

# Assessing sustainable “green boat” practices of water taxi operators in the Grenadines

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## ABSTRACT

The Grenadines is an island chain in the Windward Islands of the West Indies. The islands are situated between mainland St. Vincent and Grenada and lie across the boundary of the countries of St. Vincent and the Grenadines and Grenada. The coastal and marine ecosystems of all the Grenadine islands are of considerable value to the national economies and quality of life. Residents depend on the resources for their livelihoods through various activities. Water taxiing is an important form of employment in the Grenadines that services both the tourism industry and the local transportation system.

During the development of the strategic plan in Phase 1 of the Sustainable Grenadines project, building capacity of water taxi operators to provide better customer service and reduce impact on the environment was identified as a priority. The majority of the water taxi operators from the islands take their tourists to the Tobago Cays Marine Park in St. Vincent and the Grenadines and to other areas near Carriacou and Petite Martinique in Grenada that are in the process of being protected.

Along with tourist arrivals and more frequent, stronger storms, it has been identified that water taxi operators are also contributing to the degradation of the marine environment in and around these areas of interest by engaging in non-environmental boating practices. To verify this, a study was conducted titled, “Assessing sustainable ‘green boat’ practices of water taxi operators in the Grenadines”.

Fifty water taxi operators were randomly selected and interviewed in six Grenadine islands. The water taxi operators were questioned about their routine boating practices, threats to the marine environment, the value of the marine resources and measures that should be put in place to protect them.

Results indicate that water taxi operators’ current practices are often not environmentally friendly. This is evident through improper anchoring, littering, usage of non-environmentally friendly cleaning agents and equipment, etc. Using the results of the in-depth survey, a booklet compiling the best environmental practices for boat operation covering several topics has been drafted for the water taxi operators. Considering the importance of the marine resources to all stakeholders, the resources need to be protected and laws enforced to ensure intergenerational equity. Improved boating practices by water taxi operators can contribute significantly to marine environmental conservation in the Grenadine islands.

Key words: “Green boat”, water taxi, Grenadines

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# 1 INTRODUCTION

## 1.1 Background

The Grenadines is an island chain in the Windward Islands of the West Indies. The islands are situated between mainland St. Vincent and Grenada and lie across the boundary of the countries of St. Vincent and the Grenadines and Grenada. The 30 islands and cays that comprise the Grenadine Islands are among the most popular cruising grounds in the Caribbean, surrounded by coral reefs and clear blue waters ideal for diving, snorkelling and boating ([www.lonelyplanet.com](http://www.lonelyplanet.com)).

The islands in the Grenadines have an interesting history of indigenous Ciboney, Arawaks, French and British settlers. These settlers mixed with each other giving the Grenadines its unique mixture of cultures and traditions. During the 1700s alone, it was settled by the British, captured by the French and then restored to the British in the late 1700s. Of the six islands where this survey was carried out, Carriacou is the largest island and most developed and Mayreau the smallest and least developed. Bequia remains the most visited island in the Grenadines due to its close proximity to mainland St. Vincent. The least visited islands are Carriacou and Petite Martinique, which only get the tourists that trickle down from the northern Grenadine islands.

The coastal and marine ecosystems of all the islands are of considerable value to the national economy and quality of life (French Cooperation Programme, 1994). Residents in the Grenadines have traditionally relied on the sea for their livelihoods; they use it for fishing, travelling, recreation and other activities. For the residents of the Grenadines, tourism and fishing are the major activities and income earners. The environment, however, that these industries rely on has been significantly degraded. The beaches, land and marine water quality have all been degraded, while the food resources of the land and sea have been depleted.

Most of the Grenadine islands have been struggling with the concept and practices of sustainable development and this can be attributed to several factors. Islands such as Mustique and Bequia have taken some of the measures and implemented programmes focusing on sustainability, but many of the other islands do not have the human or technological resources to put such measures in effect. Other reasons why this has not been successful include lack of governmental support, lack of organisations to spearhead such programmes on several islands and lack of knowledge or information on such initiatives. Examples where one industry (tourism) is causing adverse effects on the environment and threatening the marine ecosystem of the Grenadines include poor coastal development, increase in solid wastes, beach degradation, and poor boat operation practices. There are regulations, conventions and agreements that provide the basis for developing programmes, measures and alternatives that may be adopted to reverse the situation in the Grenadines.

The Sustainable Grenadines Project is addressing some of the impacts mentioned above. This project started in 2002 with the overall goal to promote integrated sustainable development of the Grenadine Islands for the social and economic well being of the people who live there ([www.cermes.cavehill.uwi.edu](http://www.cermes.cavehill.uwi.edu)). The project has two purposes, which are first to develop a participatory co-management framework for integrated sustainable development in the Grenadines and second, to demonstrate participatory sustainable development that can be adapted by small islands systems. ([www.cermes.cavehill.uwi.edu](http://www.cermes.cavehill.uwi.edu)). Phase 1 of the project, “Stakeholder assessment and participatory project development” was successfully completed in

2003. Phase 2 constitutes implementing the participatory strategic plan developed in phase one, over a five-year period (November 2003-December 2008). It has four focal areas including continued capacity building of the non-governmental organizations and government departments; creating networks to develop functioning linkages between stakeholders and assisting stakeholders in developing proposals to seek funding for other projects.

During Phase 1 of the Sustainable Grenadines Project, participants and partners recognised that the water taxi operators have the potential to significantly impact the environment throughout the Grenadines because of their daily activities. The majority of the water taxi members are small-scale operators who struggle to make a living from the business. They work throughout the Grenadines providing transportation services to the other islands and charter tours for tourists and locals in both the high and low seasons. The high season represents high influx of tourists and plenty business opportunities for the water taxi operators. Low season on the other hand, represents limited visitors; hence, business declines and some operators revert to other sources of income. Negative impacts of working at sea daily may arise from poor boat operation practices such as inappropriate anchoring, grounding on reefs, waste disposal and improper boat maintenance, among others. Although operators have been using boats to carry out their activities for years, they have only recently formed and become members of water taxi associations in the Grenadines. These are the Southern Grenadines Water Taxi Association (SGWTA) of St. Vincent and the Grenadines, which formed in early 2004, and the Carriacou and Petit Martinique Water Taxi Association (CPMWTA), which formed in June 2004.

It was during the development of the strategic plan in Phase 1 of the Sustainable Grenadines project, that building the capacity of water taxi operators to provide better customer service and reduce impact on the environment was identified as priority. The planning was followed-up specifically for the water taxi operators in June 2004 in a vision and project-planning workshop (CEC, 2004). This led to the submission of a proposal to the Global Environment Facility (GEF) seeking funding for a project to build environmental stewardship through workshops and training sessions among the water taxi operators from both associations (CEC, 2005). The inception meeting for this project was held in April 2005.

This study focuses on one of the five components of the Water Taxi Project: “assessing the sustainable ‘green boat’ practices of water taxi operators in the Grenadines”. The aim is to assess their sustainable boat operation practices and subsequently, inform the operators about their impacts on the natural environment. This is intended to help the water taxi operators become better caretakers of the environment and be more capable of passing on the information to their customers and the public in general (CERMES, 2004).

Finally, the perception of the value of the marine ecosystem to the operators and the knowledge the operators have about sustainable practices are unclear. This study will also serve to provide strategic recommendations to address any problems identified. This information will then help to inform the operators about sustainable practices, while ensuring the protection of the environment.

## **1.2 Goal and objectives**

The primary goal of this project is to “assess the sustainable ‘green boat’ practices of the water taxi operators in the Grenadines” and to inform them about ways to improve their boat operation. The objectives of this project are:

- (a) To identify the water taxi operators on Union Island, Bequia, Mayreau, Canouan, Petite Martinique and Carriacou.
- (b) To research sustainable boating practices world wide, in the Wider Caribbean and in the Grenadines
- (c) To identify which sustainable practices can be adopted or adapted for the Grenadines
- (d) To contribute to the Sustainable Grenadines Project via providing information and recommendations for green boat operation training for water taxi operators.

## **2 LITERATURE REVIEW**

The Earth is rich with various types of natural resources. However, the management of these resources since the early 1960's have been a growing concern throughout the world. This has been driven by the increasing awareness of the local and global damage that is inflicted upon the environment as a result of several direct and indirect anthropogenic activities (Goodbody et al., 2002). It was not until about thirty years later that there was a joint global effort at the Earth Summit in 1992 that all countries were issued a mandate to protect the environment for the present and future generations. Since then, the Earth Summit has served as the base for some important conventions relevant to sustainable development and protection of the natural resources. The Convention on Biological Diversity among others is of partial interest for this paper as it seeks to conserve and promote the sustainable use of biodiversity on Earth (<http://www.joburg.org.za/summit/simple.stm>). In addition, there are also several marine conventions, agreements, etc. that seek to conserve the resources of the marine environment. These conventions and other non-binding agreements are evident on the international, regional and local levels.

The marine environment is also exposed to many anthropogenic activities, many of which have significant impacts on coral reefs. Anthropogenic activities such as habitat destruction, overexploitation and introduction of invasive species all result in species depletion. Humans then, are largely responsible for this and the overall degrading quality of all ecosystems on Earth. So then, the management of the resources really means to manage the people and their diverse and potentially damaging activities whether within their private places or shared resources (Goodbody et al., 2002). However, for people to fully cooperate with sustainable development and how to best achieve these goals, they must be sufficiently informed, their livelihoods understood and the benefits explained.

The growing, unsustainable, tourism industry throughout the Caribbean is to blame for many of these negative impacts. There are increase water transportation, visitor arrivals, more coastal construction for hotels, resorts and beach facilities. While these are no different for the Grenadines, one major factor that the Sustainable Grenadines Project is focusing on is boat operation in the Grenadines where operators in general, engage in daily activities that degrade the environment. There are several approaches by many people throughout the world to reduce the negative impacts by boat operators. This is carried out on several levels of green boating across the globe. Some examples include clean-up programmes, regulations and guidelines (international, regional and national), environmental best practices manuals, boat operation and environmental awareness and education about the entire integrated ecosystems being affected.

## 2.1 Programmes

Support from international and regional organizations are helpful, but interest and initiative from the countries that need such practices, are usually more effective. There are various countries throughout the world and region that are promoting sustainable boating practices on different levels as measures to protect the environment. Some examples that put forth different approaches to green boating include the environmentally sound boating and marinas: the good mate/clean marinas partners. This is organised by The Ocean Conservancy in partnership with the United States and the British Virgin Islands. They are hoping that this will serve as a model for other Caribbean States.

In California, USA, there is the ‘Boating Clean and Green Campaign’ designed to reduce pollution from boating and marine businesses. This programme combines boater education (focusing on environmentally sound boating practices) with technical assistance to local government and marine businesses. The programme also incorporates a variety of stakeholders including universities, non-governmental organizations and more. It helps to install services that reduce oil and fuel spills, sewage discharges, hazardous wastes and marine debris through absorbent pad exchange programmes, oil-change services that collect used oil for recycling, bilge-pump outs, plus oil water separation facilities and more ([www.ucce.ucdavis.edu](http://www.ucce.ucdavis.edu)).

There have been efforts in Florida and Australia in establishing “clean marina programmes” and other environmental programmes that aim to protect the marine ecosystem. In Florida, the Florida Department of Environmental Protection (DEP) has established the Clean Marina Programme (CMP) for marinas, boatyards and boaters. This programme works closely with the Clean Boating Partnership, where the CMP is having a positive impact on educating Florida’s boat industry and preserving its waterways ([www.floridacleanboatingpartnership.com](http://www.floridacleanboatingpartnership.com)). It focuses on the recreational aspect of waterway access on topics such as hurricane preparedness, boat cleaning, boat impact on plant and sea life etc. Education resulting in positive action is the basis for these programmes.

In Australia, there is also an established “Clean Marina” programme that applies to all yacht clubs, boat clubs, slips, boatyards and marinas across Australia. The programme supports Australia’s marine industries in all their endeavours, while protecting the waterways ([www.bia.org.au](http://www.bia.org.au)). The programme not only provides rules on valuable environmental practices, but also rewards benefits. There is also the Boating Industry Association Ltd. (BIA)’s Code of Practice and the Environment. It demonstrates members’ concerns for environmental recreational boating facilities and services. The BIA also encourages their customers to follow the rules set out in part seven (7) of the code, whereby it discusses responsible boat navigation, maintenance, and preventative actions by each individual to maintain clean water and minimise the near shore water based recreation ([www.bia.org.au](http://www.bia.org.au)). Through the BIA there are also many programmes that focus on environmental practices such as “Best Management Practice for Marinas and Boat Repair Facilities”; “Project Anchor”; and the “Pollution Reduction Programme”.

These programmes can be adapted to suit the situation in the Grenadines. The CMP could be beneficial to the islands especially Carriacou since the new marina is in the construction phase. Other environmental programmes that seek to inform boat operators about their malpractices while protecting the environment are vital as operators can see value in changing their boating practices for the protection of the resources on which they depend.



## 2.2 Regulations and Guidelines

### 2.2.1 International

Several international organisations' objectives, goals, meetings, conventions and agreements address impacts, mitigations, adaptations etc., concerning negative impacts on the marine environment by marine vessels; however, only one focuses on small crafts. All aim to: protect international waters from pollution (liquid and solid), reduce loss of marine biodiversity, ensure that information is shared globally and to ensure that support is provided. Some international examples include:

1. The International Maritime Organisation (IMO)
2. The International Convention for the Pollution from Ships (MARPOL 73/78)
3. World Summit on Sustainable Development (WSSD)
4. Jakarta Mandate
5. Convention on Biological Diversity

An example of an international organisation that addresses such issues is the International Maritime Organisation (IMO), which is one of the responsible international organisations for improving maritime safety and preventing pollution to water and air from marine vessels. The IMO also serves as the Secretariat for the International Convention for the Pollution from marine vessels MARPOL 73/78. In 1996, the IMO also took on the role as leader to ensure that other international organisations and programmes coordinated the development of the global programme of action clearing house mechanism with respect to oils and marine litter. MARPOL is the international convention aimed at controlling pollution from the shipping sector. It has five annexes that cover specific kinds of pollution and Annex V deals with garbage and litter ([www.marine-litter.gpa.unep.org](http://www.marine-litter.gpa.unep.org)). In Annex V, the Wider Caribbean Sea and regions along with the North and Baltic seas were designated as "Special Areas". The disposal of all garbage especially plastics, into these areas is strictly prohibited.

The World Summit on Sustainable Development (WSSD) held in Johannesburg 2002 re-emphasised Agenda 21. Agenda 21 is a comprehensive plan for global, national and local action by organisations of the United Nations, governments and major groups in every area where humans impact the environment ([www.marine-litter.gpa.unep.org](http://www.marine-litter.gpa.unep.org)). Chapters 17 and 21 of Agenda 21 pertain to bodies of salt water and solid waste disposal, respectively. These are the heavily impacted areas many depend on and therefore raise several issues. Chapter 17 discusses the protection, national use and development of their living resources. Chapter 21 deals with solid waste disposal (domestic refuse and non-hazardous waste) that may be in large or small quantities.

The Jakarta Mandate on Marine and Coastal Biodiversity is a subunit of the Convention of Biological Diversity (CBD), which is a global consensus on the importance of marine and coastal biological diversity. The CBD aims at promoting the conservation of biodiversity; the sustainable use of its components; and the fair and equitable sharing of benefits arising out of the utilisation of biodiversity resources.

The only international agreement that outlines specific guidelines for small crafts is Safety of Life at Sea (SOLAS), but since it addresses safety regulations, it is beyond the scope of this paper.

Some of the international organisations, meetings and conventions discussed here all seek environmentally sound waste management. This however, should not be concerned only with safe disposal or recovery, but also with the root cause of the problem.

### 2.2.2 Regional

On the regional “Wider Caribbean” scale, the Caribbean Sea is protected by most of its coastal countries. There are also several regional organisations, conventions, programmes and action plans that apply to the Caribbean region for protection of the Caribbean Sea from litter, habitat destruction, discharge, inter alia. Over the past ten years this has especially been the focus for Small Island Developing States (SIDS). The SIDS Plan of Action has now been adapted for developing countries. So far, there has been a lot of progress for some developing countries, but rather than laws, there are more organisations, actions plans, and programmes that have been formed, implemented and adopted.

Some regional examples include:

1. Cartagena Convention
2. United Nations Environment Programme (UNEP)- Regional Seas Programme
3. Global Environment Facility (GEF)-International Waters Project

Source: ([www.marine-litter.gpa.unep.org](http://www.marine-litter.gpa.unep.org)).

The Cartagena Convention - Convention for the Protection and Development of Marine, Environment and Wider Caribbean -- is binding. It is a convention that entered into force in 1986 for achieving sustainable development of coastal and marine resources in the Wider Caribbean region through effective integrated management that allows for increased economic growth. The convention covers various aspects of marine pollution and requires that the contracting Parties adopt measures aimed at preventing, reducing and controlling pollution from ships, dumping, and land based activities among others ([www.cep.unep.org/](http://www.cep.unep.org/)). In addition, the Parties to the convention take measures to preserve fragile ecosystems (like coral reefs and seagrass beds), as well as habitat depletion, threatened or endangered species and develop technical and other guidelines.

An example of a regional programme is the Caribbean Environmental Programme (CEP), which was established under the UNEP regional seas programme by the diverse states and territories of the Wider Caribbean to collectively address the protection and development of coastal areas using the framework known as the Caribbean Action Plan, which was established in 1981. The UNEP regional seas programme, which was initiated in 1974, focuses not on the mitigation and elimination of the consequences, but also on the causes of environmental degradation as a global programme implemented through regional components ([wwwv.marinelitter-gpa.unep.org](http://www.marinelitter-gpa.unep.org)). The programme also focuses on solid waste and marine debris and oil and litter as major issues in the region. The CEP has four sub programmes, namely Specially Protected Areas and Wildlife (SPAW), Assessment and Management of Environmental Pollution (AMEP), Information Systems for the Management of Marine and Coastal Resources (CEPNET) and Education Training and Awareness (ETA). Although each sub-programme has different objectives, a common goal is to regionalise the global conventions, agreements etc., for the Caribbean region,

through coordination, sharing information, data networking, and improving the research and technical managerial capacities to address environmental issues adequately ([www.cep.unep.org/](http://www.cep.unep.org/)).

The GEF international waters project is in progress, but has not yet been approved. This is the sustainable management of the shared marine resources of the Caribbean's large marine ecosystem and adjacent regions. Some objectives of the project include implementing legal policy; policy and institutional reforms (regionally and nationally) and to improve shared knowledge base so that sustainable use and management of the transboundary living marine resources will be possible and more abundant.

### 2.2.3 National

St. Vincent and the Grenadines has only recently considered putting regulations in place for small boat operators. The SGWTA held discussions with the Port Authority, Tourism Authority and the Coast Guard about measures that should be put in place for the safety and certification of small boat operators (Smith, personal communication). To date, these have not even been drafted. The only official action that has taken place is the registration of the SGWTA. It was registered in 2004 as a non-profit organisation under the Company Act of 1994, sections 5 and 329 (Smith, personal communication). A constitution was then developed for the SGWTA, which explains the duties of the executive committee, resignation and removal of members, projects and activities, publications, meetings and many more important matters relating to this body. The SGWTA has developed some rules and regulations that all water taxi operators should abide by while operating their boats in the Grenadines. It is noted however, that not all operators recognise or respect these rules and regulations and therefore they must be revised. The SGWTA executive members hope that these new rules and regulations can be implemented and enforced in the near future (Smith, personal communication).

It may have also been beneficial for the government of St. Vincent and the Grenadines to implement the mandatory provision of the IMO and the International Ship and Port Facility Security Code in 2004. It is a new, comprehensive security regime that seeks to establish an international framework of co-operation between governments, government agencies and the shipping and port industries in order to detect and take preventive measures against security incidents affecting ships or port facilities used in international trade<sup>1</sup>. This however has not been done and the coastguards seldom patrol the Grenadine waters. On the other hand, using the National Environmental Management Strategy Plan for St. Vincent and the Grenadines the government agencies have various jurisdictions of environmental management and addresses several environmental issues, but due to lack of proper management, effective enforcement and awareness<sup>2</sup>, but water taxi operators, among others, who depend on the sea's resources continue to destroy and pollute the waters intentionally and unintentionally.

The Grenada Ports Authority is the official licensing authority for all water taxis operating in Grenada, Carriacou and Petite Martinique. The water taxis are separated into two categories (inshore and charters) and must meet certain requirements in order to get a license and operate. Unlike the SGWTA, the CPMWTA has not drafted any rules and regulations for the water taxi

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<sup>1</sup> ([http://www.imo.org/Newsroom/mainframe.asp?topic\\_id=583&doc\\_id=2689#code](http://www.imo.org/Newsroom/mainframe.asp?topic_id=583&doc_id=2689#code))

<sup>2</sup><http://72.14.203.104/search?q=cache:AK4qricmMf8J:www.oecs.org/esdu/documents/Nems/SVG%2520NEMS%2520Final2%252019Apr04.pdf+Environmental+Laws+of+St.+Vincent+and+the+Grenadines&hl=en&gl=bz&ct=clnk&cd=5>

operators. This is something that they are working on for the future (Bethel, personal communication). The government of Grenada has already implemented some measures to ensure sustainable boating practices, but they concern only safety issues. In the future under SOLAS, all boaters will be required to have distress flares, first aid kit, engine repair tools and VHF radio. Also, starting 2008, the Grenada Ports Authority has stated that they will not issue licenses to water taxi operators with gasoline engines. All water taxi operators will be required to have diesel engines by that time (CERMES, 2004). Apart from that Grenada has about 40 pieces of legislation that govern the protection and management of Grenada's biodiversity and addresses environmental management and protection. Water taxi operators in Grenada among other users of the environment continue with the same non-environmentally friendly practices due to the lack of effective enforcement of existing legislations and at mitigating adverse impacts on the environment. In addition, general lack of awareness and understanding of the value, sustainable use and the need for immediate conservation of natural resources by decision makers and stakeholders and other identified gaps in the legal system<sup>3</sup>, also contribute to such practices.

### **2.3 Assessment of sustainable boating**

The most useful literature on assessments of sustainable boating was from other parts of the world than the Caribbean and it is suggested that the Grenadine boat operators adopt the environmentally friendly boat practices. Several assessments that were conducted throughout the world looked at the following main issues and the best practices for each. These include general vessel maintenance, anchoring, waste disposal, education of the water taxi operators and passengers, engine maintenance and fuel/ oil. It is quite possible that boat operators and other users of the marine environment can adopt these best practices and therefore start minimising the negative impacts occurring throughout the Grenadines.

The Maryland Department of Natural Resources (Maryland Clean Marine Initiative for Chesapeake Bay) in the United States has a manual that they developed for boaters using the Bay. This guide discusses the issues, the legal setting as it is in the United States, and best management practices for each issue. For example, for vessel maintenance, it explains the effects of each stage of refurbishing namely sanding, washing, and painting and outlines the best practices ([www.dnr.state.md.us](http://www.dnr.state.md.us)).

The Centre for Environmental Leadership in Business (CELEB), Coral Reef Alliance (CORAL) and Tourism Operators Initiative (TOI) together have also developed a manual as a practical guide detailed with best practices for all users of the marine environment. Some of the topics discussed include anchoring, boat maintenance, boat operation, viewing marine wildlife, waste disposal and more. It also has a self-assessment checklist whereby operators; owners of marinas and other users of the marine environment can evaluate themselves based on the daily activities they carry out. The manual discusses each issue and explains why people should care about such issues and suggests some best practices that should be followed at all times (CELB, et. al., 2001).

The Australian government has outlined its own best practices that boaters must practice while operating in and around the great Australian barrier reef. Their guidelines also discuss several activities that affect the marine environment and the best practices that boaters can follow or implement ([www.gbrmpa.gov.au](http://www.gbrmpa.gov.au)).

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<sup>3</sup> <http://72.14.203.104/search?q=cache:HVP4ruym5mgJ:www.biodiv.org/doc/world/gd/gd-nr-01-en.pdf+Environmental+Laws+of+Grenada&hl=en&gl=bz&ct=clnk&cd=6>

Other sources of information concerning green boat practices include websites and online groups that the researcher was subscribed to. These include the Sustainable Grenadines yahoo group, the CAST group, MBT (Marine Based Tourism) group, Ocean Journal for environmental managers, and several websites.

### **3 METHODOLOGY**

The research comprises four parts:

- Literature survey and review;
- Preliminary survey of water taxi operators;
- In-depth questionnaire survey of the sample of water taxi operators;
- Data analysis.

#### **3.1 Literature survey and report reviews**

Programmes, training and other best environmental practices for boat operation developed in different countries were reviewed and compared with those of the Grenadines. Best practices for sustainable boating practices have been implemented worldwide; these have been researched and reviewed to determine if they are applicable and adaptable to alleviate the non-environmental boat operation in the Grenadines.

Laws, conventions and protocols such as those mentioned in the literature review were also reviewed to determine which ones apply to the activities of small boat operators. These may be helpful in the Grenadines where they can be adapted and implemented or used to amend the current laws concerning boating throughout the islands.

Meetings/interviews with key informants were carried out with the water taxi associations' presidents, the secretary and manager of the Sustainable Grenadines Project, members of the Carriacou Environmental Committee (CEC) and Ms. Susan Mahon, manager of Counterpart Caribbean. Information gathered through the interviews with these various people was used as background information to determine the variables that were researched and to understand their concerns of the boating activities.

In addition, information from the literature survey and review suggests that the Caribbean region is behind in implementing and in some cases enforcing the necessary environmental laws that relate to protection and conservation of the marine resources. The Caribbean is also behind in adopting techniques, taking measures and making the general public aware of such environmental issues that people can associate with. Many reports show that other countries, usually the developed, first world countries have addressed the issues on a larger global scale that many underdeveloped and developing countries cannot adhere to or take part in. As a result, the countries including St. Vincent and the Grenadines and Grenada are now struggling to understand the concept of sustainable development through 'green boat' practices on a smaller scale and are aiming at localising the efforts to reach that of developed countries.

#### **3.2 Preliminary survey of water taxis members**

The preliminary survey was carried out on the islands of Union Island, Bequia, Canouan, Mayreau, Petite Martinique and Carriacou. This initial survey was a collaborative effort between Alexcia Cooke and the researcher since both were interviewing the same group of people. Her research focused on "A livelihoods analysis of the water taxi operators in the Grenadines".

Both persons worked together to develop the questionnaire (Appendix I) and shared the effort of administering them to the water taxi operators throughout the Grenadines. The preliminary survey was conducted throughout the islands to find out who were water taxi operators; members of the two water taxi associations; and to establish contacts and beginning to understand water taxi operators and their business. Other basic information about the boats such as length, type of boat, type of engine and boat name among other things was also acquired. To find out how many operators there were on each island, the researchers used the “snowball approach” asking each water taxi operator that was interviewed to name others and the location on the island where they could be found and so on, until no new names came up. On Bequia and Carriacou, significant members in the community associated with the water taxi operators, suggested to them that they meet with the researchers. A total of one hundred persons were interviewed from across the islands for this preliminary survey.

This first survey also served as an icebreaker for the water taxi operators, because all were informed about the second survey. After the sample size was determined many from each island were re-interviewed for the in-depth survey. The timeframe for this preliminary survey was approximately eight days to cover all the islands. After the preliminary survey was completed, all the data were analysed using the Statistical Package for Social Sciences (SPSS).

### **3.3 In-depth questionnaire survey**

Of the one hundred water taxi operators that were initially identified and interviewed throughout the Grenadines, a fifty percent (50%) sample was taken; only 47 were successfully interviewed, which represents a confidence of ninety-five percent (95%) confidence interval and error level of six (3.5%). Ninety-five percent (95%) is used as the rule of thumb when it is difficult to determine confidence interval or error level of the results. Using the confidence interval, sample size (50 respondents) and number of completed interviews, the error level was calculated using the online “random sample calculator”.<sup>4</sup> These fifty (50) people were spread across all the islands by means of a random selection using Excel Data Analysis tool. Other respondents were selected as back-up in the event that those persons who were randomly selected could not be interviewed. For this in-depth survey, the fifty water taxi operators served as the representative sample of all water taxi operators from Union Island, Bequia, Mayreau, Canouan, Petite Martinique and Carriacou using a more in-depth questionnaire. The number of persons that were selected for a re-interview for each island is as follows: Union Island (20); Bequia (8); Canouan (1); Mayreau (7); Petite Martinique (5) and Carriacou (10). The number of back-up respondents used from each island is as follows- Union Island (3); Mayreau (1) and Carriacou (2). Each person with a contact number was called before departing for the island to verify if they would be available on the suggested day. Others were informed of our return by personal communication with the researcher or through their colleagues.

The in-depth survey was also conducted by means of an administered questionnaire (Appendix II). The questions in this survey focused on several issues concerning boating practices that the water taxi operators carry out daily in the Grenadines. The structure of the questionnaire included open-ended, close-ended and selection questions. It covered subheadings such as coastal and marine activities, attitudes/perceptions of the marine environment and environmental practices, threats/problems to the marine environment etc. The variables for the questions in this

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<sup>4</sup> <http://www.custominsight.com/articles/random-sample-calculator.asp>

questionnaire were drawn from various sources found during the literature review. The estimated time frame for this second survey was approximately nine days to cover all the islands.

### 3.3.1 Data analysis

The questionnaires from the in-depth study were reviewed to ensure all the questions were completely answered before the analysis started. The information for each water taxi operator was entered into a Statistical Package for Social Sciences (SPSS) database in “data view” as the first part of the electronic analysis. The data was then transferred from SPSS to an Excel spreadsheet to facilitate the analysis.

## 4 RESULT

### 4.1 Preliminary survey of water taxis operators

The preliminary survey covered basic information about the water taxi operators across the Grenadines and served as background information about each water taxi operator in reference to their boat name, boat size, boat type, engine type and engine horsepower, among other variables. This information was then used as the basis to develop the questionnaire for the in-depth questionnaire and to begin understanding the water taxi operators from each island and their preference in boats. This activity is reported on fully by Cooke et al., 2005.

### 4.2 In-depth questionnaire survey

Of the fifty water taxi operators (representing a 50% sample size) that were randomly selected from those identified in the initial survey, only forty-seven were successfully interviewed. Some questions did not apply to the water taxi operators in Bequia because they do not have a water taxi association. Lastly, as expected, there were questions that some water taxi operators deliberately did not answer for the fear of being identified or because they did not think it was appropriate to reveal the malpractices of other water taxi operators.

Union Island has the largest number of water taxi operators and the largest number that are registered. This may be attributed to the association having its own constitution under the laws of St. Vincent and the Grenadines. As a result, most of the water taxi operators that were re-interviewed came from Union Island. Bequia and Carriacou both had eight people, followed by Mayreau with seven people, Petite Martinique with five and Canouan with only one person (Table 4.1). Majority of the water taxi operators were a member of a water taxi association with SGWTA having the most registered members. Bequia presently does not have a water taxi association and it seems that there is interest in forming one, but the idea is controversial.

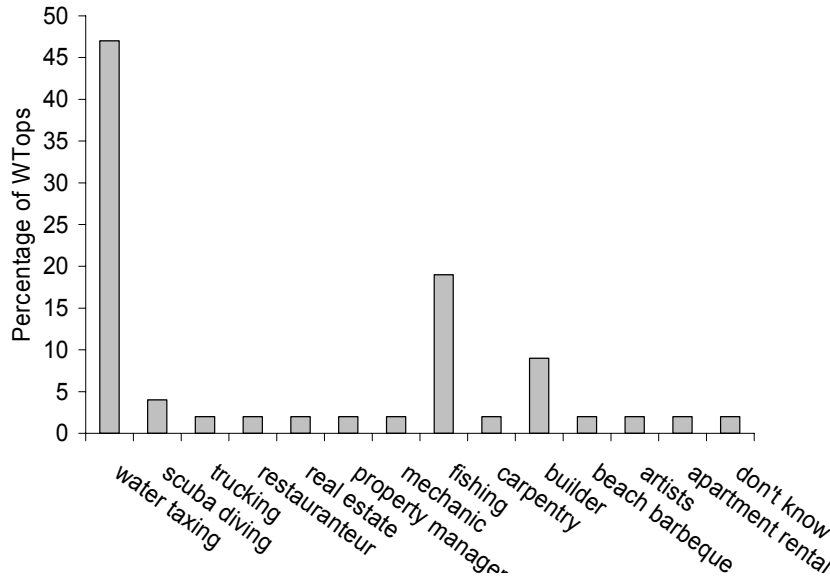
Using the results of the in-depth survey, a booklet compiling the best environmental practices for boat operation covering several topics has been drafted for the water taxi operators. It is expected that the operators will work together in unison with personnel from the Sustainable Grenadines Project and with each other to modify the drafted booklet to suit them.

#### 4.2.1 Water taxiing as an occupation

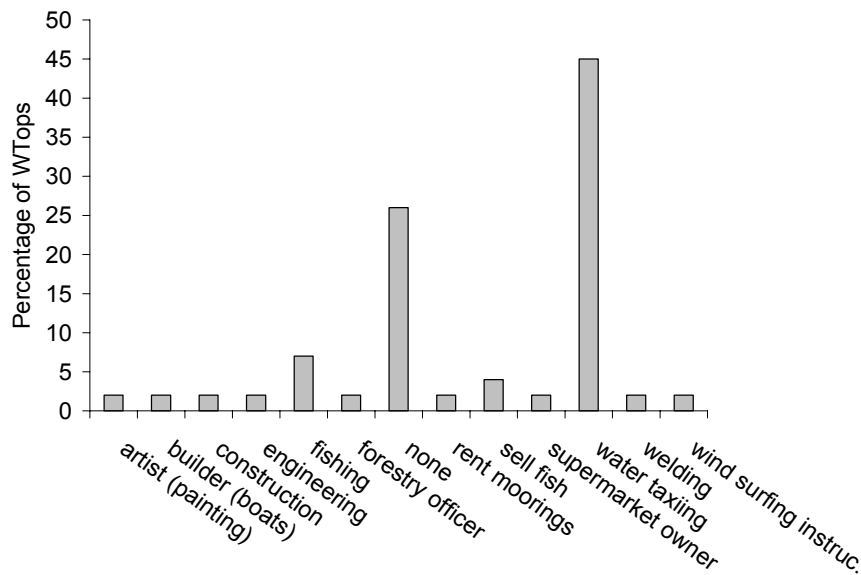
Twenty-four respondents fall within the 31-40 yrs age group with half having completed primary and secondary level education respectively. Eighteen respondents (38%) have been water taxi operators for more than ten years falling in the 11-20 yrs range and with an even amount of 13 respondents being operators for less than five years and between 6-10 years. Three water taxi operators completed tertiary level education. These three people and the majority of those who had completed secondary school were from either Carriacou or Petite Martinique (Grenada).

Contrary to what some water taxi operators say, water taxiing provides many of the respondents with the most income. The graphs below show that water taxiing provides the highest proportion of income for people whether it is their primary (Figure 4.1) or secondary job. Figure 4.2 shows that there are many who do not have a second occupation and rely on water taxiing alone.

Fishing also ranks high as an occupation that provides high income. Others who have yet a third job are only a few and the choices vary from artist, security officer and mooring renter.



**Figure 4.2: The occupations that provides the highest proportion of income for water taxi operators**



**Figure 4.1: The occupations that provide the second highest proportion of income for water taxi operators**



Mayreau, Carriacou and Petite Martinique are the islands where occupations other than water taxiing provide the highest proportion of income (Table 4.1). Fishing provides more or about the same income as water taxiing in two of the islands. Unlike Union Island and Bequia, WTops are making a decent living from being water taxi operators, as it is their main source of income.

#### 4.2.2 Marine awareness and value of marine resources

Each water taxi operator interviewed was fully aware that the Tobago Cays is a marine park. Of the 47 respondents, only one water taxi operator said that he does not respect the Tobago Cays as a marine park.

More than 50% of the water taxi operators were aware of the rules and regulations (all and some combined) for the Tobago Cays Marine Park (TCMP) and of these, 25% said that they did not know all the rules. On the other hand, 46% of the water taxi operators said that they were totally unaware of the rules and regulations of the Tobago Cays Marine Park (TCMP) put forth by the SGWTA (Table 4.2).

46% of water taxi operators believed that their colleagues respected the TCMP while 40% believed that the water taxi operators did not respect the Tobago Cays as a marine park. 12% did not know if the majority of other operators respected the park (Table 4.3).

**Table 4.1 Cross tabulation of Grenadine Islands and jobs that provide the highest proportion of income**

Occupations	Grenadine Islands					
	Bequia	Canouan	Mayreau	Union Island	Petite Martinique	Carriacou
Apartment rentals						1
Artists (painting)				1		
Beach barbeque			1			
Builder (boats)				1		1
Builder (houses)					2	
Carpentry			1			
Fishing			2	3	1	3
Boat mechanic					1	
Property manager	1					
Real estate				1		
Restaurateur				1		
Scuba diving				1		1
Trucking	1					
Water taxiing	5	1	3	9	2	2
Don't know	1					
Percentage of WTops	22.7	4.5	13.6	40.9	9.1	9.1
TOTAL (percentage %)	17.0	2.1	14.9	36.2	12.8	17.0
TOTAL (WTops)	8	1	7	17	6	8

**Table 4.2 Frequency and percentage of water taxi operators' awareness of the rules and regulations of TCMP**

Response	Frequency	Percent
Yes	13	27.7
No	22	46.8
Not all	12	25.5
Total	47	100.0

**Table 4.3 Frequency and percentage of water taxi operators' respect for the TCMP**

Response	Frequency	Percent
Yes	22	46.8
No	19	40.4
Don't know	6	12.8
Total	47	100.0

The majority (55%) said that the park should not be zoned and one person had no opinion on zoning the park (Table 4.4). Of the 26 respondents who thought the park should not be zoned, 24 gave a reason why. Most were of the opinion that the park should remain open to the public with everyone having equal access to the park and its resources (Table 4.5).

The majority of the water taxi operators expressed that they highly valued the marine environment because they depended on the resources for their livelihood. Many said the marine environment's beauty interests them and that tourists come to see the natural attractions. Only two persons said that they value the marine environment as an area that is kept safe for water taxi operators and tourists (Table 4.6).

**Table 4.4 Frequency and percentage of water taxi operators' opinion on zoning TCMP**

<b>Response</b>	<b>Frequency</b>	<b>Percent</b>
Yes	20	42.6
No	26	55.3
Don't know	1	2.1
Total	47	100.0

**Table 4.5 Frequency and percentage of water taxi operators' reasons for not zoning TCMP**

<b>Response</b>	<b>Frequency</b>	<b>Percent</b>
Free full public access	20	42.6
It would create segregation	4	8.5
Not applicable	19	40.4
No response	4	8.5
Total	47	100.5

**Table 4.6 Frequency and percentage of water taxi operators' perception of the value of the marine resources**

<b>Response</b>	<b>Frequency</b>	<b>Percent</b>
Dependent on the resources for livelihood	24	51.1
Natural attraction for water taxi operators and tourists	20	42.5
That the area is kept safe for water taxi operators and tourists	2	4.3
No response	1	2.1
Total	47	100.0

Only two respondents (4%) did not know that the marine environment serves many roles and functions to both humans and marine organisms. All other forty-five persons (95%) said that they were aware that the marine environment has different roles and functions to all life that depends on its resources.

Only nine (19%) water taxi operators were not aware that certain boating activities/practices could be harmful to the marine environment. Only one of these nine persons, although unaware that some practices were harmful, did not express interest in learning more about environmentally friendly boating practices. The other 46 respondents were enthusiastic that they could learn more about boating and in the process learning to take better care of the environment on which their livelihood depends. After understanding that certain boating practices could cause potential damage and being informed that keeping their boat in the best

conditions can reduce such negative impacts, 46 respondents said that they were willing to upgrade their boats.

#### 4.2.3 Threats and solutions

This section reports on the perceived threats and possible solutions to the negative impacts on the marine environment as stated by the water taxi operators throughout the Grenadines. More than half the water taxi operators have observed other water taxi operators doing activities/practices that could potentially harm the marine environment. Although some claimed to have seen other water taxi operators in the act, many declined to say what they actually saw. The leading responses from those who did respond were littering and speeding in the harbour.

**Table 4.7: Frequency and percentage of water taxi operators that prefer to use the different entrances to the Tobago Cays Marine Park**

Entrance	Frequency	Percentage
Horseshoe back reef (east)	2	2.1
Petite Bateau (west)	2	2.1
Petite Ramadal/Baradal (north)	13.4	28.6
Jamesby (south)	22.3	47.6
Do not go to TCMP	9.2	19.5

The average speed that water taxi operators drive when approaching harbours or beaches is six knots, but majority

said they drove at a consistent five knots in these areas. In respect to deeper waters, they drive much faster but say they do slow down when approaching the reefs. Many patch reefs surround the Tobago Cays, but water taxi operators are keen on using the areas with few reefs with channels that will take them through to the Cays. The map of the Tobago Cays in Appendix III shows the islands and the reef areas. Water taxi operators from all the islands who make trips to TCMP prefer to enter the Tobago Cays using the southern entrance by Jamesby Cay; this accounted for more than 47% of all operators (Table 4.7).

Water taxi operators agree that the marine environment is under stress from various threats. Some provided many possible threats to the environment, whilst the majority gave only one. The following graphs display the opinions and the possible solutions to some of these primary threats (Figures 4.3 and 4.4).

The majority thinks that enforcement against speeding and garbage disposal into the sea is necessary and should be implemented as soon as possible. Others suggested that water taxi operators be informed about these wrongs and also empower them to help enforce some of the rules and regulations. Two persons said frequent boat servicing and regular inspection from officials might reduce impacts on the marine environment from boats

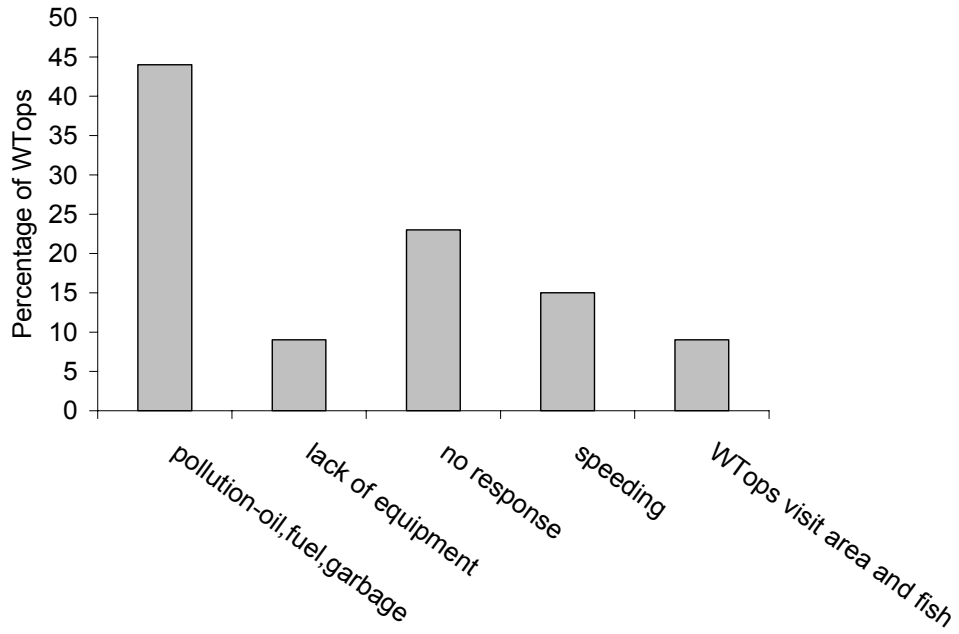


Figure 4.3: Primary threats to the Tobago Cays Marine Park

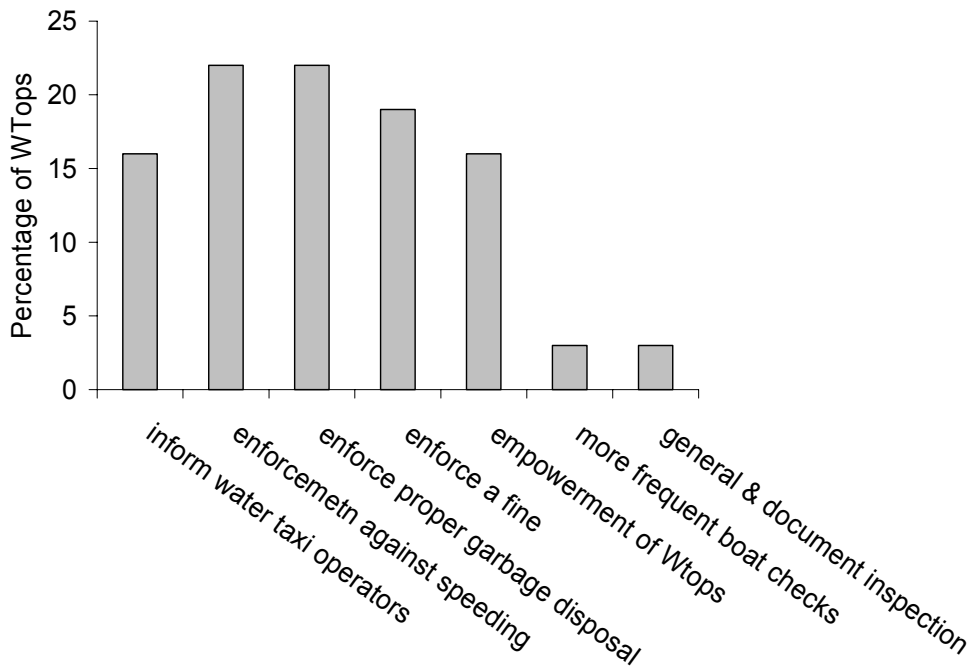


Figure 4.4: Possible solutions to the threats at the Tobago Cays Marine Park

#### 4.2.4 Service(s) offered

Most of the water taxi operators provide more than one service for their customers, with transporting people between islands and taking passengers on day-long boating trips being the two most common services (Table 4.8). Some provide only limited services, but most provide as many as they can, especially during the low season when business is restricted to only limited number of trips and days for the week. The high and low seasons vary for each Grenadine Island; Carriacou, Petite Martinique and Mayreau water taxi operators say unlike other islands, they do not have seasons per se.

**Table 4.8: The number of water taxi operators offering different services**

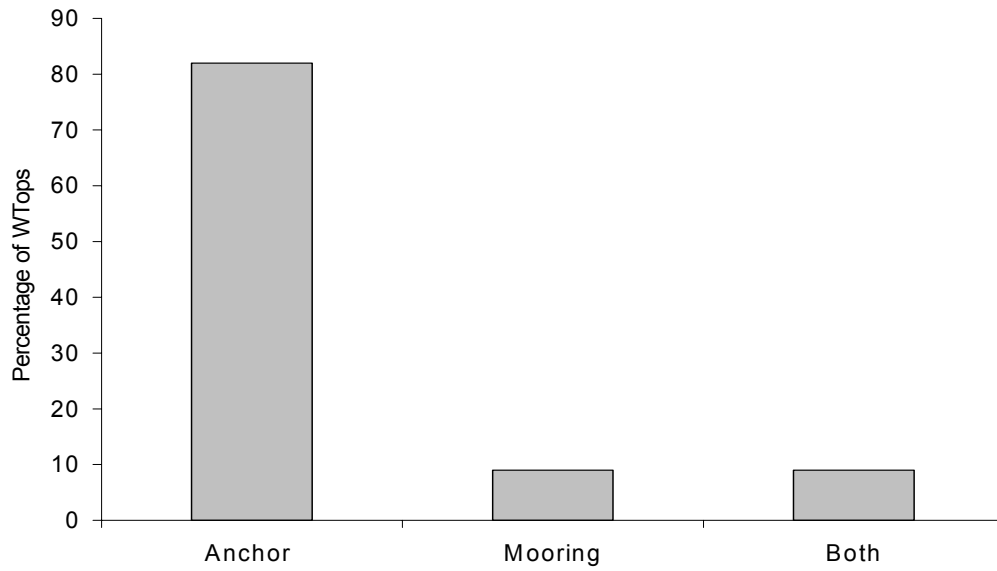
<b>Response</b>	<b>Boating trips</b>	<b>Transportation b/w islands</b>	<b>Transportation from yachts to shore</b>	<b>Selling goods</b>	<b>Collecting and disposing of garbage</b>	<b>BBQ at night</b>
Offered	38	40	30	27	12	1
Not offered	9	7	17	20	35	46

#### 4.2.5 Anchoring

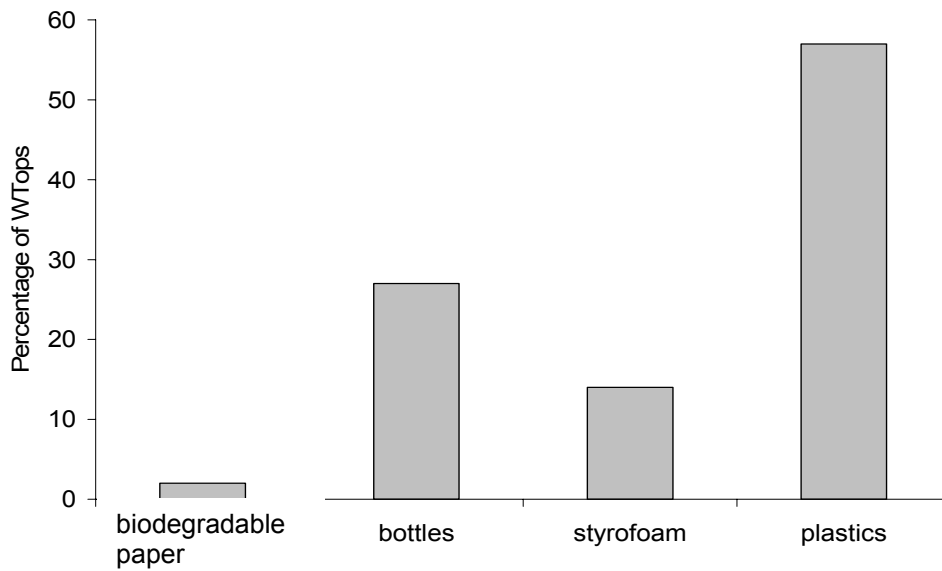
The use of anchors by water taxi operators is a potential problem if the anchors are deployed in dense reef or seagrass areas as this could damage these fragile marine ecosystems. Water taxi operators must take extra precaution when selecting an area to anchor, as coral reefs and seagrass beds are particularly susceptible to anchor damage. Most water taxi operators use anchors to secure their boats at sea (Figure 4.5). A few said they prefer to use moorings if they are readily available for rental or they use their own moorings. A few others said they use them interchangeably, that is, they use anchor if they are renting their moorings. More than half (27 respondents) has both bow and stern lines for more secure tying when docking and for emergency purposes.

#### 4.2.6 Solid waste

More garbage is being produced in the Grenadines with increasing visitors. Many people are deeply concerned about improper waste disposal in the Grenadines. They are concerned about waste disposal from boat operators and visiting tourist yachts. Solid waste (empty oil bottles, paper, garbage collected from yachts etc.) is often thrown overboard by irresponsible boat operators or disposed of on a nearby beach. Solid waste is generated on board for about 60% of the water taxi operators. Many provide food and drinks for the passengers on day trips. The solid wastes vary and include bottles, plastics and aluminium foil. Those that do provide food and drinks say they take the garbage to a bin or the local dump upon returning to their island. For Mayreau and Petite Martinique, the waste is taken to Union Island and Carriacou respectively, which have dumpsites. It is evident that plastics are the most common of all solid wastes, followed by bottles (Figure 4.6).



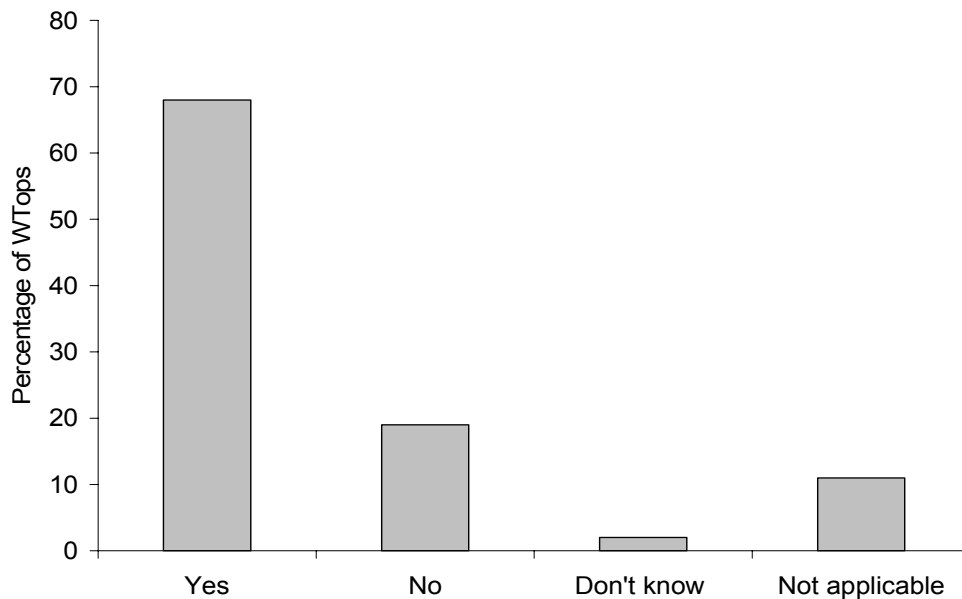
**Figure 4.5: Percentage of water taxi operators who use anchors/moorings solely or both**



**Figure 4.6: Percentage of water taxi operators who generate a variety of solid wastes**

#### 4.2.7 Fuel and oil

All the water taxi operators use gas for their engines whether it is a portable tank or a built in system for direct fuel injection. About 68% of water taxi operators are aware that the tank should only be filled to ninety percent capacity. Only a few water taxi operators said that when they are adding the oil to the gas, they fill the tank up to the brim. This particular question was not applicable to those operators with two-stroke direct fuel injection and four-stroke engines because these particular engines have a system where the engine does the mixing of the oil and the gas. One person said they did not know if they filled the tank to the brim when adding the oil (Figure 4.7).



**Figure 4.7: Percentage of water taxi operators who fill gas tanks to the brim when adding oil**

#### 4.2.8 Engines and engine maintenance

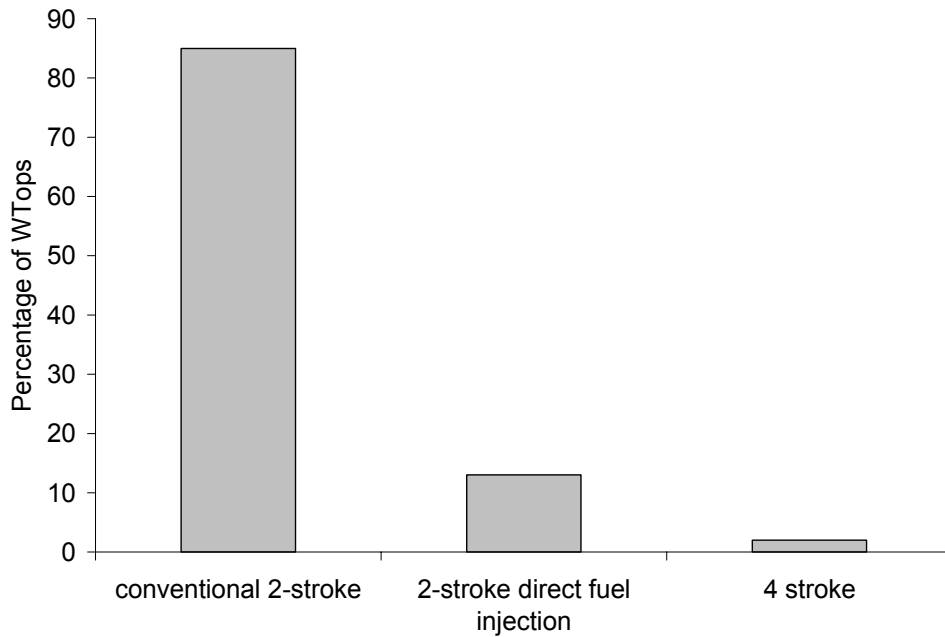
Water taxi operators are very particular with the engine brand they use. The water taxi operators identify brand with durability and reliability from those that have proven to be successful for water taxi operators in the past. Yamaha is the leading brand that water taxi operators across the Grenadines prefer and therefore accounted for 93% (forty-four persons) from the sample size. Johnson and Evinrude were the other two engine brands used (Table 4.9).

More than 85% of the water taxi operators in the Grenadines have the conventional two-stroke engine. Only a few of them have the resources to afford a two-stroke direct fuel injection engine or a four-stroke engine (Figure 4.8). There may be several reasons for this fact.



**Table 4.9: Frequency and percentage of the engine brands water taxi operators use**

Types of engines	Frequency	Percent
Yamaha	44	93.6
Johnson	2	4.3
Evinrude	1	2.1
Total	47	100.0



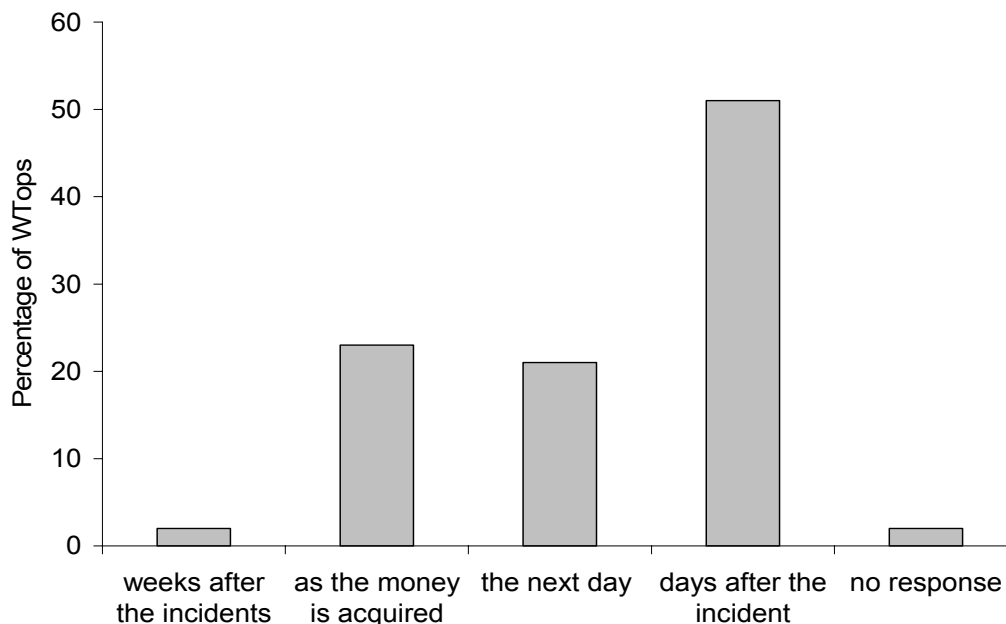
**Figure 4.8: Percentage of water taxi operators using conventional and direct fuel injection 2-stroke engine**

Many water taxi operators carry out general routine engine maintenance to ensure that the boat is functioning properly before they depart on their boating trips. A total of 27% check the gas tank hoses before they go out on each trip, while others check daily, but surprisingly many rarely check them at all. In addition, 34% of individuals also conduct a general engine service before each trip and 25% only check the engine when they think it needs servicing (Table 4.10).

Twenty percent of water taxi operators change a damaged propeller the very next day after it is damaged (Figure 4.9). About the same percentage said that they could only change a damaged propeller when they have sufficient money. The majority of more than 50% however, said that they usually wait a few days before changing it.

**Table 4.10: Frequency and percentage of water taxi operators checking their hoses and servicing engines at different intervals**

Response	Checks hoses for leaks and breaks		Services engine	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Daily	11	23.4	5	10.6
Weekly	8	17.0	9	19.1
Monthly	0	0	5	10.6
Each trip	13	27.7	16	34.0
As needed	5	10.6	12	25.5
Rarely	8	21.3	0	0



**Figure 4.9: Percentage of water taxi operators showing the timeframe in which they can afford to change a damaged propeller**

Although most boat engines have a built-in electric tilt, on some boats it does not function, but there are also many water taxi operators who do not use the tilt to raise the engine when in shallow waters even though it may be working. More than 55% of the water taxi operators said that their engine had an electric tilt. The follow-up question of whether the tilt was working properly did not apply to those who did not have an engine with a tilt. Only one person admitted that their tilt was not working properly. All those without a tilt said they had to manually pull up the engine(s) when in shallow waters or approaching shallow reef areas. Table 4.11 shows that 12% of the water taxi operators admitted to not using the tilt or manual pull-up when it was necessary.

**Table 4.11: Frequency and percentage of water taxi operators who use the tilt on the engine or manually pull it up**

Types of engines	Frequency	Percent
Yes	41	87.2
No	6	12.8
Total	47	100.0

#### 4.2.9 Vessel maintenance

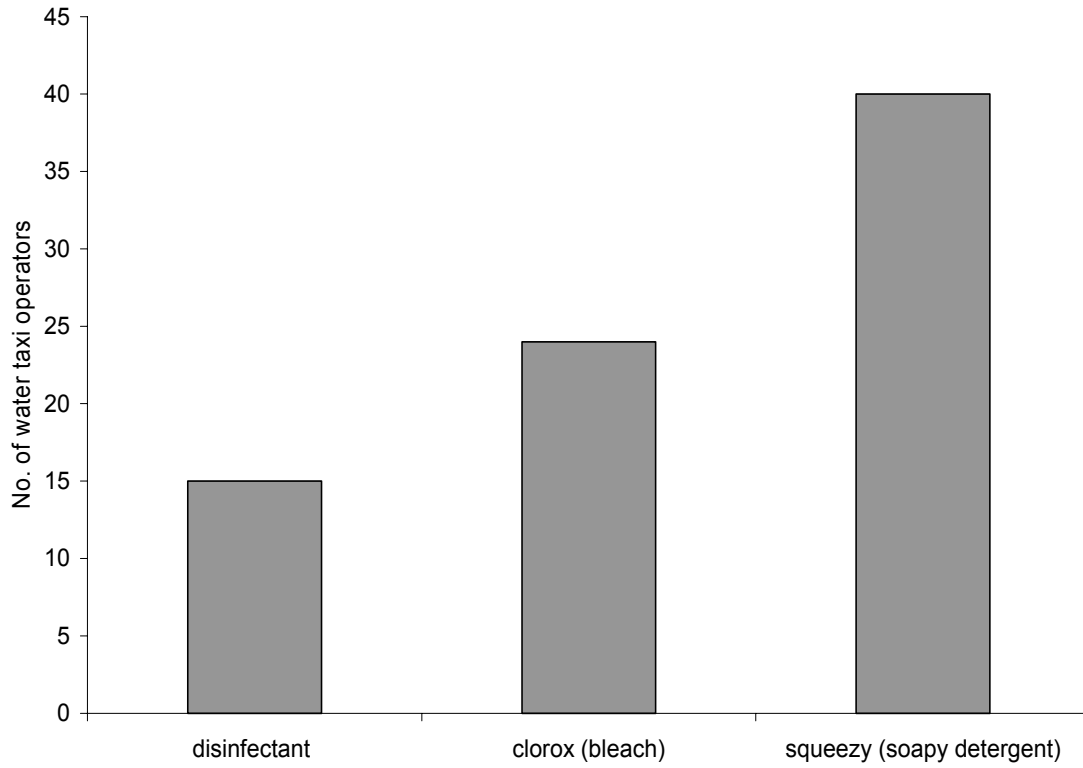
Most water taxi operators in the Grenadines agree that a well-maintained vessel is necessary for good customer service, aesthetics and releases less pollution to the marine environment. Maintaining a clean vessel, however, through basic washing/cleaning the boat (inside and outside) and also through the various processes of scraping, painting, etc., has high potential of releasing toxins into the marine environment. Many water taxi operators, 46% clean their boats daily and about 30% clean them weekly (Table 4.12).

<b>Table 4.12: Frequency and percentage of how often water taxi operators clean their boat</b>		
<b>Response</b>	<b>Washing/Cleaning boat</b>	
	<i>Frequency</i>	<i>Percentage (%)</i>
Daily	22	46.8
Weekly	14	29.8
Monthly	1	2.1
As needed	9	19.1
Rarely	1	2.1

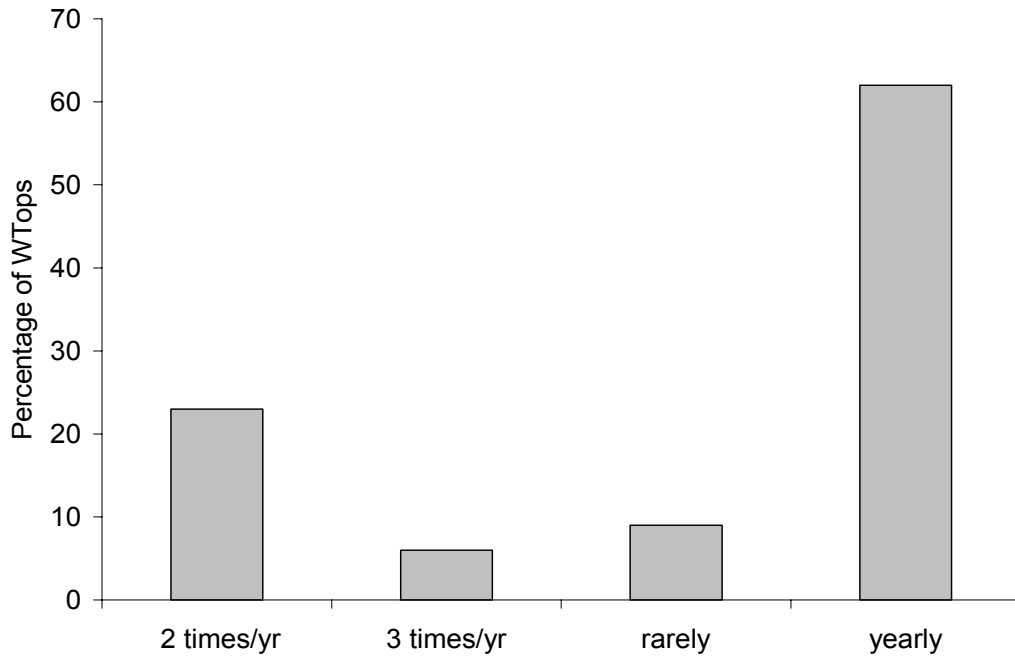
Water taxi operators use these three main agents to clean their boats. About 40 persons (85%) use a soapy detergent; 24 persons (51%) use bleach and 15 persons use disinfectant to get rid of ‘germs’ and odours (Figure 4.10).

For most of the Grenadine Islands, water taxi operators find it best to refurbish their boats during the low season, when they are less busy. Most water taxi operators refurbish their boats once a year, which accounts for more than 60%. Some prefer to or rather, can afford to refurbish their boats more than once a year. A few rarely refurbish their boats (Figure 4.11).

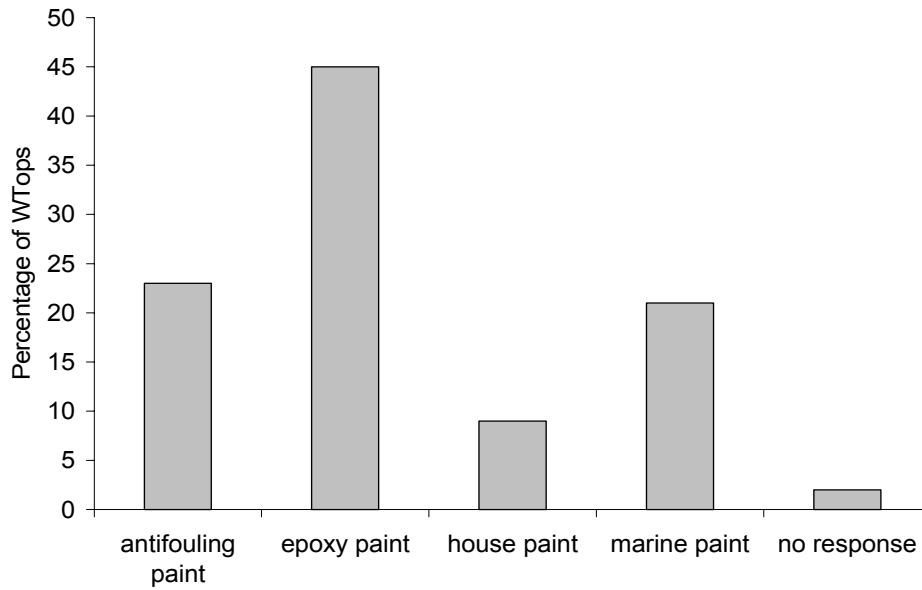
Only nine percent of water taxi operators do not use a special type of paint on the hull of their boats. These four water taxi operators use house paint and one person chose not to respond. Figure 4.12 shows 45% of water taxi operators use a type of epoxy paint on the hull of their boats, while 23% use marine and antifouling paint.



**Figure 4.10: Number of water taxi operators who use each cleaning agent**



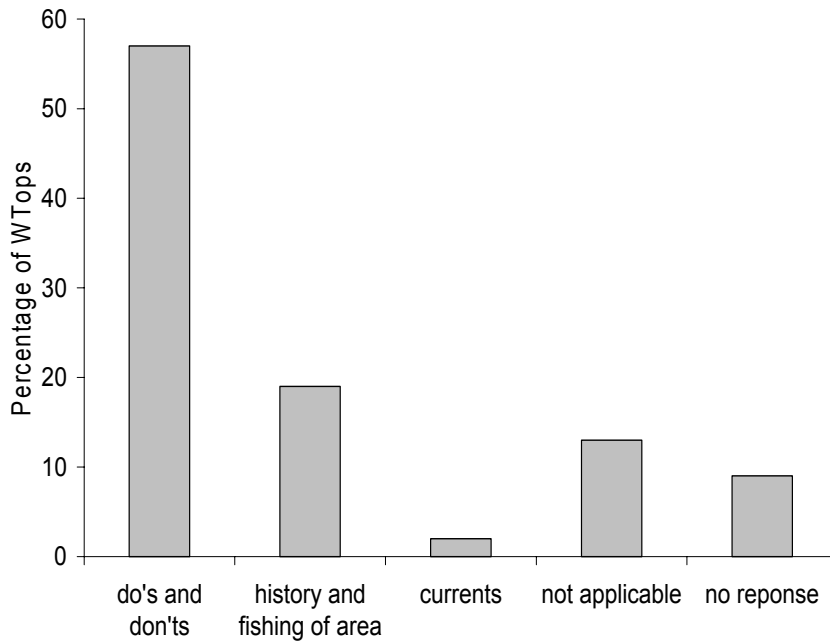
**Figure 4.11: Percentage of water taxi operators who refurbish their boats at different intervals**



**Figure 4.12: Percentage of water taxi operators who use different types of paint**

#### 4.2.10 Education

Nine percent of water taxi operators do not give an information briefing for passengers, but this is attributed to the fact that they do not provide the service of day trips. Those who do give a briefing say that they talk about do's and don'ts for the surrounding waters and about the corals they are familiar with (e.g. fire coral). This was reported as the most popular topic followed by historical information about the area and about fishing as an occupation and recreational activity (Figure 4.13).



**Figure 4.13: Percentage of water taxi operators who discuss different topics for the educational briefing**

## 5 DISCUSSION

As with most research studies, there are several limitations to note and avoid in future studies of this type. Although this research survey provides many answers and insights, there were gaps and unresolved issues that were inevitable.

1. The representative sample size of fifty persons was not met due to two refusals from the water taxi operators and one water taxi operator who did not show up for the interview.
2. Since the operators live throughout the Grenadines (including Bequia, Canouan, Mayreau, Union Island, Petite Martinique and Carriacou), there were logistical problems with locating some of the boat operators and getting cooperation. Not everyone that was randomly selected was met for the in-depth-survey. Some people were out of the island, some did not want to be re-interviewed; some were busy rebuilding after the hurricane, etc. As the researcher did, it best to ensure that a few people from the sample size are selected as back-up interviewees.
3. There was insufficient secondary information about sustainable boat practices specifically for the Grenadines. The current research on the practices of water taxi operators provides baseline information for water taxi associations to utilise along with the reports from workshops conducted with water taxi operators. These documents should be collected as a library to be used by operators and the public for the further development of the operators and the associations.
4. The estimated time for the study was three months, but more time was needed due to unforeseen circumstances such as Hurricane Emily, which occurred on July 13<sup>th</sup>, 2005. It delayed getting information for Petite Martinique and Carriacou. Future researchers are advised to plan for such unforeseen circumstances and have a few extra days set aside.
5. A member of the community associated with the water taxi association was reluctant in helping out and withheld pertinent information (such as names of additional members of the water taxi association) from the researcher. Future researchers are advised to plan ahead meet with key informants some days before conducting the survey.
6. The “Taking Care of Our Coastal Environment” workshop held in Carriacou before this survey may have biased some answers given by the water taxi operators by increasing environmental awareness right before the survey. For future workshops that may influence/bias the results of a survey should be conducted after such survey is completed.

In reference to the different approaches to green boating, the two governments of the Grenadine islands have accomplished some goals. Results however show that the majority of the water taxi operators do not practice environmentally friendly boat operation. It is clear that many water taxi operators need to become more informed in sound environmental practices and also to have a better understanding of the role and importance of marine resources. Having future ‘green boat’ workshops for water taxi

operators will help them to understand and remember environmentally friendly boat practices; the benefits and to also encourage them to become conscientious consumers.

Reasons for Grenada having more water taxi operators with higher-level education include the fact that Grenada has only two Grenadine islands of which one is relatively large; and it may have been easier to provide secondary education. Indeed, the proximity of Petite Martinique to Carriacou, allows Petite Martinique students to attend school in Carriacou by taking the daily 'school boat'. In general however, majority of the water taxi operators in the Grenadines only completed primary level education. Increasing awareness in the other Grenadine islands through various teaching methods by introducing the topic of sustainable 'green boat' practices at the primary and secondary school levels can have significant long term benefits.

Bequia was the pioneer for water taxiing in the Grenadines and for many from that island; it has proven to be very profitable (Phillips, personal communication). Bequia and Union Island get more tourists than the other islands therefore having more business opportunities for the water taxi operators there. Yachts are also common in the harbours at Bequia and Union Island and water taxi operators provide many services for them. For Mayreau, Petite Martinique and Carriacou, water taxiing is a seasonal occupation and compared to the other islands, they get limited customers that ask for the water taxiing service. As a result, the operators there must rely on other jobs to sustain themselves and their families. The second most common occupation is fishing. Most water taxi operators who are capable of fishing, fish for lobsters, conch and fish and sell them to yachts, restaurants and locals. One water taxi operator said, "I prefer fishing because the hours are shorter, the business is more economical and I make more money" (Rocke, personal communication). Although this alternative job is beneficial to some, governments could invest in short courses for the water taxi operators certifying them in various fields, other than fishing.

So few water taxi operators may have known about the rules and regulations of the TCMP because: (1) they do not take passengers there and so are not familiar with the governance of the area; (2) they are not aware that such rules exists; (3) the information may not be readily available; and (4) the low literacy rate as evidenced by many having only completed primary level education. Water taxi associations can review the rules and regulations at their meetings throughout the course of the year, especially for new members.

Many water taxi operators do not want the park to be zoned because they believe that the resources are there for the entire public and no one should be restricted to use any part of the marine park. Some believe that restricting the public will create segregation among the water taxi operators from the different islands and other users of the marine park and therefore heighten user conflict issues for the area.

Although 95% of water taxi operators are aware that the marine environment serves many functions to both humans and marine life, they do not know what these functions and roles are or appreciate the links between ecosystems. Most water taxi operators are aware that certain boating activities/practices can harm the environment, but as one operator puts it, "some things that we do are inevitable, but then again some water taxi operators just don't care" (Simmons, personal communication). Boating

activities/practices that could harm the environment include improper anchoring, disposal of garbage, cleaning/washing boats on the beach etc. Some of these activities are indeed 'inevitable', but the water taxi operators could be informed about better alternatives and ways of minimising impacts. The "Best Practices" manual in Appendix IV outlines various environmental issues and what water taxi operators can do to reduce impacts on the environment. For example, the impacts that antifouling paints can have on the environment is explained.

Most of the 46 respondents that were willing to upgrade their boats said that they would definitely need assistance from the government, the associations and the Sustainable Grenadines Project to achieve this goal, especially if they will need to comply with new standards that may be introduced. The water taxi operators need this assistance because the job is not profitable enough to provide for their families and do everything that is required to become an outstanding environmentally friendly operator. To assist water taxi operators, governments of St. Vincent and the Grenadines and Grenada should introduce tax-free measures on 4-stroke engines; other boat equipment needed for safer and more environmentally friendly boat operation or provide low interest loans.

In addition to bad boat operation, some water taxi operators in the Grenadines have been seen littering at sea and on beaches. Any person seen littering should be warned first and if the act reoccurs, they should be fined, according to the legal policies and Acts against pollution in St. Vincent and the Grenadines and the Littering Act of 1973 in Grenada. However, there are no enforcement officers for such activities. Hitting an object in the water can also damage the boat or engine, putting the operator at great expense. The next issue is speeding in the harbours; it is a threat to both humans and coral reefs. Water taxi operators or other officials should be appointed to monitor improper boat operation activities, such as speeding and illegal dumping. Water taxi operators can also work with the associations and the port authority to assist with patrolling the Grenadine waters.

In respect to the TCMP, many water taxi operators use the southern entrance by Jamesby Cay, where there are numerous reefs. This can have negative impacts and along with increased pollution, can degrade the area. Marker buoys like those upon entering Union Island's harbour can be placed in strategic areas in the TCMP to guide boaters indicating entrance channels or reef areas. Boaters can also invest in flares, moorings and boat lights for better navigation and reef protection.

As expected, operators use anchors more than moorings. Reasons for this are simple-moorings are not readily available; they are limited and expensive to rent. Many water taxi operators have seen their colleagues anchor improperly in sensitive areas. A 'Reef Check' team recently conducted a study in the Grenadines and the results, for the TCMP did not reveal extensive reef damage in the marine park. If business increases however, the reef around TCMP and throughout the Grenadines may be susceptible to destruction in the future. Water taxi operators and other locals can continue to participate and request that more 'Reef Check' monitoring is carried out in the area to determine the health of the reef. Sustaining the 'Reef Check' surveys will provide continuous assessment of possible damages to the reefs in the Grenadines, especially in the marine protected areas.

The high and low seasons are not of equal proportion for all islands in the Grenadines. Some islands have long, productive high seasons, while others have extended low



seasons. Operators from Mayreau say that they only get business when the cruise ships dock offshore, but even then, there is heavy competition (Ollivierre, personal communication). This is so because many people who are not regular water taxi operators also take on the job when the ships arrive. Carriacou on the other hand does not get as many tourists as the northern Grenadine Islands. According to some operators, Carriacou experiences the “trickle-down” effect of tourists who tour the northern Grenadines first. Some reported that they rarely get business from these tourists; therefore leading them to say, “No seasons exist in Carriacou and we are often accused of charging too much for trips” (Gittens, personal communication). They also believe that because cruise ships do not visit Grenadine waters near Petite Martinique or Carriacou, this has limited their business opportunities (Alexander, personal communication). A water taxi operator suggested that the water taxi associations draft proposals and submit them to the governments of St. Vincent and the Grenadines and Grenada (Ministry of Tourism) suggested that they boost the tourism via marketing the services of the water taxi operators. Perhaps this will create more business for the water taxi operators in Mayreau, Carriacou and Petite Martinique.

Plastics are among the most harmful solid waste materials for the environment. They are not biodegradable and may kill many marine organisms including turtles, corals, and fishes. These plastics originate from picnic lunches, oil bottles, fishing nets, garbage collected from yachts and many possible land sources. It is also very unsightly and reduces the appeal to visitors and locals. Water taxi operators should be fined or more drastic measures of license suspension should be done if one is caught illegally disposing garbage. Also, they can be encouraged to invest in equipment such as non-abrasive cleaning cloths, non-plastic/styrofoam utensils, garbage bins for oil bottles can be placed in areas near the beach and possibly even implement a recycling programme.

The other issue is filling the gas tanks with oil and fuel. Filling the gas tanks to the brim does not leave any space for the expansion of these liquids. When the engine heats up, the fuel and oil mixture will expand, if the tank is filled to the brim it will overspill. This waste may enter the marine environment when the drain plugs are opened during cleaning or will mix with the bilge water that is pumped or bailed out of boats. Water taxi operators should fill the gas tanks only to 90% capacity and refrain from cleaning on the beach, draining plugs on or near the beach and burying used oil in the beach sand. Although diesel fuel is preferred by international standards for boats because it is more environmentally friendly, it's not a panacea for impacts caused by gas fuel. Diesel engines are expensive and difficult to maintain among other factors.

Yamaha is the leading brand for boat engines. It is known for its reliability, durability and the wide selection that it offers (e.g. Yamaha salt-water series engine). Engines that are not serviced regularly can cause harm to the environment. They become clogged with oil and release smoke upon starting the engine and while operating. The most popular engine type is the conventional two-stroke engine. This type is more harmful to the environment in several ways, for example, they put about fifty percent of the oil used into the water and they release smoke and fumes. Two stroke engines are what the water taxi operators in the Grenadines can afford and are familiar with. Any well-serviced engine however, runs more smoothly, costs less to maintain and has less impact on the environment.

Finally, although it can be said that water taxi operators in the Grenadines are not currently practicing environmentally friendly boating, they are aware of the many measures that they need to take on to be on the path to become environmentally friendly boat operators. Some practices seem suitable, but many need to be changed. Hopefully, these changes will come about with increased knowledge and water taxi operators will see the benefits of changing to better alternatives. One way this can be done is through involving the water taxi members in decision-making processes and supports them in forming NGOs and CBOs as a means of co-management for the protected areas. The issues that need more attention include anchoring, vessel maintenance, waste disposal and awareness. The last of these may be the key to leading many to become green boat operators. Other information about 'green' boat operation can be disseminated to the operators and also a follow-up survey should be conducted to assess the effectiveness of the "Taking care of our coastal environment" and Sustainable 'green boat' training workshops". On a larger scale, boat operation of stakeholders such as the ferry lines in St. Vincent, the Osprey ferry line of Grenada and yachts all need to be assessed.

The results of this study will be used by the Sustainable Grenadines Project under the Water Taxi component to initiate discussions with the water taxi operators to determine the sustainability and the environmental friendliness of their boat operation. It is hoped that they will use the information to guide positive action to increase benefits to the environment and the people.

## **6 RECOMMENDATIONS**

Several recommendations were forthcoming from water taxi operators across the Grenadines and the researcher.

1. Future researchers conducting survey about water taxi operators in the Grenadines should ensure that a few people from the sample size are selected as back-up interviewees; plan ahead to meet with key informants and plan for unforeseen circumstances.
2. Provide information about 'green boat' workshops in the future so that water taxi operators may fully understand environmentally friendly boating and its benefits.
3. The governments can invest in short courses for the water taxi operators certifying them in various fields, other than fishing.
4. Water taxi associations should review the rules and regulations at their meetings throughout the course of the year, especially for new members.
5. Governments of St. Vincent and the Grenadines and Grenada should introduce tax-free measures on 4-stroke engines other boating equipment needed for safer and more environmentally friendly operations or provide low interest loans.
6. Urge water taxi operators to cooperate with the association and seek to implement arrangements through water taxi associations that would allow operators to monitor and patrol the Grenadine waters.
7. The government or local businesses can provide assistance to the water taxi operators with safety equipment such as moorings, flares, and boat lights for better navigation and reef protection.

8. The water taxi associations should draft proposals to the government of St. Vincent and the Grenadines and Grenada (Ministry of Tourism) suggesting that they boost the tourism product via marketing the services of the water taxi operators. Perhaps this will create more business for the small-scale water taxi operators in the Grenadines, especially in Mayreau, Carriacou and Petite Martinique.
9. Water taxi associations should be encouraged to invest in equipment for proper and environmentally friendly boating (inland boat yard, spray guns, etc.). In addition, they can invest in disposal bins for oil bottles and place them in strategic areas, possibly even implement a recycling programme.
10. Water taxi operators should follow the guidelines in the best practices manual.

There are also a number of long-term recommendations that emerged from the study.

1. The current research provides baseline information for water taxi associations to utilise along with the reports from workshops conducted with water taxi operators. These documents should be collected as a library to be used by operators and the public for the further development of the operators and the associations.
2. Increasing awareness in the other Grenadine islands through various teaching methods by introducing the topic of sustainable ‘green boat’ practices at the primary and secondary school levels can have significant long term benefits.
3. Sustain ‘Reef Check’ surveys to provide continuous assessment of possible damages to the reefs in the Grenadines, especially the TCMP and other protected areas.
4. Governments should involve water taxi operators in the decision-making process and support them in forming NGOs and CBOs as a means of co-management.
5. Conduct follow-up research in the Grenadines to assess the effectiveness of the “Taking care of our coastal environment” and “Green boat training” workshops.
6. Sustainable Grenadines Project and/or both governments should conduct a survey to assess the sustainable boating practices of the other boating stakeholders: the ferry lines in St. Vincent; the Osprey ferry line of Grenada; yachts; day charter operators and SCUBA operators in the Grenadines.

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## 8 APPENDICES

### Appendix 1: Questionnaire for preliminary survey

**Purpose of Questionnaire:** To establish a database of water taxi operators throughout the Grenadines for the Sustainable Grenadines Project. It will also provide a basis for selecting a sample size for the in-depth survey to be carried out on the livelihoods and green boat practices of water taxi operators.

**Surveyor's name:** \_\_\_\_\_

Respondent #: \_\_\_\_\_

Date: \_\_\_\_\_

1. Name of Boat: \_\_\_\_\_
2. Registration Number: \_\_\_\_\_
3. (a) Name of Owner: \_\_\_\_\_  
(b) Male \_\_\_\_\_ Female \_\_\_\_\_
4. How many persons operate this water taxi? \_\_\_\_\_.
5. Name and sex of Operator/s:  
Name: \_\_\_\_\_ Sex: \_\_\_\_\_  
Name: \_\_\_\_\_ Sex: \_\_\_\_\_
6. Length of Boat: \_\_\_\_\_.
7. Type of Boat: \_\_\_\_\_.
8. Where do you dock your boat? \_\_\_\_\_.
9. Are you a member of a Water Taxi Association (WTA)?  
Yes \_\_\_\_\_ No \_\_\_\_\_
10. Which WTA? \_\_\_\_\_.

We will be conducting two in-depth surveys in approximately two weeks on your livelihoods and your boating practices. We would therefore appreciate if we could interview you again at your convenience.

**Appendix 2: In-depth Questionnaire**

This questionnaire is for the assessment of the boating practices of the water taxi operators in the Grenadines. This study will provide information for the Water Taxi Project under Sustainable Grenadines Project. It is also a requirement for the completion of D.T. Lizama’s, MSc. in NRM degree at UWI. The information collected will be confidential. A training workshop will be held for the water taxi operators in October 2005 using the results from this study.

Name of respondent \_\_\_\_\_  
Island: \_\_\_\_\_ Respondent  
# \_\_\_\_\_  
Dock Location: \_\_\_\_\_ Date: \_\_\_\_\_  
Boat Name: \_\_\_\_\_  
Length of boat: \_\_\_\_\_  
Registration #: \_\_\_\_\_

**Demographics**

- 1. How old are you?  
Less 20 \_\_\_\_\_ 20-30 \_\_\_\_\_ 31-40 \_\_\_\_\_ 41-50 \_\_\_\_\_ 50 and over \_\_\_\_\_
- 2. What was the last level of education you completed?  
\_\_\_\_\_
- 3. What job provides you with the most income?  
\_\_\_\_\_
- 4. Do you have any other jobs?  
1<sup>st</sup> \_\_\_\_\_ 2<sup>nd</sup> \_\_\_\_\_ 3<sup>rd</sup> \_\_\_\_\_
- 5. Are any other members in your household involved in the water taxi operation?  
Yes \_\_\_\_\_ No \_\_\_\_\_  
Who? \_\_\_\_\_  
\_\_\_\_\_
- 6. Do you have any other relatives involved in the water taxi operation?  
Yes \_\_\_\_\_ No \_\_\_\_\_  
Who? \_\_\_\_\_  
\_\_\_\_\_
- 7. Are you a member of the Water Taxi Association?  
Yes \_\_\_\_\_ No \_\_\_\_\_

**Attitudes and Perception**

8. Are you aware that the Tobago Cays is a marine park?

Yes \_\_\_\_\_ No \_\_\_\_\_

9. Are you aware of the rules and regulations concerning the marine park?

Yes \_\_\_\_\_ No \_\_\_\_\_

10. Do you respect the marine park?

Yes \_\_\_\_\_ No \_\_\_\_\_

11. Do you think that most water taxi operators respect the regulations of the marine park?

Yes \_\_\_\_\_ No \_\_\_\_\_

12. Do you think that the marine park should be zoned in respect to the different activities carried out in the park?

Yes \_\_\_\_\_ No \_\_\_\_\_

If no, why? \_\_\_\_\_

13. What is the value/importance of the marine resources to you? **OR** How important is it to you that the marine resources remain in abundance?

\_\_\_\_\_  
\_\_\_\_\_

14. Do you know that the marine environment serves many functions to both human and a variety of marine organisms?

Yes \_\_\_\_\_ No \_\_\_\_\_

15. Are you aware that some of the activities that you carry out may be harmful to the environment?

Yes \_\_\_\_\_ No \_\_\_\_\_

16. Would you be willing to learn more about environmentally friendly boating to gain more knowledge and gain a better understanding as to why this is important?

Yes \_\_\_\_\_ No \_\_\_\_\_

17. Would you be willing to upgrade your boat for the safety of yourself, your passengers, and the environment?

Yes \_\_\_\_\_ No \_\_\_\_\_

### **Threats and Problems**

18. Have you observed any conflict between water taxi operators concerning environmentally friendly boating in the Grenadines?

Yes \_\_\_\_\_ No \_\_\_\_\_



If yes, of what nature? \_\_\_\_\_ 19.

19. What do you think are the top three threats to the marine environment from boating operation here in the Grenadines?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

20. Can you suggest some solutions to reduce the negative impacts caused on the environment?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

21. Do you report non-environmentally friendly activities?

Yes \_\_\_ No \_\_\_

22. Do you take any action against activities by your passengers that may potentially harm the environment?

Yes \_\_\_ No \_\_\_

### Coastal and Marine Activities

23. How many years have you been a water taxi operator?

Less than 5 \_\_\_ 6-10 \_\_\_ 11-20 \_\_\_ 21-30 \_\_\_ over 30 \_\_\_

24. What type of service do you offer? (can check more than one)

- \_\_\_ taking passengers on boating trips (snorkelling, swimming..)
- \_\_\_ transporting people between islands
- \_\_\_ transporting people from yachts, ships to shore
- \_\_\_ taking goods to the yachts
- \_\_\_ taking garbage from them
- \_\_\_ other

25. About how many days of the week do you conduct water taxi services?

High season: \_\_\_ 1-3 days                      Low season: \_\_\_ 1-3 days.  
                  \_\_\_ 4-6 days                              \_\_\_ 4-6 days.  
                  \_\_\_ 7 days a week                              \_\_\_ 7 days a week

26. What is your estimated number of trips per day?

High season: \_\_\_ 1-3 trips                      Low season: \_\_\_ 1-3 trips  
                  \_\_\_ 4-6 trips                              \_\_\_ 4-6 trips  
                  \_\_\_ 7-9 trips                                \_\_\_ 7-9 trips  
                  \_\_\_ > 10 trips                                \_\_\_ >10 trips

27. What is the passenger capacity of your boat?

\_\_\_\_\_ persons

28. What is the estimated number of passengers you take out per trip  
\_\_\_\_\_ persons

**Boating Practices**

29. What brand of engine do you have?  
\_\_\_\_\_

30. Which type of engine do you have?

\_\_\_\_ traditional 2-stroke carburetted

\_\_\_\_ 2 strokes direct fuel injection

\_\_\_\_ 4-stroke

31. What type of fuel does your boat require?

\_\_\_\_ gas

\_\_\_\_ diesel

32. If boat is 2 stroke carburetted, you are filling the tank with the mixture (oil and fuel),  
do you fill the tank to the brim?

Yes \_\_\_\_ No \_\_\_\_

33. How often do you check your hoses for leaks and breaks? (choose only one)

\_\_\_\_ daily

\_\_\_\_ each trip

\_\_\_\_ weekly

\_\_\_\_ rarely

34. Where is the boatyard located?

\_\_\_\_ inland

\_\_\_\_ near the sea

35. How often do you service your engine(s)?

\_\_\_\_ weekly

\_\_\_\_ monthly

\_\_\_\_ yearly

\_\_\_\_ as needed

\_\_\_\_ rarely

36. How quickly do you replace a damage propeller? (choose one)

\_\_\_\_ days after an incident

\_\_\_\_ weeks after an incident

\_\_\_\_ as you get enough funds

\_\_\_\_ other

37. How often do you wash/clean your boat?

\_\_\_\_ weekly

- monthly
- yearly
- as needed
- rarely

38. What kind of cleaning agents do you use? (soapy detergent, Clorox, etc.)

\_\_\_\_\_

39. How often do you refurbish your boat?

\_\_\_\_\_

40. Do you use a special type of paint on the bottom of your boat? (e.g. brand, antifouling)

Yes  No

41. Whether yes or no, what kind of paint do you use on the boat?

\_\_\_\_\_

42. In open waters, do you use anchor or moorings?

\_\_\_\_\_

43. Do you have both primary and secondary anchor lines on board?

Yes  No

44. Do you have a tilt on your engine?

Yes  No

45. Does the tilt on your boat work properly?

Yes  No

46. If not, what do you do in areas where it would be necessary to use the tilt?

\_\_\_\_\_

47. Do you always use the tilt or manually pull up the engine in shallow waters?

Yes  No

48. What entrance do you take to enter the Tobago Cays Marine Park?

\_\_\_\_\_

49. How fast do you go near the shoreline/beaches in the harbour? (when approaching)

\_\_\_\_\_

50. If you take passengers out for a trip, do you give them any kind of educational briefing about the marine environment? (do's and don'ts; value of the marine environment to the Grenadines etc.)

Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, what do you talk about?

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51. Is solid waste generated on board?

Yes \_\_\_\_\_ No \_\_\_\_\_

52. What kind of solid waste is it? (plastics, Styrofoam, cigarette butts)

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53. Where do you dispose of the garbage?

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54. Are there any other concerns pertaining to water taxi operation/boating and the environment that you would like to mention or that I did not cover?

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Appendix 3: Map of the Tobago Cays and entrance channels

