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THE SUSTAINABLE GRENADINES PROJECT

**SUSTAINABLE INTEGRATED DEVELOPMENT AND BIODIVERSITY
CONSERVATION IN THE GRENADINE ISLANDS**

**FINAL ASSESSMENT OF SUSTAINABLE “GREEN BOAT” PRACTICES OF
WATER TAXI OPERATORS IN THE GRENADINES**



CERMES, UWI
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Abstract

Water taxi operators (WTOs) are one of the main resource users in the Grenadines. While no direct evidence has been found, it has been observed that they have the potential to negatively impact on the marine environment due to a range of boating practices. A study conducted by D.T. Lizama 2005 verified that these operators were engaging in non-environmentally friendly boating practices which could lead to degradation of the marine ecosystem. Through the Water Taxi Project, operators were educated about the marine environment and boating best practices via two workshops, "Greening boats" and "Caring for our coasts and our future". They were also provided with the necessary training to strengthen their capacity as operators.

This paper sought to determine if there has been a change in the boating practices of operators since the finale of the Project. Research has found a noteworthy change in some of the boating practices for the better and for the worse. There is an increase in the positive attitudes of operators towards the marine environment. However some of their boating practices e.g. the use of hazardous substances, infrequent servicing of engines and checking of hoses for leaks and breaks, do not reflect this. Furthermore pollution is becoming an ever-increasing problem and with more plastic waste being generated on board exacerbates the problem.

The overarching problem in the boating practices of operators is the lack of compliancy and possibly to a lesser extent, inadequate financial support. However this must be further investigated. Recommendations were made recognising the issues of improper solid waste disposal, lack of enforcement, use of hazardous products and education.

Keywords: water taxi operators, sustainable practices, green boats, Grenadines

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Cover Photo: A water taxi boat beside a schooner in Port Elizabeth, Bequia.

1 INTRODUCTION

The transboundary Grenadine island chain lies on the Grenada Bank which extends between the two sovereign nations of St. Vincent and the Grenadines and Grenada. There are over 20 islands, of which 9 have permanent settlements. Two are resort islands. The largest islands have towns and communities with public and private supporting infrastructure. Most others are visited by yachters, and fishers. Much of the bank area occupied by the Grenadine Islands (about 1,500 km²) is shallower than 50 m and supports the most extensive coral reefs and related habitats in the south-eastern Caribbean (Mahon *et al.*, 2004).

Inhabitants of the Grenadine Islands are highly dependent on the marine environment for sustainable livelihoods. Marine-based activities such as tourism and fishing are the foremost sources of employment. There is heavy reliance on the sundry of marine resources and thus a high vulnerability to coastal and marine degradation. Over the years, these small island communities have suffered from detrimental anthropogenic activities such as recreational abuse of coral reefs, habitat degradation, pollution of sewage and solid waste, overfishing and use of destructive fishing practices. All these activities have long term implications for sustainability in the Grenadines.

Integrated sustainable development is being promoted by the Sustainable Grenadines Project which began in 2002. The Project has recognized the importance of the marine resources to the people and that a holistic approach to sustainable development is required to protect the resources and the capacity of the people living there. During phase 1 of the Sustainable Grenadines Project, stakeholders recognized that the water taxi operators have the potential to considerably impact the environment throughout the Grenadines because of their daily activities. 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 (CCA CaMMP, 2002).

1.1 *Water taxi operators- the main resource user*

Water taxi operators can be considered one of the principle marine resource users in the Grenadines. They typically operate in the Grenadine islands of Bequia, Canouan, Mayreau, Union, Petit Martinique and Carriacou, transporting either locals or tourists (Figure 1.1). The transport service is convenient for locals especially whereby the ferry service is irregular, and for tourist to go snorkeling and diving around famous marine attractions such as the Tobago Cays and Sandy island. Operators also provide other services for their customers such as boating trips, transportation from yachts to shore, collecting and disposing of garbage and selling goods (Lizama, 2005). The water taxi industry is largely unregulated. The operators usually utilize small, open, outboard powered boats which are generally poorly equipped. According to CEC 2005, “the operators are seldom trained in the skills that are necessary to operate a passenger craft or a small business and much lack the necessary capacity to provide safe and efficient service. For this reason, they are often marginalized in favour of a few well-equipped water taxi operators that are recognized by the tourism authorities as being capable of providing safe, reliable service.”



Figure 1.1: Passengers being transported via a water taxi, Clifton, Union Island

The industry hosts mainly small-scale operators who are struggling to make a living (CEC, 2005). Some are even fishers by trade to earn additional income (Baldwin *et al.*, 2006) while for others it is simply a pastime. According to Cooke, 2006, operators earned the majority of their money from visitors (Figure 1.2), locals accounted for approximately 20% and the sale and transport of goods for 10%. Goods are also sold to yachts and they also supply fishing boats from Martinique, hotels and restaurants with a variety of seafood also provide supplemental income (Figure 1.2).

The extensive operation of water taxis throughout the Grenadine Islands suggests that they have the potential to significantly impact the marine environment. Lizama (2005) indicated that the majority of the WTOs highly valued the marine environment because they depend on it for their livelihoods. However they were not engaged in environmentally friendly practices which would protect the marine environment. At that time, the majority of water taxi operators believed that speeding boats and improper garbage disposal into the sea was the largest threat facing the marine environment of the Grenadines (Lizama, 2005). Many operators continued to use anchors to secure their boats; use non-environmentally friendly cleaning agents and equipment and improper boat maintenance. According to CEC (2005), water taxis impact the marine environment directly through poor operating or waste disposal practices leading to pollution, or physical impacts through grounding and anchoring. According to Lizama (2005) the operators were aware of the measures needed to become more environmentally friendly operators but perhaps greater and innovative efforts are required to educate the WTOs. These negative impacts caused by WTOs had not been quantitatively assessed but they could be commonly observed across the islands.



Figure 1.2: Divers being transported to the Tobago Cays

1.2 The Water taxi project

Water taxis are an important and integral component of sustainable livelihoods and social life in the Grenadines. With approximately 169 water taxi operators across the Grenadines (Baldwin *et al.*, 2006), their cumulative inapt practices can have repercussions on the marine environment along with other marine users such as yachters. In 2004, the impacts of the water taxi operators were identified as a significant issue during phase 1 of the project. Subsequently the Water Taxi Project (WTP) was developed to focus on strengthening the capacity of operators to acts as stewards for the environment while at the same time enhancing their capacity to earn a living from the marine environment. The project focused on four specific objectives:

- Environmental education,
- Customer service straining,
- Safety at sea, and
- Organisational strengthening.

The table below illustrates the timeline of the achievements of the WTP (Table 1.1).

Table 1.1: Timeline of activities occurring during the implementation of the Water Taxi Project

Year	Achievements	
2004	Formation of the water taxi associations	-Southern Grenadines Water Taxi Association -Carriacou and Petit Martinique Water Taxi Association
	Visioning and project planning	
2005	Environmental stewardship education	-Greening boats operation training -Environmental Stewardship Education -Production and distribution of environmental education material
2006	Safety at sea project	-Acquisition of office equipment and supplies -Safety equipment demonstration and training -Safety at sea procedures
	Organisational strengthening	-Negotiation skills/conflict management training -Production of WTA's website -Training of WTA leaders in Leadership

Within the water taxi industry, there are various problems and opportunities for stewardship. These were recognized by water taxi operators in Bequia, Union Island, Canouan, Mayreau, Carriacou and Petite Martinique. As a result two associations were formed: Southern Grenadines Water Taxi Association and the Carriacou and Petit Martinique Water Taxi Association. The associations sought to address various problems through training and capacity building. A significant portion of the operators are members of the association. The island of Bequia currently has no association; however the formation of such an association is in progress (pers. comm., 2007)

With limited research on the water taxi industry, studies were undertaken relating to their boating practices (Lizama, 2005) and livelihoods (Cooke, 2005). The research has provided some baseline information about the operators which is useful for alleviating management issues. From the project, a guidebook was prepared by Lizama and Mahon in 2006 entitled “Sustainable ‘Green boat’ practices for water taxi operators in the Grenadines. Best practices for a cleaner marine environment through improved boating operations.” The guidebook covers key aspects such as vessel and engine maintenance, cleaning, fuelling, waste disposal, anchoring *inter alia*. It provided knowledge to both new and experienced operators within the industry.

The need of formal education for the operators about best practices and safety procedures was addressed. The operators have benefited from a number of workshops particularly the “Greening boats” (Box 1.1) and “The Caring for our coasts and our future” (Box 1.2) which focused on the environment, negative impacts and how they as operators can help to preserve and protect the marine environment. The

Box 1.1: Elements of the Greening boats workshop

- Overview of the natural step approach to environmental stewardship
 - Managing non-renewable resources-
 - Avoiding pollution
 - Managing the natural resources upon which our lives depend
 - Being fair and equitable
- Developing a checklist of good practices
- Reconciling the checklist
 - Maintenance
 - Fuel and engines
 - Safety equipment
 - Anchoring
 - Setting an example
 - Education

participants are expected to elicit environmentally sound practices and services during their daily marine interactions. Whether this has resulted in a significant impact on their operations is yet to be determined (Figure 1.3).

Box 1.2: Elements of the Caring for our coasts and our future workshop

- The coral reef ecosystem in the Grenadines
 - Overview of reef types and coral biology
 - Unhealthy coral: bleaching and disease
- Human interactions with coastal systems
 - People and turtles
 - Reported damaged corals
 - Identification of damaged corals that can be restored
 - Coral handling and security
 - Good ethical practices
- Developing good practices- where do we go from here?
 - Interactions with corals, fish, turtles and other sea life
 - Mooring buoys installation and maintenance
 - A proposed coral response team
 - The CEC and communications
 - Reef monitoring
 - Briefing and managing your visitors
 - Proper boat care
 - Accreditation
- Designing the learning and accreditation scheme
- Telling our story
- Developing our story-where do we go from here
 - Peoples' interactions with sea life
 - Landmarks/attractions of special significance
 - Communications
 - Briefing and managing your visitors
 - Proper boat care

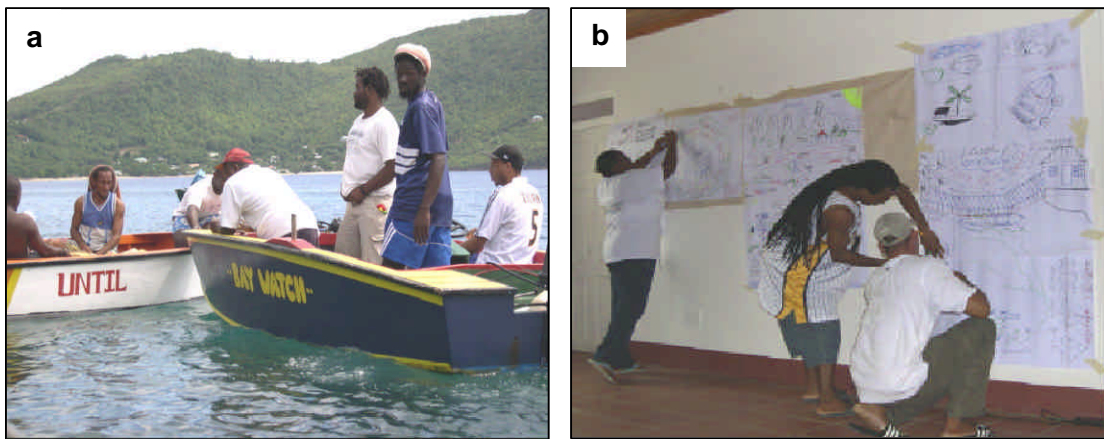


Figure 1.3: Operators participating in the various workshops (a: Operators training in green boat operations; b: Operators participating in environmental stewardship education)

In many ways the WTO project has addressed the knowledge gaps of the WTOs so that they not only become stewards of the environment but it has also strengthened their capacity as operators. However it is not quite clear whether this has made a significant difference in the operators' attitudes and perceptions. This paper seeks to determine if the Water Taxi Project has made any significant changes in the boating practices of water taxi operators in the Grenadines.

1.3 Research purpose and objectives

The purpose of this project is to evaluate if there has been any change in the use of “green boat” practices by water taxi operators in the Grenadines subsequent to implementation of the Water Taxi Project. The objectives of the report are:

- a) To interview water taxi operators from Bequia, Mayreau, Union Island, Petit Martinique and Carriacou about their current boating practices.
- b) To compare the current boating practices with those documented by Lizama (2005) to determine whether the current practices are more environmentally friendly.
- c) To identify any gaps and the lesson learnt from the project.

2 METHODS

2.1 Data acquisition

An individual survey was conducted to determine if there has been any significant change in boating practices, coastal and marine activities, attitudes and perception and threats/problems to the marine environment since 2005 (Appendix 1). The survey was based on Lizama’s survey in 2005. Information pertaining to the use of the water taxi booklet and its influence on their boating practices were also acquired. The surveys were conducted during a 7 day period from the 15th October to the 22nd October 2007 on only five of the inhabited Grenadine islands.

A total of 35 operators were surveyed: Bequia (6), Mayreau (6), Union Island (9), Petit Martinique (5) and Carriacou (9). The list of interviewees was based on the list of known water taxi operators who took part in the previous assessment (Lizama 2005) and the two aforementioned workshops. In some cases other operators who did not attend the workshops were involved in the survey due to the scarcity of the selected operators during the survey period. Furthermore some of the selected operators were out of the island or doing alternative jobs since it was off-season.

2.2 Data analysis

All data were entered into SPSS and analysed. Descriptive statistics were used to determine if there were any changes in boating practices since 2005.

2.3 Data limitations

There was a reduction in sample size used in the survey due to the scarcity of water taxi operators on the islands of Union Island, Carriacou and Petit Martinique. In addition, operators who were not involved in Lizama’s survey in 2005 were also interviewed. While this may affect some of the results, it will give a perspective in terms of the sharing of knowledge between water taxi operators.

3 RESULTS

3.1 Water taxiing as an occupation

Water taxiing is the major source of income for water taxi operators. In 2007 48% of the respondents indicated that their highest proportion of income was from water taxiing compared to 46% in 2005 (Figure 3.1). In 2005 17% of the operators identified fishing as a major income

source while in 2007, the occupations that were significant contributors to income were predominantly bar/restaurant owners (14%), seaman/marine men (11%) and divers (9%). Results indicated that there was a decrease in the number of operators who are members of the water taxi association from 68% in 2005 to 51% in 2007. The majority of vessels are more than 15.5ft (Figure 3.2).

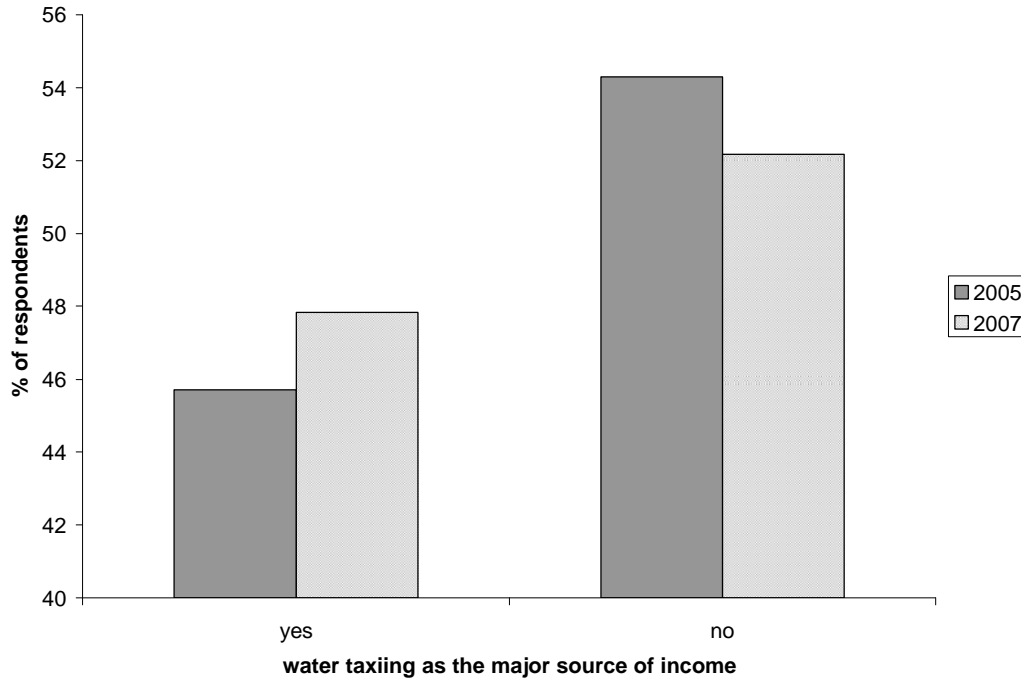


Figure 3.1: Water taxiing as the major source of income

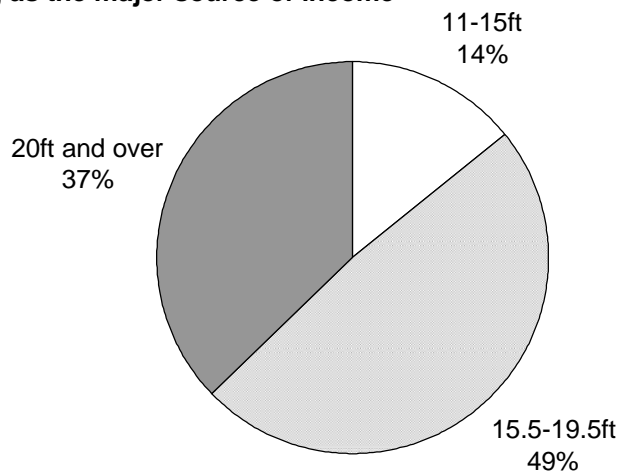


Figure 3.2: Boat length of the water taxi vessels

The map below illustrates the docking sites used by the operators throughout the Grenadines in 2005 and 2007. Most of the docking sites are located near the main towns of the islands (Figure 3.3).

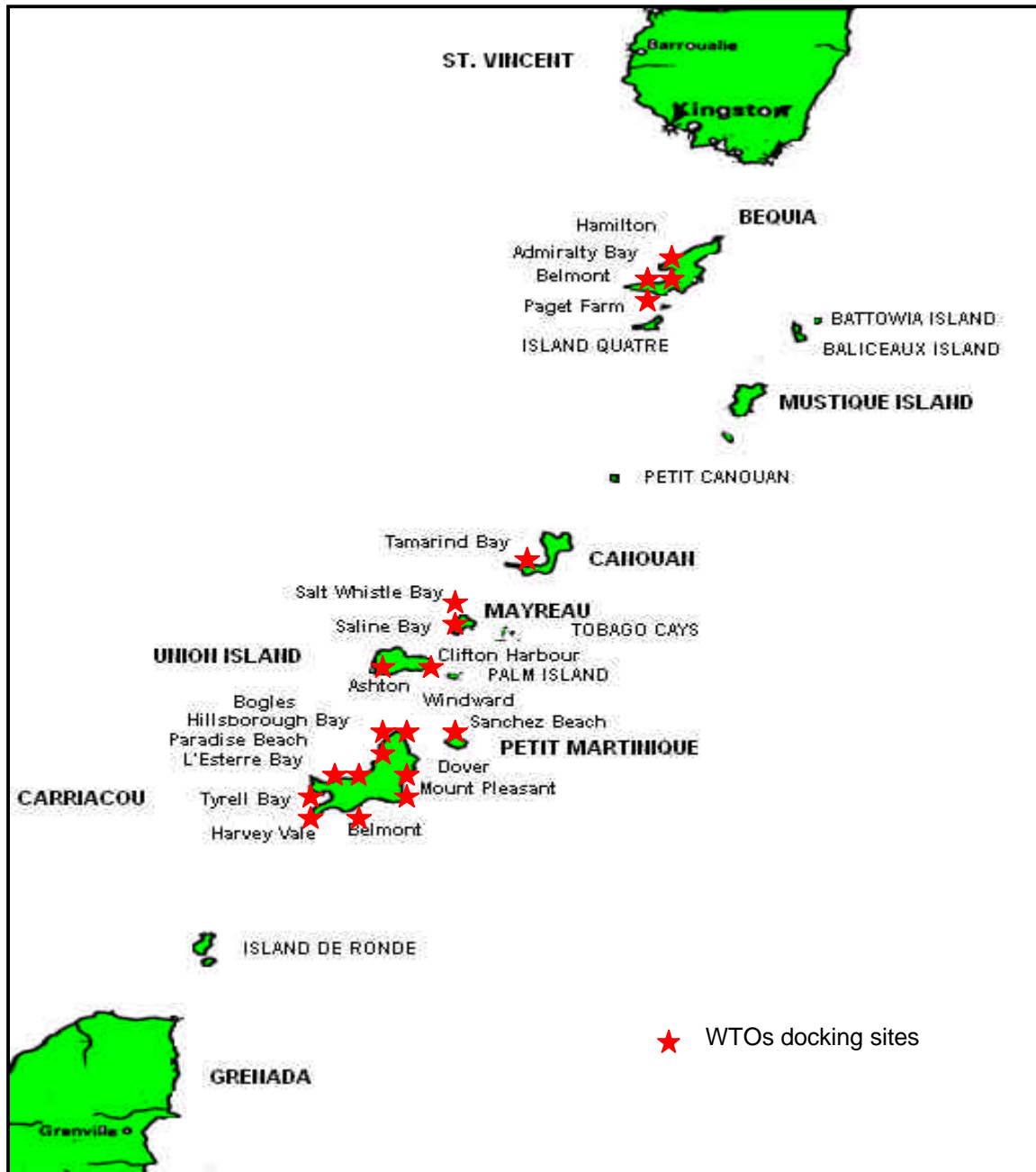


Figure 3.3: Docking sites used by water taxi operators in 2005 and 2007

3.2 Marine awareness and value of marine resources

The majority of the water taxi operators (89%) interviewed was aware of the Tobago Cays Marine Park (TCMP), compared to 98% in 2005. Most of them (74%) in 2007 compared to only 28% in 2005 were aware of the rules and regulations stipulated by TCMP management. The majority of the operators (97%) in 2007 and (98%) in 2005 respected the park (Figure 3.4). In 2007, 90% of the operators supported the idea of zoning the park in respect to different activities carried out in the park such as scuba diving compared to only 44% in 2005.

Most of the operators (61%) in 2007 agreed that they are dependent on marine resources for their livelihoods (Figure 3.5). This is a 7% increased compared to in 2005. Similar to results of 2005, the majority of the operators (97%) are aware of the functions of the marine environment to both humans and marine organisms. All of the respondents are willing to upgrade their boat except for those (6%) whose boat is fully equipped and already meet the International standards. Now in 2007 even more operators (86%) are aware that the activities that they carry out may be harmful to the marine environment, particularly damage to coral reefs and oil pollution compared to only 81% of operators in 2005.

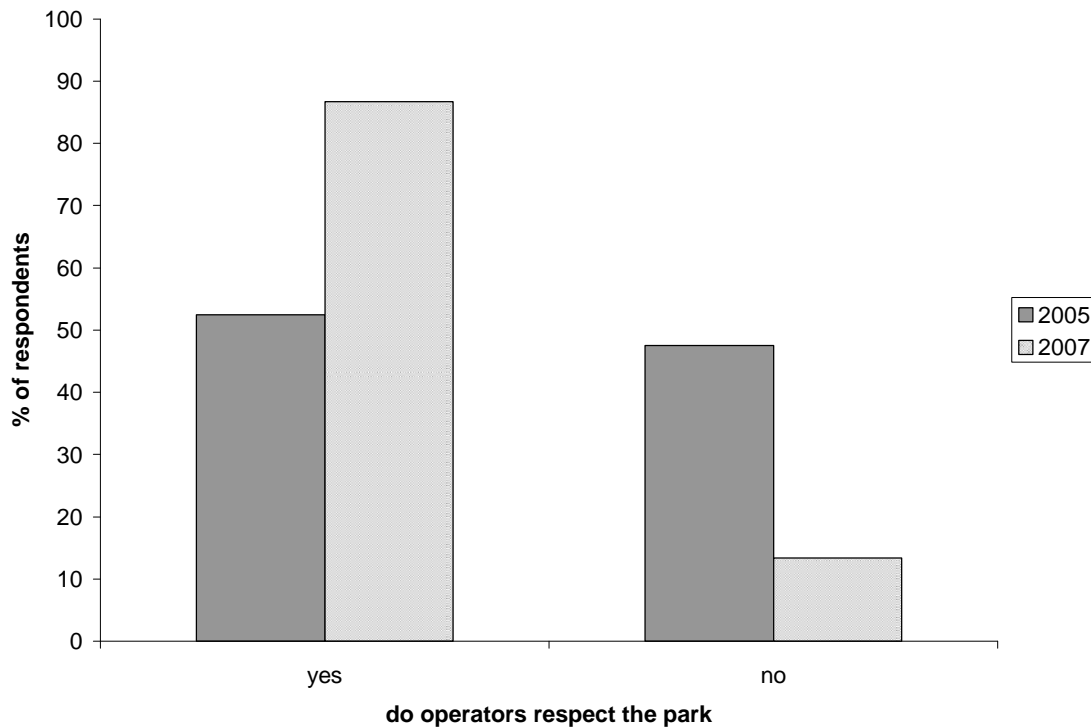


Figure 3.4: Percentage of operators who respect the park

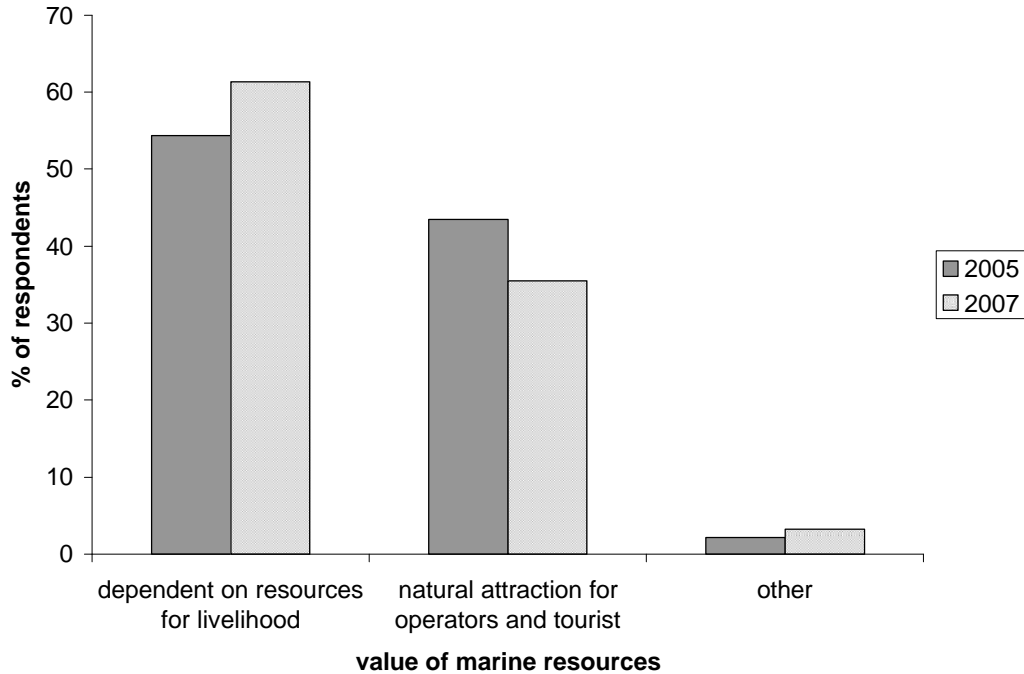


Figure 3.5: The value of marine resources to the operators

3.3 Awareness of the Water Taxi Project

Most of the operators (94%) were aware of the WTP but only 71% attended the workshops. Thirty-six percent attended the “Greening boats” workshop, 80% attended the “Caring for our coast and our future” workshop and 68% attended the “Safety at sea” workshop (Figure 3.6). Most (68%) knew about the Water Taxi booklet. Of the 38 persons who received the booklet, only a small portion (38%) read the booklet and found it useful. Thus far only one respondent has used the guidelines in the book.

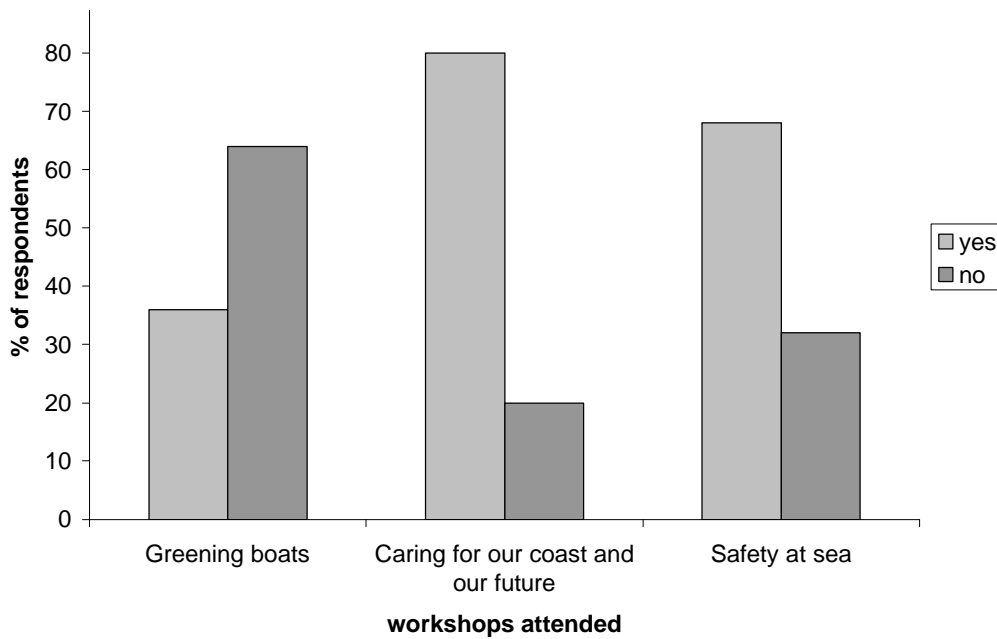


Figure 3.6: Percentage of respondents attending greening boats workshop

3.4 Boating threats and solutions

Results indicate that there has been an increase in the number of conflicts observed between operators regarding environmentally friendly boating practices. In 2005, 60% of the operators observed conflicts while currently in 2007, 67% of the operators have observed such conflicts. While the types of conflicts are limited, the highest proportion of conflicts arises from improper garbage disposal. This was evident in 2005 and 2007 with 38% and 25% of the operators identifying garbage disposal as a major conflict. An interesting note is the high percentage of operators who refused to define the type of conflicts observed. The percentage of operators who refused to define the type of conflicts observed in 2007 was 57%. This is a 26% increase from 2005.

Boating operations of water taxi operators constitute a number of threats that have the potential to indiscreetly impact the marine environment. In 2005 operators identified the perceived threats to be speeding, lack of equipment, fishing and pollution (Figure 3.7). However in 2007 operators have recognised other threats regarding anchoring (9%), entering prohibited areas of the Marine Park (3%) and individuals being uneducated about the park (3%). Overall, the threat of pollution remains paramount as the pressure facing the marine waters. This threat was indicated by 61% of the respondents in 2005 and 76% of respondents in 2007.

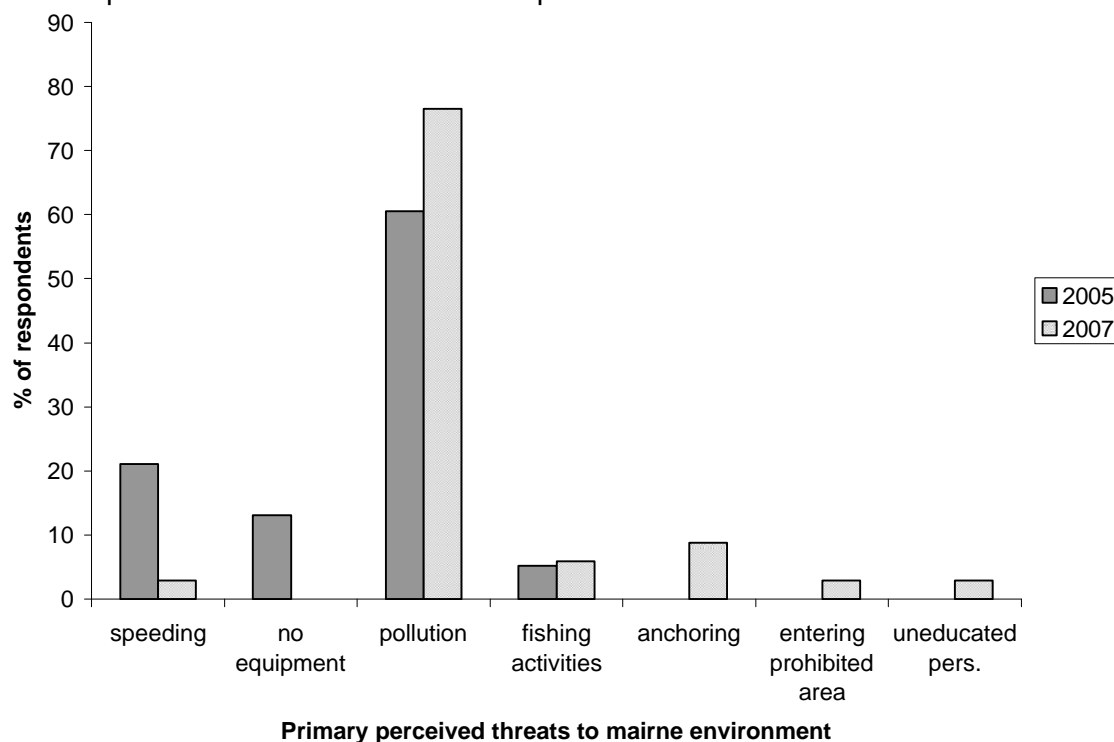


Figure 3.7: Primary perceived threats to the marine environments from boating operations

Water taxi operators have proposed some resolutions to alleviate these identified threats to the marine environment. In 2005, the suggestions made by operators were predominantly adequate garbage disposal (21%), limiting speeds (21%), implementing fines/penalties (21%), education (16%) and monitoring 16%. In 2007, 48% of the operators suggested that educated is the essential solution followed by 24% indicating adequate garbage disposal (Table 3.1). In 2007, even less operators (54%) are reporting non-environmentally friendly activities compared to 57% in 2005. In 2007, there was a 17% decrease in the percentage of operators reprimanded their passengers when they potentially harm the environment compared to 2005.

3.5 Operation and services

Similar to results of 2005, most of the operators (38%) in 2007 have been in the water taxi business for around 11-20 years. Results show that taking passengers on boating trips and transporting people between islands remain as customary services of the water taxi operators. These services are tendered by the majority of operators in 2005 and 2007 (Figure 3.8). In 2007, fewer operators are involved in yachting related activities compared to in 2005. In 2007 51% took people to yachts, 51% took goods to yachts and 23% took garbage from yachts while in 2005 64% took people to yachts, 57% goods to yachts and 26% took garbage to yachts. An interesting note is the increase in the additional services offered such as fishing, beach barbeques *inter alia*. In 2007 29% of the respondents offered these services compared to a mere 2% in 2005.

Table 3.1: Solutions to the perceived threats suggested by operators in 2005 and 2007

Solutions	2005 (%)	2007 (%)
Limit speed	21	4
Fines/penalties	21	8
Boat inspection	3	0
Adequate garbage disposal	21	24
Education	16	48
Monitoring	16	0
Appoint a garbage collector	0	8
Licensing	0	8
Suggest more engine services	3	0
Security	0	4

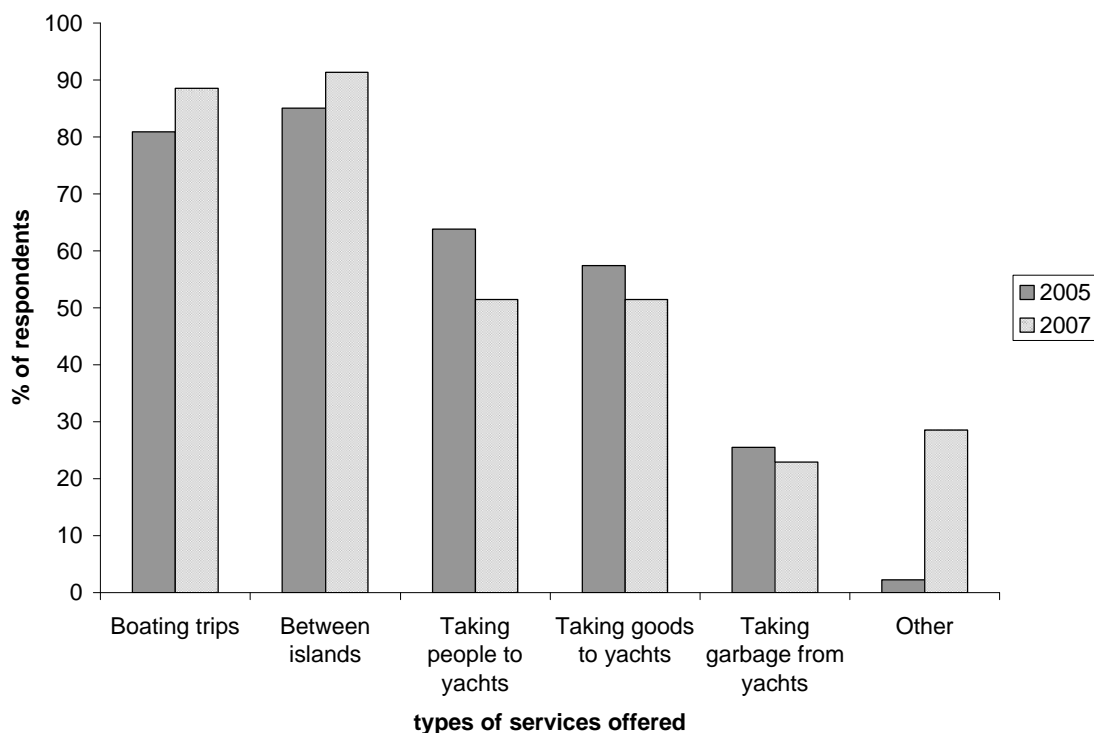


Figure 3.8: Types of services offered by water taxi operators

3.6 Solid waste

Results indicate that there is an increase in respondents who state that they generate garbage on board water taxi vessels from 60% in 2005 to 74% in 2007. Plastics remain a major waste product on board these vessels with 93% of the respondents generating plastics in 2005 and

96% in 2007 (Figure 3.9 and 3.10). There is an 8% increase in glass generated from 44% in 2005 to 52% in 2007. The percentage of paper waste remains constant with only 8% of the respondents generating paper waste. Figures 3.8 and 3.9 illustrate the changes in the types of waste generated during 2005 and 2007. Most of the respondents (73%) dispose of their garbage at their landing sites when coming to shore (Figure 3.11). Some (15%) take the garbage to their nearby facility e.g. the vegetable market in Bequia. The remaining 12% either took their garbage home, to the local dumpsite or wherever was appropriate.

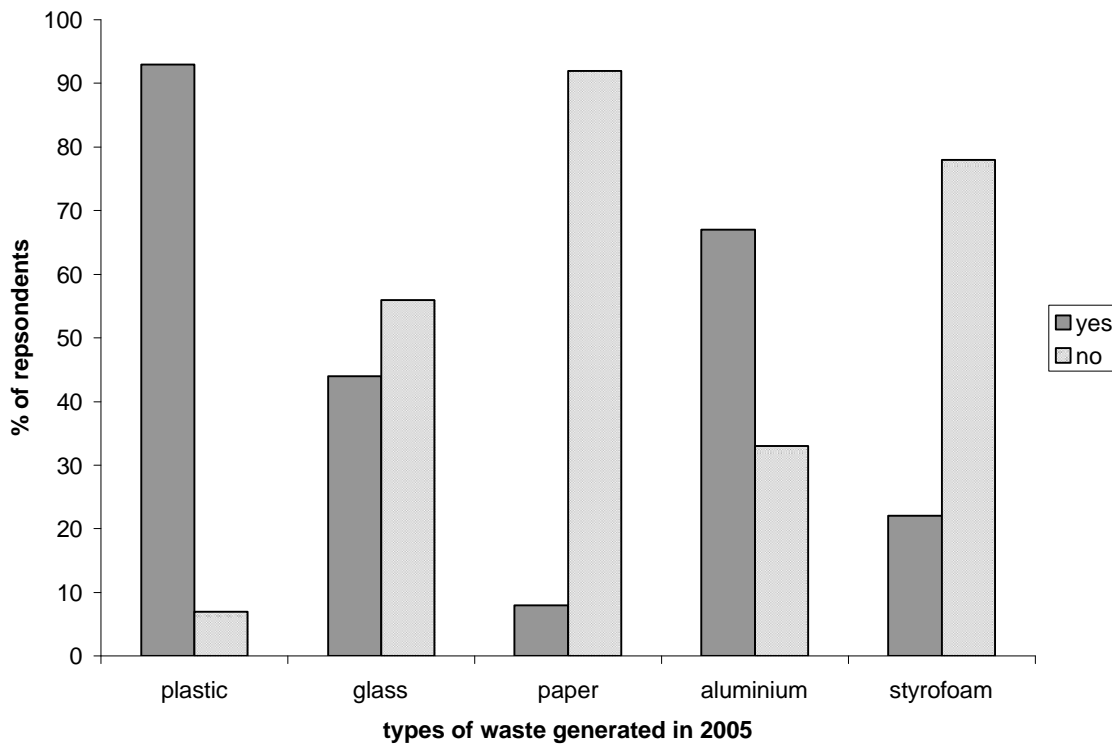


Figure 3.9: Types of waste generated on board water taxi boats in 2005

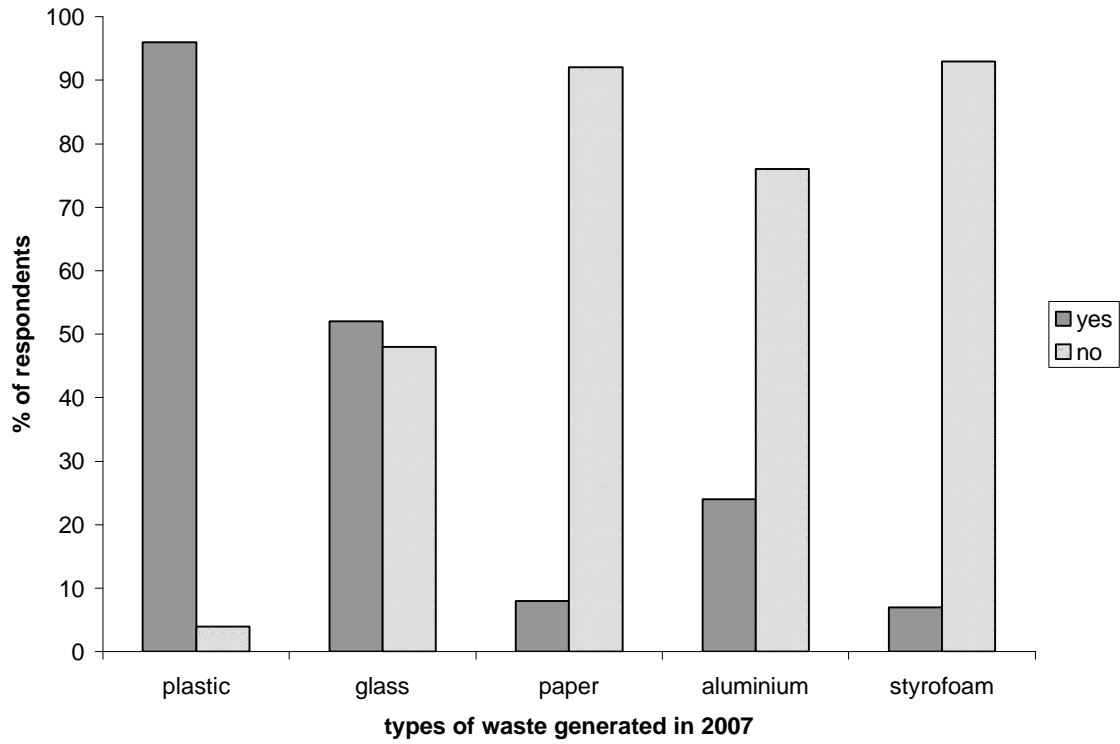


Figure 3.10: Types of waste generated on board water taxi boats in 2007

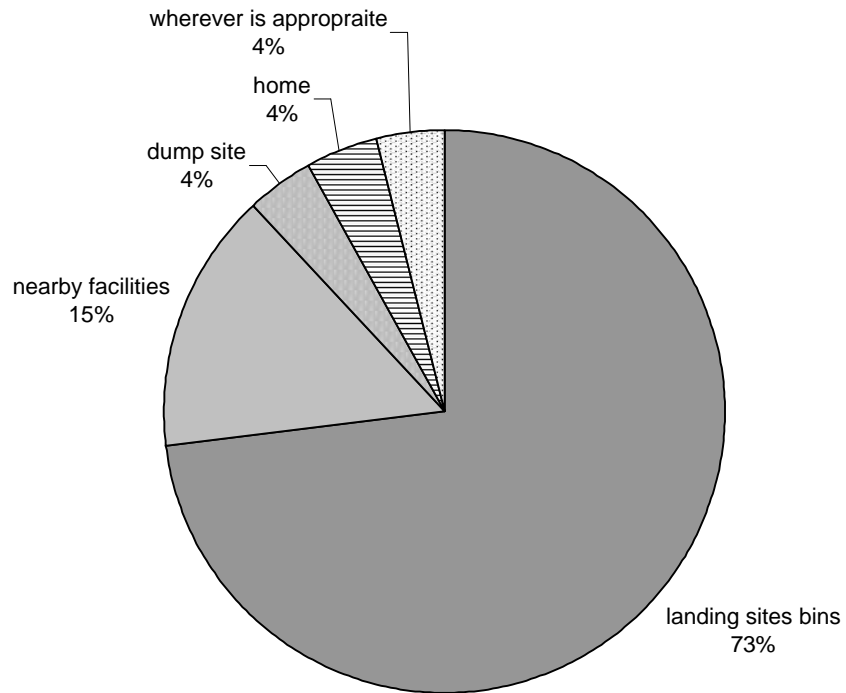


Figure 3.11: Garbage disposal sites used in 2007

3.7 Vessel maintenance and fueling operations

As in 2005, the Yamaha engine remains the most popular engine being used by the operators. Most of the operators have a two-stroke carbureted engine which is less efficient and potentially harmful to the environment. However it seems most operators in 2007 (25%) are counteracting their effects by ensuring they do not fill the tanks to the brim compared to 21% in 2005.

The boats of the water taxi operators are regularly maintained. The frequency at which operators check their hoses for leaks and breaks is similar to that of 2005 whereby most operators check their hoses before every trip. There is a notable increase in respondents who state that they rarely check their hoses (Figure 3.12). Most of their vessel engines were serviced weekly and currently 46% service their engine rarely with 26% servicing monthly. Operators replace their damaged propeller immediately i.e. days after the incident. The percentage of operators who replace their propellers immediately has increased from 53% in 2007 to 63% in 2007.

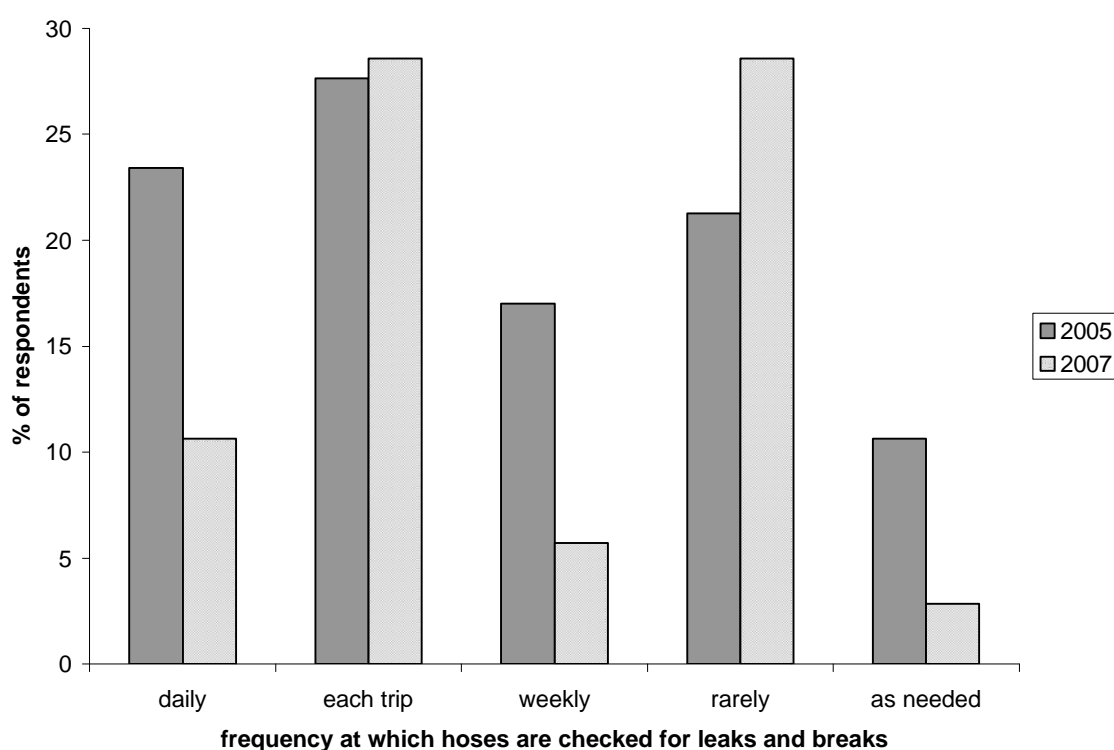


Figure 3.12: Frequency at which hoses are checked for leaks and breaks

Currently most of the operators (80%) wash their vessels everyday and 85% of them use soapy detergents, particularly squeezy as their cleaning agent. Three persons claimed to use baby shampoo, boat soap and a mixture of products to clean their vessels. The percentage of respondents using bleach (Clorox brand) has decreased slightly from 51% in 2005 to 46% in 2007. The amount of respondents using disinfectants has also declined considerably to only 11% in 2007 (Table 3.2).

Table 3.2: Various types of cleaning agents used by respondent in 2005 and 2007

Cleaning agents	2005 (%)	2007 (%)
Soapy detergent	85	97
Bleach	51	46
Disinfectant	32	11

Over the last two years most of the operators refurbished their boats on a yearly basis. Sixty-eight percent of the operators claimed to refurbish their boats in 2007 compared to 62% in 2005. A significant portion of the operators (80%) used a special paint on the hull as in 2005. This special paint, epoxy paint was used on the hull of the majority of water taxi vessels. It has been used by 46% in 2005 and 41% in 2007. However there is a notable increase in operators who were using anti-fouling paint (Figure 3.13).

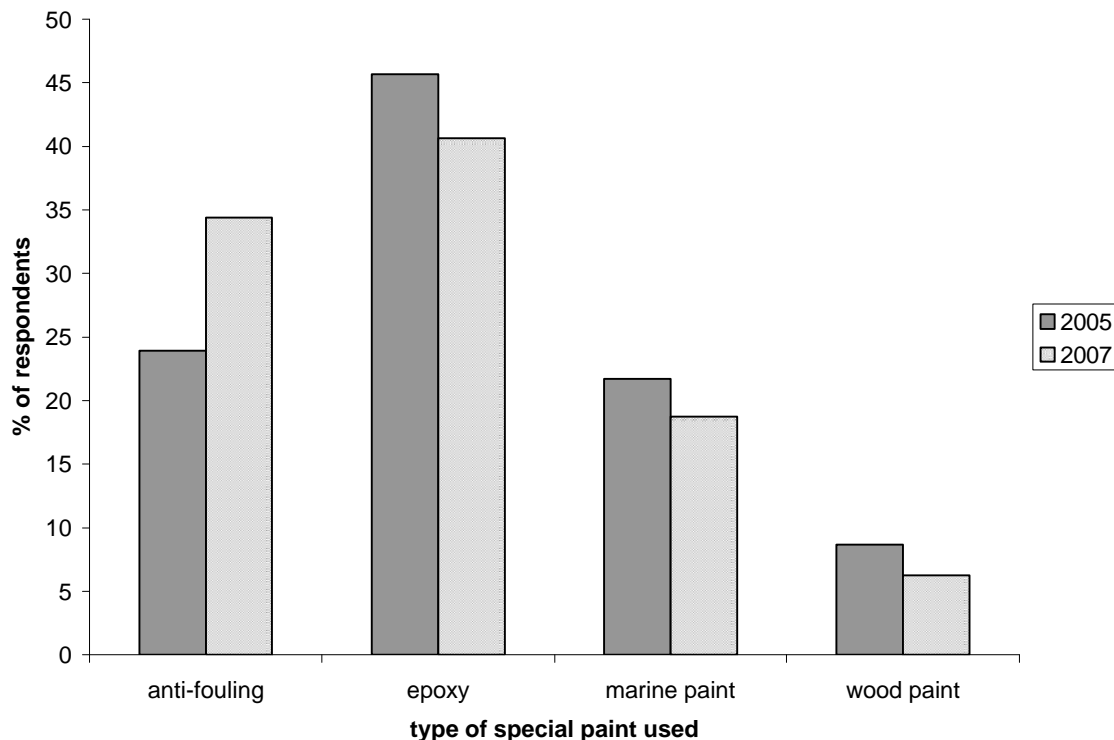


Figure 3.13: Type of special paint used by operators

Most of the operators from 2005 to 2007 indicated that they have a primary and secondary anchor line on board as well as a tilt on their engine. The majority of the tilts are functioning except for one individual. There is a 14% increase in those who have a tilt on their engine from 2005 to 2007. All of the operators assured the interviewer that they use the tilt or manually pull up the engine in shallow waters compared to 87% in 2005.

Anchoring of boats is considered a threat to coral reef ecosystems. Both in 2005 and 2007, operators tend to use anchors compared to moorings. However in 2007, there is a 15% increase in the amount of operators who use moorings rather than anchors.

Results indicate that there is an increase in the percentage of operators who are abiding by the speeding limit. This year most of the operators (57%) drive at the legal speed of under 5 mph when approaching the shore compared to only 17% 2005 (Figure 3.14). There are still some (37%) who continue to drive between 5-10 mph. One person stated that his speed depended on whether people were snorkelling in the area or relaxing on the beach.

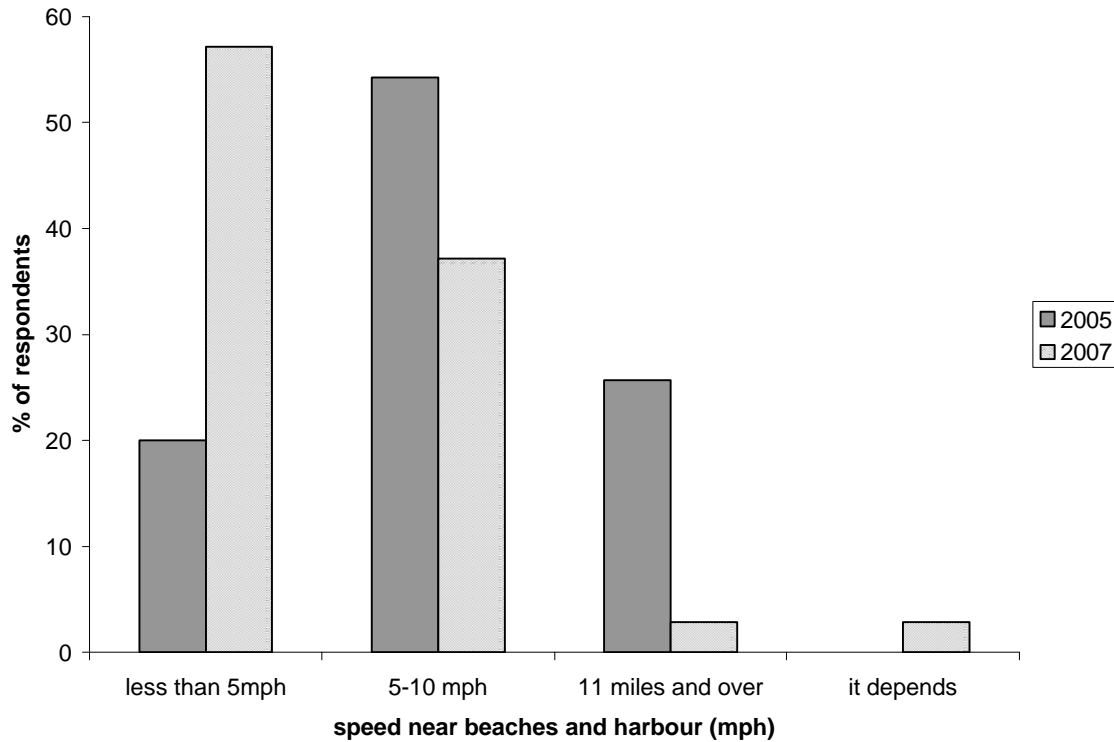


Figure 3.14: Speed at which operators travel at when approaching beaches or the harbour

3.8 Education

Education of the passengers is an important avenue to promote the protection of the marine environment and to ensure their safety while at sea. The majority of the operators stated that they brief their passengers about the marine environment when taking them on boating trips (Figure 3.15). The number of operators who brief their passengers has increased from 2005 to 2007 by 12%. Only a small percentage (6%) did not brief their passengers about the environment. Their reasoning was that comparatively, the tourist knew more about the marine environment. Of the operators who informed their passengers, most (77%) were focusing on a new range of topics compared to the topics used in 2005. Some of the topics included safety at sea, rules/regulations of the Tobago Cays Marine Park and information about the marine environment. The majority of the operators (52.1%) focused on a variety of topics which encompassed the aforementioned topics as well as the dos and don'ts about coral reefs (Table 3.3).

Table 3.3: Kind of information given in educational briefing to water taxi passengers

	2005	2007
Do's and don't about coral	73	15
Currents	3	0
History and fishing of area	24	0
Variety of issues	0	52
Rules/regulations	0	18
Safety	0	9
About the marine environment	0	6

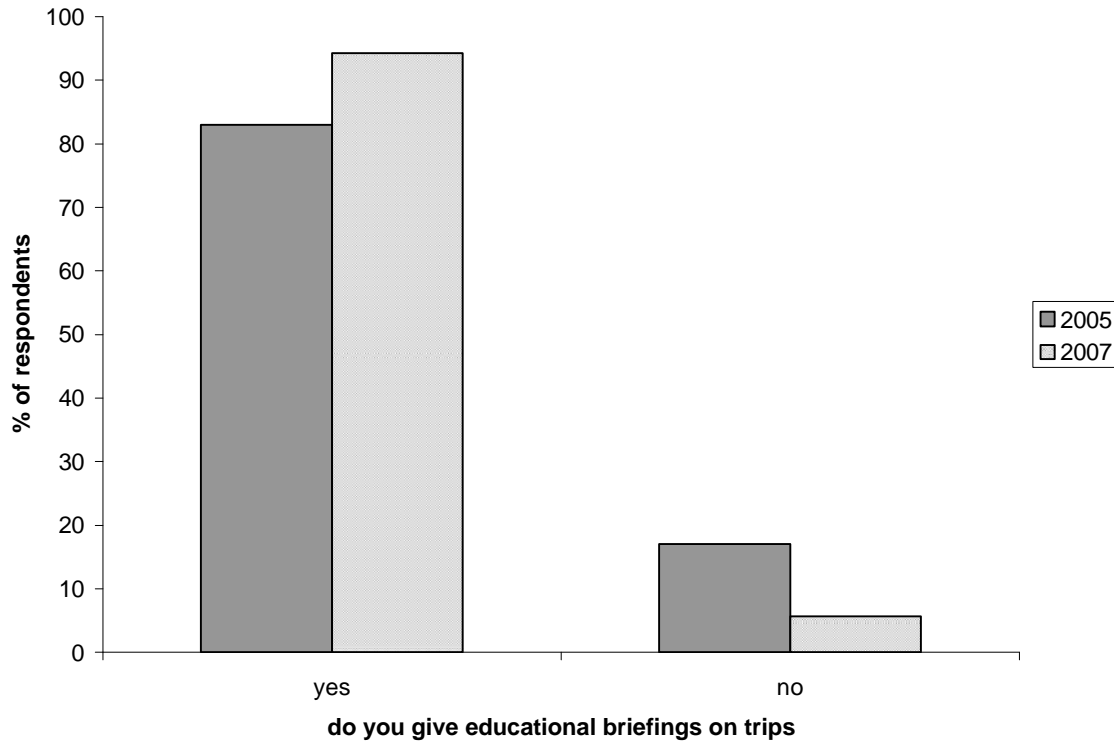


Figure 3.15: Provision of educational briefing on trips in 2005 and 2007

4 DISCUSSION

4.1 Livelihood and resource valuation

Water taxiing remains a major source of income for the operators over the past two years. The instability of income particularly during the low tourist season impels operators to engage in other income generating strategies. The involvement in multiple occupations such as fishing, scuba diving by operators has been realized as a useful economic strategy. Most of the operators have over 11-20 years of experience in the water taxi business. There is no evidence of the amount of income that these operators receive on a daily basis. Results indicate that over the past two years, there have been no new water taxi operators. There are already over 169 operators offering their services throughout the Grenadines (Baldwin *et al.*, 2006). It can be concluded that people are not entering the business anymore as it is not economically viable for them to maintain a living.

Marine resources continue to have an intrinsic and fundamental value to most water taxi operators who state that they depend on marine resources for their livelihood. A healthy marine ecosystem is important, as part of the operators' market is dependant on the image of protection of the fragile marine environment. The operators' most popular clientele visit the islands to view the diversity of marine flora and fauna existing in the region for activities such as diving and snorkeling. This supplies the much needed income for their survival. The operators are also conscious of the interrelationship between marine resources and humans. They are acquainted with the impacts that boating practices have on marine resources and are also willing to upgrading their boats for the safety of themselves, their passengers, and the environment.

Apart from valuing marine resources, results indicate that management is also gaining the support of the water taxi operators through their various endeavours. There is a positive correlation between awareness of the park, its regulations and adherence to those regulations; all of which are adequately understood by the water taxi operators. Operators also support the zoning scheme of the park which will facilitate the preservation of the marine environment which they solely depend on.

4.2 *Perceived threats and solutions*

Many marine activities are known to considerably impact the environment. From 2005 to 2007, one of the perceived threats identified by operators is the improper disposal of solid waste material. This is a major issue as it is the precursor for the animosity evolving between operators. Many operators have observed conflicts between other operators concerning improper waste disposal practices. Some operators have disposed of their oil bottles into the open waters after fueling their tanks without any concern about its impact. Oil residues can severely impact coral reef communities by reducing the coral reproductivity rate and viability. It has also significant impact on other marine life (Loya and Rinkevich, 1980).

There is a possibility of other environmental conflicts which arise among the operators but these are unknown. Some of the operators refuse to state the types of conflict observed between operators because they fear that their boats may be damaged or tampered with by the accused operators. Comparatively fewer operators are reporting non-environmentally friendly boating practices than in 2005. Operators indicated that there was no enforcement agency to report and reprimand people for these bad practices. Prohibited activities occurring in the cays can be reported to the TCMP office or rangers; however there is no agency to respond when bad practices occur in the open waters. Operators will have to continue with self enforcement measures. A significant percentage of operators have reprimanded their passengers who may have potentially harmed the marine environment.

The solutions recommended by operators to combat these threats were predominantly education and adequate garbage disposal. Education is one of the stepping stones to increase awareness and subsequently reduces bad practices. There are many legislative instruments relating to negative marine impacts by marine vessels (Box 4.1); but whether operators are aware of these laws is unknown. The deficiency in enforcement of the rules and regulations further perpetuates the problem of compliance. While educational programmes target the operators, there are still a number of operators who are non-participative in the process and are hindering the protection of the marine environment. The lack of garbage facilities on the islands is not an issue but that the bins are not easily accessible to operators i.e. at the jetty or dockyard, or operators may lack respect for the marine environment as they are not well-informed.

4.3 *Boating services and practices*

Water taxi operators offer a wide range of services. Transporting people between islands and taking passengers on boating trips remain customary services to date. This is obviously where operators attract more income. According to Baldwin 2006, the majority of operators' income is generated from business with visitors, ranging from about 25% to 100%. Yacht-related services are mainly offered by water taxi operators who operate from communities located near yachting beaches such as Tyrrel Bay in Carriacou, Port Elizabeth in Bequia and the Tobago Cays. According to Lizama (2005), additional services are offered during the low season when businesses are restricted to a limited number of trips. These services include fishing, beach barbeques and to a lesser extent taking fuel/gas to yachts. These types of services have

increased in 2007 when compared to 2005. It appears that operators have found another niche through which they can gain supplemental income.

Box 4.1: Some legislative efforts/instruments concerning marine impacts from marine vessels (UNEP, 2005)

International level

1. The International Convention for the Pollution from Ships (MARPOL 73/78)
2. World Summit on Sustainable Development (WSSD), Agenda 21
3. Jakarta Mandate on Marine and Coastal Biodiversity
4. Convention on Biological Diversity
5. Safety of Life at Sea (SOLAS)
6. International Convention Civil liability for Oil pollution Damage
7. Oil pollution compensation Act
8. Convention on the Prevention of Maritime Pollution by Dumping of Wastes and other Matter

Regional Level

9. Cartagena Convention
10. United Nations Environment Programme (UNEP)- Regional Seas Programme
11. Global Environment Facility (GEF)-International Waters Project

Local level

St. Vincent and the Grenadines

12. Marine Parks Act
13. Marine Parks (Tobago Cays) Declaration Order
14. Management of ship generated solid waste Act
15. Dumping at Sea Act
16. Waste Management Act

Grenada

17. Fisheries (Marine Protected Areas) Regulations
18. Waste Management Act

The service that water taxi operators offer requires that their boats are well maintained and fully operational. However boat maintenance and fueling operations have a high potential of releasing pollutants into the marine environment especially as most of the operators have their maintenance site located near the sea. The majority of the operators clean their boats on a regular basis using three main cleaning agents: soapy detergents (e.g. Squeezy), bleach and Disicline. The number of operators who still use bleach (e.g. Clorox) as a cleaning agent is a cause for concern because of the significant threat that this hazardous agent can pose to marine ecosystems.

Today most of the operators are still using a gasoline engine which is two-stroke carbureted. This type of engine is less efficient and potentially harmful to the environment compared to the four stroke engine. The use of the two stroke engine is a major source of persistent form of pollution that has devastating effect on the marine environment. An estimated 30 percent of all fuel and oil used in two-stroke engines ends up in the water (Transport Canada, 2006). The purchase price of the four-stroke engine is the financial obstacle which the operators will experience as it is relatively expensive compared to the two-stroke engine. Epoxy is used by a

greater proportion of the operators surveyed. An increasing proportion of operators are using the more affordable anti-fouling paints compared to epoxy on the hull of their boats. However further investigation is required to determine the type of anti-fouling products used. According to Transport Canada (2006) there are three types of antifouling coatings: ablative, non-ablative, and hard antifouling. The hard antifouling type is the most environmentally friendly as it has extended antifouling properties with limited leaching or sloughing of toxic metals into the marine environment. Changes to more environmentally friendly products and boating equipment cannot take immediate effect due to their high costs and the operators' lack of financial support.

Operators are abiding by the speed limit regulations by driving less than 5 mph when approaching the shore when compared to 2005. However there are still some who continue to drive between 5-10 mph. In such cases where there is a lack of enforcement, compliancy issues will arise. Anchor use by operators is a potential problem as it can damage fragile marine habitats such as coral reefs. A high proportion of operators are using moorings compared to anchors. However, most of them indicate that moorings are not always available.

4.4 Education

Literature has illustrated the damage of coral reefs resulting from human interference. Damage inflicted by divers and snorkelers results from breaking fragile corals, walking on reefs and collecting specimens. There has been an eleven percent increase in the number of operators who brief their passengers about the marine environment. Most of the operators can now inform their passengers about an array of topics as they attended the "Greening boats", "Caring for our coast and our future" and "Safety at sea" workshops. With their increased knowledge, they can become teachers and advocates of good environmental practices. It is shown that most of the operators tend to share a variety of information with their passengers e.g. the rules/regulations of the marine park, safety at sea, knowledge of corals reefs and marine organisms. The sharing of such critical knowledge will assist with long-term marine environmental protection in the Grenadines.

4.5 Future work

Research has been conducted examining the socio-economics and livelihood analysis of water taxi operators. However an economic analysis of water taxiing as an occupation should be investigated. Such research could examine gasoline expenses, taxi rates, no. of clients/day, *inter alia* but this requires some record keeping by the operators. This will assist with the feasibility of operators to purchase eco-responsibly. Further activities should be conducted through the Water Taxi Project to continue to monitor the attitudes and behaviour of operators over time in aims to protect the environment.

5 CONCLUSION AND RECOMMENDATIONS

The implementation of the Water Taxi Project can be seen as a stepping stone to improving boating practices of water taxi operators in the Grenadines. Operators are well aware of the value of marine resources are willing to implement best practices to alleviate any harmful impacts from boating. With increased knowledge operators can become environmental stewards and advocates of the marine environment through sharing information with their passengers. Despite such positive responses, some of their boating practices continue to be non-environmentally friendly. Improper boating maintenance practices and garbage disposal practices still remain a fundamental concern and must be a priority for management. The development of the water taxi booklet was one method to facilitate the best practices of operators. Unfortunately the influence of the booklet on the practices could not be readily determined as only a few operators have read the booklet due to its late distribution.

5.1 Recommendations

The establishment of the Water Taxi Project was a valuable initiative for promoting boating best practices among the water taxi operators. However greater effort is required as promoting best practices is a long-term commitment. The following are recommendations based on the gaps acknowledged in the report: lack of compliance, inadequate financial support and lack of participation and to lesser extent education (Table 5.1).

Table 5.1: Recommended actions to deal with issues affecting sustainable green boat practices

Issues	Recommendations
Improper solid waste disposal	<ul style="list-style-type: none"> • Provide facilities that are easily accessible to operators e.g. near the docking sites, maintenance area, jetties, ports (see list of docking sites). • Develop waste management programmes to control and dispose of waste generated from boats (especially plastics) through the WTP. • Develop recycling programmes e.g. bottle refunds. • Designate garbage collectors to retrieve solid waste from water taxi operators and even yachters.
Lack of enforcement	<ul style="list-style-type: none"> • Increase the human capacity of the marine police to monitor and patrol Grenadine waters and accept complaints/reports. • Educate operators about the legislation pertaining to the marine environment and associated fines/penalties through informal and formal means. • Use of signage illustrating illegal practices.
Use of hazardous products and non-eco-friendly equipment	<ul style="list-style-type: none"> • Promote use of organic boat soap for washing boats and epoxy paint for hull maintenance. • Encourage partnership between government and the water taxi association. • Duty-free allowances to allow operators to purchase environmentally friendly products and equipment e.g. four stroke engines. • Subsidize on gasoline so operators can make more appropriate use of their income through eco-responsible purchasing. • Seek funding opportunities for operators to purchase eco-friendly products and equipment and upgrade their boats.
Lack of participation	<ul style="list-style-type: none"> • Provide benefits of joining the WTA. • Implement incentive programmes to encourage operators to join the water taxi association. • Improve communication strategies through use of media and political and locally respected individuals.
Lack of education	<ul style="list-style-type: none"> • Sustain educational opportunities over a longer period. • Conduct education awareness campaigns about best boating practices; consequences of marine pollution and illegal marine practices. • Develop a sense of personal and eco-responsibility.

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