained and the initiatives conducted has been the identification of a group of individuals interested in becoming an official Community Based Organisation (CBO) that would continue to work towards achieving the project's goals.

5.2 *Adequate time and finances*

While significant strides were made during the course of the year to foster community interest in the marine environment and its associated activities, the time was not sufficient to realise the full potential of the project. Community-based management requires a minimum of 3-5 years of targeted community engagement, training and nurturing to become a reality. A dedicated source of income is also needed to facilitate the highly specialised training and knowledge building initiatives that are required to equip community members with the skills to begin managing their resources.

5.3 *Dedicated presence*

Any project that promotes a community-based approach to management needs to ensure that the implementing agency has a dedicated presence. The success of the project from the perspective of engaging the community will be greatly improved if the community has ready access to those driving the process. Ideally, the person(s) responsible for advancing this process should be an influential member of the community, someone who already has a working relationship with and the trust of the community members. A non-community member leading this process will need to become a community member through regular engagements or by actually living in the community. This will engender a level of awareness and understanding of community dynamics that will drive what initiatives should get developed and implemented to promote project objectives.

5.4 *Relevance*

The methods by which information and training were disseminated to community needs to be relevant to effectively reach the desired target audience. For example, the scholarship programme offered by CCC was not fully utilised by the local community because there were limitations such as inability to dedicate two weeks to Scuba training. The programmes



Speyside Marine Area Community-based Management Project



offered need to be adaptable and where possible flexible to accommodate the needs of the recipients.

6. Conclusions

The many facets of the SMACMP ensured that both the community and the environment's needs were addressed in a harmonious manner. Many opportunities through which the community could benefit socially and financially from their natural resources were identified. There is a renewed energy and interest on the part of the community to arm themselves with the knowledge and the skills they would need to allow them to use their resources wisely.

In particular, there are five individuals who availed themselves of the various trainings and scholarships offered under the project and they are very keen to form a CBO that would allow them to actively pursue managing and educating their fellow community members about the importance and benefits of the marine environment. This group of residents has already identified specific areas that they would like to focus on and resources must be dedicated to ensure the necessary training and capacity building programmes are available to them. BRT and CCC will continue to provide guidance and technical support towards realising their goals.

The management recommendations presented as part of this project have been informally presented to the Tobago House of Assembly's Secretary of Agriculture, Marine Affairs, Marketing and the Environment who has indicated that the THA is currently engaging in the development of an Environmental Policy for Tobago of which the Speyside marine area is a critical component. The data collected and the recommendations provided are a valuable supplement to the management plan developed by the Institute of Marine Affairs for the Speyside Marine Area and will play a crucial role in the creation of the Environmental Policy for Tobago.

The SMACMP officially ended in September but the work and initiatives coming out of the project will ensure that the project's objectives continue.

Appendix I - List of persons that benefited from the Scholarship programme

Name	Geographic Source	Type of Scholarship
Robin Ramdeen	Trinidad	2 week
Fadilah Ali	Trinidad	2 week
Cory Lee Qui	Tobago	4 week
Wayne Gray	Speyside	4 week
Devon Eastman	Charlotteville	2 week
Deon Walcott	Pembroke	4 week
Tina Eastman- de Jonge	Charlotteville	4 week
Michael Joseph	Trinidad	4 week
Arielle Aberdeen	Trinidad	4 week
Ife Smenkh-Ka-Ra	Trinidad	4 week
Lisa Shari Wellington	Trinidad	4 week
Chitrlekha Deopersad	Trinidad	4 week
Marianna Rampaul	Trinidad	4 week
Swiss Robinson	Speyside	2 week
Rhea Nelson	Trinidad	4 week
Stephanie Ramsaroop	Trinidad	4 week
Marisela Aguilar	Trinidad	4 week

List of persons that benefited from the “Flexible” Scholarship programme

Name	Geographic Source	Scholarship equivalent
Jace Bishop	Speyside	2 week
Zolani Frank	Speyside	2 week
Rupert McKenna	Speyside	2 week
Stephan Skeete	Speyside	2 week
Peter Trotman	Speyside	2 week

Appendix II - Scientific Report

A quantitative baseline survey technique was designed to provide a comprehensive assessment of shallow coastal ecosystems quickly and effectively. Originally used on CCC projects in Fiji, it has been adapted for use on the SMACMP. Local knowledge and satellite maps were used to determine survey site locations throughout the main reef systems of Speyside. Surveys were conducted parallel to the reef crest, which is usually parallel to the coast.

The survey method was developed in order to make it compatible with existing, regional survey methods conducted in the wider Caribbean such as Atlantic and Gulf Rapid Reef Assessment (AGRRA) (Steneck *et al.* 2003) and Reef Check (www.reefcheck.org) reef monitoring protocols. This allowed for the comparison of results from Tobago with other island states in the region. Survey depths were chosen at intervals where coral cover and diversity was generally highest, usually at 7 and 12m. In addition, the 7 and 12 m depths were the same as for the bleaching surveys carried out in 2005 (O'Farrell *et al.*, 2005).



Figure 11 CCC volunteers learning how to identify corals

1.1 Survey Technique

Surveys were conducted along two 50m transect lines which were laid along each depth parallel to the reef crest for each station surveyed. All surveys were conducted over reef areas. Depths for stations which did not contain reefs were not surveyed.

On each transect data was collected on the abundance of all targeted commercial and pelagic fish species, size estimates of selected fish families (5-10cm, 11-20cm, 21-40 cm and >40cm) coral cover, fish diversity, coral disease and benthic composition. The focus species and families were selected to represent a range of target organisms characterizing the main functional groups present on Caribbean reefs, including sessile benthic organisms, motile invertebrates, and reef fish.

Underwater fish counts were conducted along two 50m transects at each of the survey depth. Fishes were counted within 2.5m on either side of the transect (English and Wilkinson 1997). On each transect fish abundance and size estimates were collected for all targeted commercial and pelagic fish species recorded. Simultaneously, abundance of demersal and more cryptic reef fish families and targeted species were recorded along the same belt transect. Fish of less than 5cm length were generally not included unless the adult phase was less than this size.

At 50cm intervals along the 50m transect, the type of substratum or benthic organism (sessile) under each point were recorded. This was done over two 20m sections of the 50m transect with a 5m gap between sections (0-20m and 25-45m). Each section contained 40 points. Each depth had four transects and thus contained 160 benthic survey points in total. Coral recruits and bleached corals were also recorded if they were found directly underneath a point.

Coral disease and bleaching prevalence were estimated along four 10m long by 2m wide sections along the 50m transect. Within each section, the total numbers of healthy and diseased or bleached colonies were estimated.

Other data collected included oceanographic data and observations of obvious anthropogenic impacts and activities. Sea surface temperature, tide level and a salinity sample were recorded from the survey boat. The survey team below records the depth of the transect, the temperature at the maximum survey depth (i.e. at the start of the survey), reef rugosity and the reef zone. Visibility, a surrogate for turbidity (sediment load) was recorded both vertically and horizontally. A Secchi disc was used to measure the vertical visibility, while horizontal visibility through the water column was measured by divers' estimates while underwater. A water sample was taken at the survey depth to measure salinity after the survey.

Survey divers qualitatively assessed the strength and direction of water currents at each survey site. Similarly, surface team qualitatively estimated the strength and direction of the wind at each survey site. Cloud cover was measured on a scale of 1 to 8 Octas.

Natural and anthropogenic impacts were assessed both from the surface, from the survey boat and underwater by the divers during each survey. Surface impacts were categorised as 'driftwood', 'algae', 'litter', 'sewage', 'nets' and 'other'. Sub-surface impacts were categorised as 'coral fragmentation', 'major overgrowth', 'fish bite damage', 'litter', 'human' and 'other'. All data was collected as 'present/absent'. Any boats noted seen during a survey were recorded along with information on the number of occupants and its activity.

Data from each survey were recorded onto data forms and checked prior to being entered into the database, which is compatible with a range of Geographical Information Systems (GIS) software used for data analysis.

1.2 Data Analysis

In order to analyse outputs from reef surveys and make comparisons between sites, only surveys with >5% hard coral cover were included in this analysis. A total of 99 reef surveys were analysed.

Comparisons between benthic composition, coral cover and coral diversity were made using data from 2005 bleaching assessments (O'Farrell *et al.*, 2005). Only those surveys which were conducted on the same depth bands and locations were used for these comparisons.

Comparisons of fish and benthic abundance and diversity were also made with similar reef data collected from 150 surveys at 7 and 12 metres on the Caribbean side of Tobago as part of the Tobago Coastal Ecosystem Mapping Project (van Bochove *et al.*, 2008).

Comparative data was also used from the Bonaire National Park, Dutch Antilles (Steneck *et al.*, 2007). The reefs of Bonaire National Park were considered to be representative of the Caribbean, well managed and similar in size to Tobago.

The field data was entered into an MS Excel 2003 database. ArcGIS (ESRI Software) was used to facilitate data analysis and display survey results. Shannon-Wiener diversity indices were generated in PRIMER-5 (Plymouth Routines in Multivariate Ecological Research).

Benthic data were converted into percentage cover and belt transect data (fish and invertebrate abundances) were converted into # of individuals per hectare. Commercial fish abundances were converted to biomass (kg/ha) using published length weight relationships (Froese, R. and D. Pauly, 2009). Fish species were divided into two trophic levels for the analysis; predatory fish and herbivorous fish. A list of all target species can be found in Appendix III. Coral disease and bleaching prevalence were calculated by dividing the percentage of diseased and or bleached colonies by the total number of colonies of that coral genus/species.

1.3 Geographical Information System (GIS)

GPS points recorded at the start of each survey were entered into the database and associated with the survey data collected along each transect. Ecological values from the survey data were entered into a database and imported into a Geographic Information System (GIS) to enable spatial analysis. Relationships between the data from various survey sites were then explored to highlight geographical regions of key interest. The visual nature of GIS outputs facilitates the interpretation of such data by non-technical persons who may nonetheless be key decision-makers.

The density function in the Spatial Analyst of ArcView (ESRI software) was then used to highlight areas displaying a particularly high or low density of the various criteria. These values are represented in this report on a colour ramp to facilitate visual interpretation.

Using five ecological indices, comparisons between site records were made in order to highlight key areas of ecological importance. The indices used were the site record values for live hard coral cover, the total number of benthic targets (not including nutrient indicator algae), total number of reef fish targets and the Shannon diversity indices (H) for both benthic and reef fish targets.

To calculate the Conservation Management Value (CMV) of each survey site, an inter-survey analysis was made to determine the ecological 'value' of each survey site relative to the others. To do this, the average value for each of the 5 indices was calculated for each site, and these values were then used to determine the overall averages for each index across all sites. The sites were then compared against these overall averages to determine the number of indices in which each site is above or below the overall average. If, for example, a site was below average in all 5 indices, it would score a CMV value of 0; if it was above average in only 1 index, it would score a CMV value of 1, and so on up to a maximum CMV value of 5 (above average in all 5 indices).

Note that this technique compares each site against the other sites within a region, and thus it is a *relative value* for that region only. The fact that a site is displayed as a low CMV does not necessarily mean it is biologically 'poor', but simply that there are biologically 'richer' areas in the same region.

2. Results

In this analysis, the indicator organisms were adapted from those defined by the Reef Check Foundation (Hodgson, 1999) as well as those used in a report by Steneck *et al.*, 2007. These indicators are recognised as robust gauges of general reef health. In addition to these indicators, some focus has also been given to coral disease prevalence in the area, as this is currently a subject of great concern for the reefs of Tobago.

The outputs from these surveys are in graphical and GIS format and aim to provide a general picture of the status of coral reefs around Speyside and draw management recommendations from this. The depth contours analysed were at 7 and 12 metres as these provided the most consistent datasets.

2.1 Survey Progress

Between December of 2008 and August of 2009, CCC survey teams conducted 99, 50 m transects at 7 and 12 metres depth on the fringing coral reefs around Speyside. Figure 12 illustrates the total number of surveys completed each month over the 9-month survey period of the SMACMP. Figure 13 displays the locations of those surveys around Speyside.

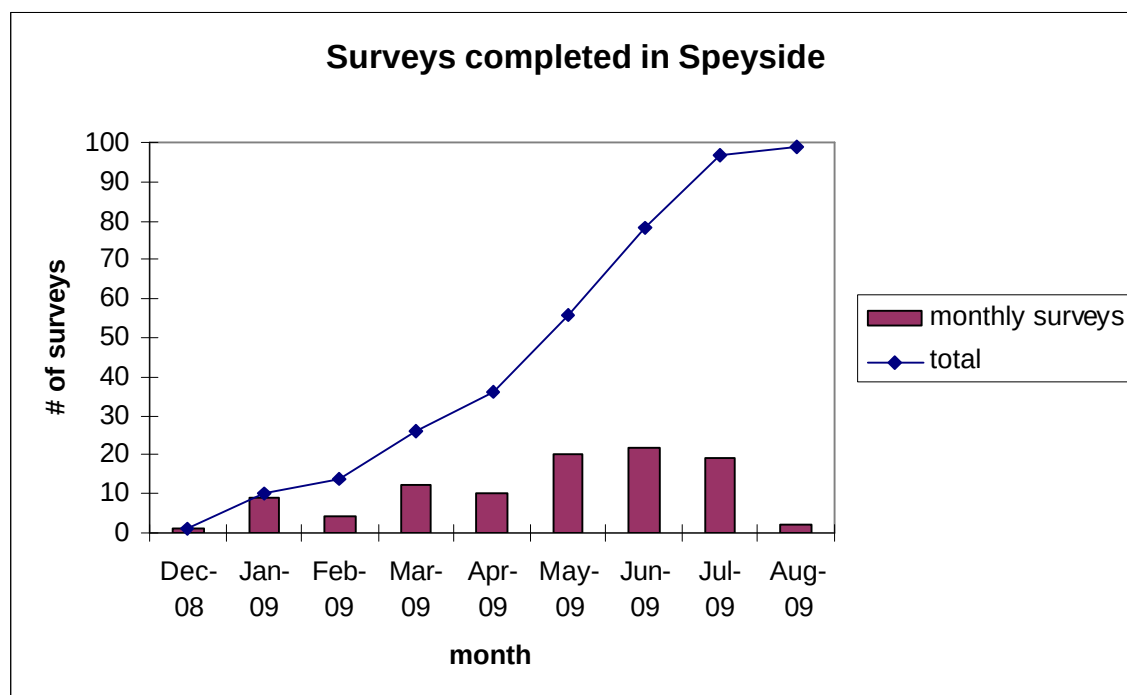


Figure 12 Number of CCC baseline surveys conducted between December of 2008 and August of 2009. The blue line is the cumulative number of surveys completed. The bars are the number of surveys completed each month.

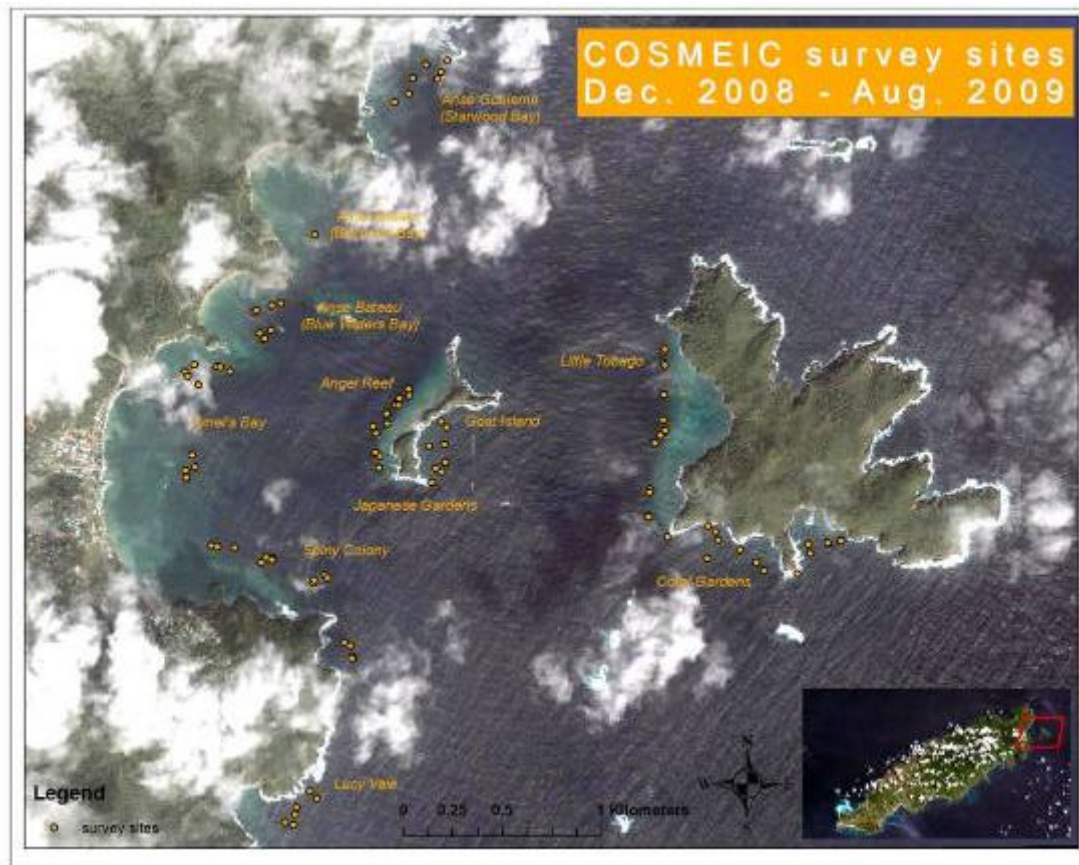


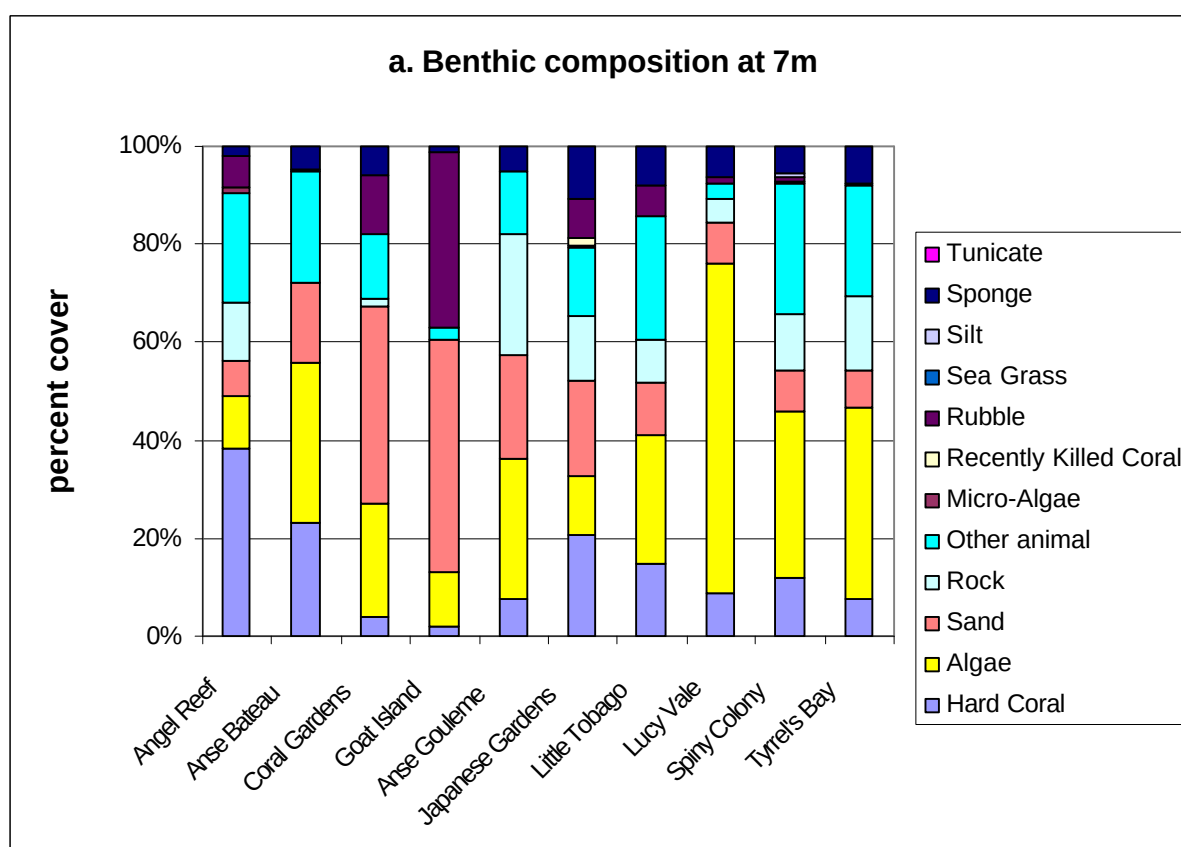
Figure 13 CCC baseline survey locations at 7 and 12 metres depth (orange dots), conducted around Speyside between December 2008 and August 2009. Inset – Tobago Island with the Speyside area highlighted in red.

2.2 Benthic Composition

The most common benthic substrata found at both depths and surveys were coral, macroalgae and sand although there was a high variation between sites and depths. Figure 14 shows the composition of benthic substrata at both depths for selected reef sites. Hard coral cover is investigated further in the next section.

Algae species were pooled into 2 functionally important groups – macroalgae and microalgae (also known as turf algae). Reef sites at 12 metres depth had higher algal coverage than sites at 7 metres. Many Caribbean coral reefs have become macroalgae dominated reefs since the 1980s, undergoing ‘phase shifts’ from a coral dominated to an algae dominated state (see Gardner *et al.*, 2003, Bak *et al.*, 2005). Macroalage cover for selected sites consisted mostly of *Dictyota* species and was high for many of the sites surveyed (16%), particularly around Lucy Vale. Macroalgae coverage was also higher on average than the Caribbean side reefs (~5% vs. 16% resp. See van Bochove *et al.*, 2008). Bonaire’s reefs average about 5% macroalgae cover (Steneck *et al.*, 2007).

Bare substrate (rock) coverage was low (~8%) when compared to Caribbean side reefs (~44%). These are potentially suitable habitats for settlement of coral recruits and therefore important substrates for any reef recovery. The ‘Other animals’ category included octocoral species and seafans. These were further assessed by means of a belt transect.



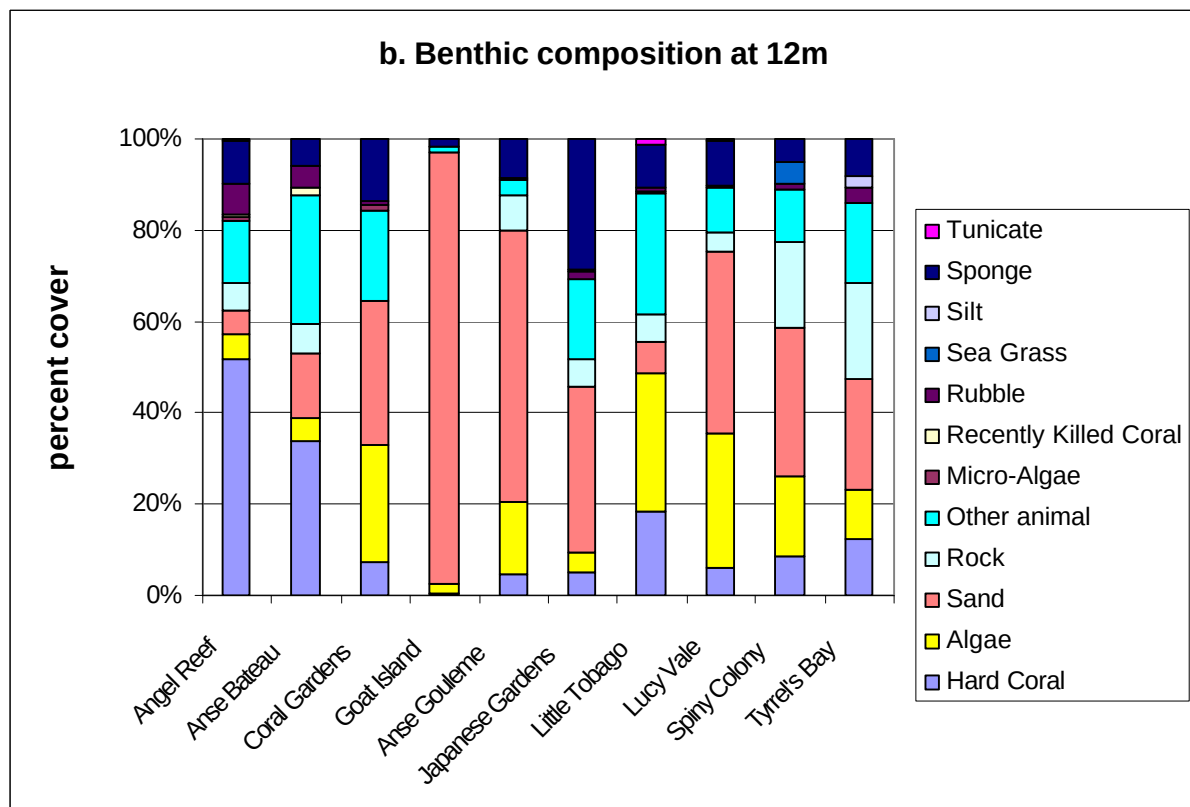


Figure 14 Benthic composition several key reef sites around Speyside at 7m (a.) and 12m (b.) survey depths.

2.3 Coral Cover

Speyside's reefs have not shown any dramatic declines in hard (scleractinian) coral cover since the 2005 bleaching event when rapid reef assessments were conducted to assess the bleaching impact. In contrast, coral cover on the Caribbean side has shown to be declining (van Bochove *et al.*, 2008). Figure 15 shows mean coral coverage at 7 and 12 metres over 2 survey periods for reef sites Speyside.

Comparisons between surveys conducted during the 2005 bleaching event and baseline surveys over 2008-2009 at the same sites and depth indicate that mean coral cover has remained the same at both 7 metres (24% in 2005 and 26% in 2009) and 12 metres (25% and 22% resp.). There is some variation between sites but these can easily be attributed to a slight variation in the exact survey locations.

In comparison, average coral cover for reefs around the Caribbean islands was around 10% in 2003 (Gardner *et al.*, 2003) and is probably lower now. Comparisons with the Bonaire reefs reveal that Speyside's coral cover is below the 7-year mean coral cover of 47% for Bonaire.

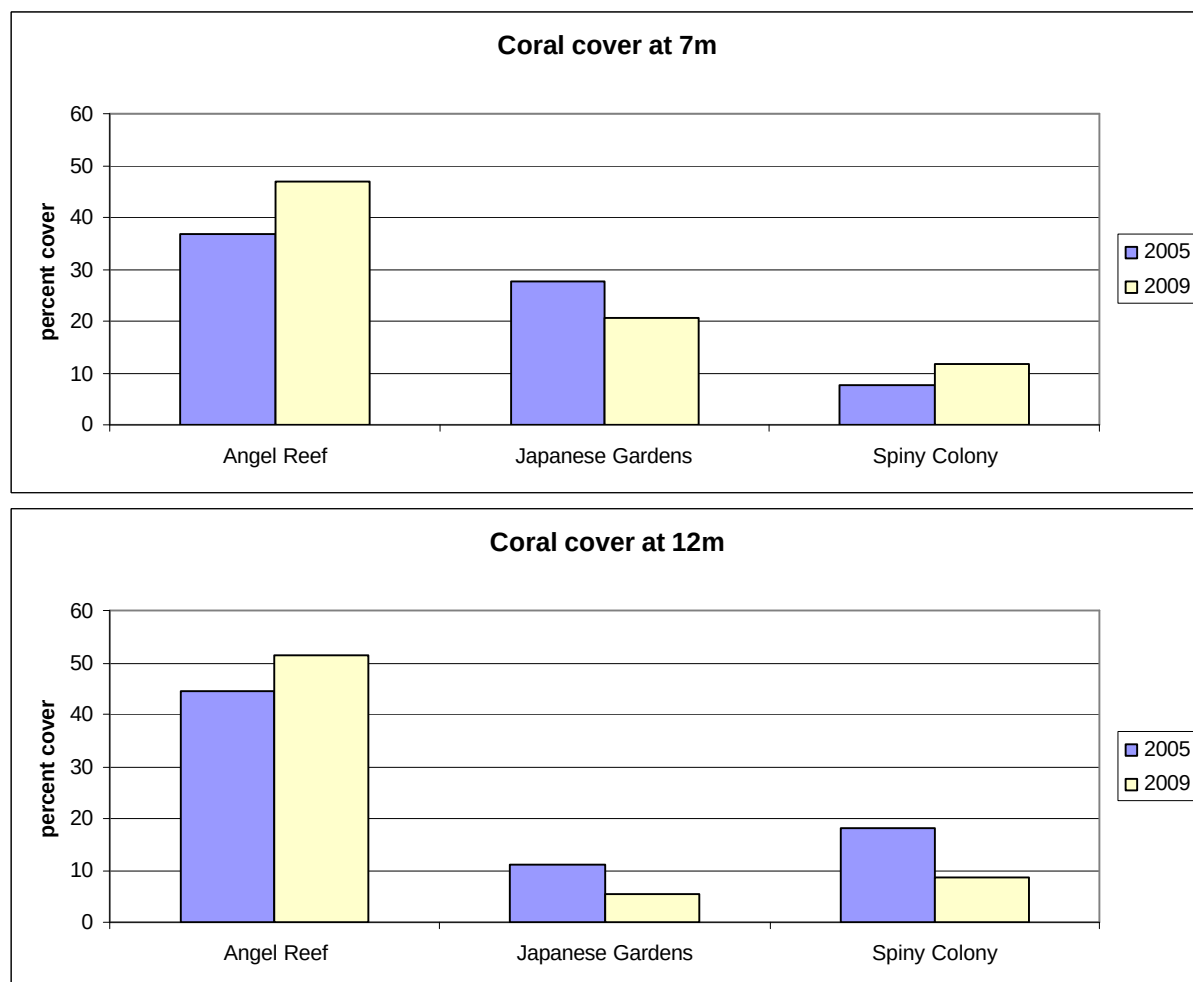


Figure 15 Hard coral cover at three reef sites in Speyside during and 3 years after the 2005 bleaching event for two depth bands; above– 7 metres, and below – 12 metres.

Table 2 (next page) displays the different taxa of hard coral that were recorded from all surveys. A total of 46 hard coral targets (species and genus') were observed. *Madracis mirabilis* (Yellow Pencil coral) was the most abundant hard coral, comprising nearly 30% of corals seen. *Montastrea* corals were a dominant coral genus comprising 14.4% of corals seen. *Montastrea* corals (apart from *M. cavernosa*) were not always identified to species level. Of the ones identified, *M. faveolata* was the most abundant (6.2%). *Millepora spp.* were the third most dominant genus, comprising 13% of hard corals. *Siderastrea sideria* and *Diploria strigosa* were also relatively abundant corals (8.1% and 7.1%). These 7 species of coral dominate Speyside's reefs, comprising over 80% of reef-building hard corals. *Acropora palmata*, once an abundant species in the shallows but now the first coral acknowledged by CITES as a threatened species, comprised only 0.5% of hard corals seen on all surveys. Before the White-Band Disease outbreaks between 1977 and 1982, they were the dominant family of reef building coral on shallow water reefs (Wilkinson, 2004).

Table 2 Hard coral species recorded during surveys in Speyside.

Hard coral species	Percentage of all coral species
<i>Madracis mirabilis</i>	29.6
Montastraea spp.	14.4
<i>Montastraea faveolata</i>	6.2
<i>Montastraea franksi</i>	1.7
<i>Montastraea annularis</i>	1.0
<i>Millepora spp.</i>	13.1
<i>Siderastrea siderea</i>	8.1
<i>Diploria strigosa</i>	7.1
<i>Porites astreoides</i>	5.6
<i>Colpophyllia natans</i>	4.3
<i>Meandrina meandrites</i>	2.9
<i>Agaricia spp.</i>	2.3
<i>Siderastrea radians</i>	2.1
<i>Agaricia agaricites</i>	1.8
<i>Montastraea cavernosa</i>	1.6
<i>Madracis decactis</i>	1.3
<i>Porites porites</i>	1.0
<i>Acropora palmata</i>	0.5
<i>Dichocoenia stokesi</i>	0.5
<i>Eusmilia fastigiata</i>	0.5
<i>Scolymia spp</i>	0.5
Other coral species (see below)	1.8
<i>Diploria clivosa</i>	0.3
<i>Helioseris cucullata</i>	0.3
<i>Agaricia tenuifolia</i>	0.3
Unidentified Live Hard	0.3
<i>Porites furcata</i>	0.2
<i>Stephanocoenia intersepta</i>	0.2
<i>Stylaster roseus</i>	0.1
<i>Oculina diffusa</i>	0.1
<i>Diploria labyrinthiformis</i>	0.1
<i>Mussa angulosa</i>	0.1
<i>Isophyllastrea rigida</i>	0.1

Figures 16 and 17 show the coral diversity and coral cover of the same reefs sites surveyed in 2005 and 2009. No significant changes were found in either coral diversity or coral cover. This is in contrast to the Caribbean side where coral cover dropped significantly over the same period.

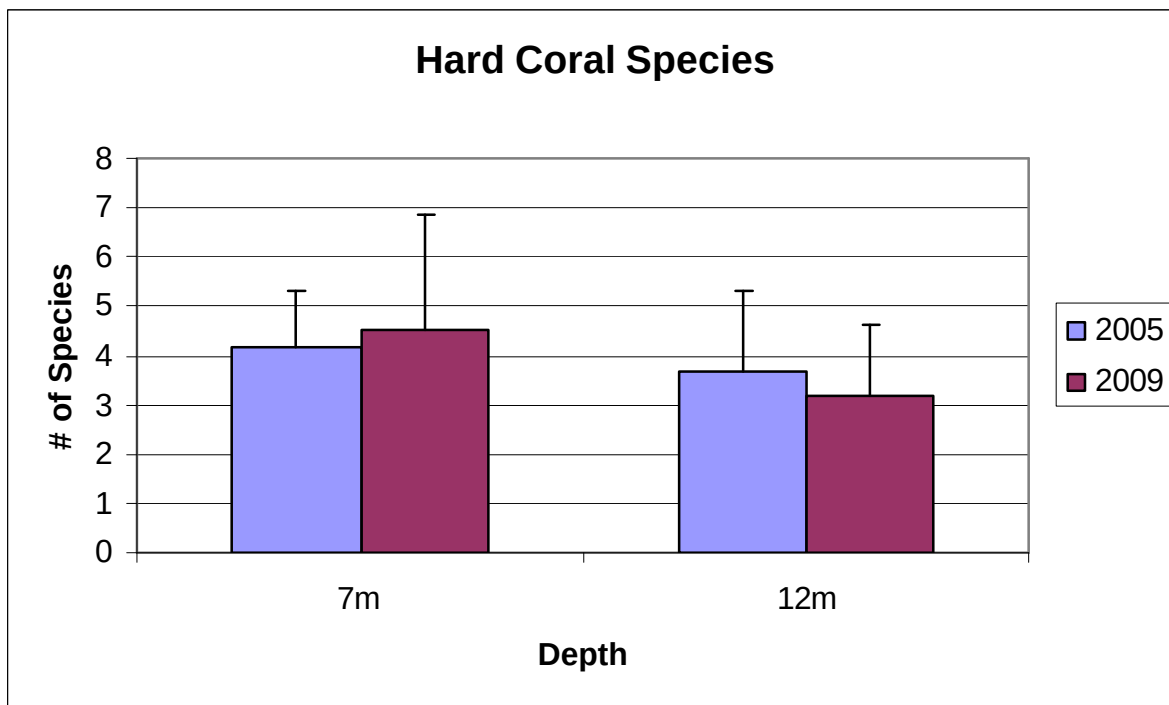


Figure 16 Hard coral diversity for the same survey sites in 2005 and 2007 at 7 and 12 metres. Error bars indicate standard deviation.

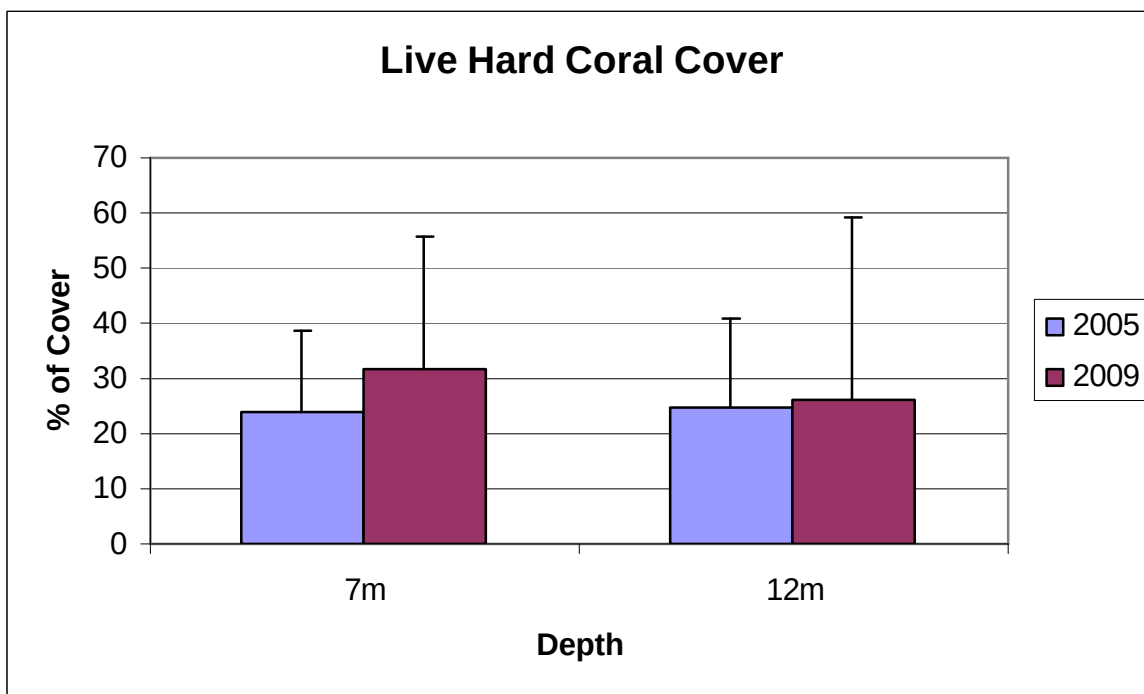


Figure 17 Hard coral cover for the same survey sites in 2005 and 2007 at 7 and 12 metres. Error bars indicate standard deviation.

Figure 18 displays the hard coral composition at 7 and 12 metres. The most dominant coral species at 12 metres are *Madracis mirabilis* (40%) and *Montastrea spp.* (15%). At 7 metres,

the 3 corals that dominate are *Madracis mirabilis* (19%), *Montastrea spp.* (20%) and *Millepora spp.* (20%).

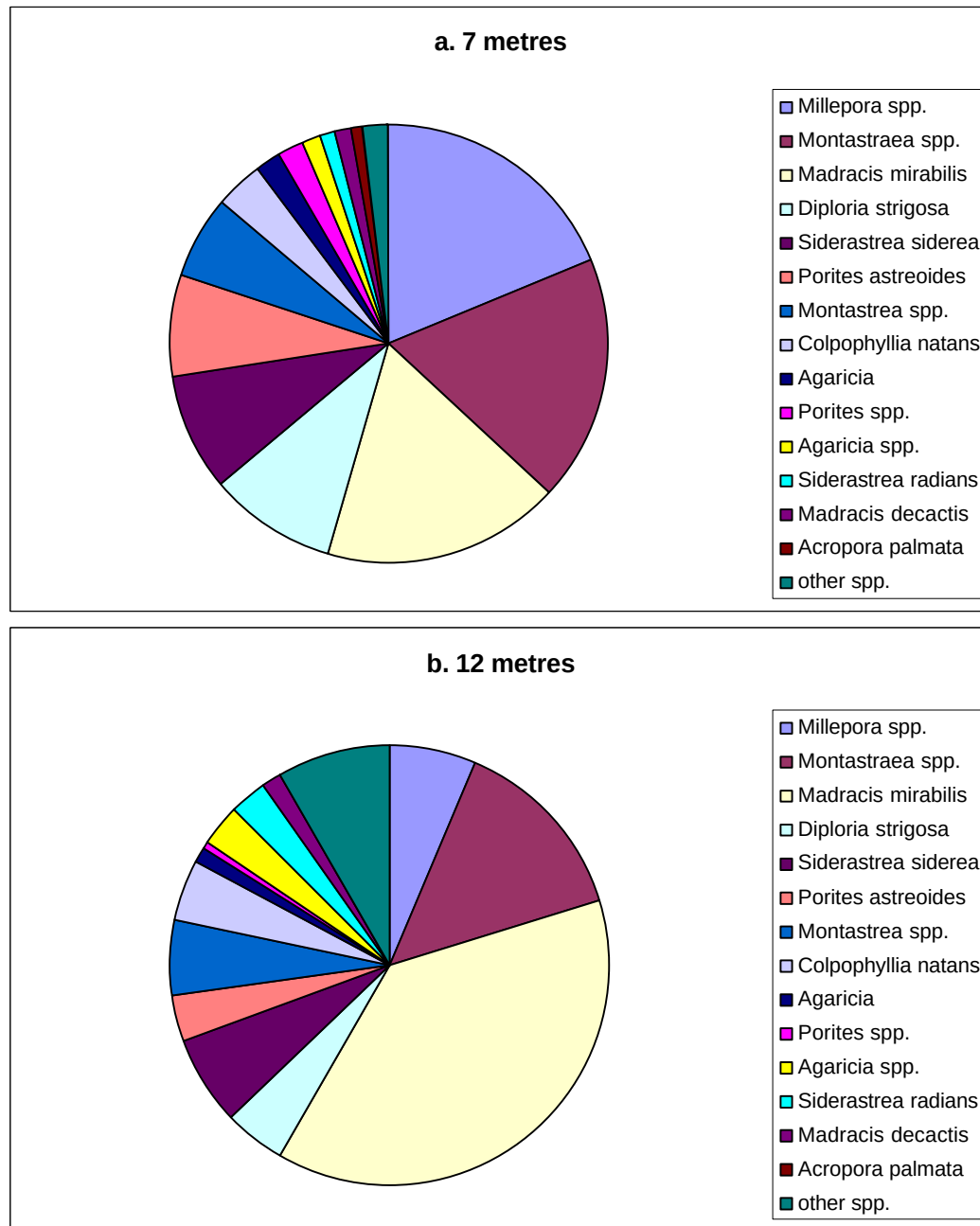


Figure 18 Hard coral composition of 14 of the most dominant groups of corals at a. - 7 metres and b. - 12 metres survey depth.

2.4 Reef Fish

Reef fish play an important role on coral reef ecosystems. They help reduce macroalgal levels, thereby increasing the substrate availability for coral recruits and their subsequent survival (Lirman 2001). Parrotfish (*Scaridae*) are an important reef herbivore, particularly so after the *Diadema* die-off of the 1980's (Mumby *et al.* 2006). Commercially targeted families such as Groupers (*Serranidae*), Snappers (*Lutjanidae*) and Grunts (*Haemulidae*) form an important part of the reef ecosystem and are often the first to suffer severe population declines in overfished areas. Groupers and Snappers often spawn in aggregations and are extremely vulnerable to over-exploitation. In addition to reducing their numbers, the effects of fishing tend to lower their average size and modify their species composition (Van't Hof, 2001) by selectively removing larger individuals.

Predatory Reef Fish

Grouper densities were generally low (33 individuals/hectare) and similar to Caribbean side densities (Figure 19). Four species of groupers comprised all grouper sightings for all surveys: *C. cruentatus*, *C. fulva*, *E. guttatus* and *E. adscensionis*. No Nassau Groupers (*E. striatus*) were seen.

Snapper densities were also low (37 individuals/hectare) and similar to abundances on Caribbean reefs. Grunts were the most abundant predatory fish family although their abundance was lower than Caribbean reefs (272 vs 365 individuals/hectare).

Biomass of both Groupers and Snappers was nearly half that of the reefs on the Caribbean side of Tobago indicating that these key predatory fish were not only less abundant but also smaller in size. Grunts, although less abundant in Speyside, were generally larger in size. Their mean biomass was higher than for the reef on the Caribbean side of Tobago (48 kg/ha vs. 39 kg/ha).

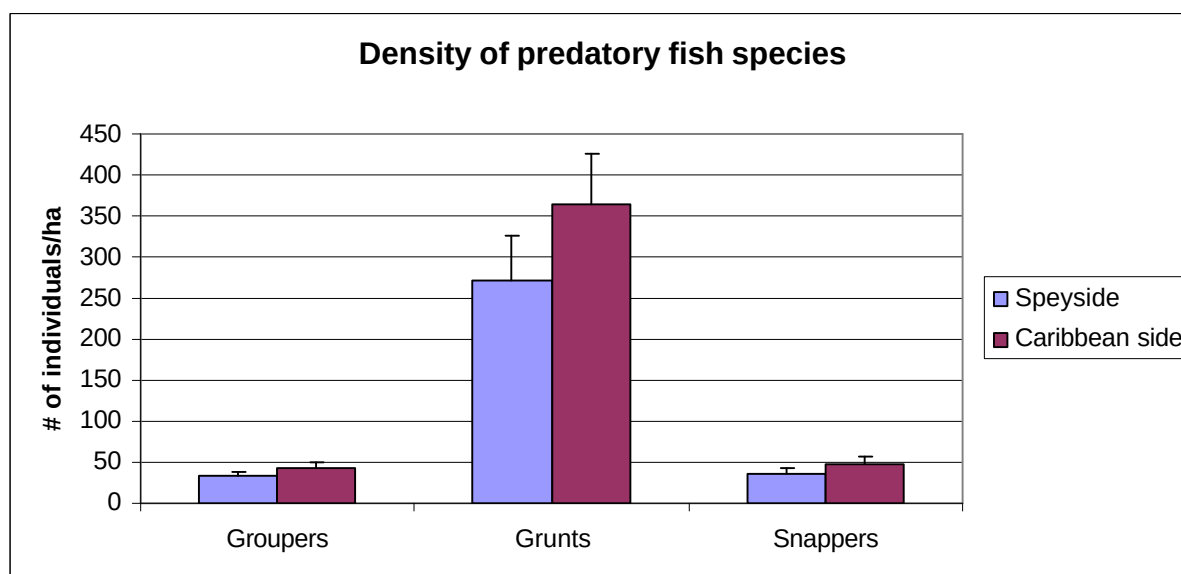


Figure 19 Density of 3 selected predatory fish families for the Caribbean side and Speyside reefs of Tobago. Error bars indicate standard error.

Herbivorous Fish

Being the dominant algae grazers on most Caribbean reefs, herbivorous fish have an important role to play within the reef ecosystem (Mumby *et al.* 2006). Mean densities of Parrotfish (Scaridae) were around 420 individuals per hectare (Figure 20). This is half of the parrotfish abundance of Caribbean side reefs (893 individuals per hectare). For Surgeonfish (Acanthuridae), another important reef grazer, there were about 560 individuals per hectare, which is similar to Caribbean side reefs (523 individuals per hectare).

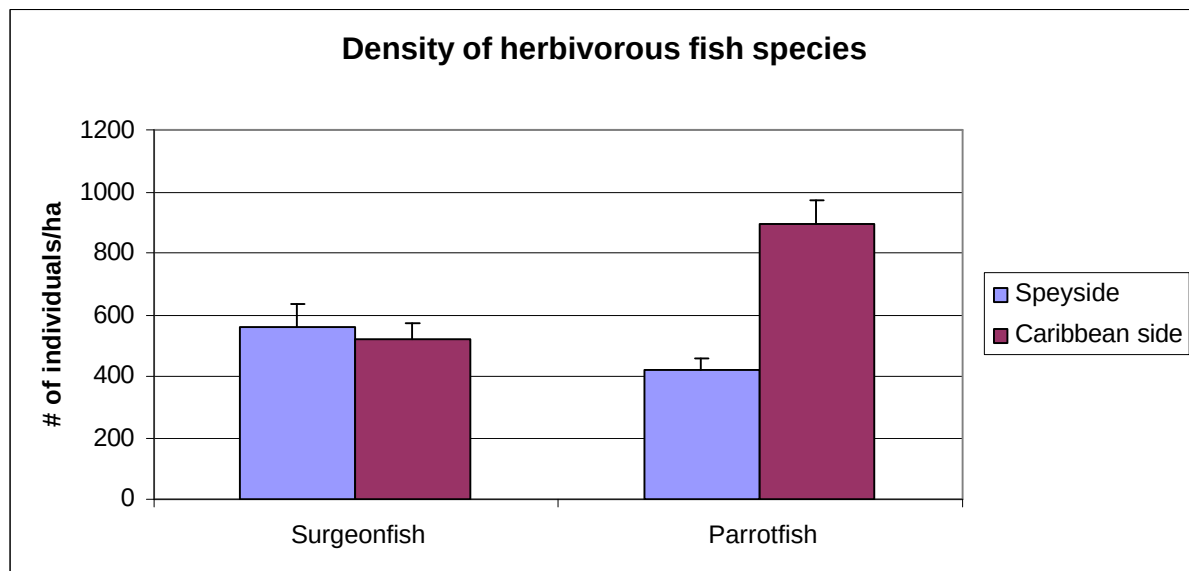


Figure 20 Density of Surgeonfish and Parrotfish for the Caribbean side and Speyside reefs of Tobago. Error bars indicate standard error.

Commercial Fish Biomass

Average Parrotfish biomass for the selected sites was lower in Speyside (87 kg/ha) than for the Caribbean side reefs (156 kg/ha). Overall, the biomass of commercially targeted fish in Speyside was 255 kg/ha (Figure 21). This is very similar to the Caribbean side reefs where biomass was (263 kg/ha).

Comparisons with Bonaire's reefs indicate that the Parrotfish biomass in Speyside is only a fraction of that in Bonaire (400kg/ha). Snapper biomass in Bonaire was over 10 times greater than in Speyside.

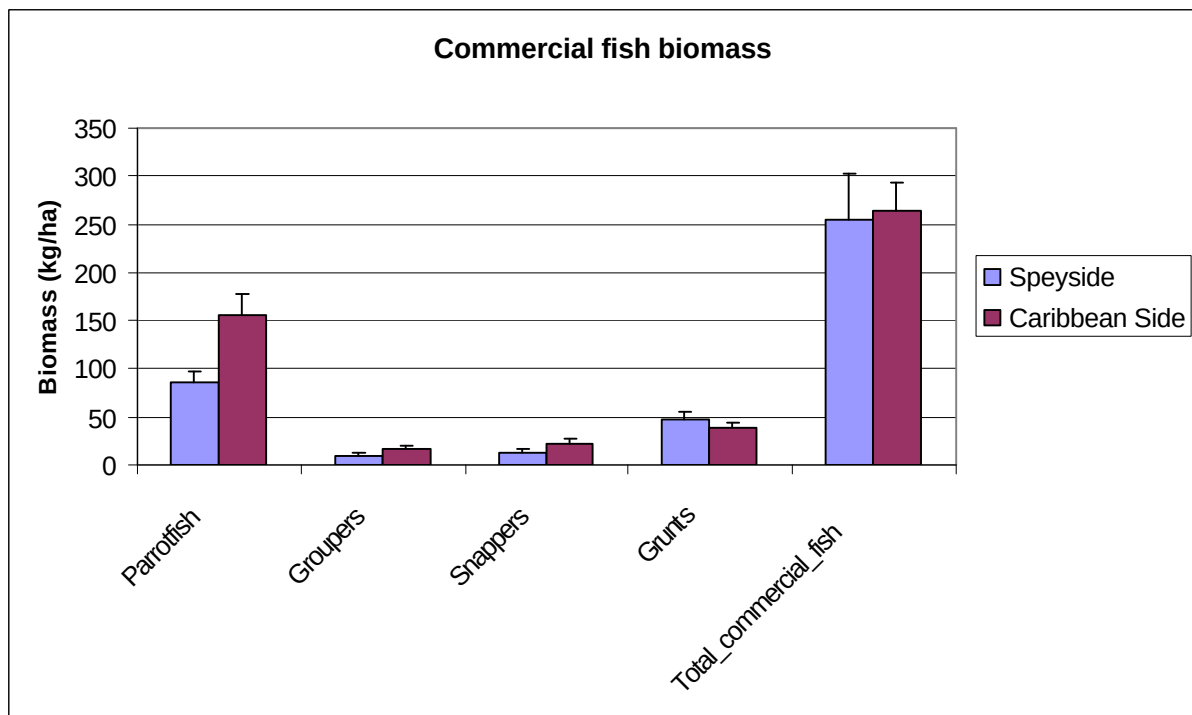


Figure 21 Commercial fish biomass for 4 selected families for the Caribbean side and Speyside reefs of Tobago. Error bars indicate standard error.

2.5 Invertebrates

A number of important invertebrate indicator species were selected which are either commercially harvested or ecologically important.

Diadema antillarum densities between and within sites were highly variable but overall combined abundance was about 38 individuals/ha for surveys conducted around Speyside (Juveniles and Adults combined, Figure 22). Ratios of juveniles to adults were similar for both regions. Abundances were less than for the reefs on the Caribbean side of Tobago (73 individuals/ha) but higher than *Diadema* numbers found around Bonaire National Park in the Dutch Antilles where mean abundances of 15 individuals/ha were found at similar survey depth (10 metres) in 2007 (Steneck *et al.* 2008). In 2005, no *Diadema*'s were seen on 84 reef surveys in Tobago.

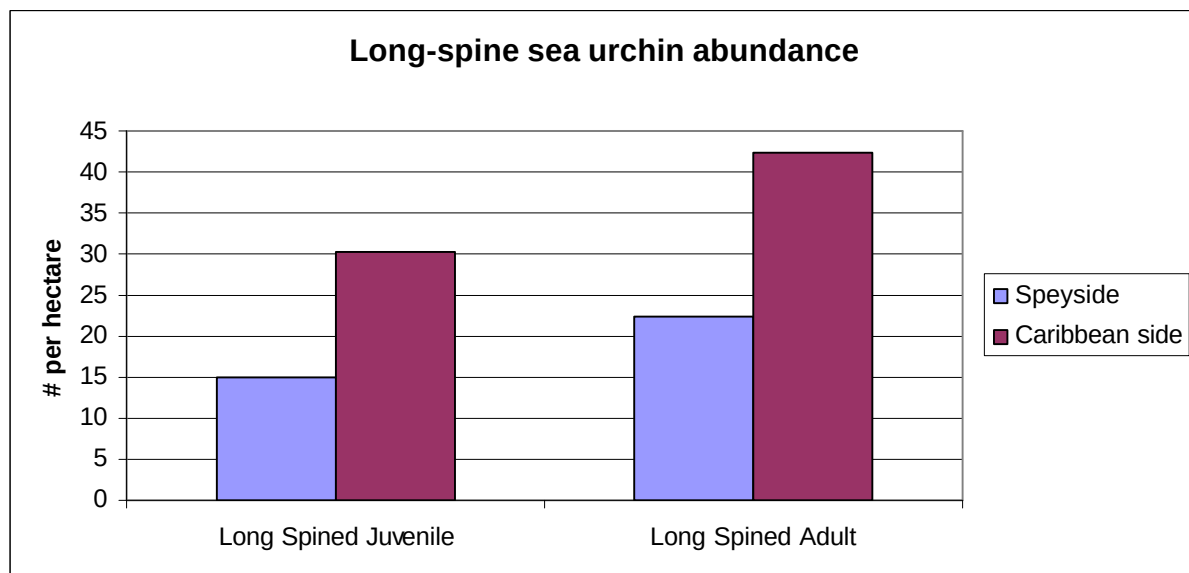


Figure 22 Abundance of adult and juvenile of Long-spine Sea Urchins for the Caribbean side and Speyside reefs of Tobago.

Key indicator species of invertebrates were pooled for all survey sites and depths, as abundances of most of these were very low (Figure 23). Pencil Urchins (*Eucidaris tribuloides*) particularly compared to Caribbean side reefs of Tobago were rare (>1 per hectare), while Banded Coral Shrimps (*Eucidaris tribuloides*) (13 per hectare), were more abundant. Queen Conch (*Strombus gigas*) was recorded on only one of the 99 surveys while only 7 Spiny Lobster individuals (*Panulirus* spp.) were encountered on all surveys. The very low encounter rate of queen conch and lobsters on surveys is indicative of severe overharvesting.

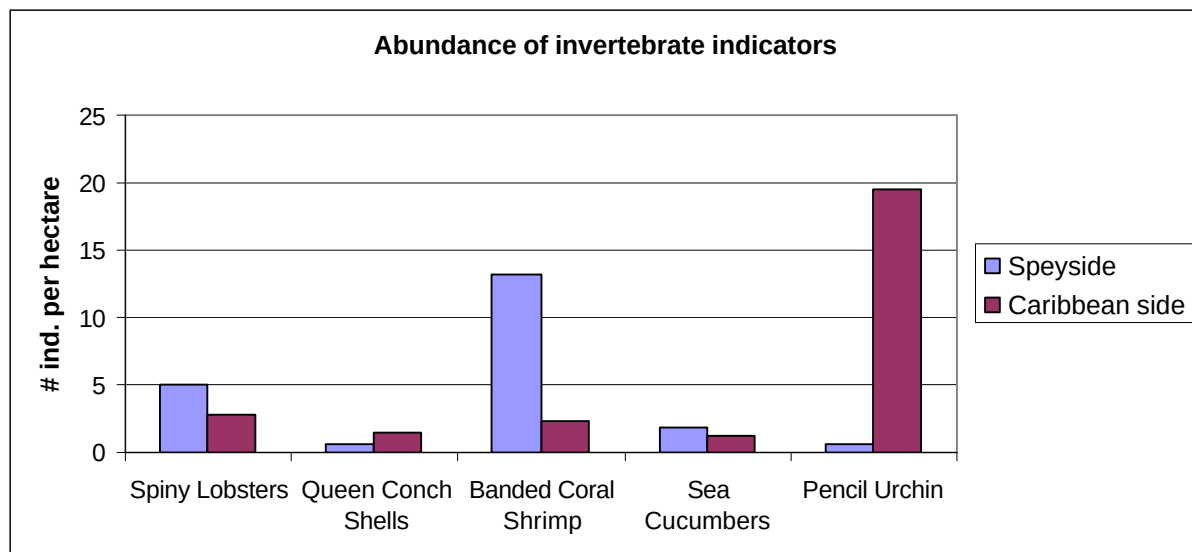


Figure 23 Abundance of key invertebrate indicator species on the Caribbean side and Speyside reefs of Tobago. Data is expressed as the total number of individuals per hectare for all surveys combined.

2.6 Coral Disease

Coral disease prevalence has become a serious contributor to coral reef degradation in Tobago following the 2005-bleaching event (see O'Farrell *et al.* 2005 and van Bochove *et al.* 2008).

Figure 24 depicts the prevalence of 3 common coral diseases encountered on surveys as a percentage of the total amount of colonies observed. Yellow band disease (YBD), which is a bacterial induced disease infecting massive corals (mainly *Montastrea* spp.) infected 7% of *Montastrea* corals at 7 metres and 14% of colonies at 12 metres. Dark Spot Syndrome (DSS), which infects mostly *Siderastrea* spp., infected 27% and 31% of these corals at 7 and 12 metres respectively. Aspergillosis, which is a fungal disease affecting sea fans, was recorded on 75% of 12-meter surveys and 67% of 7-meter surveys. Prevalence of both yellow band disease and dark spot syndrome was much lower in Speyside than the Caribbean side reefs of Tobago. Aspergillosis however, had a much higher prevalence in Speyside.

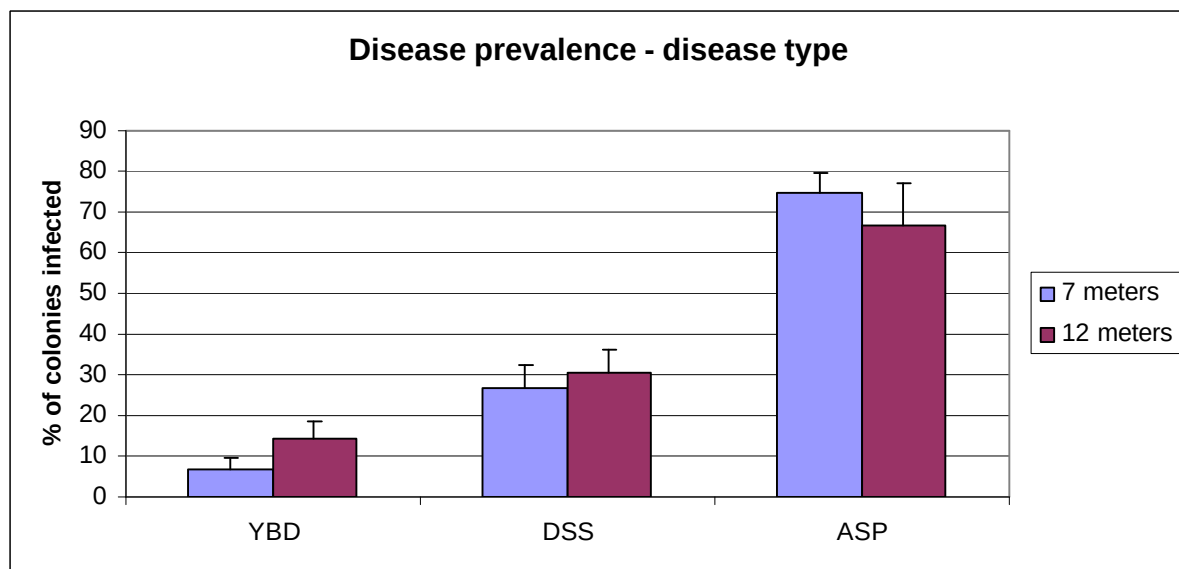


Figure 24 Disease prevalence of 3 common coral diseases; yellow band disease (YBD), dark spot syndrome (DSS) and Aspergilliosis (ASP) for 2 survey depths. YBD is given as a percentage of the *Monastrea spp* it infected. DSS is given as a percentage of *Siderastrea spp.* it infected. ASP is given as the percentage of seafans it infected. Error bars indicate Standard Error.

Figure 25 shows the prevalence of all diseases combined on two major reef building families – Brain corals and *Montastrea spp.* Less than 10% of brain corals were infected by coral disease. The disease prevalence for *Montastrea spp.* was slightly higher with 11% of colonies being infected. Overall disease prevalence on all hard coral species combined was 9% at 7 metres and 13% at 12 metres. This is much lower than disease prevalence on the Caribbean side where overall disease prevalence was estimated to be 60% at 7 m and 38% at 12 m.

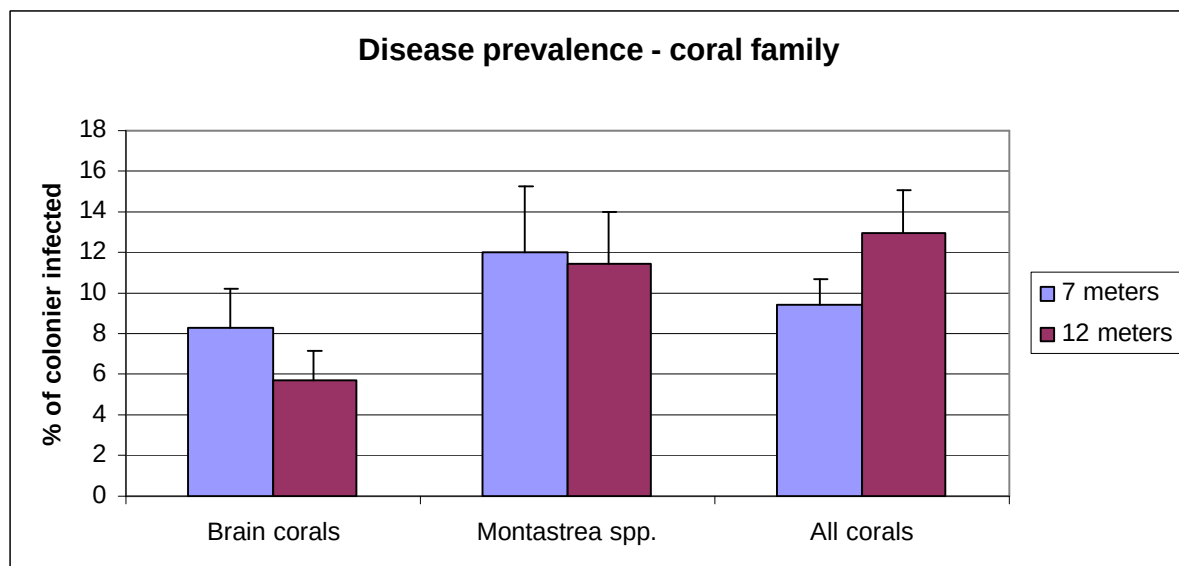


Figure 25 Disease prevalence on 2 main coral family types; brain corals and *montastrea* corals. The third columns represent the total number of hard coral colonies infected by a coral disease. Results given for two survey depths. Error bars indicate Standard Error.

Although the National Oceanic and Atmospheric Administration (NOAA) has given several bleaching warnings for Tobago's waters, no major bleaching episodes have taken place since

the mass-bleaching event affected the islands reefs in 2005. Coral bleaching was more often a result of high sedimentation levels smothering corals than major oscillations in temperature or UV stress.

51

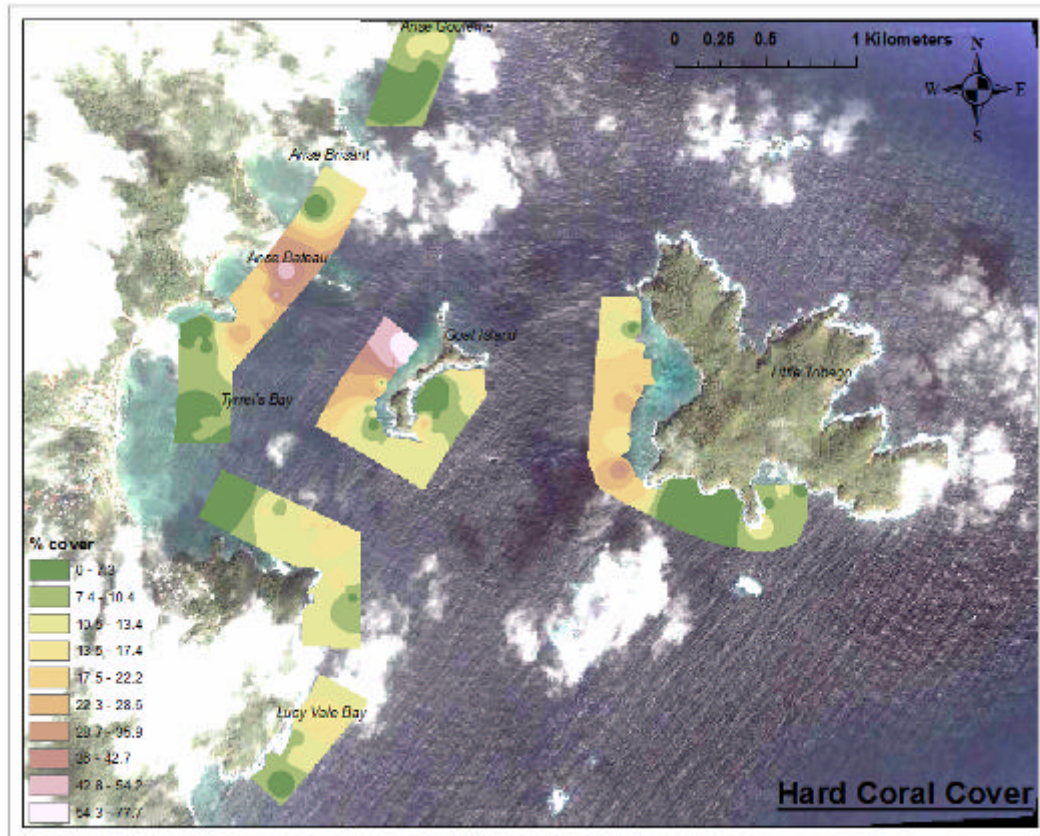


Figure 27 Colour contour map of the percentage live hard coral cover for the fringing reefs surveyed around Speyside

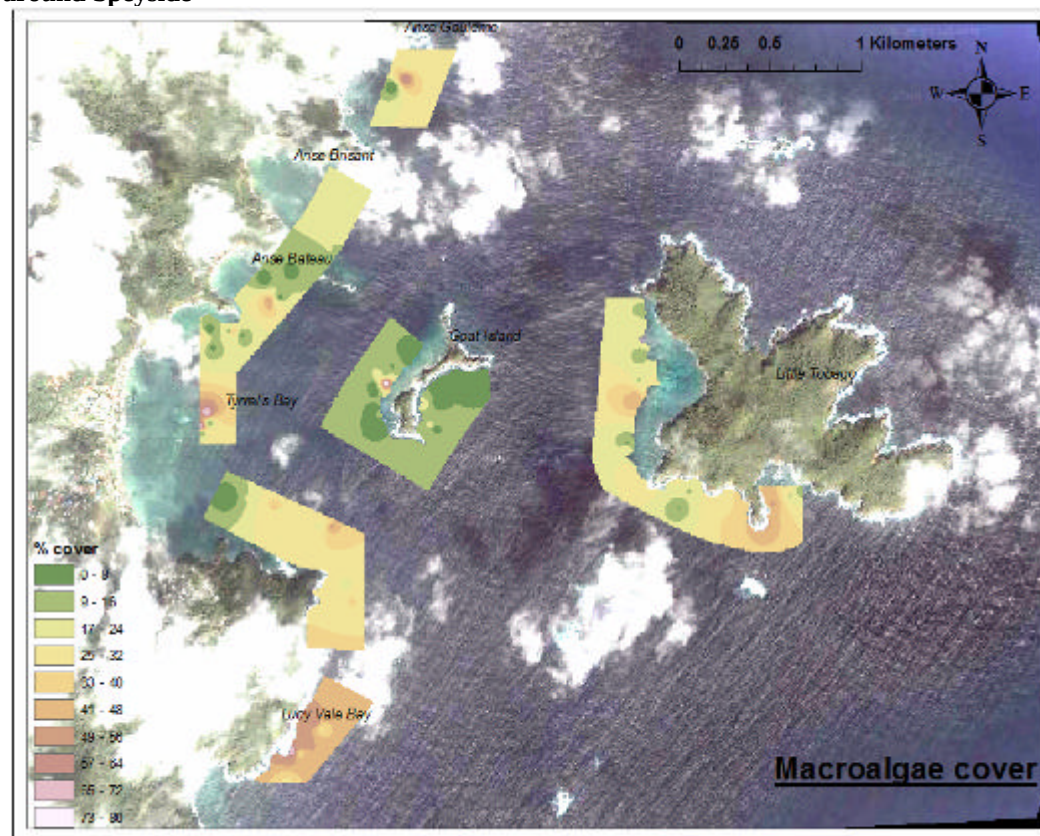


Figure 28 Colour contour map of the percentage macro-algae cover for the fringing reefs surveyed around Speyside.

3.2 Invertebrates

The density of *Diadema antillarum* sea urchins is presented in Figure 29. Densities were generally less than 100 individuals per hectare. Lobsters were seen on only a few surveys around Speyside (Figure 30).

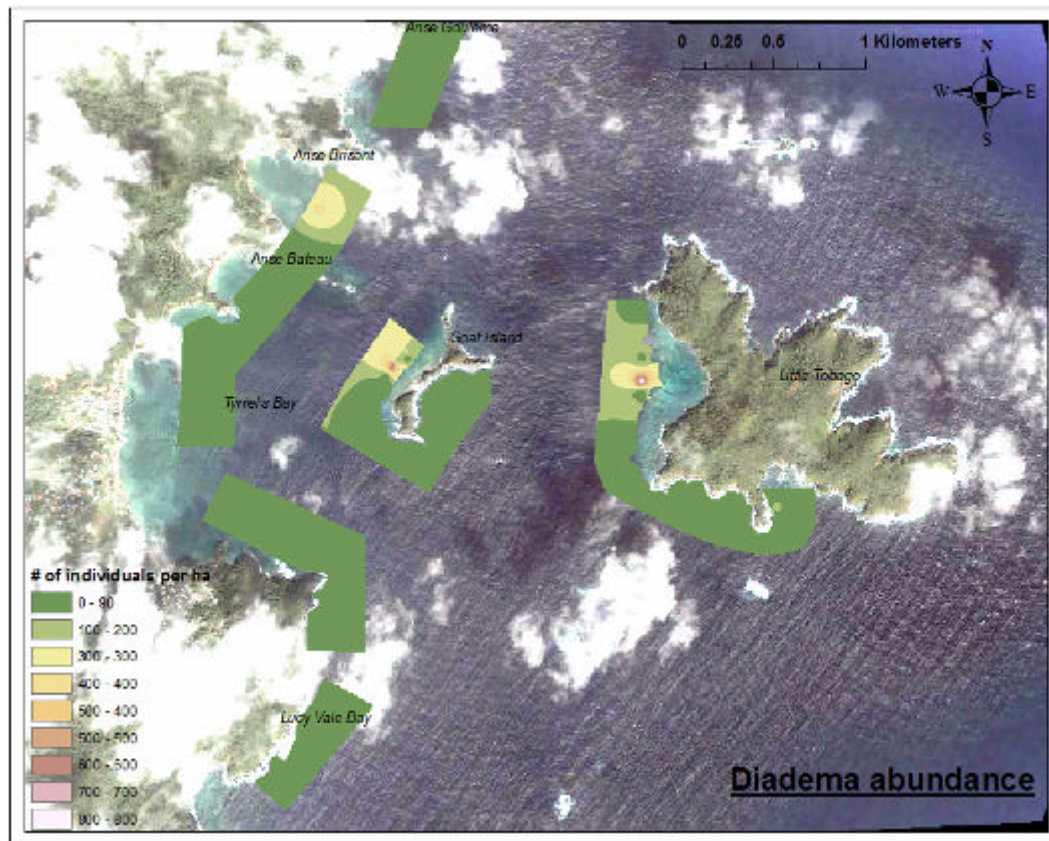


Figure 29 Colour contour map of the abundance of *diadema* sea urchins (individuals/ha) for the fringing reefs surveyed around Speyside.

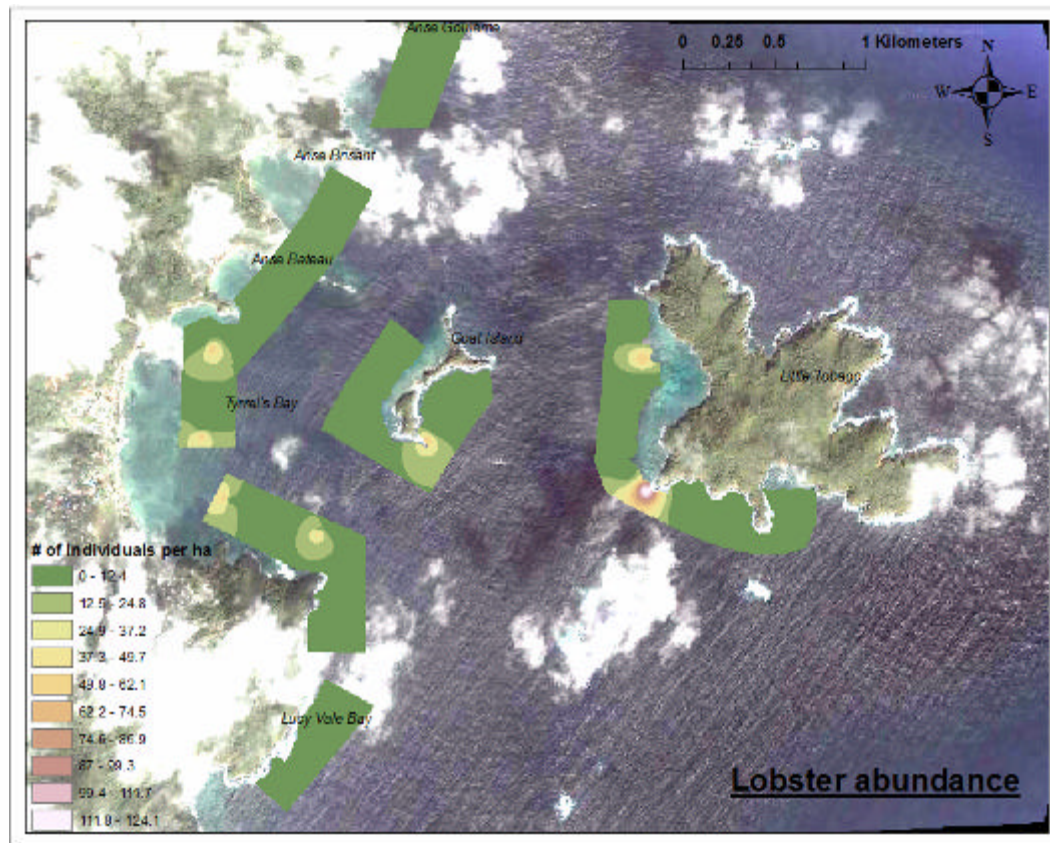


Figure 30 Colour contour map of the abundance Spiny Lobsters (individuals/ha) for the fringing reefs surveyed around Speyside.

3.3 Reef Fish

Fish diversity was calculated using a Shannon diversity index and is presented in Figure 31. The biomass of four commercially targeted reef fish families are presented in Figures 32-35. Fish biomass is presented as the number of kilograms per hectare of reef area (kg/ha). The total biomass for all commercial and pelagic target species is given in Figure 36. Most of this biomass can be attributed to Parrotfish and Grunts encountered on surveys.

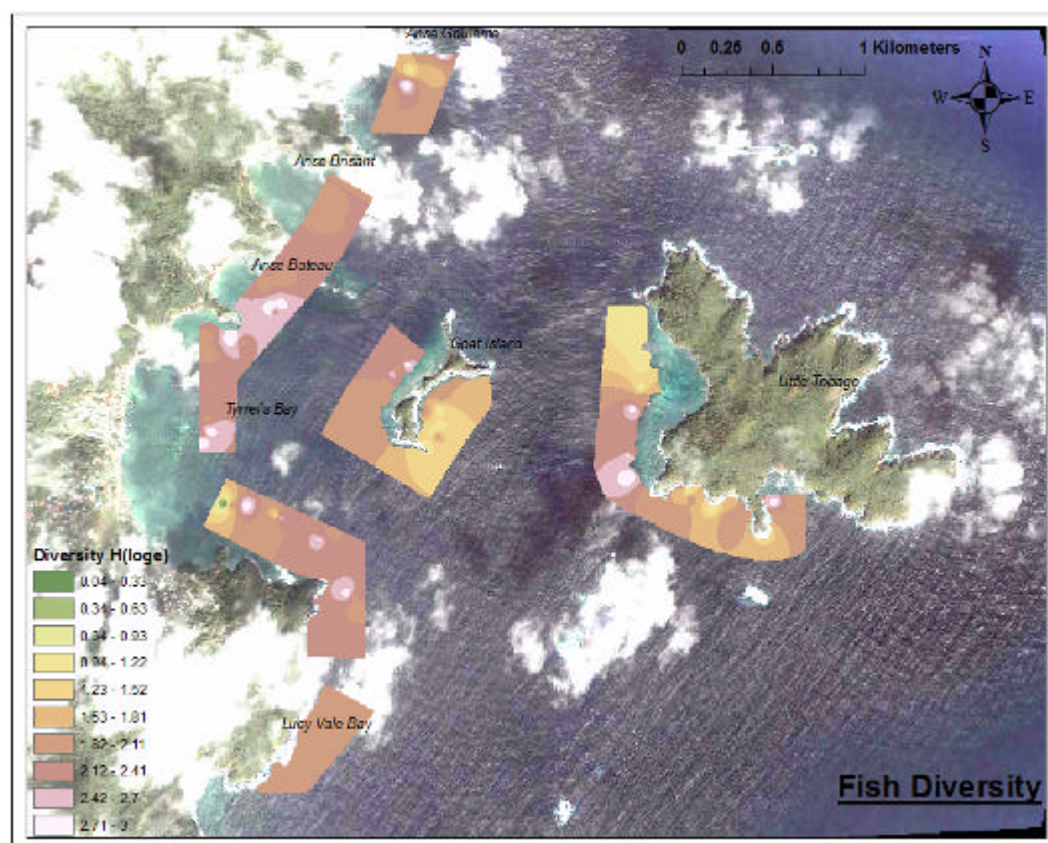


Figure 31 contour map of the diversity of fish species (Shannon diversity index (H)) for the fringing reefs surveyed around Speyside.

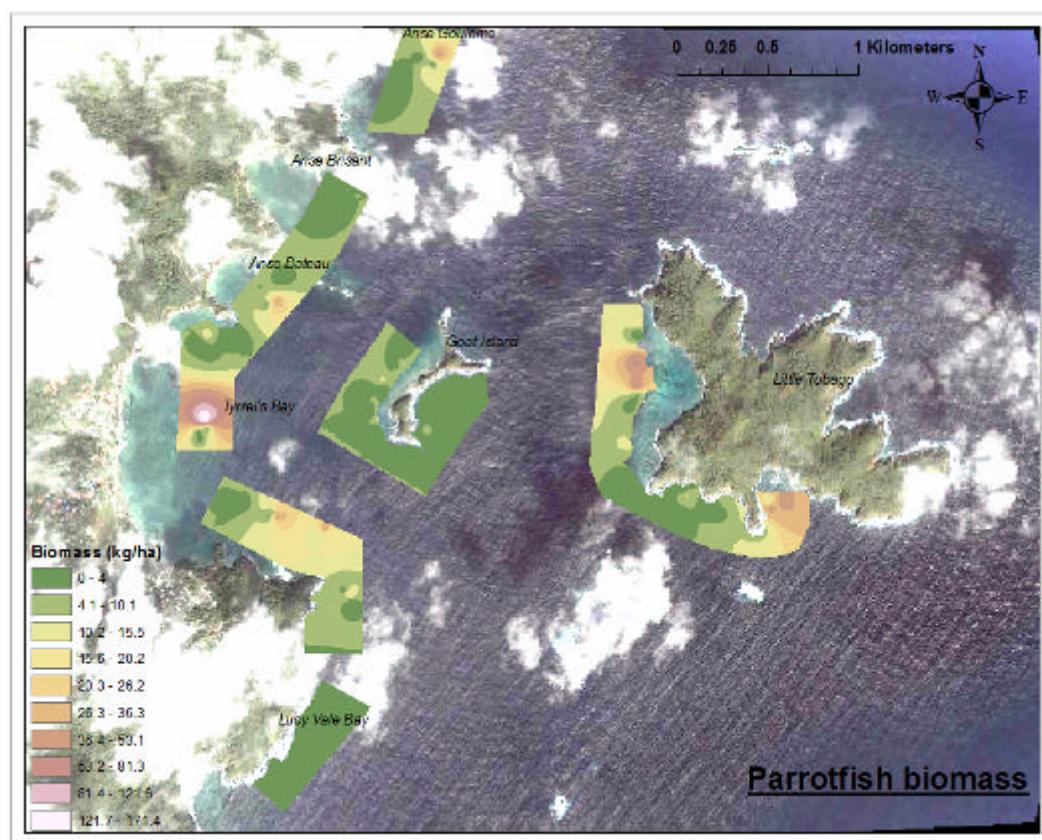


Figure 32 Colour contour map of the biomass of parrotfish (kg/ha) for the fringing reefs surveyed around Speyside.

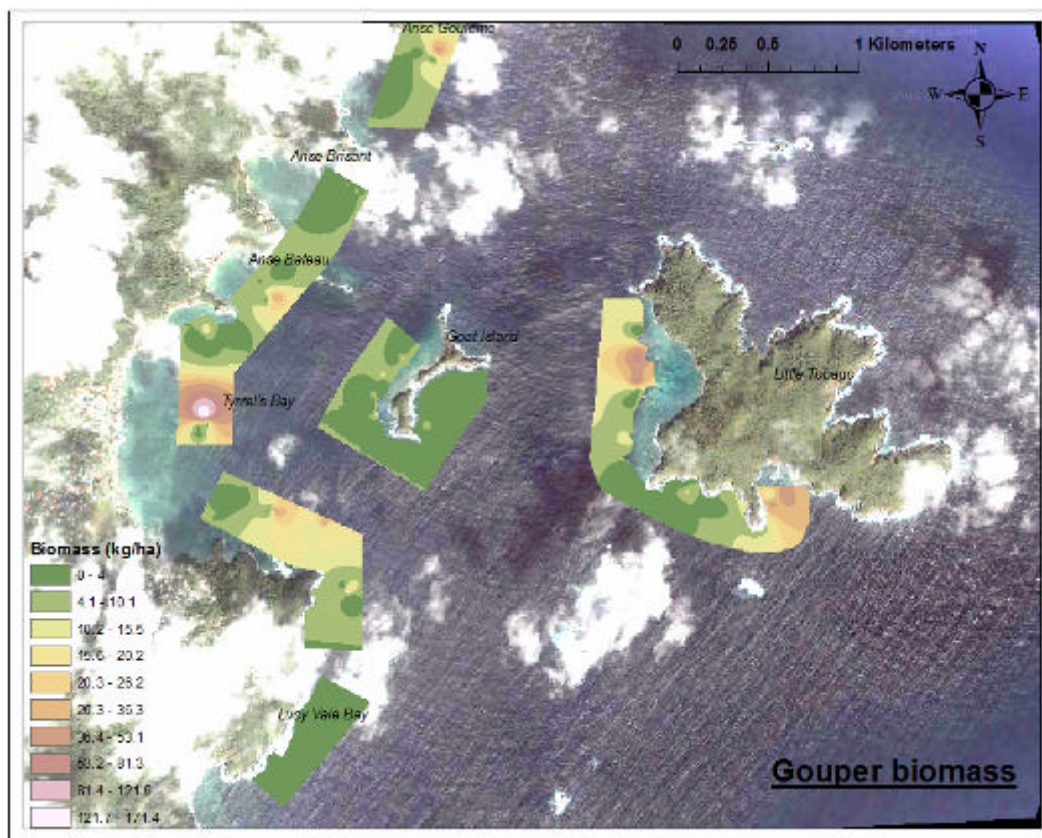


Figure 33 Colour contour map of the biomass of groupers (kg/ha) for the fringing reefs surveyed around Speyside.

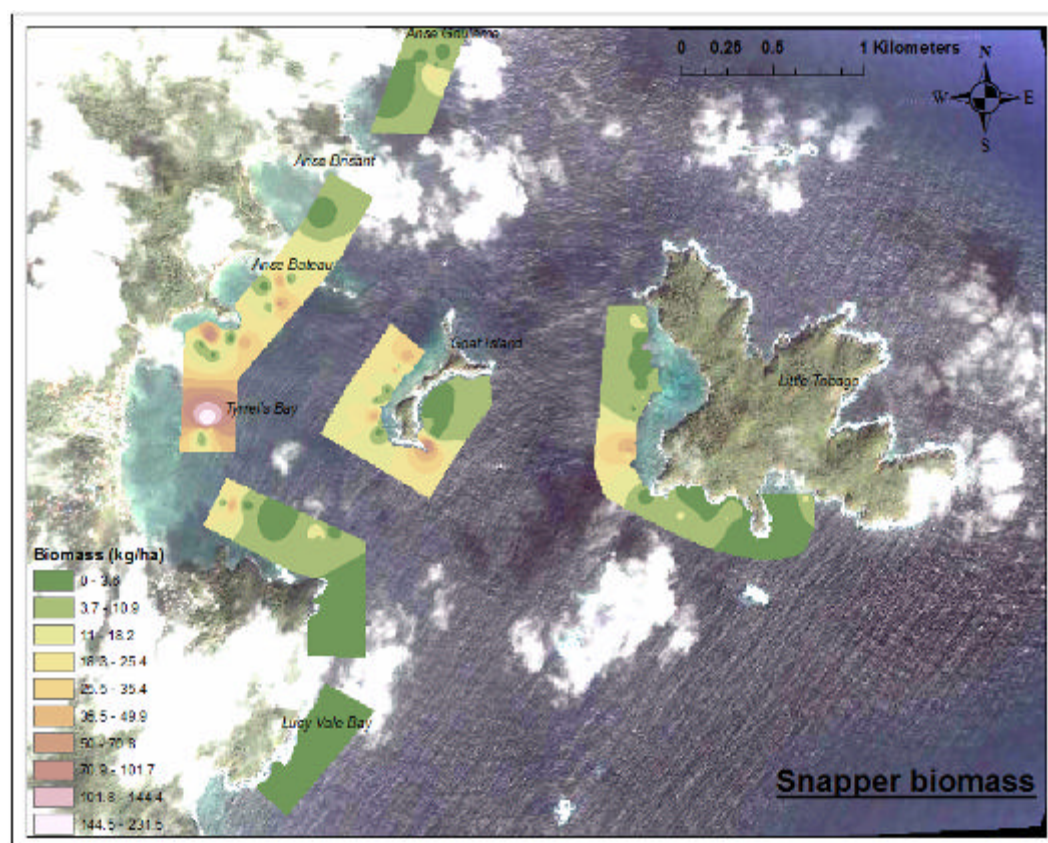


Figure 34 Colour contour map of the biomass of snappers (kg/ha) for the fringing reefs surveyed around Speyside.

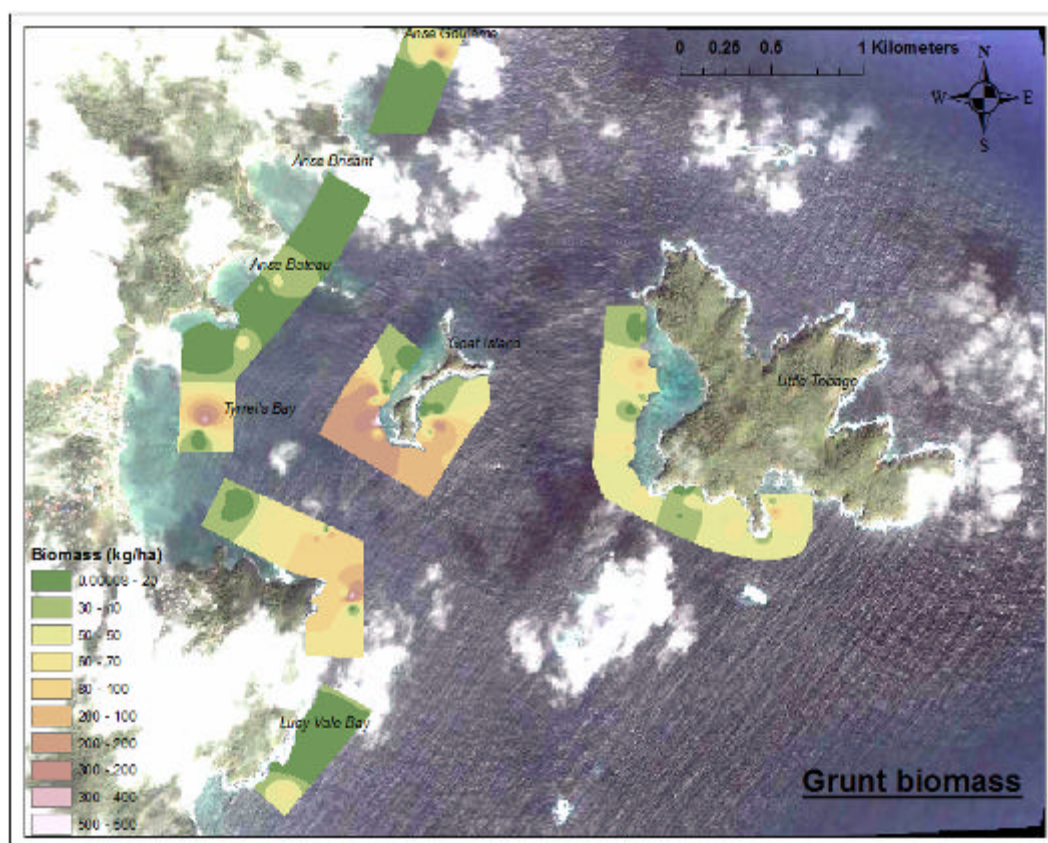


Figure 35 Colour contour map of the biomass of grunts (kg/ha) for the fringing reefs surveyed around Speyside.

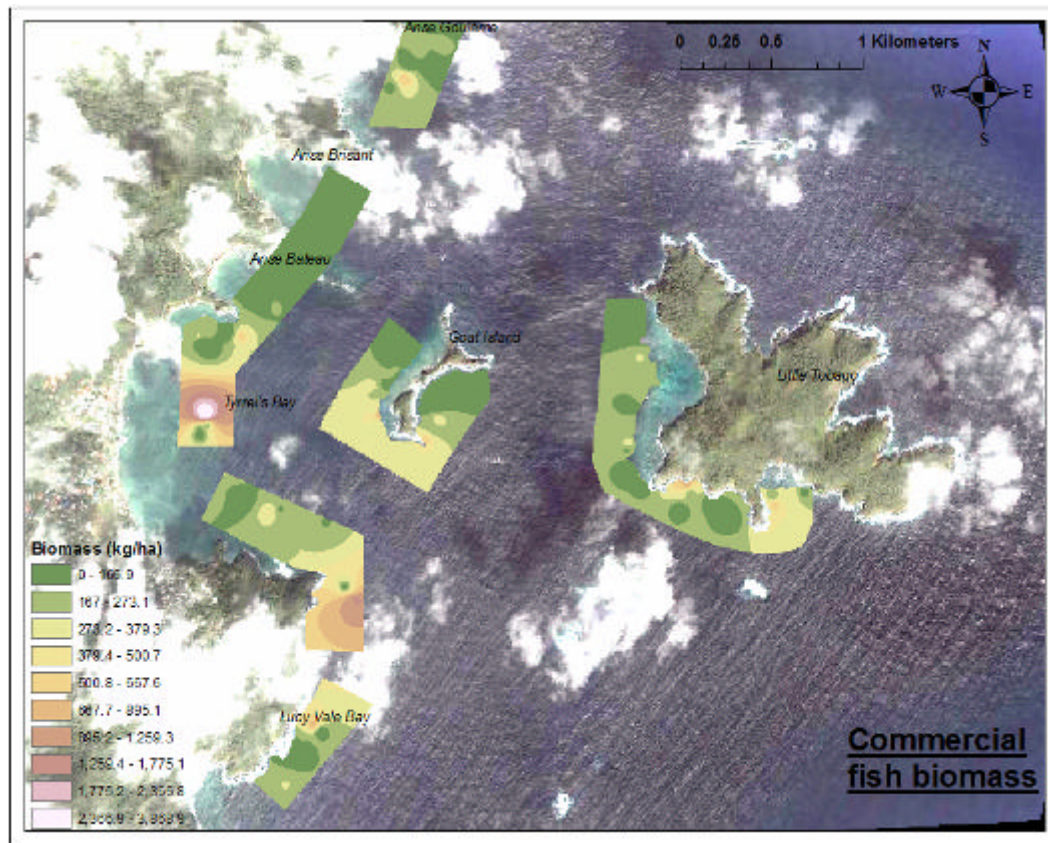


Figure 36 Colour contour map of the total biomass of commercial fish (kg/ha) for the fringing reefs surveyed around Speyside.

3.4 Coral Disease

Three common coral diseases infecting corals around the Caribbean have been presented here in order to map coral disease prevalence around Speyside. Yellow band disease typically infects *Montastrea* corals (Figure 37). Prevalence of this disease was found to be 90% in some areas but was generally less than 10%. Dark spot syndrome typically infects *Siderastrea* corals. Although highly variable, some sites displayed 100% prevalence of this disease (Figure 38). Aspergillosis infects Common Seafans and was found to be highly prevalent throughout the Speyside region (Figure 39).

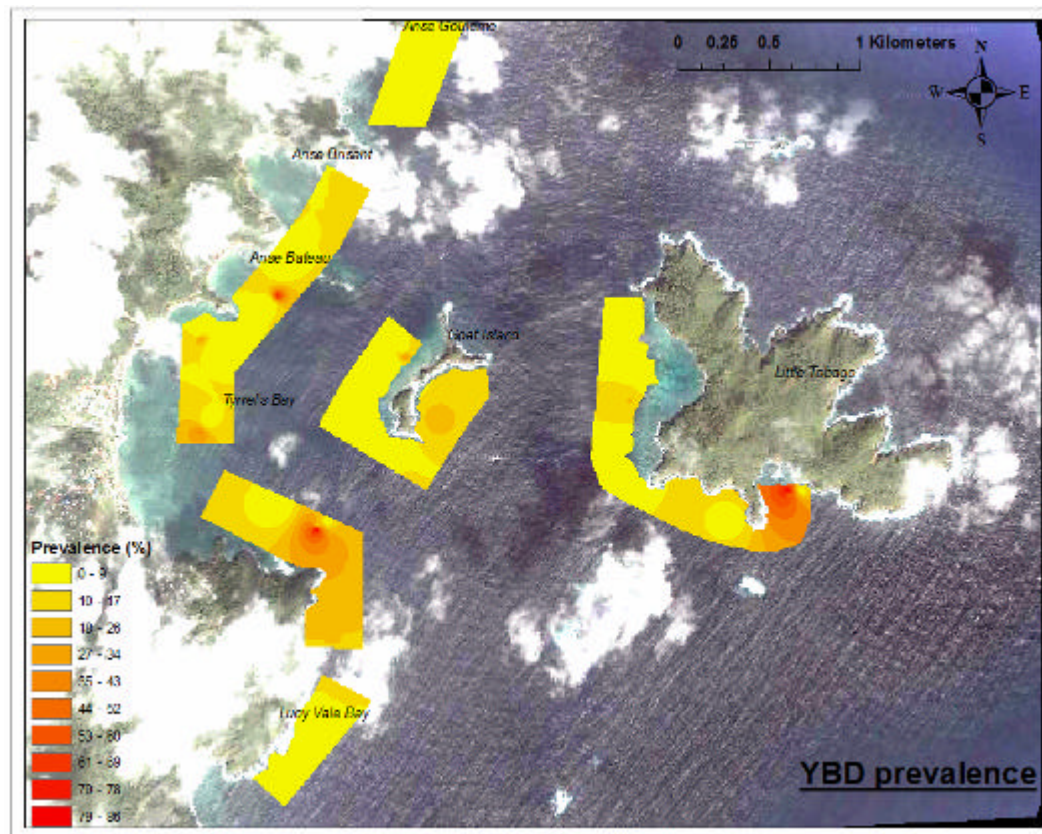


Figure 37 Colour contour map of the prevalence of yellow band disease for the fringing reefs surveyed around Speyside. Prevalence is given as a percentage of *Montastrea* spp. colonies infected.

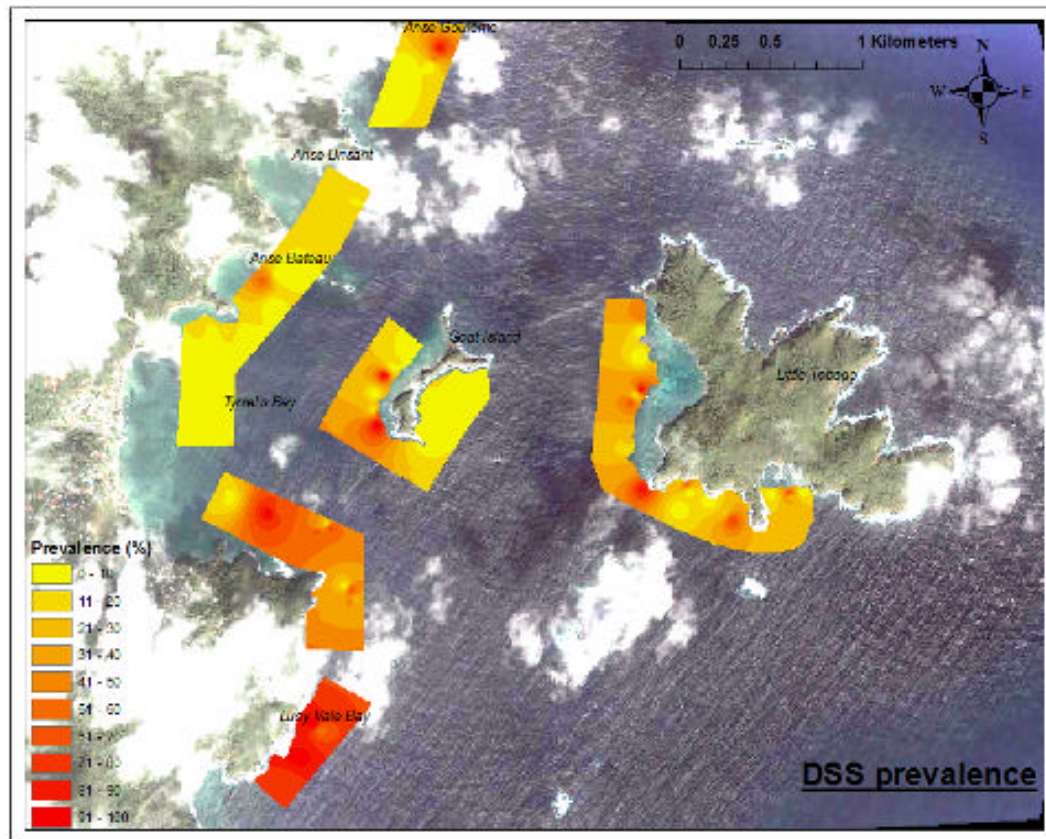


Figure 38 Colour contour map of the prevalence of dark spot syndrome for the fringing reefs surveyed around Speyside. Prevalence is given as a percentage of *Siderastrea* spp. colonies infected.

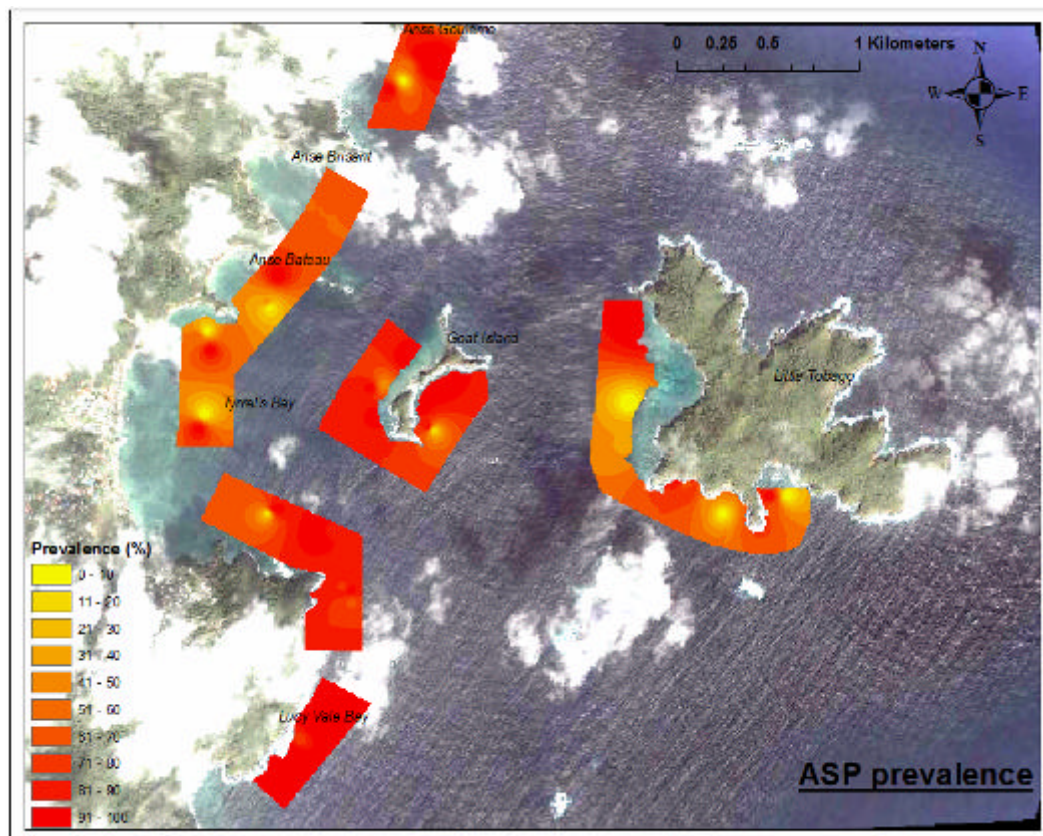


Figure 39 Colour contour map of the prevalence of Aspergilliosis for the fringing reefs surveyed around Speyside. Prevalence is given as a percentage of seafan colonies infected.

3.5 Conservation management values

High Conservation Management Values (CMV) were found throughout the Speyside region (Figure 40). Consistently high values were along the fringing reef along the western side of Little Tobago, north and south of Tyrrel's Bay and Anse Bateau. Comparisons have also been made between Speyside and the Caribbean side of Tobago (Figure 41). Unlike the previous map, which compares CMV values within Speyside, this map compares CMV values of all surveys conducted thus far on the Caribbean side of Tobago (including Speyside). High CMV values can be found all along the northern coast. Particularly good sites were found around Buccoo Reef, Plymouth, Brother's and Sister's rocks and Speyside.

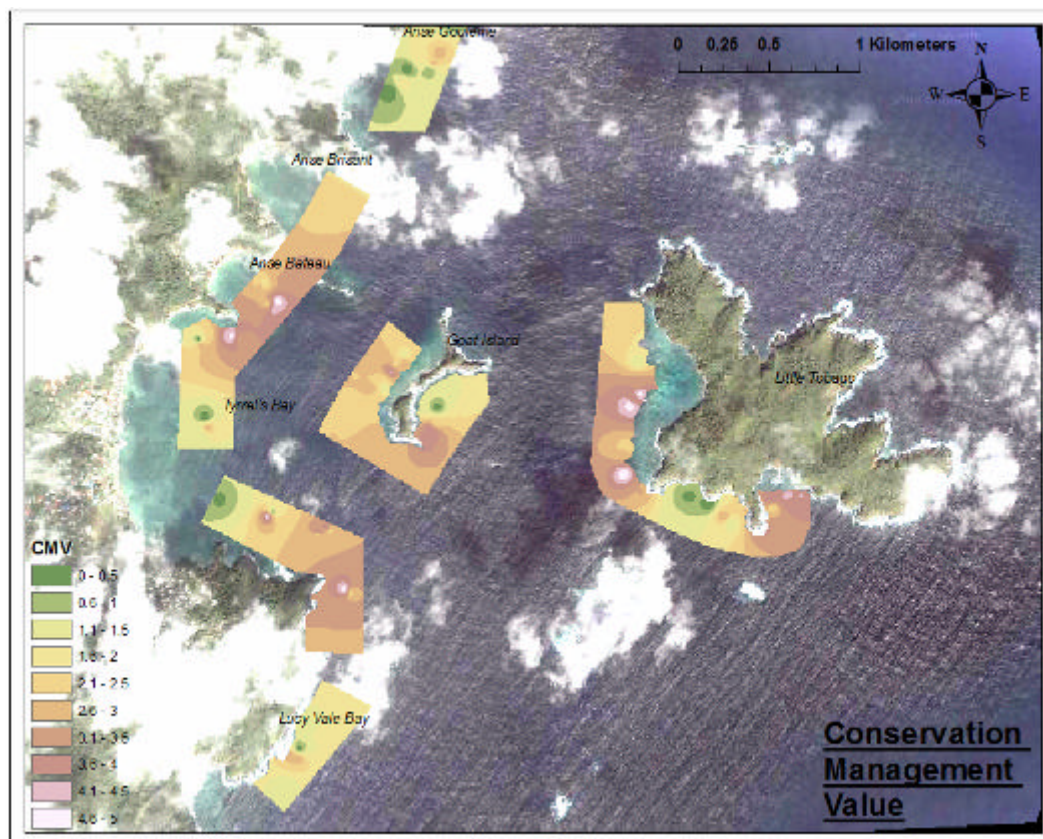


Figure 40 Conservation Management Values for coral reef habitats for the fringing reefs surveyed around Speyside.

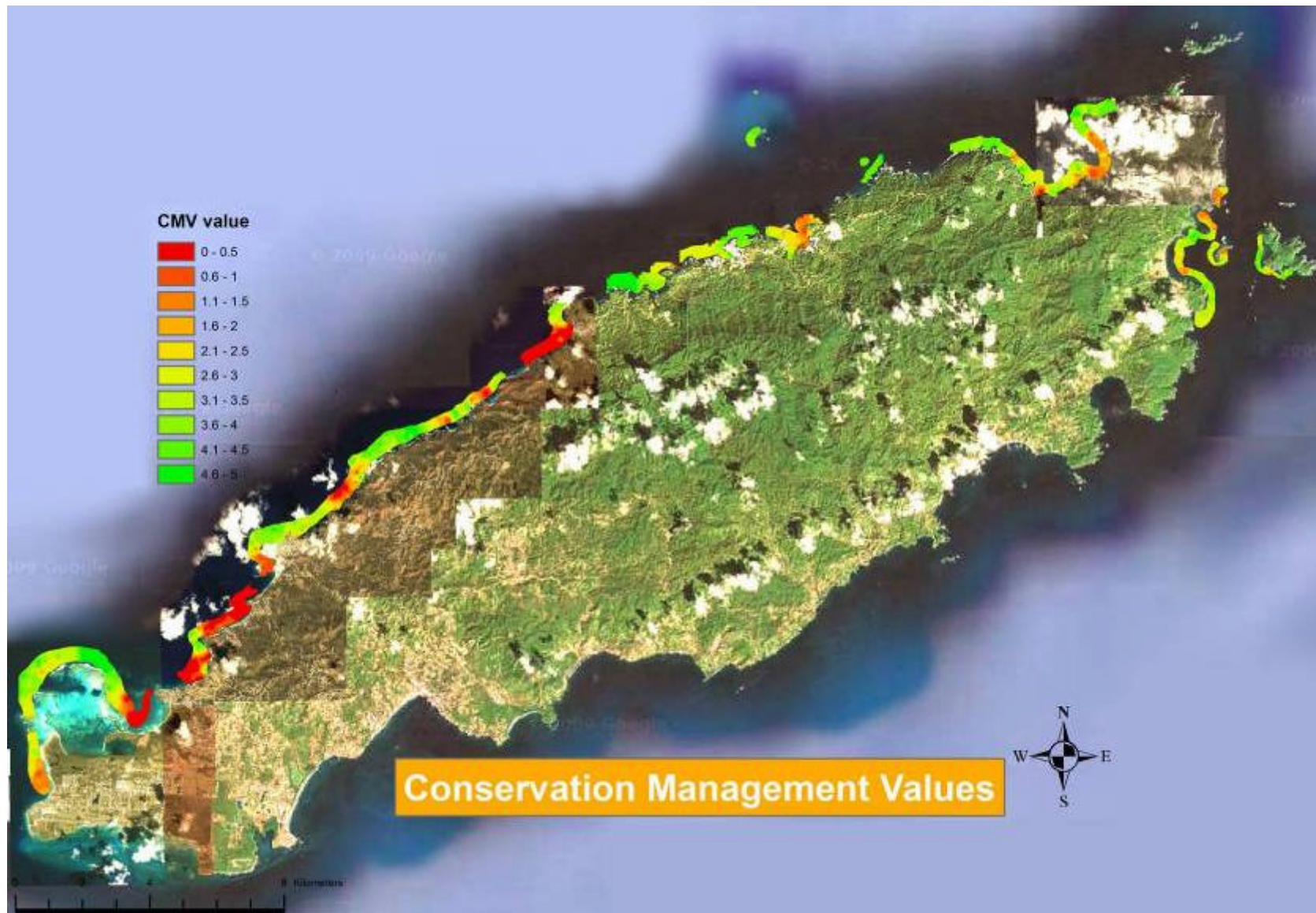


Figure 41 Conservation Management Values for coral reef habitats for the fringing reefs surveyed around Tobago between April 2007-August 2009

4. Discussion

4.1 *Benthic composition*

The reefs around Speyside consist mainly of algae covered rock and hard corals. In contrast, the Caribbean side reefs of Tobago consist of rubble, bare rock and sparse patches of coral with little to no macroalgae cover. Some sites such as Spiny Colony and Angel Reef exhibited some of the highest coral cover with values over 50%, well above most reef sites surveyed in the rest of the Caribbean. Monitoring observations done at the same sites and survey depths around Speyside indicate that coral cover and diversity have remained relatively stable in contrast to many reef sites on the Caribbean side of Tobago which saw a significant decline in coral cover between 2005 and 2007/2008. Although the coral cover has remained relatively high since the reefs were surveyed in 2005, the high level of macroalgae, especially at 7 metres, is cause for concern. Currently, no major phase shifts have taken place although an exception may be in Lucy Vale where macroalgae cover was as high as 70% on the shallow, 7-metre reefs.

Influx of nutrients from agricultural and sewage sources as well as prolonged periods of high sedimentation loading of coastal waters from land runoff are thought to be major contributors to the overall degradation and algal prevalence of the reefs surveyed. These local stressors can weaken the corals' natural defence mechanisms and make them susceptible to future, regional impacts such as coral bleaching and hurricane damage. This has already become apparent by the 2005 bleaching event that killed many of the affected corals and led to the disease outbreaks currently prevalent on the Caribbean side of Tobago.

4.2 *Reef Fish*

Reef fish data presented indicates that a number of commercially fished families were rarely recorded on reef surveys. Although total biomass of commercially fished species was similar to the Caribbean side of Tobago, the lack of Grouper, Snapper and Parrotfish abundance and biomass at all reef sites is of great concern. Their low abundance is most likely the result of overfishing in combination with habitat loss. Parrotfish biomass for example, was less than half that of the Caribbean reefs. The high cover of macroalgae on many of Speyside's reefs is likely to be attributed to low numbers of parrotfish in conjunction with high nutrient levels.

Comparisons with well-managed reefs of Bonaire in the Dutch Antilles indicate that biomass of these key species in Speyside is only a fraction of that of Bonaire. The importance of herbivorous Parrotfish in keeping algae cover low in order to promote coral recruitment has been well documented (Mumby *et al.*, 2006, Mumby *et al.*, 2007, Bellwood *et al.*, 2004, Bellwood *et al.*, 2006, Williams and Polunin, 2007). Any management initiatives will need to address this issue if harvesting of these reef fish is to continue.

Although the distribution of Grunts was very patchy, there were some indications that those sites that still have relatively good reef health contained the highest biomass of grunts. Grunts use coral overhangs for shelter and protection during the daytime and disperse at dusk when they become active foragers for invertebrate prey. As with most reef-associated fish, a decrease in the availability of suitable habitat for shelter will directly correlate with a decrease in their population numbers.

4.3 Invertebrates

Low abundances of key invertebrate species, particularly Queen Conch and Spiny Lobsters were found throughout the Speyside survey area, indicating serious over-harvesting. With no management practices in place to protect the remaining populations and under sustained fishing intensity, most reefs have already been depleted. It is recommended that no-take zones be established at key reef sites in addition to imposing restrictions on the minimum size of queen conch and lobsters caught as well as no-catch policies for egg-bearing female lobsters.

Next to the herbivorous Surgeonfish and Parrotfish families, an echinoid species, *Diadema antillarum* (long-spined sea urchin), plays a key role as a reef grazer potentially preventing phase shifts (Hughes, 1994). Abundances were lower than most of Tobago's Caribbean side reefs and the high macroalgal cover is likely to be due to low grazing pressure from both sea urchins and Parrotfish. Continued monitoring over the next years will establish whether there is a recovery of *Diadema* abundances.

4.4 Coral Disease and Bleaching

Yellow band disease and dark spot syndrome were the most common coral diseases around Speyside, infecting around 10% of hard corals. Both of these diseases attack massive, slow-growing coral colonies and can significantly lower the structural complexity of Speyside's reefs if these levels of prevalence continue. Levels of other diseases such as Black Band Disease and Red Band Disease were generally low to non-existent on most reefs. The few *Acropora palmata* stands that remain in shallow waters are susceptible to white pox and patchy necrosis.

The high levels of Aspergillosis infecting seafans is cause for concern. At some sites, all seafans were infected. As Aspergillosis is a land-derived fungus, it may be the case that sewage and agricultural effluent are amplifying its prevalence around Speyside.

Low levels of coral bleaching were observed but not to the extent of the mass-bleaching event of 2005. Coral disease levels were not as high around Speyside as they are for the Caribbean side of Tobago where disease prevalence has led to a significant reduction in hard coral cover.

It is worth noting that significant levels of coral disease were not observed on surveys conducted in 2005 during the mass coral bleaching outbreak (O'Farrell *et al.*, 2005). This strongly indicates that the disease outbreaks currently affecting Tobago are directly linked to post-stress symptoms from the mass bleaching event of 2005. The fact that disease prevalence has remained relatively low around Speyside is an important indicator of the area's resilience towards climate-change related impacts such as coral bleaching.

4.5 General Conclusions and Management Recommendations

Healthy coral reefs are an essential part of Speyside's economy and efforts must be made to ensure that reef health is improved. Disturbingly, all of the reefs visited for surveys are showing some signs of stress. Although the signs vary, they generally include: high macroalgae cover, coral diseases, high sedimentation, low fish density and direct physical damage such as anchor and trampling damage. Whilst current reef health is a cause for genuine concern, it is likely that the reefs observed still retain the capacity to recover. Speyside's reefs have shown to be highly resilient to regional, climatic influences such as increased sea surface temperatures. This was observed in 2005 when bleaching levels around Speyside remained relatively low compared to the rest of Tobago (see O'Farrell *et al.*, 2006). Findings from this report provide further evidence for the ecological importance of Speyside's reefs. Coral cover has remained stable and disease levels are not as high as those reefs severely impacted by the 2005 event. As it has already been hypothesised, Speyside's reefs are not as susceptible to coral bleaching events thanks to the strong currents pushing through the area, thereby preventing an accumulation of increased sea surface temperatures over a long period.

In order to deal with the high and increasing levels of sedimentation and nitrification, management strategies will need to address proper treatment of sewage and agricultural runoff through waste treatment facilities and routing runoff through wetlands and artificially created sediment ponds before it enters the sea. Furthermore, upland and coastal construction projects need to undergo rigorous environmental impact assessments and effective mitigation measures must be implemented before construction is allowed to commence. Strategies may include minimizing construction during the rainy season and replanting schemes to hold soil in place on exposed slopes. Mangrove and seagrass replanting schemes can be effective in acting as nutrient 'sinks' before they wash onto the reefs. Their important role as nursery grounds for many species of fish and invertebrates help to promote an increase in fish abundance and diversity on adjacent reefs.

Action to reduce local impacts such as overfishing, sedimentation and nitrification on the coral reefs and their associated habitats are of primary importance in order to maintain coral reef resilience and minimise the chances of phase shifts to algal dominated communities over the next years. A series of small-scale, well-managed no-take zones should be implemented for those areas which have extensive and relatively healthy reef systems such as Little Tobago, Goat Island and Anse Bateau. These no-take zones will promote the recovery of threatened reef fish families such as Groupers and Parrotfish and aid in the recovery of other endangered reef creatures such as queen conch and lobsters. This in turn would lead to a sustainable fishing industry and increased income to the Speyside community from dive and snorkel related tourism.

In order to assess the cultural, social and wider ecological implications of management measures proposed, fisheries surveys would need to be conducted within the Speyside community in order to provide valuable data on catch composition, weight and effort. This kind of data is currently absent. These outputs would provide information on what trophic levels are currently being fished and to what extent the fishing is disrupting the structure and function of coastal marine food webs. Furthermore, the information would enable the community to make informed decisions about the continued management of their coastal resources.

Continued capacity building programmes should be conducted for reef tour operators, marine park wardens and SCUBA instructors, allowing the Speyside community to benefit from livelihoods created through tourism. This can be achieved through programmes initiated through collaborative efforts between the THA and environmental NGOs such as the BRT and CCC as well as exchange programmes with other Caribbean island states. Training programmes must also strive to 'arm' stakeholders with the knowledge, technical capacity and will to manage Speyside's coastal resources in a sustainable manner. Finally, an extensive public education and awareness campaign is needed to build on existing efforts and ensure that all users appreciate and understand the value of these precious coastal resources.

Appendix III - Target species

BENTHIC CATEGORIES

19-Jun-07

		Lifeform	Species			Lifeform	Species			Lifeform	Species
SUBSTRATES				SESSILE INVERTEBRATES				HARD CORALS cont.			
Rock	>15cm diameter	1		<u>Porifera</u> (Sponges)				Smooth Star	<i>S bourmoni</i>	28	67
Sand	<0.5cm diameter	2		Encrusting		14	30	Knobby Star	<i>S hyades</i>	28	68
Silt/Clay	clouds when wafted	3		Barrel		14	31				
Rubble	0.5 to 15cm diameter	5		Vase		14	32	Elliptical Star	<i>D stokesi</i>	42	69
Recently Killed Coral		4		Tube		14	33	Golfball	<i>F fragum</i>	42	70
Other Animal *		6		Branching		14	34				
				Ball		14	35	Mustard Hill	<i>P astreoides</i>	29	71
				Rope		14	36				
MICRO-ALGAE				Lumpy		14	37	Lesser Starlet	<i>S radians</i>	30	72
<u>Cyano-Bacteria: Blue-Green</u>		7		Red Boring Sponge		14	38	Massive Starlet	<i>S siderea</i>	30	73
				Coral Encrusting Sponge		14	39				
MACRO-ALGAE								Knobby Brain	<i>D clivosa</i>	31	74
<u>Chlorophyta: Green</u>								Symmetrical Brain	<i>D strigosa</i>	31	75
Green Filamentous		8	1	<u>Cnidarians</u>				Grooved Brain	<i>D labyrinthiformis</i>	31	76
Acetabularia		8	2	Zoanthid		15	40	Maze	<i>M meandrites</i>	31	77
Avrainvillea spp.		8	3	Hydroid		15	41	Rose	<i>M areolata</i>	31	78
Caulerpa spp.		8	4	Corallimorph		15	42	Boulder Brain	<i>C natans</i>	31	79
Halimeda spp.		8	5	Encrusting Gorgonian		15	43				
Codium spp.		8	6					Sunray Lettuce	<i>H cucullata</i>	32	80
Neomeris spp.		8	7	<u>Tunicates</u>		16					
Udotea spp.		8	8					Lettuce	<i>A agaricites</i>	33	81
Ulva spp.		8	9	<u>Bryozoans</u>		17		Thin Leaf Lettuce	<i>A tenuifolia</i>	33	82
								Low Relief Lettuce	<i>A humilis</i>	33	91
<u>Phaeophyta: Brown</u>				HARD CORALS				Other Lettuce	<i>Agaricia</i> spp.	33	83
Dictyota sp.		9	11	Lace	<i>S roseus</i>	18					
Padina sp.		9	12					Ridged Cactus	<i>M lamarckiana</i>	34	84
Lobophora sp.		9	13	Fire spp.	<i>Millepora</i> spp.	19		Knobby Cactus	<i>M aliciae</i>	34	85
Styopodium zonale		9	14					Rough Cactus	<i>M ferox</i>	34	86
Turbinaria sp.		9	15	Staghorn	<i>A cervicornis</i>	20	50				
Sargassum sp.		9	17	Fused Staghorn	<i>A prolifera</i>	20	51	Rough Star	<i>I rigida</i>	41	93
				Elkhorn	<i>A palmata</i>	20	52				
<u>Rhodophyta: Red</u>								Spiny Flower	<i>M angulosa</i>	35	87
Encrusting Coralline Algae		10	18	Thin Finger	<i>P divaricata</i>	21	53	Smooth Flower	<i>E fastigiata</i>	36	88
Galaxaura sp.		10	19	Branched Finger	<i>P furcata</i>	21	54	Orange Cup	<i>T coccinea</i>	37	89
Amphiroa sp.		10	20	Clubtip Finger	<i>P porites</i>	21	55				
Jania sp.		10	21					Misc Cup Corals		40	92
Red Filamentous		10	22	Pillar	<i>D cylindrus</i>	22		Scolymia spp.		38	90
Sheet		10	23					Other Live Hard Coral *		39	
Wrangelia penicillata		10	24	Diffuse Ivory Bush	<i>O diffusa</i>	23					
Laurencia spp.		10	25								
Liagora spp.		10	26	Yellow Pencil	<i>M mirabilis</i>	24	58				
				Eight-Ray Finger	<i>M formosa</i>	24	59				
Other Macro Algae *		11		Ten-Ray Star	<i>M decactis</i>	24	60				
MARINE PLANTS				Blushing Star	<i>S intersepta</i>	25					
<u>Seagrass</u>											
Turtle		12	28	Boulder Star Complex		26	62				
Manatee		12	29	Lobed Star	<i>M annularis</i>	26	63				
Halophila		12	30	Mountainous Star	<i>M faveolata</i>	26	64				
				Boulder Star	<i>M franksi</i>	26	65				
Mangroves		13									
				Great Star	<i>M cavernosa</i>	27					

* If substrate, algae or coral falls into 'other' category please justify with a description or an identification in notes.

Demersal Fish Species				18-Jun-07			
<u>BUTTERFLY</u>	1	<u>HAMLETS</u>	25	<u>SQUIRRELFISH</u>	50	<u>BOXFISH</u>	75
Spotfin	2	Barred	26	<u>BIG EYES</u>	51	Cowfish	76
Foureye	3	Indigo	27	<u>CARDINALFISH</u>	52	Trunkfish	77
Banded	4	Yellowbelly	28	<u>GOBIES</u>	53		
Reef	5	Shy	29	<u>BLENNIES</u>	54	<u>TRIGGERFISH</u>	78
Longsnout	6	Black	30	<u>JAWFISH</u>	55	Queen	79
		Butter	31	<u>FLOUNDER</u>	56	Black Durgon	80
<u>ANGEL</u>	7	Yellowtail	32	<u>BATFISH</u>	57		
Rock Beauty	8	Golden	216	<u>TOADFISH</u>	58	<u>FILEFISH</u>	81
Queen	9			<u>SCORPIONFISH</u>	59	Scrawled	82
French	10	<u>BASS</u>	33	<u>FROGFISH</u>	60	Orangespotted	83
Gray	11	Harlequin	34	<u>FLYING GURNARD</u>	61	Whitespotted	84
Cherubfish	12	Tobacco	35	<u>LIZARDFISH</u>	62		
		Fairy Basslet	36	<u>SEAHORSE</u>	65	<u>GOATFISH</u>	85
<u>SURGEON</u>	13	Blackcap	37	<u>PIPEFISH</u>	66	Spotted	86
Ocean	14	Greater Soapfish	38	<u>HAWKFISH</u>	67	Yellow	87
Doctor	15	Creolefish	39	<u>TRUMPETFISH</u>	68		
Blue Tang	16			<u>CORNETFISH</u>	69	<u>DRUM</u>	88
		<u>WRASSE (TP only)</u>	40	<u>TILEFISH</u>	70	Spotted	89
<u>DAMSELFISH</u>	17	Spanish Hogfish	41			Highhat	90
Yellowtail	18	Puddingwife (also IP)	42	<u>PUFFER</u>	71		
Bicolour	19	Creole (also IP)	43	Bandtail	72	<u>SWEEPERS</u>	91
Sergeant Major	20	Yellowhead	44	Sharpnose	73		
Night Sergeant	21	Slippery Dick	45			<u>EELS</u>	92
Blue Chromis	22	Blue Head	46	<u>PORCUPINEFISH</u>	74	Moray	93
Brown Chromis	23	Clown	47			Conger	94
Sunshine Fish	24	Blackear	48			Garden	95
		Rosy Razorfish	49			Snake	96

Commercial and Pelagic Fish				Target Invertebrates		18-Jun-07		
<u>MISC SILVERY</u>		97	<u>GROUPE</u>	141	<u>ANNELIDS</u>		<u>ECHINODERMS</u>	
Needlefish		105	Goliath / Jewfish	142	Lugworm	169	Feather Star	194
Barracuda spp.		106	Nassau	143	Xmas Tree Worm	170	Sea Star	195
Boga		107	Comb	144	Feather Duster Worm	171	Brittle Star	196
Bonefish		108	Black	145	Spaghetti Worm	172	West Indian Sea Egg	197
White Mullet		109	Yellowfin	146	Fireworm	173	Long Spined Urchin	
Saucereye Porgy		110	Yellowmouth	147			Adult	199
Mojarra spp.		111	Tiger	148	<u>ARTHROPODS</u>		Juvenile	200
Tarpon		112	Marbled	149	Spiny Lobster	175	Pencil Urchin	201
Chub		113	Red Hind	150	Slipper Lobster	176	Sea Cucumber	202
Spadefish		114	Rock Hind	151	Banded Coral Shrimp	230		
			Graysby	152	True Shrimp	177	<u>FLATWORMS</u>	203
			Coney	153	Mantis Shrimp	178		
<u>MACKERELS</u>					Hermit Crab	184	<u>CNIDARIANS</u>	
Cero	101		<u>WRASSE</u>		Porcelain Crab	180	Jellyfish	204
Spanish Mackerel	102		Hogfish (all phases)	154	Spider Crab	179	Anemone (Sea)	214
King Mackerel	103				Batwing Coral Crab	182	Anemone (Tube)	215
Little Tunny	104				Yellowline Arrow Crab	183		
			<u>JACKS</u>	155	Other Crab	181	<u>OCTOCORALS</u>	
<u>GRUNTS (adults)</u>	116		Bar	156			Common Seafan	205
Bluestriped	117		Horse-eye	157	<u>MOLLUSCS</u>		Deepwater Seafan	206
Spanish	118		Yellow	158	Queen Conch	185	Rod	207
Smallmouth	119		Permit	98	Triton Trumpet	186	Plume	208
Striped	120		Palometa	99	Bivalve	187	Red Sea Whip	209
White	121		Scad spp.	100	Cowrie	188	Flat Sea Whip	210
Cesar	122		Blue Runner	115	Seahare	189	Corky Sea Finger	211
Cottonwick	123				Nudibranch	190		
French	124		<u>PARROT (TP + IP)</u>	159	Sea Slug	228	<u>BLACK CORALS</u>	
Tomtate	125		Queen TP	160	Flamingo Tongue	191	Black Coral Bushy	212
Margate	126		Rainbow TP	161	Octopus	192	Black Coral Wire	213
Black Margate	127		Princess TP	162	Squid	193		
Porkfish	128		Blue TP	163	Other Snail	229		
Latin	129		Striped TP	164				
Black	130		Midnight TP	165				
Corocoro	131		Stoplight TP	166				
			Redband TP	167				
<u>SNAPPER</u>	132		Yellowtail TP	168				
Schoolmaster	133		Redtail TP	169				
Mahogany	134		Queen IP	218				
Dog	135		Rainbow IP	219				
Gray	136		Princess IP	220				
Mutton	137		Blue IP	221				
Lane	138		Striped IP	222				
Yellowtail	139		Midnight IP	223				
Cubera	140		Stoplight IP	224				
			Redband IP	225				
			Yellowtail IP	226				
			Redtail IP	227				

Appendix IV – Project Appraisal Attendance List and Testimonials

Speyside Marine Area Community Based Project Appraisal 07th October 2009. List of Attendees

Name	Community Organisation /Affiliation
Ruth Redman	Department of Marine Resources and Fisheries
Esther Tobias	Department of Marine Resources and Fisheries
Clem McPherson	Speyside Village Council
Jamie Persad Mohammed	Blue Waters Inn
Rawle Frederick	SWMCOL
Patricia Turpin	Environment Tobago
Hilton Sandy	Division of Agriculture, Marine Affairs, Marketing and the Environment
Ken Webster	Speyside A.C. Primary School
Handa Melville	Speyside
Leida Buglass	CANARI
Daniel P Nicholson	Division of Tourism
Trudy Ann Baptiste	Speyside
Khadedria Lyons	Speyside
Rupert McKenna	Speyside
Gerald MacFarlane	Buccoo Reef Trust
Jace Bishop	Nature Tours, Speyside

Name	Community Organisation /Affiliation
Stephan Skeete	Speyside
Zolani Frank	Tour Guide, Speyside
Wordsworth Frank	Boat Tours, Speyside
Peter Raines	Coral Cay Conservation
Makeeda George	Assistant to Speyside THA Representative Tracey Davidson –Celestine
Margaret Sampson	Speyside High School
Peter Trotman	Speyside
Marcia de Castro	Resident Representative, United Nations Development Programme
Anna Cadiz	National Coordinator, GEF/SGP
Diann Cooper-Mark	National Steering Committee
Carrall Alexander	National Steering Committee
Kerry-Ann Thompson	Intern, GEF/SGP
Deborah Baird	Buccoo Reef Trust
Cherece Wallace-Haywood	Buccoo Reef Trust
Barry Lovelace	Buccoo Reef Trust
Kern Spencer	Dive Operator, Speyside

Testimonials:

Deon Walcott, SMACMP Scholar

An experience worth having

“I think anyone who has the chance should take full advantage of the scholarship programme. When the bleaching effect took place, I was working as a Dive master, I was a bit confused,

but after being at Coral Cay I knew what had happened and what we can do to monitor our reefs. The ocean is our most precious possession. We eat from it, we earn money from it, and we benefit from it so much it is time we took interest in preserving it. At Coral Cay I learned how best we can do this. I would advise anyone; tour operators, dive masters, anyone to try Coral Cay there is a lot for you to learn.”

Trudy-Ann Denoon, Speyside High School Student

“I was introduced to this by the UNESCO Club of the Speyside High School. Through the UNESCO Club, Coral Cay Conservation and Buccoo Reef Trust, we went to a lecture in Trinidad; A Disaster Preparedness Seminar. The Buccoo Reef Trust gave us the information to do our presentation. I have learnt about the different species of fishes and how it is important to conserve our biodiversity and that the ocean does a lot for us. [I learnt about] all the things around us, the natural ecosystems, the rainforest and all these things. I think that what Coral Cay is doing is a great thing to protect our environment. It will be a great thing for the future generations to come and see the same things we are seeing today.”

Daniel Nicholson, Tobago House of Assembly’s Division of Tourism and Transport

“Congratulations to the consortium that got this program going and I am proud that the community has bought into it effectively”

Rupert Mc Kenna, Flexible Scholar

“It’s a pleasure to be part of this program. There [are] five (5) persons willing to form a group to carry on the work of protecting the reef in Speyside. We are willing to be trained to carry out the work that Buccoo Reef Trust and Coral Cay ha[ve] started.”

Hon. Hilton Sandy, Tobago House of Assembly Secretary for Agriculture, Marine Affairs, Marketing and the Environment

“The exercise this afternoon is really to teach the people of Speyside; the people of Tobago, good practices in managing the resources we call the coral reefs of Tobago. All that is said and done this afternoon is welcome, but (it is the) implementation (that) is key! ...the reef is situated in Speyside and if the people of Speyside have to live off the reef, you have to learn how to manage the resource....

I want to congratulate Buccoo Reef Trust, Coral Cay Conservation; all the NGO’s, CBO’s that funded this project. The project can only be good if we implement what is coming out of the study. ...I am asking the same five who said they are volunteering to run with...the conservation of the park....Your first job is to mobilise the people of Speyside to be appreciative of what was done and what is to be done to make this thing a success.”

Appendix V - References

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