


Please provide the following details on the origin of this report

Contracting Party	St. Lucia
National Focal Point	
Full name of the institution:	Ministry of Planning, Development, Environment and Housing.
Name and title of contact officer:	Ms. Allison King-Joseph, Permanent Secretary
Mailing address:	Graeham Louisy Administrative Building The Waterfront Castries, St. Lucia P.O. Box 709
Telephone:	758-468-4459
Fax:	758-452-2506 758-451-6958
E-mail:	directorofplanning@candw.lc
Contact officer for national report (if different)	
Full name of the institution:	Ministry of Agriculture, Forestry and Fisheries
Name and title of contact officer:	Dr. James Fletcher Permanent Secretary
Mailing address:	Ministry of Agriculture, Forestry and Fisheries The Waterfront Castries, St. Lucia
Telephone:	758-468-4100
Fax:	758-453-6314
E-mail:	ps@slumaffe.org
Submission	
Signature of officer responsible for submitting national report:	 <div style="float: right; border: 1px solid black; padding: 5px;"> UNCTAD 16982 [] </div>
Date of submission:	March 2001

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Please provide summary information on the process by which this report has been prepared, including information on the types of stakeholders who have been actively involved in its preparation and on material which was used as a basis for the report

Benefit Sharing Report

Preparation Mechanism

The primary draft was written by Mrs. Joan Norville, Plant Biologist in the Research and Development Division in the Ministry of Agriculture, Forestry and Fisheries. Mrs. Norville represents the Ministry on matters related to intellectual property rights. Mrs. Norville is also a member of the St. Lucia Biodiversity Project Steering Committee.

The primary draft of the report was reviewed by the Biodiversity Steering Committee (BSC) and then circulated to a wider group of stakeholders for comments.

Stakeholders and resource persons were afforded four (4) weeks to review the document and submit their comments to the BSC. During this period, regular contact was maintained with the stakeholders to ensure active participation in the process.

The second draft was adjusted following receipt of comments. It was then submitted to the Permanent Secretary of the Ministry of Agriculture, Forestry and Fisheries (which is the implementing agency for the Biodiversity Project) for approval and submission to the National Focal Point.

Stakeholders and Resource Persons

Department of Fisheries, Ministry of Agriculture, Forestry and Fisheries

Department of Forestry, Ministry of Agriculture, Forestry and Fisheries

Water Resources Management Unit, Ministry of Agriculture, Forestry and Fisheries

Research and Development Unit, Ministry of Agriculture, Forestry and Fisheries

Ministry of Community Development, Culture, Local Government and Co-operatives

CARDI – Caribbean Research and Development Institute

CANARI – Caribbean Natural Resources Institute

IICA – Inter-American Institute for Co-operation on Agriculture

The Folk Research Centre

The St. Lucia National Trust

Attorney General's Chambers

UNESCO

St. Lucia Heritage Tourism Programme

SAINT LUCIA

COUNTRY REPORT

**Intellectual Property and Traditional
Knowledge Related to Genetic Resources**

December 2000

SAINT LUCIA COUNTRY REPORT

Intellectual Property and Traditional Knowledge Related to Genetic Resources

Definition of relevant terms including subject matter of traditional knowledge and scope of existing rights.

- (a) Definition of relevant terms is difficult since various interpretations may be attached to each term. Therefore there is need for harmonisation of terminology within the country and also within the region. An additional factor is the fact that St. Lucia has two 'languages'
- 1) English - the official language
 - 2) Creole - mainly French dialect with a mixture of English and African words

The above sometimes creates difficulty in that some of the terms and phrases are better expressed in Creole. Creole used to be the more popular tongue decades ago and in trying to translate the Creole into English sometimes the entire meaning is lost or it does not fit appropriately.

Terms

Traditional Knowledge

Indigenous Knowledge

'Cultural' heritage

Folklore

Intellectual Property (IP)

- property rights accredited to persons over the creations of their minds. They include inventions, industrial designs, literary, artistic and scientific works, symbols, names, images and plant variety protection.

Others

Scope of existing rights under law in St. Lucia is extended to patents, trademarks, copyrights, geographical indications, industrial designs, unfair competition and in the near future, plant variety protection (new plant varieties).

It is foreseen that legislation should be enacted under the various articles of the Convention on Biological Diversity (CBD) specifically article 8 to allow for identification of holders of traditional knowledge and equitable sharing of benefits derived from the use of this knowledge.

Although it is not adequately addressed under the proposed new Plant Variety Protection (PVP) Act, farmers' rights have been recognized. It is foreseen that additional legislation may be required to ensure that indigenous communities continue to have continued access to genetic resources and traditional knowledge for their use.

Existing intellectual property rights regimes in relation to the protection of traditional knowledge.

- (b) Existing Intellectual Property Rights (IPR) regimes cannot be used adequately to protect traditional knowledge since most of the IPR cover only new creations.

Options for the development of sui generis system for the protection of traditional knowledge rights.

(c) Options include:

- Legislation utilizing the WIPO/UNESCO "Model Provisions for National Laws on the Protection of Expressions of Folklore against Illicit Exploitation and other Prejudicial Actions." This Model Provisions legislation should include provisions for indigenous or local beliefs - whether they are scientific or part of our traditional practices.
- Modified versions of copyright laws, patents, plant variety protection and geographical indications legislation to allow for the inclusion of traditional knowledge and the protection of indigenous knowledge, genetic resources and novel products using plant and animal resources and indigenous knowledge of their use.

Relationship between customary laws governing custodianship, use and transmission of traditional knowledge and the formal intellectual property system.

- (d) The introduction of the formal IPR system is cause for concern for traditional knowledge holders on some issues. Whereas cultural heritage, traditional knowledge and their uses have been regulated by customary law in the past, modern IPR regimes require documentation or written records and strict procedures. Now that the economic benefits of traditional knowledge are being exploited, it is imperative that holders of traditional knowledge and genetic resources in the country seek to identify and document these resources and arrange legal protection to govern the access and use of these resources including traditional knowledge. Current IPR legislation generally focuses on the protection of new innovations, though traditional knowledge and informal innovations may be used in the innovations. A lack of awareness of the

legal issues and their impact on our cultural heritage may result in our indigenous knowledge being no longer accessible to us in the future or our communities being unable to benefit economically and otherwise from their use.

Means by which holders of traditional knowledge, including indigenous peoples, may test means of protection of traditional knowledge based on existing intellectual property rights, sui generis possibilities and customary laws.

- (e) Holders of traditional knowledge may test means of protection by reviewing various legislation and agreements to see what will be appropriate for St. Lucia. They may then enter into agreement, or contracts with relevant parties and determine the best approach for example:
- ❑ Agreement between parties using the CBD guidelines
 - ❑ Formal patent or legislation governing the access and use of informal innovations using traditional knowledge.
 - ❑ Sui generis systems

Methods of ensuring that granting intellectual property rights does not preclude continued customary use of genetic resources and related knowledge.

- (f) In order to ensure that granting IP rights does not preclude continued customary use of genetic resources and relevant knowledge, the following steps are required:
- ❑ First the country's authorities need to identify and document the genetic resources and related traditional knowledge in existence in the country.
 - ❑ The next step is to review existing and proposed legislation in the country to ensure that the rights of communities for the use of those genetic resources and related knowledge are not compromised.
 - ❑ The current legislation may then need to be modified or new legislation enacted to protect community and farmers rights including the holders of traditional knowledge and genetic resources.

Intellectual property rights access and benefit sharing agreement

Regulation of the use of resources in order to take into account ethical concerns.

- (g) There is need to ensure that the policy makers are aware of and sensitive to the cultural heritage of the country including the areas of traditional knowledge and beliefs. Also a participatory approach and consultation involving all stakeholders may assist in addressing ethical concerns.
- (h) Ways to ensure the continued customary use of genetic resources and related knowledge:

- ❑ Amendments of existing legislation to ensure that the rights of holders of traditional knowledge, including communities, are protected.
- ❑ Enactment of additional legislation especially those meeting the objectives of the various articles of CBD.

Approaches to create provisions for the exploitation and use of intellectual property rights to include joint research, obligation to work any right on inventions obtained or provide licenses.

- (i) A system of co-management is a priority. There is need for a national body or authority with legal powers to ensure equitable sharing of any economic or other benefits to be derived from genetic resources and traditional knowledge. Legal agreements or contracts between interested parties would stipulate the purposes or reasons for which those resources could be used, access to these resources and the conditions under which access would be given.

WIPO suggests the establishment of collecting societies, which would have four primary functions

- ❑ Acquisition of rights from members
- ❑ Licensing
- ❑ Collection of fees
- ❑ Distribution of royalties

Joint ownership of intellectual property rights.

- (j) The country strongly advocates the collective management approach and the establishment of bodies such as the SMMA has shown this approach to be reasonably successful.

CASE STUDY ON BENEFIT SHARING ARRANGEMENTS – MANKOTE MANGROVE

1. OVERVIEW

Main actors involved:

- a. Department of Fisheries; Due to the fact that Mankote is a declared Marine Reserve under the Fisheries Act (No. 10 of 1986) it falls under the jurisdiction of the Department of Fisheries for active management.
- b. Aupicon Charcoal and Agricultural Producers Group (ACAPG): An informal cooperative of about 15 individuals who harvest mangrove wood to produce charcoal.
- c. CANARI: formerly ECNAMP (Eastern Caribbean Natural Area Management Programme) which in 1989 became The Caribbean Natural Resource Institute is a non governmental organization which has been involved in the management and monitoring of activities regarding Mankote since 1981. They were largely responsible for organizing the harvesters into the informal cooperative. The area is currently being co-managed by the DOF and CANARI and the local group of charcoal producers who have also expanded into ecotourism activities, such as bird watching within the mangal.

The type of benefit-sharing arrangement that has been produced: Although the charcoal harvesters were putting pressure on Mankote, they practiced a number of sound

management measures. For example, they cut on a rotational basis, allowing time for the trees to regenerate before recutting, and left uncut species of mangroves that make poor charcoal but provide cover to impede the evaporation of the swamp (World Resource Institute). CANARI advocated that the mangrove be managed in collaboration with the harvesters, a landless, poor group with no legal right to the resource, but also the people most dependent on the mangrove and most damaging to it. With the government's tacit approval, CANARI launched what has become an ongoing effort to test ways to save the mangrove and maintain the charcoal producers' incomes (Geoghegan and Smith 1998:4, 7) in WRI 2000-2001)

The ecosystem- Mangrove description

These mangal systems serve very important functions in maintaining the health of ecosystems- maintaining coastal stability, fish breeding and nursery ground, avifauna habitat, silt trap, water quality maintenance and nutrient exporter. They contribute to biological productivity by recycling nutrients from leaf decomposition.

The diversity of this habitat type in St. Lucia ranges from a few scattered scrub patches to the more diverse riverine and fringing mangal systems. Mangroves account for about 179.3 hectares, which represents 0.29% of the islands landmass.

There are many threats to this ecosystem in St. Lucia today. The general public generally regards such systems as a health threat which should be eradicated. They see them as breeding grounds for mosquitoes. These sites are then targeted for landfills, solid waste

disposal and deforestation. St. Lucia has since 1986 moved to protect a number of mangroves around the island declaring them as marine reserves.

The Mankote mangrove is a basin mangrove which at 40 hectares is the largest mangrove in St. Lucia. The Crown has ownership of this land. It represents 20% of the total mangrove area in St. Lucia (Portecop and Benito-Espinal 1985). Mangrove species identified there include the red (*Rhizophora mangle*), black (*Avicennia germinans* and *Avicennia schaueriana*), white (*Laguncularia racemosa*) and buttonwood (*Conocarpus erecta*) (Conservation & Sustainable livelihoods). Mankote is critical to the protection of wildlife and for the control of erosion.

The Time frame addressed; The area had been under use and misuse from 1960 when after the WWII and the closure of an American air base established on the site, Mankote was returned to the government and the general populace began exploiting it for subsistence purposes. By 1980's, charcoal production had become a major source of subsistence income and an important cottage industry. Mankote became the main supply of charcoal for about 15,000 residents of Vieux Fort and others in the southeast portion of the island (WRI 2000-2001). With the collaboration between CANARI and the ACAPG, by the 1980's the overall trend of degradation of the tree cover had been reversed. Monitoring of the four main species of trees in each of four transects between 1986 and 1992 showed a significant increase in the number of mangrove stems larger than 25 mm/m² –from 0.10 to almost 2 (Smith and Berkes 1993:126-127).

It is acknowledged that Mankote's future is still uncertain. There are various ventures proposed currently before the government which could jeopardize this ecosystem. It is therefore imperative that concerned institutions maintain research on "other potentially significant pressures on the mangrove" and test the effectiveness of current silvicultural practices and the impact on the wildlife (WRI). Monitoring should include other potential environmental threats particularly SLR (sea level rise) due to climate change and solid waste disposal from domestic or industrial sources.

Mankote Mangrove: Its relevance to the Bioiversity Convention

St. Lucia's national conservation policies and legislation supports the effort of sustainable resource use in the Mankote Mangrove. It also subscribes to the ideals expressed in CBD. The articles and their objectives which apply to this project are:

Article 6: General measures for conservation and sustainable use

(a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity and (b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

Article 7: Identification and monitoring

(a) Identify components of biological diversity important for its conservation and sustainable use.

(b) Monitor, through sampling and other techniques, the components of biological diversity, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use

(c) Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques; and

(d) Maintain and organize, by any mechanism data, derived from identification and monitoring activities.

Article 8: *In-situ* conservation

- (a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;
- (b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;
- (c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;
- (d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;
- (e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas;
- (f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, *inter alia*, through the development and implementation of plans or other management strategies;
- (i) *Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components;*
- (j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the *equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;*
- (k) Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations;

Article 10: Sustainable use of components of biological diversity

- (a) Integrate consideration of the conservation and sustainable use of biological resources into national decision-making;
- (b) Adopt measures relating to the use of biological resources to avoid or minimize adverse impacts on biological diversity;
- (c) *Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements;*
- (d) Support local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced; and
- (e) *Encourage cooperation between its governmental authorities and its private sector in developing methods for sustainable use of biological resources.*

Article 12: Research and training

- (a) Establish and maintain programmes for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity and its components and provide support for such education and training for the specific needs of developing countries;
- (b) Promote and encourage research which contributes to the conservation and sustainable use of biological diversity, particularly in developing countries

Other relevant articles that support the current management approach to Mankote

Mangrove include 13 and 14.

2. Description of the Context

The status of the ecosystem: Mankote was declared as a protected area in 1986 as the largest contiguous tract of mangrove. However the site is currently harvested for charcoal, the mangrove and surrounding private property is continuously targeted for development by entrepreneurs. “There is agreement among all parties that the informal,

collaborative arrangement at Mankote currently provides greater protection to the mangrove than any government agency or other institution can do on its own. (WRI2000-2001)”

Mankote Mangrove’s Biological Resources

Wildlife

List of birds utilizing the Mankote Mangrove and environs

Local Species	
Scientific name	Common Name
<i>Bubulcus ibis</i>	Cattle egret
<i>Butorides virescens</i>	Green Heron
<i>Coereba flaveola</i>	Bananaquit
<i>Dendroica adelaidae</i>	Adelaides Warbler
<i>Elaenia martinica</i>	Caribbean elaenia
<i>Eulampis holosericeus</i>	Green throated Carib
<i>Icterus laudabilis</i>	St. Lucia Oriole
<i>Loxigilla noctis</i>	Lesseer Antillean bullfinch
<i>Orthorhyncus cristatus</i>	Antillean crested hummingbird
<i>Quiscalus lugubris</i>	Carib grackle
<i>Saltator albicollis</i>	Lesser Antillean saltator
<i>Vireo altiloquus</i>	Black whiskered Vireo

Migratory Species	
Scientific name	Common Name
<i>Anas americana</i>	American widgeon
<i>Anas discors</i>	Blue winged teal
<i>Ardea alba</i>	Greater egret
<i>Ardea herodias</i>	Greater blue heron
<i>Arenaria interpres</i>	Ruddy turnstones
<i>Atitis macularia</i>	Spotted sandpiper
<i>Aythya affinis</i>	Lesser scaup
<i>Calidris alba</i>	Sanderling
<i>Calidris fuscicollis</i>	White rumped sandpiper
<i>Calidris himantopus</i>	Stilt snadpiper
<i>Calidris mauri</i>	Western Sanpiper
<i>Calidris melanotos</i>	Pectoral Sandpiper
<i>Calidris minutilla</i>	Least Sandpiper
<i>Calidris pusilla</i>	Semipalmated sandpiper

<i>Catoptrophorus semipalmatus</i>	Willet
<i>Ceryle alcyon</i>	Belted kingfisher
<i>Charadrius semipalmatus</i>	Semipalmated Plover
<i>Circus cyaneus</i>	Northern Harrier
<i>Dendrocygna autumnalis</i>	Black bellied whistling duck
<i>Egretta gularis</i>	Western Reef Heron
<i>Egretta thula</i>	Snowy egret
<i>Egretta tricolor</i>	Tricolor heron
<i>Falco columbarius</i>	Merlin
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Fulica caribaea</i>	Caribbean Coot
<i>Limnodromus griseus</i>	Short billed Dowitcher
<i>Limosa haemastica</i>	Hudsonian Godwit
<i>Numenius phaeopus</i>	Whimbrel
<i>Pandion haliaetus</i>	Osprey
<i>Pluvialis squatarola</i>	Black bellied plover
<i>Porphyryla martinica</i>	Purple gallinule
<i>Porzana Carolina</i>	Sora
<i>Protonotaria citrea</i>	Prothonotary Warbler
<i>Seirus motacilla</i>	Louisiana waterthrush
<i>Seirus noveboracensis</i>	Northern waterthrush
<i>Tringa flavipes</i>	Lesser yellowlegs
<i>Tringa melanolueca</i>	Greater Yellowlegs
<i>Tringa solitaria</i>	Solitary sandpiper

Marine

Scientific name	
<i>Centropomus undecimalis</i>	<i>Crassostrea rhizophorae</i>
<i>Oreochromis mossambicus</i>	<i>Penaeus (Farfantepenaeus) subtilis</i>
<i>Oreochromis nilotica</i>	<i>Lebistes spp.</i>
<i>Paguristes erythrops</i>	<i>Callinectes danae</i>
<i>Eleotris spp.</i>	<i>Lutjanus griseus</i>
<i>Dormitator maculatus</i>	<i>Eucinostomus jonsei</i>
<i>Cardisoma guanhuma</i>	<i>Erotelis smargdus</i>
<i>Bathygobius soporator</i>	<i>Caranx hippos</i>
<i>Sesarme spp.</i>	<i>Gymnothorax funebris</i>
<i>Tarpon atlanticus</i>	
<i>Mugil curema</i>	
<i>Ucides cordatus</i>	
<i>Uca mordax</i>	
De Beauville-Scott, S. 2000	

Plants

Scientific Name
<i>Sophora tomentosa</i>
<i>Sporobolus spp.</i>
<i>Cocos nucifera</i>
<i>Sesuvium portulacastrum</i>
<i>Frimbristylis spathacea</i>
<i>Spartina patens</i>
<i>Rhizophora mangle</i>
<i>Avicennia germinas</i>
<i>Laguncularia racemosa</i>
<i>Conocarpus erecta</i>

Portecop and Espinal (1985)

The mangrove has been targeted for development in the past, particularly for large scale resorts and golf course development. The most important resource use is charcoal production which remains a vital cottage industry undertaken by small-scale producers. Secondary use includes activities such as seasonal fishing, bird hunting, crab hunting, therapeutic bathing, and wood harvesting for construction (Smith and Berkes). Charcoal has remained an important fuel source inspite of the increasing use of propane gas. Charcoal is used for barbecuing and is considered to be more efficient for lengthy cooking times.

Each charcoal producer uses one cutting area per season (two seasons per year, before and after the rains),and rotates cutting areas, returning to a cut-over area after about two years. They cut selectively in strips of 10-20 m. zig-zagging to access clusters of suitable stems. Cutting area of each is generally known to others in a given season; this helps avoid conflicts. Related individuals often cut in adjacent areas to facilitate exchange of help. Cut stems are placed in rectangular pits dug in the forest floor, about 4-6m long,

partially covered with grass or leaves and then with soil, and fired for three days. The charcoal is then bagged in old flour sacks, each sack holding about 22 kg and selling for about EC \$30 (US \$11 in 1992). Charcoal is retailed in smaller lots in the town market and in rural areas. (Smith, A. H. and F. Berkes. 1993)

The institutional and organizational structure of local communities and concerned institutions including their decision-making processes

Mankote is adjacent to Vieux Fort which is an urban commercial district which hosts the major international airport, a number of hotels, major docking facilities and an industrial complex. It is the second highest population center in St. Lucia (#?). There are other nearby communities which are mainly rural and are primarily agricultural or fisheries (e.g. Laborie, Micoud). The primary institutions involve local government (eg. Vieux Fort Town Council).

Most of the charcoal produced from the Mankote mangrove is sold in the local market and commercial area in Vieux Fort. Most of the destruction of the mangrove was from residents of Vieux Fort and adjacent communities.

Legal or policy measures behind the arrangement

There are existing policies and legislative acts which support the traditional practice of harvesting of the mangrove for charcoal. Acts such as the Forest, Soil and Water Conservation Ordinance (1946) and the Wildlife Protection Act (1980) provide the framework for regulating harvesting activities. However, the process of empowering the

subsistence producers has produced beneficial results in terms of the protection of the mangrove and the government has granted tacit approval. Current data shows that the basal area of the mangrove to be increasing based on research by CANARI

3. Purpose/Objectives of the Benefit Sharing Arrangements

The reasons and objectives for the different actors which entered into the benefit sharing arrangement.

The Mankote mangrove was in decline due to unregulated fishing, spraying of pesticides, cutting of tracks, timber harvesting, and waste dumping,. These issues were leading to severe environmental problems. In order to encourage rational development planning, St. Lucia National Trust in 1981 proposed a study of conservation and development requirements for the south east coast. The concept was accepted by government and the study was conducted by ECNAMP. The condition, use and conservation requirements of Mankote were given prominence-(Smith, A. H. and F. Berkes.1993)

The charcoal producers who were working in the mangroves were poor landless individuals and families of the lowest social and economic levels in the society. Because of their lack of options, their dependence on the mangrove was great. Research efforts of CANARI and the local secondary school produced interesting findings showing that the local charcoal producers practiced a number of management measures to sustain the resource base. For example by cutting on rotational basis, allowing the trees to regenerate for two or three years before cutting. They also left the *Avicennia* trees, said to make poor charcoal, uncut to provide cover to impede evaporation of the swamp. The report

recommended the development of a management plan for the mangrove that would take an “experimental approach, which attempts to respect existing popular uses and attitudes, while fully involving users in the decision –making process” and that would permit the reinforcement of popular practices and the introduction, where necessary, of new techniques to increase production while reducing adverse environmental impacts (ECNAMP 1983). These recommendations demonstrated an early recognition of the stakeholder rights of subsistence users, even those without legal rights to the resources being exploited. These stakeholder rights are now widely respected.

4. Process for Establishing of the Arrangements

The early stages involved dialogue with the charcoal producers, obtaining information on traditional harvest practices and management measures. Procedures as to areas to be cut, the informal rotation system and how it was affected by seasonal changes in the water level, and reasons for the selection of the species were obtained.

A monitoring programme was established in 1986, designed to estimate the rate of exploitation and trends in the status of the mangrove tree biomass. The ACAPG records the number of bags of charcoal produced by each group member each month, and the density and mean stand diameter of the four mangrove tree species are estimated periodically using standard transect or quadrat methods. The data are managed by CANARI, and the results of monitorings are shared with the ACAPG through regular meetings and discussions.

As a result of this dialogue, the following rules have been agreed upon by ACAPG and other agents involved (CANARI, DOF, Forestry Department.)

- Preservation of young branches, determined by the harvesters by level of maturity and by others by stem size (less than 50 mm in diameter);
- No cutting of red mangrove trees that line the waterways;
- Preservation of large trees for seeds shade, and shelter for birds;
- Careful stacking of stash to allow resprouting, or coppicing, of stumps;
- Cutting at a slant without splitting the stump, and cutting at sufficient height above the ground to prevent rotting;
- Cutting only the wood needed for one pit at a time, in order to prevent loss of stockpiled wood from rain, flooding or pilferage.

This set of rules, which has been followed by members of ACAPG for some time, has recently been incorporated into their membership agreement. The rules also form the

basis for a draft management agreement that was sent to the appropriate agencies for review in 1993.

This arrangement has grown to incorporate a tour guiding operation within the reserve. The group has upgraded the entrance to the mangrove area, established a viewing tower and a well maintained trail. The presence of the ACAPG has allowed the Department of Fisheries, which is responsible for marine reserves, to manage the area cost effectively through a strategy of user participation rather than direct involvement. In September 1996, the Department formalized the longstanding *de facto* agreement authorizing the ACAPG members and no others, to use the mangrove for purposes of managed cutting for fuelwood. The groups participation in the project has been directly linked to the benefits they have been able to reap as individuals through their involvement, including an increased and more secure supply of wood for charcoal; alternative forms of employment and revenue through agriculture and tour guiding ; acquisition of new knowledge and skills, resulting in increased social status in the community (Geoghegan and Smith 1996).

Policy, legislative and administrative context

The major national stake holders include the Department of Fisheries, which is responsible for the management of marine reserves; the Forestry Department which is responsible for forest and wildlife management on government lands; the St. Lucia National Trust (SLNT), the country's lead organization in the conservation of natural and cultural heritage and the National Development Corporation (NDC), the agency

responsible for Governments lands and slated for eventual development and legal owner of Mankote (Geoghegan and Smith 1996).

The need for legal provision of cutting rights for the existing subsistence-level charcoal producers was first noted in 1981 and began to be generally accepted around 1990, but did not actually occur until 1996, and then only in the form of a letter from the Deputy Chief Fisheries Officer. During much of that time period, insecurity of tenure had negatively affected the charcoal producers commitment to the management regime and their efforts at group formation (Geoghegan and Smith 1996).

The main legal instruments governing forest use and management are the following:

- The Forest, Soil and Water Conservation Ordinance of 1946, amended in 1956 and 1983. It stipulates the conditions for timber harvesting, makes provision for control of squatting and defines other offences.
- The Wildlife Protection Act of 1980 places authority for wildlife legislation in the hands of the Minister of agriculture, and makes provision for the conservation and management of wildlife, through the listing of species, the establishment of reserves, and the setting of fines for offences.
- The Crown Lands Ordinance of 1946 establishes the position of Commissioner of Crown Lands and sets the conditions for the management of Crown Lands.
- The Land Conservation and Improvement Act of 1992 establishes a Land Conservation Board and gives it a broad mandate with respect to the management of land and water resources.

The Government is also party to other international conventions which provide additional support to national policies governing natural resource management:

- The International Convention on the trade of Endangered Species;
- The Convention on Desertification;
- The World Heritage Convention;
- The Convention on the Protection and Management of the Coastal and Marine; environment of the Caribbean, (Cartagena Convention)

Conclusions of the Project

Since the implementation of the project in the 1980's, the overall trend of degradation of the tree cover has been reversed. The conditions behind this reversal are ascribed to the shift from an open access policy to a communal property regime. That is the wood products of an area that used to be freely open to all potential users is now used mainly by an organized community of a limited number of charcoal producers. The more secure resource use rights of the charcoal-producers precipitates a change in behaviour and attitude. Instead of cutting wood indiscriminately, the security of tenure makes it possible to cut with more care and conserve for the medium and long term. The major lesson from the case study is that integrated conservation-development projects have good potential to be effective if they can lead to the avoidance of open-access conditions, and to specification of property rights (Smith and Berkes 1992).

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SOUFRIERE MARINE MANAGEMENT AREA – CASE STUDY

1.0 Overview

History

Soufriere is located on the central west coast of the Caribbean island of St Lucia. It is bordered by a narrow submarine shelf which supports the island's most diverse and productive reefs. The land terrain comprises a series of steep, volcanic ridges separated by fertile valleys, fringed in the south by two spectacular volcanic plugs: the Pitons. Virtually no tourist leaves the island without spending at least a short time in the picturesque town of Soufriere.

The area is rich in terms of its agricultural fertility, tourism potential and coastal fishery resources. Traditionally, agriculture and fishing have provided two main sources of employment and income. However, with the increased focus on development of the tourism industry, fishermen -the traditional users of the area- found themselves competing on a daily basis with a variety of tourism related users.

Main actors involved:

Stakeholders involved in the management of the SMMA were numerous and diverse. These included a variety of government and non-government organisations, as well as community groups and other interested persons.

Government:

- Ministry of Agriculture, Forestry and Fisheries
- Ministry of Tourism
- Ministry of Planning
- Ministry of Health
- Customs and Excise Department
- Government Information Service
- Parks and Beaches Commission
- St Lucia Royal Police Force
- ENCORE Project (local site team)
- Organisation of Eastern Caribbean States (regional organisation)

Non Government:

- Soufriere Development Foundation
- Caribbean Natural Resources Institute
- Dive Operators
- Yachting Sector
- St Lucia Tourist Board
- Hotel and Tourism Association
- St Lucia Air and Sea Ports Authority

- St Lucia National Trust

Community groups and other persons:

- Fishermen's Cooperative
- Hoteliers
- Soufriere Water Taxi Association
- Soufriere Town Council
- Concerned citizens
- Copra manufacturers

Ecosystem, species and genetic resources concerned:

The coastal area of Soufriere comprises sandy plains, boulders with coral veneer, patch reef and narrow fringing reefs. The reefs within this area are some of the healthiest and most diverse on the island.

Benefit-sharing arrangements:

To ensure an equitable sharing of benefits from the use of these coastal/marine resources, an agreement regarding the use of these resources, was drawn up by all the stakeholders through a wide process of consultation. Today, management arrangements are such that it allows for continued participation from all stakeholders.

Time-frame addressed:

1986 to present

Relevance to CBD:

The SMMA has effectively illustrated the importance of participation/consultation in the conservation and sustainable use of marine biodiversity and the fair and equitable sharing of benefits to be derived from the use of marine resources. It is worth noting that the mission statement of the SMMA is:

*To contribute to national and local development, particularly in the **fisheries and tourism** sectors, through the management of the Soufriere coastal zone based on the principles of sustainable use, cooperation among resource users, institutional collaboration, active and enlightened local participation, and equitable sharing of benefits and responsibilities among stakeholders.*

2.0 Description

The area comprises sandy plains, boulders with coral veneer, patch reef and narrow fringing reefs. The reefs within this area are some of the healthiest and most diverse on the island. Compared to reefs along the north west coast, the

reefs surrounding the Pitons have been fairly protected from the many stresses (such as heavy sedimentation and liquid waste pollution) affecting many of the island's reefs.

Nearshore resources along the coast of Soufriere are considered high value resources, in that they attract many tourists for snorkelling and diving activities, support a variety of commercially important fish species and offer an aesthetically pleasing environment for yachters. Before the onset of the SMMA, the high level of use of the area by fishers and persons involved in tourism activities such as yachting, diving and snorkelling, had led to conflict among users and destruction of the fragile nearshore habitats. However, recent surveys carried out in the area are extremely encouraging and show that all of the reserve areas within the SMMA show increases in commercial fish biomass.

The number of coral species recorded for the SMMA reefs is probably very conservative, since studies have been confined to a maximum depth of twenty (20) meters and the reefs extend well beyond this depth, thus eliminating deep water species.

Current literature states that virtually all of the reefs of the Lesser Antilles are at risk. This risk is as a result of sedimentation from upland deforestation, pollution, poor agricultural practices, coastal development and added fishing pressures. In addition, St Lucia lies in the path of tropical storms, including hurricanes which play a significant role in the destruction of reefs. Since the passage of Hurricane Georges (1998) through the region, the incidence of coral bleaching around the island has increased. In fact, this phenomenon has been observed worldwide and is reported as a possible response to natural factors such as changes in water temperature, salinity levels and ultraviolet light. However, in the case of the SMMA, only *Diplora labyrinthiformes*, *Siderastrea radians* and *Montastrea annularis* appeared to have been affected, with *D. labyrinthiformes* being most affected and *M. annularis* being the least affected. The passage of Hurricane Lenny (1999) also took its toll on reefs within the SMMA accounting for over 50% of coral destruction in some areas.

The most common coral species present within the area are *Montastrea annularis* and *Porites asteroides*, which also make up the more important reef builders. *Dictyota* species and *Caulerpa racemosa* are the most common species of macroalgae.

During a survey in 1998, a total of 248 species were identified. These included: eleven (11) species of algae (not including micro (turf) species), ten (10) species of cnidaria (other than corals), fifty (50) species of corals, eight (8) species of molluscs, fourteen (14) species of sponges, eleven (11) species of echinoderms, fifteen (15) species of arthropods, eight (8) species of annelids and 121 species of fish (see Appendix). The database of the DOF had a further forty-seven (47) species of fish recorded for the Soufriere region. In addition, one species of

echinoderm (possibly *Euapta lappa* – beaded sea cucumber) and possibly nineteen (19) different species of sponges have been observed, but not identified. It has not been possible to identify all observed sponge species due to resource constraints.

Other organisms occasionally observed within the area include: *Ocyropsis crystallina* (winged comb jellies), *Ocyropsis maculata* (spot-winged comb jelly), *Mnemiopsis maccadyi* (sea walnut), *Tripneustes ventricosus* (West Indian white sea egg), *Meoma ventricosa* (red heart urchin), limpets, whelks, periwinkles and terrestrial crabs (ghost sand crabs).

The SMMA agreement establishes 5 different types of zones within the area, and these are as follows:

1. Marine reserves: These are declared under the Fisheries Act Number 10 of 1984 for the purpose of protecting the natural resources they contain. No extractive activity is allowed and entry into a reserve is subject to approval by the Department of Fisheries. For the purpose of stock replenishment and scientific research, the Department of Fisheries may designate some reserves as Sanctuaries.
2. Fishing priority areas: these areas are declared under the Fisheries Act Number 10 of 1984 for the purpose of maintaining and sustaining fishing activities which take priority over any other use of the area.
3. Recreational areas: these are terrestrial (beaches) and marine (swimming and snorkelling) areas which are reserved for public access and recreation.
4. Yachting areas: specific areas are designated to facilitate pleasure boats and yachts and for the protection of the bottom substrate.
5. Multiple use areas: these areas are where activities are regulated by existing legislation, notably the Fisheries Act and by provisions the SMMA Management Agreement (2000). Activities that may take place in these areas include fishing, diving, snorkelling and other recreational activities.

This zoning system caters to the myriad of users of the area and yet provides protection for some of the island's critical marine resources.

3.0 Purpose of benefit-sharing arrangement

In 1986 a number of fishing priority areas and marine reserves were created as an attempt to resolve conflicts between Soufriere fishermen and the growing tourism sector. However, the conflict persisted and continued to escalate. Further, uncontrolled use of coastal and marine resources in the area began to take a toll on these resources and reefs showed signs of degradation while the large carnivorous fish such as groupers and snappers declined considerably in number, some species all but disappearing altogether. However, with the onset of the SMMA, the fair and equitable sharing of benefits (use of resources) have allowed sustainable use and conservation of resources and prevented a case of 'tragedy of the commons'.

4.0 Process for establishing arrangement

In 1992, a joint effort by the Soufriere Development Foundation, Department of Fisheries and the Caribbean Natural Resource Institute devised an approach to define and resolve the conflicts. The process ensured a wide-scale, multiple representation by interest groups and government agencies at a series of consultations which allowed all users of the area to express concerns and make recommendations.

It should be noted that before major consultations were held, separate meetings were held with individual user groups such as the fishermen to strengthen and prepare them for negotiations and bargaining within the wider conference of users.

As a result of all consultations a "Preliminary Agreement on the Use and Management of Marine and Coastal Resources of the Soufriere Region" was drawn up and this apportioned the coastal zone in such a way so as to allow for the myriad of desired coastal activities to coexist, facilitating all users. The Cabinet of Ministers approved this agreement in March, 1994.

In 1997 the Technical Advisory Committee (TAC) of the SMMA, which comprises representatives of all stakeholder groups and individuals requested a review of the SMMA's institutional arrangements. This process of review officially began in November 1997 and was funded under the Fonds Francais pour l'Environnement Mondial (FFEM) Project. The first phase of the process involved the review of the SMMA, including its strengths and weaknesses and the second phase involved the formulation of a more efficient structure for the management of the Soufriere Marine Management Area (see section 6.0).

5.0 Content and Implementation of arrangement

Following the institutional review of the SMMA, which involved much consultation and discussion, the Cabinet of Ministers approved the following:

- By-laws of a Soufriere Marine Management Association, which provides the new institutional basis for the management of the area.
- An agreement to manage the Soufriere Marine Management Area.

Note that the by-laws were prepared under the provisions of the Companies Act Number 19 of 1996 to establish the Soufriere Marine Management Association and regulate its operations, and under the provisions of the Fisheries Act Number 10 of 1984, sections 18 and 19, to establish the Local Fisheries Management Authority and define its responsibilities.

It is also worth noting that in the new structure, the Stakeholder Committee (formally the TAC) consisting of broad representation of stakeholders remains an integral part of the SMMA, in keeping with its promotion of consultation and participation in management.

The day-to-day running of the SMMA is manned by a manager and 4 wardens who are based in Soufriere. User fees and the sale of souvenirs provide the revenue to cover the cost of staffing and maintenance of infrastructure (e.g. mooring and demarcation systems). However, responsibility of the overall management of the SMMA belongs to a board of directors which comprises 10 parties (see section 6.0) and an advisory body, the Stakeholder Committee. Notable, fees generated by the SMMA are occasionally used to support community projects with a conservation theme.

A scientific committee has also been established to ensure that the objectives of a Research and Monitoring Programme are met. Responsibilities of this committee include:

- Evaluation of the effectiveness of specific management decisions.
- Formulation and coordination of an overall plan and programme for research and monitoring.
- Dissemination of information.
- Coordination of the activities of external researchers.
- Provide a field terrain for the development of new knowledge about the marine and coastal resources, institutional development, sustainable resource uses and other aspects which can be tested within the SMMA.

6.0 Policy, legislation and administrative context

The Soufriere Marine Management Association formed under the Companies Act Number 19 of 1996 oversees the overall management of the SMMA. This association is guided by an 'Agreement to Manage the Soufriere Marine Management Area.' The parties which entered into this agreement comprise the Board of Directors for the SMMA and include the following:

- Ministry with responsibility for Fisheries.
- Ministry with responsibility for Planning, Development and the Environment.
- Ministry with responsibility for tourism.
- St Lucia Air and Sea Ports Authority.
- National Conservation Authority.
- St Lucia Dive Association.
- St Lucia Hotel and Tourism Association.
- Soufriere Fishermen's Cooperative.
- Soufriere Regional Development Foundation.
- The Soufriere Water Taxi Association.

The institutional and legal arrangements for the management of the SMMA are governed by the following:

- All Parties retain individual management authority for areas and sectors under their jurisdiction.
- The legal framework for the establishment and management of the SMMA if the Fisheries Act, and ultimate responsibility rest with the relevant Minister.
- Employees under the Association are made authorised officers under the Fisheries Act, and as such are empowered to enforce the provisions of both the Fisheries Act and the by-laws of the Association.
- The Association has established a Stakeholder Committee.

According to the Agreement, the Stakeholder Committee includes a broad membership to ensure representation of stakeholders and this committee meets at least once per quarter. Further, all major proposals for management and development produced or being considered by management agencies of the Association, and related to the SMMA, must be presented to the Stakeholder Committee for advice.

7.0 Impact on conservation

Over the years the SMMA has had to deal with a number of unexpected problems. One such problem involved the illegal use of marine reserves by new persons entering the fishing industry due to the temporary closure of the Copra factory and a major hotel in the area. However, continued negotiations and ongoing consultations appear to reduce the negative impacts of these problems. Studies

have highlighted positive impacts in that there has been an increase in the following:

- Fish biomass within marine reserves.
- Fish biodiversity (increased number of fish species observed per count in annual censuses).

8.0 Lessons learned and replicability

- Some of the earlier problems experienced by the SMMA resulted from an unintended omission of one sub-group of users of the area. It is thus critical that before consultations begin all users, including sub-groups, identified and brought on board.
- Community participation is vital if no-take zones (strict marine reserves) are to be effective. It is essential that at the outset of the management plan to identify and include all the different stakeholders.
- The top-down approach to management, which was quite often used in the past to resolve issues of conflict, requires high investment into enforcement capacity. But, a participatory approach requires much less enforcement as users are sensitised and have consented to management procedures prior to their establishment.
- If no-take zones cover a sufficiently large proportion of the area, are interspersed with fishing areas, and there is good compliance with no-take regulations, the benefits of marine reserves can build up very rapidly.
- It is important to have continuous involvement of the stakeholders as this allows potential conflicts to be addressed before reaching a critical stage.

The experience of the SMMA has now been used to establish a similar system (Canaries/Anse la Raye Marine Management Area) encompassing the coastal area of the two adjacent villages immediately north of Soufriere. The SMMA experience has also be drawn upon by other islands in the region who have embarked on similar projects.

APPENDIX

Species Lists

Fish Species

Family	Species	Common Name
Acanthuridae	<i>Acanthurus coeruleus</i>	Blue tang
Acanthuridae	<i>Acanthurus bahianus</i>	Ocean surgeonfish
Acanthuridae	<i>Acanthurus chirurgus</i>	Doctorfish
Antennidae	<i>Antennarius multiocellatus</i>	Longlure frogfish
Apogonidae	<i>Apogon maculatus</i>	Flamefish
Apogonidae	<i>Apogon lachneri</i>	Whitestar cardinalfish
Aulostomidae	<i>Aulostomus maculatus</i>	Trumpetfish
Balistidae	<i>Canthidermis sufflamen</i>	Ocean triggerfish
Balistidae	<i>Monacanthus setifer</i>	Pygmy filefish
Balistidae	<i>Aluterus schoepfi</i>	Orange filefish
Balistidae	<i>Cantherhines pullus</i>	Orange spotted filefish
Balistidae	<i>Balistes vetula</i>	Queen triggerfish
Balistidae	<i>Melichthys niger</i>	Black durgon
Balistidae	<i>Cantherhines macrocerus</i>	White spotted filefish
Belonidae	<i>Belonidae sp.</i>	Needlefishes
Belonidae	<i>Tylosurus crocodilis</i>	Houndfish
Blennidae	<i>Ophioblennicus atlanticus</i>	Redlip blenny
Bothidae	<i>Bothus lunatus</i>	Peacock flounder
Carangidae	<i>Caranx bartholomaei</i>	Yellow jack
Carangidae	<i>Selar crumenophthalmus</i>	Bigeye scad
Carangidae	<i>Seriola dumerili</i>	Greater amberjack
Carangidae	<i>Trachinotus goodei</i>	Palmoeta
Carangidae	<i>Caranx hippos</i>	Crevalle jack
Carangidae	<i>Caranx lugubris</i>	Black jack
Carangidae	<i>Decapterus punctatus</i>	Round scad
Carangidae	<i>Decapterus macarellus</i>	Mackerel scad
Carangidae	<i>Uraspis secunda</i>	Cottonmouth jack
Carangidae	<i>Caranx ruber</i>	Bar jack
Carangidae	<i>Sparisoma atomarium</i>	Greenblotch parrotfish
Carangidae	<i>Caranx latus</i>	Horse eye jack
Carangidae	<i>Elagatis bipinnulata</i>	Rainbow runner
Chaetodontidae	<i>Chaetodon ocellatus</i>	Spotfin butterflyfish
Chaetodontidae	<i>Chaetodon aculeatus</i>	Longsnout butterflyfish
Chaetodontidae	<i>Chaetodon striatus</i>	Banded butterflyfish
Chaetodontidae	<i>Chaetodon capistratus</i>	Foureye butterflyfish
Chaetodontidae	<i>Coryphopterus lipernes</i>	Peppermint goby
Chaetodontidae	<i>Chaetodon sedentarius</i>	Reef butterflyfish
Cirrhitidae	<i>Amblycirrhitis pinos</i>	Redspotted hawkfish
Clinidae	<i>Acanthemblemaria sp.</i>	Blenny
Clupeidae	<i>Sardinella sp.</i>	Sardines
Congridae	<i>Conger triporiceps</i>	Manytooth conger
Congridae	<i>Heteroconger halis</i>	Brown garden eel

Coryphaenidae	<i>Coryphaena hippurus</i>	Dolphinfish
Exocoetidae	<i>Hirundichtys affinis</i>	Fourwing flyingfish
Exocoetidae	<i>Hemiramphus brasiliensis</i>	Ballyhoo
Gobiidae	<i>Coryphopterus glaucofraenum</i>	Bridled goby
Gobiidae	<i>Coryphopterus personatus/hyalinus</i>	Masked/Glass goby
Gobiidae	<i>Xanthichthys ringens</i>	Sargassum triggerfish
Gobiidae	<i>Gobiosoma evelynae</i>	Sharknose goby
Gobiidae	<i>Gnatholepis thompsoni</i>	Goldspot goby
Gobiidae	<i>Gobiosoma genie</i>	Cleaning goby
Gobiidae	<i>Gobiosoma randalli</i>	Yellownose goby
Gobiidae	<i>Gobiosoma sp.</i>	Goby
Grammatidae	<i>Gramma loreto</i>	Fairy basslet
Grammistinae	<i>Rypticus saponaceus</i>	Greater soapfish
Haemulidae	<i>Haemulon album</i>	White margate
Haemulidae	<i>Haemulon parra</i>	Sailor's choice
Haemulidae	<i>Haemulon carbonarium</i>	Caesar grunt
Haemulidae	<i>Haemulon flavolineatum</i>	French Grunt
Haemulidae	<i>Haemulon chrysargyreum</i>	Smallmouth grunt
Haemulidae	<i>Kyphosus sp.</i>	Chub
Haemulidae	<i>Haemulon aurolineatum</i>	Tomtate
Haemulidae	<i>Haemulon sciurus</i>	Blue striped grunt
Haemulidae	<i>Haemulon striatum</i>	Striped grunt
Haemulidae	<i>Haemulon macrostomum</i>	Spanish grunt
Holocentridae	<i>Plectrypops retrospinis</i>	Cardinal soldierfish
Holocentridae	<i>Myripristis jacobus</i>	Blackbar soldierfish
Holocentridae	<i>Holocentrus rufus</i>	Longspine squirrelfish
Holocentridae	<i>Holocentrus adscensionis</i>	Squirrelfish
Holocentridae	<i>Holocentrus coruscum</i>	Reef squirrelfish
Holocentridae	<i>Holocentrus marianus</i>	Longjaw squirrelfish
Holocentridae	<i>Plectrypops retrospinis</i>	Cardinal soldierfish
Intermiidae	<i>Inermia vittata</i>	Boga
Istiophoridae	<i>Makaira nigricans</i>	Blue marlin
Kyphosidae	<i>Caranx lugubris</i>	Blackjack
Labridae	<i>Halichoeres garnoti</i>	Yellowhead wrasse
Labridae	<i>Clepticus parrae</i>	Creole wrasse
Labridae	<i>Thalassoma bifasciatum</i>	Bluehead wrasse
Labridae	<i>Halichoeres maculipinna</i>	Clown wrasse
Labridae	<i>Halichoeres poeyi</i>	Blackear wrasse
Labridae	<i>Halichoeres bivittatus</i>	Slippery dick
Labridae	<i>Bodianus rufus</i>	Spanish hogfish
Labridae	<i>Halichoeres radiatus</i>	Pudding wife
Lutjanidae	<i>Rhomboplites aurorubens</i>	Vermilion snapper
Lutjanidae	<i>Lutjanus buccanella</i>	Blackfin snapper
Lutjanidae	<i>Lutjanus campechanus</i>	Red snapper

Lutjanidae	<i>Etelis oculatus</i>	Queen snapper
Lutjanidae	<i>Lutjanus vivanus</i>	Silk snapper
Lutjanidae	<i>Ocyurus chrysurus</i>	Yellowtail snapper
Lutjanidae	<i>Lutjanus mahogoni</i>	Mahogany snapper
Lutjanidae	<i>Lutjanus apodus</i>	School master
Lutjanidae	<i>Lutjanus griseus</i>	Gray snapper
Lutjanidae	<i>Lutjanus synagris</i>	Lane snapper
Lutjanidae	<i>Lutjanus analis</i>	Mutton snapper
Malacanthidae	<i>Malacanthus plumieri</i>	Sand tilefish
Mullidae	<i>Mulloidichthys martinicus</i>	Yellow goatfish
Mullidae	<i>Pseudupeneus maculatus</i>	Spotted goatfish
Muraenidae	<i>Gymnothorax miliaris</i>	Goldentail morray
Muraenidae	<i>Muraena robusta</i>	Stout morray
Muraenidae	<i>Enchelycore nigricans</i>	Viper morray
Muraenidae	<i>Gymnothorax moringa</i>	Spotted moray
Muraenidae	<i>Gymnothorax miliaris</i>	Goldtail moray
Muraenidae	<i>Channomuraena vittata</i>	Broadbanded moray
Octopodidae	<i>Octopus briareus</i>	Caribbean reef octopus
Ophichthidae	<i>Myrichthys ocellatus</i>	Goldspotted eel
Ostraciidae	<i>Lactophrys bicaudalis</i>	Spotted trunkfish
Ostraciidae	<i>Lactophrys triqueter</i>	Smooth trunkfish
Ostraciidae	<i>Lactophrys polygonia</i>	Honeycomb cowfish
Pempheridae	<i>Pempheris schomburgki</i>	Glassy sweeper
Pomacanthidae	<i>Holacanthus tricolor</i>	Rock beauty
Pomacanthidae	<i>Pomacanthus paru</i>	French angel
Pomacanthidae	<i>Centropyge aurantonotus</i>	Flameback angelfish
Pomacanthidae	<i>Holacanthus ciliaris</i>	Queen angelfish
Pomacentridae	<i>Chromis cyanea</i>	Blue chromis
Pomacentridae	<i>Chromis multilineata</i>	Brown chromis
Pomacentridae	<i>Stegastes partitus</i>	Bicolor damselfish
Pomacentridae	<i>Microspathodon chrysurus</i>	Yellowtail damselfish
Pomacentridae	<i>Abudefduf saxatilis</i>	Sergeant major
Pomacentridae	<i>Stegastes diencaeus</i>	Longfin damselfish
Pomacentridae	<i>Stegastes fuscus</i>	Dusky damselfish
Pomacentridae	<i>Abudefduf taurus</i>	Night sergeant
Pomacentridae	<i>Stegastes variabilis</i>	Cocoa damselfish
Pomacentridae	<i>Stegastes leucosticus</i>	Beaugregory
Pomacentridae	<i>Stegastes planifrons</i>	Three spotted damselfish
Pomacentridae	<i>Chromis insolata</i>	Sunshine fish
Priacanthidae	<i>Priacanthus arenatus</i>	Big eye
Priacanthidae	<i>Priacanthus cruentatus</i>	Glasseye snapper
Scaridae	<i>Scarus taeniopterus</i>	Princess parrotfish
Scaridae	<i>Sparisoma viride</i>	Stoplight parrotfish
Scaridae	<i>Scarus iserti</i>	Striped parrotfish
Scaridae	<i>Sparisoma aurofrenatum</i>	Redband parrotfish

Scaridae	<i>Sparisoma rubripinne</i>	Redtail parrotfish
Scaridae	<i>Scarus vetula</i>	Queen parrotfish
Scaridae	<i>Sparisoma chrysopterygum</i>	Redfin parrotfish
Scaridae	<i>Scarus guacamaia</i>	Rainbow parrotfish
Sciaenidae	<i>Equetus punctatus</i>	Spotted drum
Sciaenidae	<i>Equetus acuminatus</i>	Highhat
Sciaenidae	<i>Equetus lanceolatus</i>	Jackknife fish
Scombridae	<i>Menticirrhus littoralis</i>	Gulf kingfish
Scombridae	<i>Tunnus albacares</i>	Yellowfin tuna
Scombridae	<i>Euthynnus alletteratus</i>	Little tunny
Scombridae	<i>Thunnus atlanticus</i>	Blackfin tuna
Scombridae	<i>Thunnus obesus</i>	Bigeye tuna
Scombridae	<i>Katsuwonus pelamis</i>	Skipjack tuna
Scombridae	<i>Acanthocybium solandri</i>	Wahoo
Scombridae	<i>Thunnus alalunga</i>	Albacore tuna
Scombridae	<i>Sarda sarda</i>	Atlantic bonito
Scombridae	<i>Scomberomorus regalis</i>	Cero
Scombridae	<i>Scomberomorus cavalla</i>	King mackerel
Scorpaenidae	<i>Scorpaena plumieri</i>	Spotted scorpionfish
Serranidae	<i>Hypoplectrus puella</i>	Barred hamlet
Serranidae	<i>Serranus tigrinus</i>	Halequin bass
Serranidae	<i>Epinephelus adscensionis</i>	Rock hind
Serranidae	<i>Epinephelus cruentatus</i>	Grasby
Serranidae	<i>Epinephelus guttatus</i>	Red hind
Serranidae	<i>Epinephelus fulvus</i>	Coney
Serranidae	<i>Hypoplectrus chlorurus</i>	Yellowtail hamlet
Serranidae	<i>Liopropoma rubre</i>	Peppermint bass
Serranidae	<i>Hypoplectrus guttavarius</i>	Shy hamlet
Serranidae	<i>Hypoplectrus aberrans</i>	Yellowbelly hamlet
Serranidae	<i>Serranus baldwini</i>	Lantern bass
Serranidae	<i>Hypoplectrus nigricans</i>	Black hamlet
Sphyraenidae	<i>Sphyraena barracuda</i>	Great barracuda
Synodontidae	<i>Synodus intermedius</i>	Sand diver
Tetraodontidae	<i>Chilomycterus antillarum</i>	Web burrefish
Tetraodontidae	<i>Canthigaster rostrata</i>	Sharpnose puffer
Tetraodontidae	<i>Diodon hystrix</i>	Porcupine fish
Tetraodontidae	<i>Diodon holocanthus</i>	Balloonfish

Species of algae

Phylum	Species	Common Name
Chlorophyta	<i>Halimeda discoidea</i>	Large leaf watercress algae
Chlorophyta	<i>Halimeda lacrimosa</i>	Bulbous lettuce leaf alga
Chlorophyta	<i>Caulerpa racemosa</i>	Green grape alga
Chlorophyta	<i>Udotea cyathiformis</i>	Mermaid's teacup
Chlorophyta	<i>Ventricaria ventricosa</i>	Sea pearl
Cyanophyta	Not identified	Fuzz ball algae
Phaeophyta	<i>Dictyota sp.</i>	Y Branched algae
Phaeophyta	<i>Hydroclathrus clathratus</i>	Swiss cheese algae
Phaeophyta	<i>Lobophora variegata</i>	Encrusting fan-leaf alga
Rhodophyta	Not identified	Crustose coralline algae
Rhodophyta	<i>Galaxaura sp.</i>	Tubular thicket algae

Species of enidaria (not including corals)

Order	Species	Common Name
Actinaria	* <i>lucida</i>	Knobby anemone
Actinaria	<i>Lebrunia coralligens</i>	Hidden anemone
Actinaria	<i>Lebrunia danae</i>	Branching anemone
Ceriantharia	<i>Arachnanthus nocturnus</i>	Banded tube-dwelling anemone
Hydroida	<i>Macrorhyncia robusta</i>	Stinging bush hydroid
Hydroida	<i>Gymnangium sp.</i>	Feather hydroid
Hydroida	<i>Halopteris carinata</i>	Thread hydroid
Zoanthidea	<i>Zoanthus pulchellus</i>	Mat zoanthid
Zoanthidea	<i>Palythoa caribaeorum</i>	White encrusting zoanthid
Zoanthidea	<i>Palythoa grandis</i>	Sun zoanthid

* Genera for this species was recently reclassified and is not available

Species of corals

Family	Species	Common Name
Acroporidae	<i>Acropora palmata</i>	Elkhorn coral
Agariciidae	<i>Agaricia humilis</i>	Low relief lettuce coral
Agariciidae	<i>Agaricia agaricites</i>	Lettuce coral
Agariciidae	<i>Agaricia lamarcki.</i>	Sheet coral
Anthothelidae	<i>Iciligorgia schrammi</i>	Deep water sea fan
Anthothelidae	<i>Erythropodium caribaeorum</i>	Encrusting gorgonian
Antipathidae	<i>Antipathes lenta.</i>	Hairnet black coral
Antipathidae	<i>Antipathes sp.</i>	Black coral
Astrocoeniinae	<i>Stephanocoenia michilini</i>	Blushing star coral
Briareidae	<i>Briareum asbestinum</i>	Corky sea finger
Caryophyllidae	<i>Catalaphyllia jardinei</i>	Elegant coral
Caryophyllidae	<i>Eusmilia fastigiata</i>	Smooth flower coral
Ellisellidae	<i>Ellisella barbadensis</i>	Devil's sea whip
Faviidae	<i>Favia fragum</i>	Golf ball coral
Faviidae	<i>Montastrea annularis</i>	Boulder star coral
Faviidae	<i>Cladocora arbuscula</i>	Tube coral
Faviidae	<i>Montastrea cavernosa</i>	Great star coral
Faviidae	<i>Diplora strigosa</i>	Symmetrical brain coral
Faviidae	<i>Diplora clivosa</i>	Knobby brain coral
Faviidae	<i>Diplora labyrinthiformis</i>	Grooved brain coral
Faviidae	<i>Manicina areolata</i>	Rose coral
Faviidae	<i>Colpophyllia natans</i>	Boulder brain coral
Faviidae	<i>Meandrina brasiliensis</i>	Rose coral
Gorgoniidae	<i>Pterogorgia citrina.</i>	Yellow sea whip
Gorgoniidae	<i>Pseudopterogorgia sp.</i>	Sea plume
Gorgoniidae	<i>Gorgonia mariae</i>	Wide-mesh sea fan
Gorgoniidae	<i>Gorgonia ventalina</i>	Sea fan
Meandrinidae	<i>Dendrogyra cylindrus</i>	Pillar coral
Meandrinidae	<i>Meandrina meandrites</i>	Maze coral
Meandrinidae	<i>Dichocoenia stokesii</i>	Elliptical star coral
Milliporidae	<i>Millepora alcicornis</i>	Branching fire coral
Milliporidae	<i>Millepora squarrosa</i>	Box fire coral
Mussidae	<i>Mussa angulosa</i>	Spiny flower coral
Mussidae	<i>Isophyllastrea rigida</i>	Rough star coral
Mussidae	<i>Mycetophyllia danaana</i>	Low ridge cactus coral
Mussidae	<i>Scolymia sp.</i>	Disk coral
Oculinidae	<i>Oculina diffusa</i>	Diffuse Ivory bush coral
Plexauridae	<i>Eunicea sp.</i>	Sea rod
Plexauridae	<i>Plexaura flexuosa</i>	Bent sea rod
Plexauridae	<i>Pseudoplexaura sp.</i>	Porous sea rod
Plexauridae	<i>Plexaurella sp.</i>	Slit pore sea rod
Pocilloporidae	<i>Madracis mirabilis</i>	Yellow pencil coral

Pocilloporidae	<i>Madracis decactis</i>	Ten ray star coral
Poritidae	<i>Porites colonensis</i>	Honey comb plate coral
Poritidae	<i>Porites asteroides</i>	Mustard hill coral
Poritidae	<i>Porites porites</i>	Finger coral
Poritidae	<i>Porites divaricata</i>	Finger coral
Seriatoporidae	<i>Madracis pharensis</i>	Encrusting star coral
Siderastreidae	<i>Siderastrea radians</i>	Lesser starlet coral
Siderastreidae	<i>Siderastrea siderea</i>	Massive starlet coral

Species of molluscs

Family	Species	Common Name
Amphineura (class)	<i>Acanthopleura granulata</i>	Fuzzy chiton
Limidae	<i>Lima scabra</i>	Rough file clam
Loliginidae	<i>Sepioteuthis sepioidea</i>	Caribbean reef squid
Octopodidae	<i>Octopus briareus</i>	Caribbean reef octopus
Strombidae	<i>Strombus gigas</i>	Queen conch
Strombidae	<i>Strombus ranius</i>	Hawkwing conch
Cypraeidae	<i>Cypraea cinerea</i>	Atlantic gray cowrie
Ovulidae	<i>Cyphoma gibbosum</i>	Flamingo tongue

Species of porifera

Class	Species	Common Name
Demospongia	<i>Pseudoceratina crassa</i>	Branching tube sponge
Demospongia	<i>Aplysina fistularis</i>	Yellow tube sponge
Demospongia	<i>Ages conifera</i>	Brown tube sponge
Demospongia	<i>Callyspongia vaginalis</i>	Branching vase sponge
Demospongia	<i>Callyspongia plicifera</i>	Azure vase sponge
Demospongia	<i>Xestospongia muta</i>	Giant barrel sponge
Demospongia	<i>Spheciospongia vesparium</i>	Loggerhead sponge
Demospongia	<i>Iotrochota birotulata</i>	Green finger sponge
Demospongia	<i>Halisarca sp.</i>	Blue encrusting sponge
Demospongia	<i>Amphimedon compressa</i>	Erect rope sponge
Demospongia	<i>Siphonodictyon coralliphagum</i>	Boring sponge
Demospongia	<i>Ectoplasie ferox</i>	Brown encrusting octopus sponge
Demospongia	<i>Siphonodictyon coralliphagum</i>	Variable boring sponge
Demospongia	<i>Niphates digitalis</i>	Pink vase sponge

Species of echinoderms

Class	Species	Common Name
Crinoidea	<i>Davidaster rubiginosa</i>	Golden crinoid
Crinoidea	<i>Analcidometra armata</i>	Swimming crinoid
Echinoidea	<i>Diadema antillarum</i>	Long-spined sea urchin
Echinoidea	<i>Tripneustes ventricosus</i>	West Indian sea egg
Echinoidea	<i>Meoma ventricosa</i>	Red heart urchin
Echinoidea	<i>Echinometra viridis</i>	Reef urchin
Echinoidea	<i>Eucidaris tribuloides</i>	Slate-pencil sea urchin
Ophiuroidea	<i>Schizostella bifurcata</i>	Sea rod basket star
Ophiuroidea	<i>Astrophyton muricatum</i>	Giant basket star
Holothuroidea	<i>Holothuria mexicans</i>	Donkey dung sea cucumber
Ophiuroidea	<i>Ophiothrix suensonii</i>	Sponge brittle star
Ophiuroidea	<i>Ophionereis reticulata</i>	Reticulated brittle star

Species of arthropods observed in the study area.

Family	Species	Common Name
Not known	<i>Thoracica sp.</i>	Sessile barnacles
Diogenidae	<i>Paguristes puncticeps</i>	White speckled hermit
Diogenidae	<i>Paguristes cadenatia</i>	Red reef hermit
Graspidae	<i>Graspidae sp.</i>	Rock runners/spray crabs
Majidae	<i>Stenorhynchus seticornis</i>	Yellowline arrow crab
Majidae	<i>Mithrax pilosus</i>	Hairy clinging crab
Palaemonidae	<i>Periclimenes sp.</i>	Cleaning shrimp
Palinuridae	<i>Panulirus argus</i>	Caribbean spiny lobster
Palinuridae	<i>Panulirus guttatus</i>	Spotted spiny lobster
Palinuridae	<i>Justitia longimanus</i>	Red band lobster
Scyllaridae	<i>Scyllarides sp.</i>	Slipper lobster
Portunidae	<i>Potunus sebae</i>	Ocellate swimming crab
Rhynchocinetida	<i>Rhynchocinetes rigens</i>	Red night shrimp
Stenopodidea	<i>Stenopus hispidus</i>	Banded coral shrimp

Species of annelids observed in the study area.

Family	Species	Common Name
Amphinomidae	<i>Hermodice carunculata</i>	Bearded fireworm
Sabellidae	<i>Bispira brunnea</i>	Social feather duster
Sabellidae	<i>Bispira variegata</i>	Variegated feather duster
Sabellidae	<i>Anomobaea orstedii</i>	Split-crown feather duster
Sabellidae	<i>Sabellastarte magnifica</i>	Magnificent feather duster
Serpulidae	<i>Spirobranchis giganteus</i>	Christmas tree worm
Serpulidae	<i>Vermiliopsis sp.</i>	Blushing star coral fanworm
Terebellidae	<i>Eupolyornia crassicornis</i>	Spaghetti worm