



## Working Paper on the Economic Valuation of Country St. Maarten's Coral Reef Resources



### NATURE FOUNDATION

Mailing address

P. O. Box 863  
Philipsburg  
St. Maarten  
Netherlands Antilles

Physical address

Wellsberg Street 1 A  
Unit 25-26  
Cole Bay  
St. Maarten  
Netherlands Antilles

Phone: 599-544-4267

Fax: 599-544-4268

E-mail

[info@naturefoundationsxm.org](mailto:info@naturefoundationsxm.org)

[www.naturefoundationsxm.org](http://www.naturefoundationsxm.org)

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Tadzio Bervoets  
Marine Park Manager

An Affiliate of



DUTCH CARIBBEAN NATURE ALLIANCE

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## Executive Summary

The St. Maarten Nature Foundation conducted an Economic Valuation of St. Maarten's coral reef ecosystems in the fall of 2010. This attempted to put a monetary estimate on the coral reefs surrounding the island. Coral Reefs are one of the island's most valuable resources; they provide a livelihood through dive tourism and fishery and provide protection from large, damaging waves caused by hurricanes. In order to properly manage the coral reef ecosystem, an economic valuation is a useful tool to determine what exactly the monetary value of a coral reef is. With an attached value, better management decisions can be made to adequately protect this most precious of resources.

In order to complete the study four questionnaires were distributed. Two dealt specifically with fisheries, one with hotel accommodations, and one with dive tourism. Data was also provided through independent research and stakeholder analysis. Coral reefs have direct and indirect influences on a wide range of economic factors, and the generation of data was crucial to the successful completion of this study. Data was inputted into a computer program created by the United Nations Environment Program and the World Resource Institute (WRI) and which was adjusted by the St. Maarten Nature Foundation to reflect St. Maarten's unique ecological and economic situation.

The findings of this study have outlined that St. Maarten's coral reef resources provide important goods and services to the economy of the island. The revenue that the resource is able to generate through coral reef associated tourism and fishery is approximately USD \$57,586,976. Although this number is high, and highlights the importance of coral reefs to the island, it also suggests that there is an increased need for conservation in order for this value not to diminish. It is therefore in the best interest of St. Maarten to incorporate environmental economic data to: (1) Establish Marine Protected Area, (2) Incorporate economic valuation into EIAs, (3) Include economic impacts in assessing fines for damages to coral reefs from activities such as anchoring in the reserves, oil spills etc, (4) Weigh revenues from a growing tourism industry against long-term economic losses from environmental impacts, (5) Evaluate distributional effects ("winners" and "losers") of proposed coastal development projects, (6) Invest in Scientific Research, (7) Increase support from the private and public sector in the proposed Marine Park Management Authority, St. Maarten Nature Foundation.

# 1 Introduction

The St. Maarten Nature Foundation conducted an Economic Valuation of St. Maarten's coral reef ecosystems in the fall of 2010. This attempted to put a monetary estimate on the coral reefs surrounding St. Maarten. Coral Reefs are one of the island's most valuable resources; they provide a livelihood through dive tourism and fishery and provide protection from large, damaging waves caused by hurricanes. Coral Reefs also provides the sand which makes St. Maarten's beaches so famous in international tourism. In order to properly manage the coral reef ecosystem, an economic valuation is a useful tool used to determine what exactly the monetary value of a coral reef is. With an attached value, better management decisions can be made to adequately protect this most precious of resources. An example of an application of an economic valuation can be to determine coral reef restoration costs in the case a large vessel drops its anchor illegally n local coral reef substrate. If there is a value estimate available reflecting the monetary value of a section of reef, management initiatives to reflect this monetary value can be initiated and cost of restoration can be determined.

In order to complete the study four questionnaires were distributed (Appendix I). Two dealt specifically with fisheries, one with hotel accommodations, and one with dive tourism. Coral reefs have direct and indirect influences on all of the above categories, and the generation of data was crucial to the successful completion of this study. Data was inputted into a computer program created by the United Nations World Environment Program (UNEP) and the World Resource Institute (WRI) and which was adjusted by Nature Foundation researchers to reflect St. Maarten's unique ecological and economic situation.

## ***1.2 Introduction to the St. Maarten Nature Foundation and the proposed St. Maarten Marine Park***

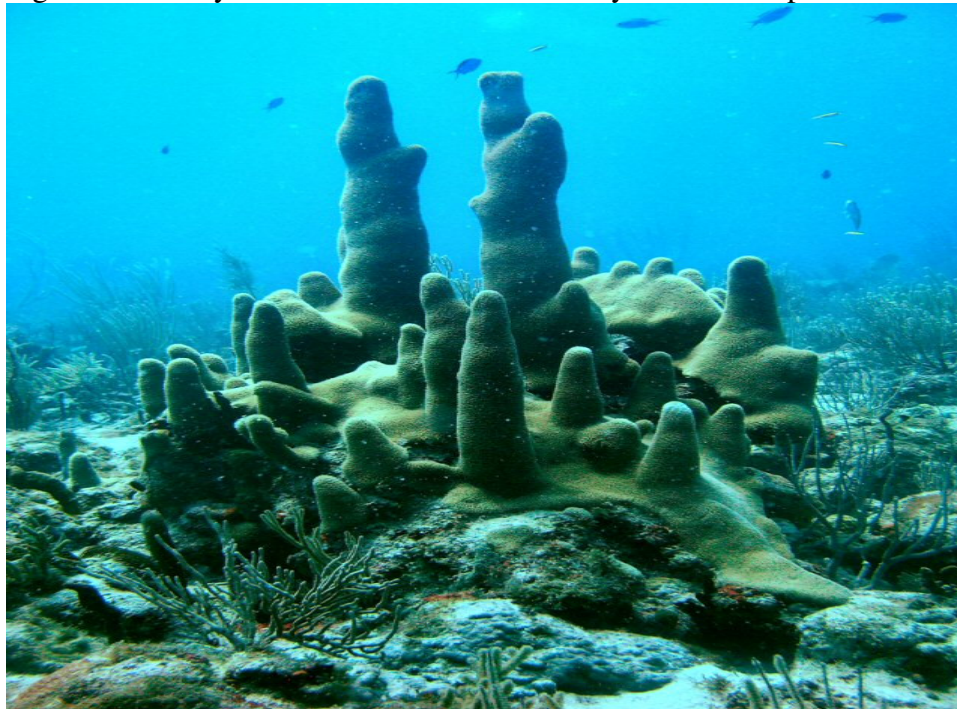
The Foundation for the Management and Conservation of Nature on Sint Maarten (short: Nature Foundation St. Maarten) was established in January 1997 with the objective to enhance the environment through proper management, education awareness and protection.

A Marine Park was established in June 1997 with funding from the Dutch World Wildlife Fund that seeks to protect areas of important natural habitat unique to St. Maarten. The St. Maarten Marine Park is a voluntary protected area until official legislation has been passed offering it legal protection. Tourist activities are concentrated on the south and eastern side

of the island, where the dive sites Molly Beday, Pelican Rock, Hen and Chicks, and Cow and Calf as well as the Proselyte Reef Complex are located. These areas embody some of the last pristine coral reef locations (figure 1, figure 2 ) locations on the island, with excellent diving. This area also constitutes an important breeding ground for marine birds, fish, sea turtles, queen conch and other marine life.

The Nature Foundation also actively manages the St. Maarten Sea Turtle Program. Every year during turtle nesting season (March to November) data is recorded on the three species of turtles that nest on our beaches; the Leatherback, Hawksbill and Green sea turtles. Patrols are carried out daily to monitor for laying turtles, turtle tracks, and any activity which could prove detrimental to nesting activities. The Foundation also monitors sea turtle nest development and hatchery success and engages the public in outreach and education programs.

Figure 1: Healthy Coral at Mike's Maze: Proselyte Reef Complex



The marine environment of St Maarten includes more than 16km<sup>2</sup> of globally threatened coral reef as well as seagrass and mangrove ecosystems. St Maarten's marine environment is a home and migratory stop over or breeding site for 3 IUCN Red List Species, 10 CITES Appendix I species and 89 Appendix II species. The beaches and waters attract approximately 2 million visitors a year, creating employment for 85% of the islands population. Tourism and the marine industry contribute \$500 million and \$30 million to the economy respectively and both depend on the health of St Maarten's marine resources.



Figure 2: Healthy Coral at Mike's Maze: Proselyte Reef Complex



The Nature Foundation is a non-governmental/non-profit organisation consisting of a Manager, Chief Marine Park Ranger, Marine Park Ranger, and Office Manager. The staff is supported by a Board consisting of five members.

The Nature Foundation is also working on an educational program to stimulate marine and environmental awareness in the schools.

### ***1.3 Introduction to Economic Valuation***

There are numerous anthropogenic impacts that negatively influence coral reef ecosystems (<http://www.wri.org/project/valuation-caribbean-reefs>). These can range from over-fishing to unrestrained coastal development and sewage discharge into the ecosystem. Many of these activities occur because an individual or group seizes an immediate benefit, without considering the broader and longer term consequences unsustainable practices may have on society (Cooper et al, 2009). An Economic Valuation analysis attempts to quantify the value of the array of goods and services provided by these ecosystems (Cooper et al, 2009) and attempts to place a 'rough' dollar estimate and seeks to highlight the importance that the goods and services provided by the coral reef ecosystem provides to the economy. Economic Valuation can help facilitate more sensible, far sighted decision-making and can help policy makers understand the benefits of investing in conservation and enforcing development regulations. Valuation can also help decision-makers identify winners and losers under current practices as well as to form future management and development decisions (Cooper et al, 2009).

There are various methods used to determine the value of an ecosystem. A Total Economic Valuation (TEV) is a broad, far-reaching study which seeks to value all of the goods and services provided by an ecosystem. A

TEV study takes into account all values placed on that ecosystem for both use and non-use values, including the value a society places on the knowledge that the ecosystem is there and will be available for future generations (Bequest Value) (Bervoets, 2008). A TEV is a very involved and lengthy process, the execution of which can have significant costs associated with it (Bervoets, 2008). Another method of valuing an ecosystem, and the method used for the valuation of St. Maarten's coral reefs, identifies and values only a subset of the goods and services which an ecosystem provides (Cooper et al, 2009). Any valuation study of a coral reef ecosystem attempts to estimate the value, or wellbeing, that society gains from an ecosystem (Pendleton 2008).

## **2 Methods**

The Economic Valuation method used in this study is adapted from the United Nations Environment Program (UNEP) and the World Resource Institute's (WRI) Coastal Capital Project. Burke et al. 2008 fully describe the methods used in the valuation study developed by the WRI. More information on the Coastal Capital Project can be found at <http://www.wri.org/project/valuation-caribbean-reefs>.

The study that was conducted in St. Maarten did not attempt to capture the Total Economic Valuation of the coral reef ecosystem, but instead focused on two of the most important goods and services provided by the coral reef resource, namely Coral reef Associated Fishery and Coral reef Associated Tourism. The data on these two resources was retrieved by way of questionnaires that were distributed to fishers, fishery officers, dive centre owners, and hotel owners/operators. The questionnaires can be easily delivered and updated as need be, allowing future repeatability of this study.

Because only two resources were valued the study significantly underestimates the true value of the coral reef resource. Future studies should involve segments on coastal protection provided by St. Maarten's coral reefs as well as the accounting for non-use values and Cruise Tourism components. This study used 2010 as a base year for all data pertaining to Coral reef Associated Fishery and Coral reef Associated Tourism.

### ***2.1 Coral Reef Associated Tourism and Recreation***

#### **2.1.1 Methods used**

In the St Maarten Study the value of Coral Reef Associated Tourism and Recreation was calculated by estimating revenues from marine recreation

(such as SCUBA diving and snorkeling) and revenues generated through the accommodation sector.

The data was acquired through the distribution of questionnaires to dive shop operators and the operators/owners of hotels (appendix). Those surveyed were asked to answer questions that reflected number of guests using their services, the prices charged for the use of those services, and the operation costs. Through cooperation from the St. Maarten Tourism Office data was also provided on the characteristics of the accommodation sector such as room rates, minimum wage and any taxes involved. Data was then inputted in the Coral Reef Associated Fisheries and Tourism Excel sheet created by the WRI and adjusted by the St. Maarten Nature Foundation.

## ***2.2 Coral Reef Associated Fisheries***

### **2.2.1 Methods used**

The data for the Coral Reef Associated Fisheries was also acquired through the use of questionnaires (Appendix). Fishermen were asked to anonymously answer questions concerning how much time is spent fishing, the costs involved in fishing, the prices at which fish are sold, and the species most targeted. Further questionnaires were delivered to fish processors as well as fish wholesalers.

Positive or negative changes within the coral reef ecosystem and in reef health in general will affect the life cycle of the most commercially viable fish species and thus fisheries productivity and thus also fisheries revenue (Cooper et al, 2009). Additional information on fisheries was gathered through information contained in Dilrosun 2004.

## ***2.3 Limitations to Study***

This study relied heavily on the distribution and completion of questionnaires, therefore the data that was collected is subject to under-guessing and over-guessing by the respondent. Data therefore might not be as reliable as it would have been had it been based on empirical research. It should also be taken into account that the results of the study are an underestimation, as the value of the resource is generally of much greater value than what has been shown in the results of the study.

It is also necessary to take into consideration that this study is just a snapshot of the levels of use currently associated with the resource (Cooper et al, 2009). It does not take into account whether these resources



are being used at a sustainable level and does not address the damage that might occur as a result of unsustainable practices such as poor diver buoyancy, poor waste treatment facilities, uncontrolled coastal development and unsustainable fisheries. It is also important to keep in mind that the potential value with regards to Coral reef Associated Tourism and Fishery is not assessed. A study determining the potential value of the coral reef resource would be an additional boost to any existing valuation study.

### **3 Results**

Results of the Valuation Study were arrived at for both Coral Reef Associated Tourism and Coral Reef Associated Fishery. As discussed in the methods section all the gathered data was inputted into the program developed by the WRI and adjusted by the St. Maarten Nature Foundation to reflect the needs of the Marine Park.

#### ***3.1 Coral Reef Associated Tourism and Recreation Results***

Results for Coral Associated Tourism and Recreation were arrived at by valuing two categories: (1) Accommodation and (2) Reef Recreation. Results were then aggregated to arrive at the total value of Reef Associated Tourism and Recreation.

##### **3.1.1 Accommodation**

Approximately 500,000 stay-over visitors visit St. Maarten on a yearly basis (<http://www.stmaarteneconomy.com/stayover.html>) and stay an average of eight nights. It was determined that approximately 80% of those visitors engage in coral reef related activities (using beaches, diving, snorkeling etc.). The total spending on Reef Related Accommodation is USD \$ 27,119,520. This is the value that coral reefs contribute to the marketability of St. Maarten's Tourist Accommodation Sector.

**Economic Valuation of Coral Reefs from Tourist Accommodation: Current and Projected Revenues and Transfers**

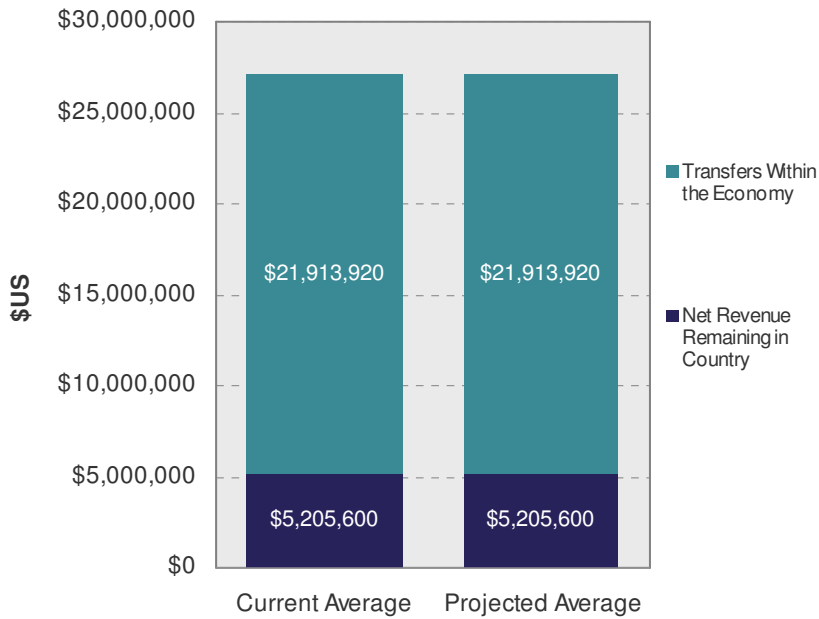


Table 1: Economic Valuation of Coral Reefs from Tourist Accommodation

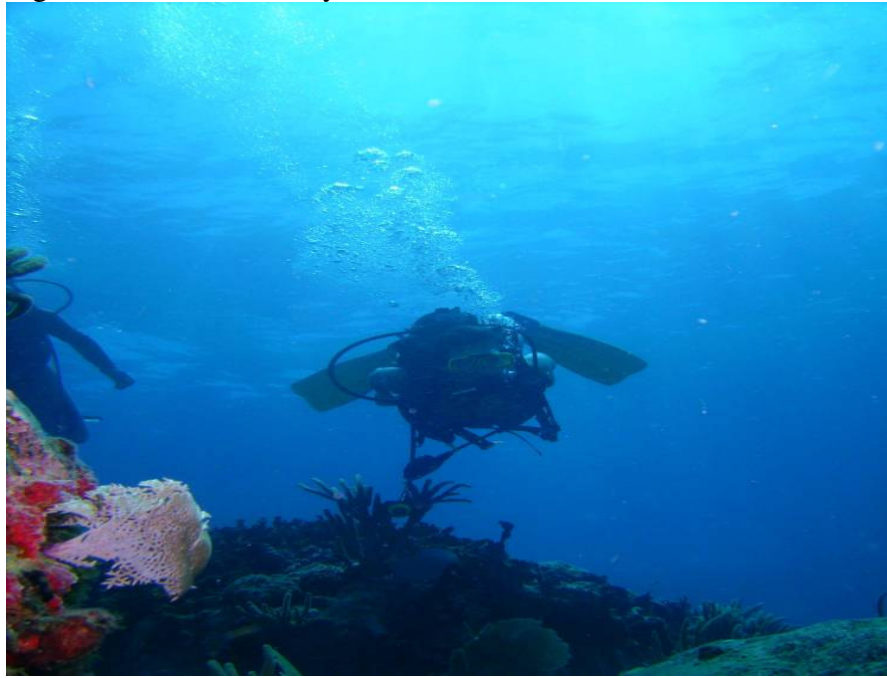
**3.1.2 Reef Associated Recreation**

Reef Associated Recreation was divided into (1) Diving, (2) Snorkeling, and (3) Local Use. All individual values were aggregated to arrive at the total value for Coral reef Associated Recreation.

**3.1.3 Diving**

It was estimated that some 15 to 20% of all visitors that visit the island engage in diving activities, either through dive trips, dive courses, or try-out dives/ resort courses. Total spending on diving is USD \$9,689,625. Considering the economic contribution of the Diving Sector to both the economy and Tourism Product of St. Maarten, the sites which attract diving guests (i.e. offshore coral reef areas) should be managed at a level which would allow them to constantly afford these goods and services.

Figure 3: Diver at Proselyte Reef



### **3.1.4 Snorkeling**

It was estimated that 50% of visitors go snorkeling and/ or boating while visiting St. Maarten. Guests engage in on average one (1) snorkel/ boating trip during their visit. 80% of all snorkelers require the use of rented equipment resulting in some revenue generated. Total spending on snorkeling and/or boating is USD \$8, 87,131.

### **3.1.5 Local Use**

Local use refers to the value placed by the local population on the Coral Reef Ecosystem, whether it is true direct coral reef recreation or through the use of white sandy beaches of coralline origin (of which all St. Maarten's beaches are). It was estimated that 80% of the 38,927 (Census 2001) residents on St. Maarten classified as 'locals' regularly engage in Coral reef related activities. It is estimated that locals use the coral reef ecosystem on average 4 times per year. Activities engaged in include swimming, snorkeling, and family get-togethers. Total spending on Local Use is USD \$1,245,664.

## **Value of Reef Associated Tourism and Recreation**

Total Spending associated with Coral Reef Associated Tourism and Recreation was arrived at through the aggregation of the above mentioned values. Total spending was estimated at approximately USD \$55,742,997 (see Table 2).

<b>1. Accommodation</b>	
Percent of accommodation revenue that is reef-related	80%
Reef-associated Gross Revenue	\$31,536,000
Reef-associated Net Revenue (Gross minus costs)	\$8,676,000
Net revenue remaining in the country (net revenue - leakages)	\$5,205,600
Transfers to the economy (taxes, via wages and service charges)	\$21,913,920
<b>Total Value</b>	<b>\$27,119,520</b>
<b>2. Diving</b>	
Gross Revenue	\$11,137,500
Net Revenue (Gross minus costs)	\$2,784,375
Transfers to the economy (taxes, via wages and service charges)	\$6,905,250
<b>Total Value</b>	<b>\$9,689,625</b>
<b>3. Snorkeling and Boating</b>	
Gross Revenue	\$10,200,150
Net Revenue (Gross minus costs)	\$2,550,038
Transfers to the economy (taxes, via wages and service charges)	\$6,324,093
<b>Total Value</b>	<b>\$8,874,131</b>
<b>4. Marine Parks</b>	
Gross Revenue	\$0
Net Revenue (Gross minus costs)	\$0
<b>5. Other Direct Expenditures - Total Value</b>	<b>\$306,000</b>
<b>TOTAL DIRECT ECONOMIC IMPACTS</b>	<b>\$45,989,276</b>
<b>6. Total Indirect (secondary) Impacts (from multipliers)</b>	<b>\$0</b>
<b>TOTAL DIRECT AND INDIRECT IMPACTS</b>	<b>\$45,989,276</b>
<b>7. Uncaptured Value</b>	
Local Use of Coralline Beaches	\$1,245,664
Local Use from reef recreation	\$389,270
Diving Consumer Surplus	\$5,568,750
Snorkeling Consumer Surplus	\$2,550,038
<b>TOTAL ECONOMIC IMPACT OF REEF-RELATED TOURISM AND RECREATION</b>	<b>\$55,742,997</b>

Table 2: Total Value of Reef Related Tourism and Recreation

### 3.2 Coral Reef Associated Fisheries

There is very little systematic data available on the fisheries composition in St. Maarten. The former Federal Department of Agriculture, Animal Husbandry and Fisheries of the Netherlands Antilles conducted an inventory of fisheries on St. Eustatius (Dilrosun 2004) (Appendix). Some data from the study are included in the valuation, however, based on the extent of time between that report and this valuation study, it was decided to survey fishermen as part of this valuation study. Fishermen were surveyed on their fishing activities and the resulting data was inputted in the WRI computer program. The Coral reef Associated Fishing component is divided into three 3) categories; (1) Commercial Fishing, (2) Local Fishing for Enjoyment and (3) Fish Cleaning.

#### 3.2.1 St. Maarten Fisheries Profile

There are two main landing sites on Dutch St. Maarten; one at Simpson Bay and one in Great Bay (Philipsburg). Although the fish is available every day, Saturday morning is the busiest day of the week. Fish is sold by the kilo, and after the fish has been purchased by the customer, the fish is de-scaled, cleaned and/or filleted at a cost of 1.00 U\$ for cleaning 1 kilo fish (LVV 2004).

The other landing site at Philipsburg has no onshore facilities and here fish is wooden tables.

The demand for fresh fish is enormous and most of the fish sold are demersal species (LVV 2004). The species commonly available on the market are what is referred to as “pot fish”, and snappers. The table below gives an overview of the local fish prices per target species in St. Maarten.

	Price per kilo (U\$)	Price per kilo (Naf)
Spiny lobster ( <i>Panulirus argus</i> )	12.00-18.00	21.60-32.40
Red snapper species	8.00	14.40
Yellowtail snapper	8.00	14.40
Conch ( <i>Strombus gigas</i> )	7.00-8.00	12.60-14.40
Pot fish	6.00	10.80
Wahoo ( <i>Acanthocybium solandri</i> )	8.00	14.40
Dolphin ( <i>Coryphaena hippurus</i> )	8.00	14.40
Tuna species	6.00-8.00	10.80-14.40
Little jack ( <i>Selar crumenophthalmus</i> )	4.00-5.00	7.20-9.00

Table I. Fish prices per target species on St. Maarten (LVV 2004).



### 3.2.2 Commercial Fishing

During the distribution of Economic Valuation Questionnaires enough data was generated to enter into the tool and gain some insight into the level of commercial fishing conducted by local fishers. There are two landing sites on the island, one in Simpson Bay and one in Great Bay (Philipsburg). The average price of Reef Fish per kilogram was set at \$11, - USD. and the average price of shellfish per kilogram was \$10, - USD. The species most targeted commercially are Grouper (Serranidae), Conch (*Strombus gigas*), and demersel species known as potfish. Of these Lobster and Conch have the highest commercial value at approximately USD \$18, - and \$8, - per kilo respectively.

The primary local market for fishery is the Hospitality Sector, with approximately 70 to 80% of locally caught fish and shellfish being sold to hotels and restaurants and the remaining catch is sold locally

Taking into account the above mentioned factors, the total contribution of Commercial Fishing to the value of St. Maarten's coral reefs is \$666,684 USD. Based on the population of the island and the amount of fish caught, this number can be significantly higher. It is commonly mentioned that the local fishery is in decline due to loss of species and destruction of habitat. Marine Parks with official protection and regulated fisheries can result in significant spillover effect of commercial fish species in local waters, enabling a reemergence of commercial fisheries on the island.

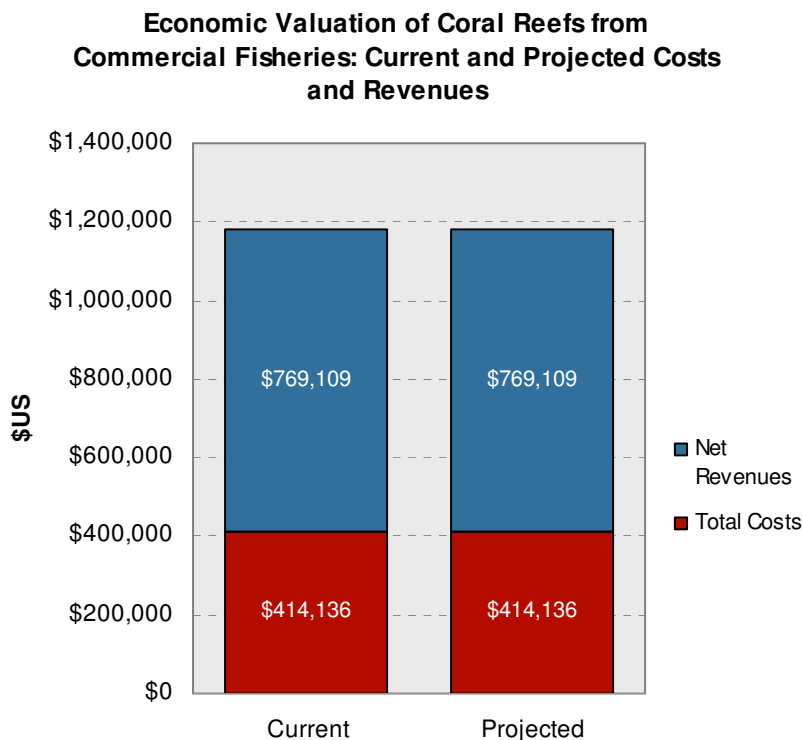


Table 3: Economic Valuation of Coral Reefs from Commercial Fisheries

### **3.2.3 Fish Cleaning**

It was decided to include the added value of fish cleaning to the study. Fish cleaning refers to the extra charge placed on the catch if the buyer wants the catch cleaned (cleaning usually consists of gutting and scaling the fish in the case of finfish and removal from shell in the case of conch and is usually conducted at the market site). 80% of all fish caught were requested to be cleaned for which a fee of \$1, - USD was charged. The total revenue from fish cleaning is \$563,289 USD.

### ***3.3 Local fishing for Sale, Consumption and Enjoyment***

Local fishing for Sale, Consumption and Enjoyment are fishing values that are not associated with commercial fishery but which do have a significant economic contribution.

#### **3.3.1 Local Fishing for Sale**

Again based on stakeholder meetings it was decided that a separate section be included in the study to reflect the value the local population places on fishing. This fishing, although categorized as fishing for local enjoyment, can also result in the catch being sold locally. Respondents were asked to place value on the sale of fish caught while not expressly engaged in commercial fishing. Based on this a value of \$1,946,350 USD was calculated for the sale of fish that was caught while fishing non-commercially.

#### **3.3.2 Local Fishing for Consumption**

The value placed on fishing for consumption is relatively high compared to that of sales. It was calculated that respondents place a total value of \$5,839,050 USD on the fishing for the consumption of local fish.

#### **3.3.4 Local Fishing for Enjoyment**

Local fishing for Enjoyment is related to fishing for the sake of fishing. Based on stakeholder questionnaires that were distributed, 15% of the local population engages in some form of recreational fishing. The total

value calculated for Fishing for Enjoyment is \$1,051,029 USD.

## Value of Reef Associated Fisheries

Total Spending associated with Coral Reef Associated Fisheries was arrived at through the aggregation of the above mentioned values. Total spending was estimated at approximately USD \$1,843,979 (see Table 4).

	<i>In Selected Currency:</i>		<i>In US Dollars:</i>	
<b>1. Commercial Fisheries</b>				
Gross Revenue	740,760	\$US	740,760	\$US
Net Revenue	481,494	\$US	481,494	\$US
Transfers to the economy (Wages)	185,190	\$US	185,190	\$US
<b>Total Commercial Fishing Value</b>	<b>666,684</b>	<b>\$US</b>	<b>666,684</b>	<b>\$US</b>
<b>2. Fish Processing and Cleaning</b>				
Gross Revenue from Processing		\$US		\$US
Net Revenue from Processing Sale	0	\$US	0	\$US
Transfers to the economy (Wages)	0	\$US	0	\$US
Total Revenue from Cleaning Fish	563,289	\$US	563,289	\$US
<b>Total Fish Processing and Cleaning Value</b>	<b>563,289</b>	<b>\$US</b>	<b>563,289</b>	<b>\$US</b>
<b>3. Local Fishing</b>				
<b>Value of Local Fish Sale</b>	<b>1,946,350</b>	<b>\$US</b>	<b>1,946,350</b>	<b>\$US</b>
<b>Value of Local Fish Consumption</b>	<b>5,839,050</b>	<b>\$US</b>	<b>5,839,050</b>	<b>\$US</b>
<b>Value of Local Fish Enjoyment</b>	<b>1,051,029</b>	<b>\$US</b>	<b>1,051,029</b>	<b>\$US</b>
<b>Total Local (non-commercial) Fishing Value</b>	<b>8,836,429</b>	<b>\$US</b>	<b>8,836,429</b>	<b>\$US</b>
<b><u>Total Direct Economic Impacts (including local use)</u></b>	<b>1,382,984</b>	<b>Euros</b>	<b>1,843,979</b>	<b>\$US</b>
<b>4. Indirect (Secondary) Economic Impacts</b>				
Indirect Effects Overall Fisheries Multiplier	0	\$EC	0	\$US
<b>Total Indirect Economic Impacts</b>	<b>0</b>	<b>\$EC</b>	<b>0</b>	<b>\$US</b>
<b>Total Economic Impact of Coral Reef Associated Fisheries</b>	<b>1,382,984</b>	<b>Euros</b>	<b>1,843,979</b>	<b>\$US</b>

Table 4: Value of Reef Associated Fisheries

## **4 Policy Applications**

Based on the results outlined above, approximately 80% of all visitors to St. Maarten enjoy the goods and services provided by local coral reefs. These goods and services vary from using coralline beaches (all of the island's beaches are coralline in origin), snorkeling, boating, and diving. Those engaging in coral reef related activities spend nearly sixty million United States dollars on accommodation, food, and coral reef oriented activities. However, with a lack of legal protection for the island's coral reef resources these goods and services are under threat of diminishing considerably. It is therefore important to enact official legislation safeguarding the continued provision of these goods and services by the ecosystem to the economy of St. Maarten.

With the increasing threat to coral reef ecosystems on a global, regional, and local scale, there has to be an increase in management options available to be better able to efficiently manage the coral reef resource. Failure to realize the importance of this can result in the resource declining and the local tourism product not being as attractive to visitors, in turn resulting in a loss to the economy of the island. It is therefore important to highlight, in monetary terms, the contribution the resource makes to the local economy and the value of that resource as is. It is in the interest of all stakeholders to marine conservation on St. Maarten, and indeed in the interest of the island as a well-functioning community, to continue to and increase support.

## **5 Conclusions and Recommendations**

The findings of this study have outlined that St. Maarten's coral reef resources provide important goods and services to the economy of the island. The revenue that the resource is able to generate through coral reef associated tourism and fishery is approximately USD \$57, 742, 997. Although this number is high, and highlights the importance of coral reefs to the island, it also suggests that there is an increased need for conservation so that this value does not diminish. As coral reefs are becoming increasingly threatened on a global, regional and local scale it would be in the best long-term interest for St. Maarten to use the value of the resource in decision making and in policy actions.

It would therefore be in the best interest of St. Maarten to:

### **Establish Marine Protected Areas**

The benefits St. Maarten's coral reef resources contribute to the economy of St. Maarten hang in a fragile balance. Without official protection and effective management the goods and services provided by the ecosystem will diminish considerably and rapidly. The St. Maarten tourism product will suffer from the reduction of quality coral reef ecosystem: coastal protection from erosion caused by storm driven waves will diminish threatening anchorage areas; the capacity for natural beach replenishment after storm events will subside resulting in more and more beaches having to be costly and artificially replenished; the snorkel and dive tourism and boating sector will suffer a great deal; local and traditional fisheries on the island will continue to degenerate.

With official legislation and effective management the above scenarios can be avoided and the economic benefits provided by the coral reef resource can continue and increase.

### **Incorporate economic valuation into EIAs.**

The old adage "money talks" has become increasingly pertinent in our modern age, and the monetary value of the resource should be included in any study on an activity that might negatively affect that resource.

### **Include economic impacts in assessing fines for damages to reefs from activities such as anchoring in the reserves, oil spills etc.**

Due to the heavy industry that occurs on and surrounding the island, it is important to set the level of compensation claims as standard in the event that the resource is damaged in some way. This will facilitate the steps toward rehabilitation of the resource.

### **Weigh revenues from a growing tourism industry against long-term economic losses from environmental impacts.**

Tourism is the single most important contributor to the economy of St. Maarten. In order to keep up with the always developing tourism market there is and will always be a need for coastal development on the island. However it is also necessary to weigh revenues against losses through the impacts placed on the resource.

### **Evaluate distributional effects ("winners" and "losers") of proposed coastal development projects.**

Every form of coastal development brings with it a portion of the population that gains and a segment of the population that loses. It is



important to determine the effect to which parties will lose or gain from a certain project, for example, will fisheries be affected if a new jetty is constructed, will a new pier affect longshore movement and take away coastal recreation areas etc. etc.

### **Invest in Scientific Research**

Scientific research is essential to know what the state of the resource is, which possible changes might happen in the future, and how to adequately protect said resource.

### **Increase support from the private and public sector in the proposed Marine Park Management Authority, St. Maarten Nature Foundation.**

Support, both in monetary terms as well as through other activities, is essential for a Management Organization to be able to protect the resource. The results of this study highlights the importance the coral reef resource has on the local economy, and that if the resource is affected the trickle down effect on the community can be significant. It is therefore important that support not only continues but increases for the Marine Park management authority, so that they may execute their mandate and adequately manage and protect the resource.

Further research: This is, by no stretch of the imagination, a definitive report on the valuation of St. Maarten's coral reef ecosystem. Rather it is the report of a pilot study attempting to establish an economic value to the island's coral reef resource. There are additional studies which would compliment this one and make it more comprehensive. A study on Shoreline Protection and the contributions of the resource to the Cruise Tourism industry should definitely be considered in the future in order to gain a wider understanding of the economic contributions of the resource. Secondly, a study incorporating both use and non-use values would be valuable, possibly using the Contingency Valuation or Choice Model Methods in order to measure local value in non-monetary terms.

Hopefully, this study has shown that St. Maarten's coral reef ecosystem contributes significantly to the economy of the island, and is an important resource that needs to be managed and protected. Although St. Maarten's coral reef ecosystem, as with all coral reef ecosystems throughout the world, are increasingly under threat, it is possible to conserve and increase the economic viability of country St. Maarten's coral reef resource.

## References

Adamowicz W., J. Swait, and J Louvriere (1994), 'Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities'. *Journal of Environmental Economics and Management* 26 (3), 271-292.

Bervoets, T. (2008). Choice Model Survey Development for the Choice Modeling of Coral Reef Ecosystems. The Economic Value of Bermuda's Coral Reefs'. Bermuda Conservation Services Technical Report.

Bervoets, T. (2010). Report on the Economical Value of St. Eustatius' Coral Reef Resource. Statia National Marine Park Technical Report.

Burke, L., S. Greenhalgh, D. Prager, and E Cooper. 2008. "Coastal Capital –Economic Valuation of Coral Reefs in Tobago and St. Lucia". WRI Working Paper. World Resources Institute, Washington D.C.

Cesar, H. and K Chong, 2000. Economic valuation and Socio-economics of Coral Reefs. World Fish Center, Economic Valuation and Policy Priorities for Sustainable Management of Coral Reefs, 17(11): pp. 50-68.

Cesar, H., 2001. The Biodiversity Benefits of Coral Reef Ecosystems: Values and Markets. Organization for Economic Co-ordination and Development: pp. 1-5.

Cooper, E., L. Burke, and N. Bood (2009). "Coastal Capital: Belize. The Economic Contribution of Belize's Coral Reefs and Mangroves". WRI Working Paper. World Resources Instutiute, Washington D.C.

Dilrosun, F (2004). Inventory of the Fishery Sector of St. Eustatius. Island Territory of Curacao, Department of Agriculture, Animal Husbandry and Fisheries.

Gustavson, K.R., 1998. Values Associated with the Local Use of the Montego Bay Marine Park. Marine System Valuation: An Application to Coral Reef System s in the Tropics. World Bank Research Committee Project: pp. 10-23.

Island Territory of Curacao; Department ofAgriculture, Animal Husbandry and Fisheries (LVV), (2004). Inventory of the Fisheries Sector of St. Maarten.

MacRae, D.R. and Esteban N. (2007), St Eustatius Marine Park Management Plan. Coastal Zone Management (UK) and St Eustatius National Parks Foundation (STENAPA).

Pendleton, L. (ed.) "The Economic and Market Value of Costs and

Estuaries: What's at Stake?" Arlington VA: Restore America's Estuaries.

The St. Maarten Nature Foundation (2007). The St. Marten Marine Park Management Plan.

The St. Eustatius Tourism Development Foundation (SEDF) (2009). Unpublished Data.

Van Beukering P., W. Haider, E. Wolfs, Y. Liu, K. van de Leeuw, M. Longland, J. Sablan, B. Beardmore, S. Di Prima, E. Massey, H. Cesar and Z. Hausfather (2006). 'The Economic Value of the Coral Reefs of Saipan, Commonwealth of the Northern Mariana Islands.' Project Report.

## Appendix I : Economic Valuation Questionnaires:



### Total Economic Valuation of Coral reef Ecosystems Accommodation Survey

Dear hotel owner,

**The Nature Foundation is initiating a research project which will attempt to place a monetary value on our local coral reef ecosystems. Information from the accommodation sector is an important component of this research project. Please answer/fill in all of the questions to the best of your ability. Thank you!**

1. What is the average hourly wage for employees at your establishment?  
Nafl. \_\_\_\_\_
2. What are the average hours worked per week per employee at your establishment?  
. \_\_\_\_\_ hours
3. How many employees are assigned to each room?  
\_\_\_\_\_ employees
4. How much do you charge as a service fee at your establishment?  
Nafl. \_\_\_\_\_
5. How many employees do you have?  
\_\_\_\_\_ People
6. How many rooms does your hotel have?  
\_\_\_\_\_ Rooms

**Thank you very much for your cooperation, your participation has made a difference in conserving our Marine Environment. All information included in this survey will be held strictly confidential**

**Total Economic Valuation of Coral reef Ecosystems**  
**Diving Survey**

**Dear dive shop owner,**

**The Nature Foundation is initiating a research project which will attempt to place a monetary value on our local coral reef ecosystems. Information from the diving sector is an important component of this research project. Please answer/fill in all of the questions to the best of your ability. Thank you!**

1. What is the average number of dives conducted per diver at your dive shop?  
\_\_\_\_\_
2. What is the average price per dive at your dive shop? Nafl. \_\_\_\_\_
3. On an annual basis, what percentage of your customers follow a course at your dive shop? \_\_\_\_\_%
4. What is the average price of a complete set of equipment rental per dive?  
Nafl. \_\_\_\_\_
5. What percentage of your customers come to go snorkeling? \_\_\_\_%
6. On average, how many trips does a snorkeler make? \_\_\_\_\_ trips
7. What is the average price of a complete set of equipment rental per snorkel trip? Nafl. \_\_\_\_\_
8. What percentage of snorkelers use rented equipment? \_\_\_\_%

**Thank you very much for your cooperation, your participation has made a difference in conserving our Marine Environment. All information included in this survey will be held strictly confidential.**



## Total Economic Valuation of Coral reef Ecosystems Fishing Survey

**Dear fisherman,**

**The Nature Foundation is initiating a research project which will attempt to place a monetary value on our local coral reef ecosystems. Information from fishermen is an important component of this research project. Please answer all of the questions to the best of your ability. Thank you!**

How many people currently fish in your household?  
\_\_\_\_\_ people

(Important Note – fishing can include any method of harvesting marine food from the sea; hook and line, spearing, netting, gathering lobster, fishtpots, etc).

How many weeks do you fish per year?  
\_\_\_\_\_ weeks

On average how many days per week do you fish?  
\_\_\_\_\_ days

On average how many hours per day do you spend fishing?  
\_\_\_\_\_ hours

How much do you usually catch?  
\_\_\_\_\_ kilos

Can you indicate your reasons for you to go fishing? (*Tick all options that apply*)

1. I enjoy fishing	<input type="checkbox"/>
2. I catch for food	<input type="checkbox"/>
3. To give catch to family and friends	<input type="checkbox"/>
4. For tradition: my family has always fished. Fishing is my life!	<input type="checkbox"/>
5. Fishing strengthens the bond with my friends and family	<input type="checkbox"/>
6. Other, specify ...	<input type="checkbox"/>
7. Don't know	<input type="checkbox"/>

What percentage of your total catch is made up of each of the following types of fish?  
 (*Distribute catch across the different types of fish, total table should add to 100%*)

Type of catch	Share (must add up to 100%)
1. Grouper	
2. Grunts	
3. Parrotfish	
4. lobster	
5. Conch	
6. Bait fish	

What is the average price per kilo you sell your catch for?

Nafl. \_\_\_\_\_ per kg.

Please indicate which fishing technique(s) you usually use? (*Tick all options that apply*)

1. Hand line	<input type="checkbox"/>
2. Rod and reel	<input type="checkbox"/>
3. Trawling	<input type="checkbox"/>
4. Diving for lobster	<input type="checkbox"/>
5. Spear fishing	<input type="checkbox"/>
6. Bait netting	<input type="checkbox"/>
7. Fishpots	<input type="checkbox"/>
8. Other techniques. Specify _____	<input type="checkbox"/>

Are you employed full time or part time?

1. Full Time	<input type="checkbox"/>
2. Part Time	<input type="checkbox"/>

Do you fish full time or part time?

1. Full Time	<input type="checkbox"/>
2. Part Time	<input type="checkbox"/>

**Thank you very much for your cooperation, your participation has made a difference in conserving our Marine Environment. All information included in this survey will be held strictly confidential.**