Coastal region and small island papers 2

COASTS OF HAITI

Resource assessment and management needs

Results of a seminar

and related field activities

UNESCO, 1997. *Coasts of Haiti – Resource assessment and management needs*. Results of a seminar and related field activities. Coastal region and small island papers 2, UNESCO, Paris, vi + 32 pp.

The 'Coastal region and small island papers' series was launched by the Organization in 1997. Information on CSI activities can be obtained at the following address:

Coastal Regions and Small Islands (CSI) Unit,
UNESCO, 1 rue Miollis,
75732 Paris Cedex 15, France.
fax: +33-1 45 68 58 08
e-mail: csi@unesco.org
website: http://www.unesco.org/csi

Cover illustration:

L'Age d'Or, painting by Wilson Anacréon. The Haitian landscape artist depicts an idyllic coastal scene, evoking a vision of his country as a "pearl of the Antilles". Taken from *La Rencontre des Deux Mondes vue par les Peintres d'Haïti*, Edizioni Carte Segrete 1992. published by Data Arte s.r.l., Rome, Italy.

Published in 1998 by the United Nations Educational,
Scientific and Cultural Organization
7, place de Fontenoy, 75352 Paris 07 SP

Printed in UNESCO's workshops
Please recycle

Printed in France

SC-98/WS/15

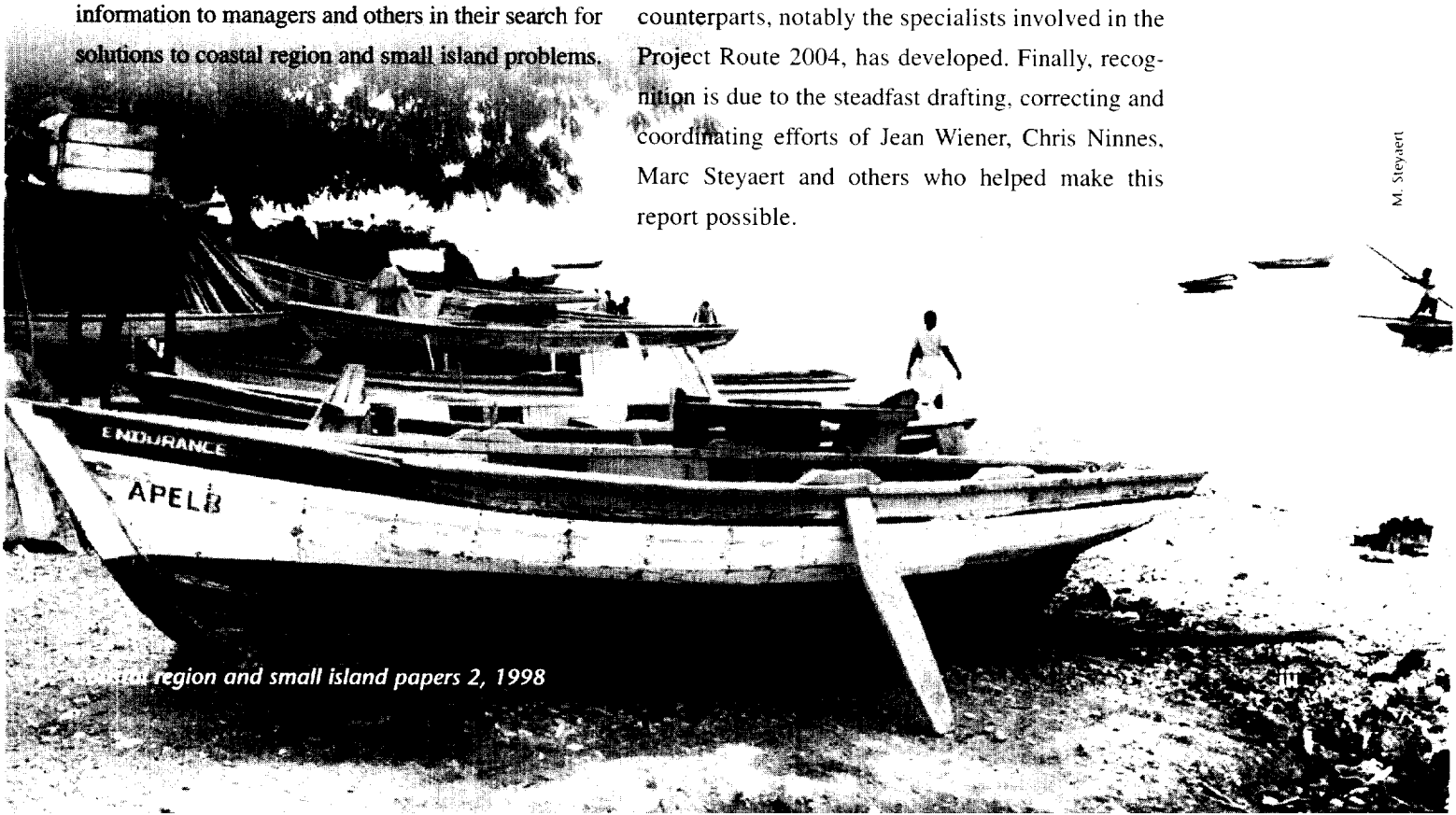
Preface

On the eve of the 21st century, some 60% of the world's population lives within 60km of the sea, and this figure is likely to rise to 75% by the year 2025. Of the world's 23 megacities, 16 are in the coastal belt. Coasts have always served as crossroads for peoples of many origins, and as a result these areas harbour intricate social and cultural mosaics. Coastal ecosystems are among the most diverse, complex and productive on Earth. As a result of an ever increasing demand on finite resources, many coastal areas have become flashpoints for conflict.

Addressing the variety of problems facing coastal regions and small islands requires transdisciplinary research and the careful formulation of policies for integrated action towards sustainable development. The UNESCO endeavour, 'Environment and Development in Coastal Regions and in Small Islands' (CSI), was launched in 1996 in response to these needs. It serves as a platform for cross-sectoral action in order to assist Member States towards environmentally sound, socially equitable and culturally appropriate development of their coastal areas. The Coastal region and small island papers series disseminates information to managers and others in their search for solutions to coastal region and small island problems.

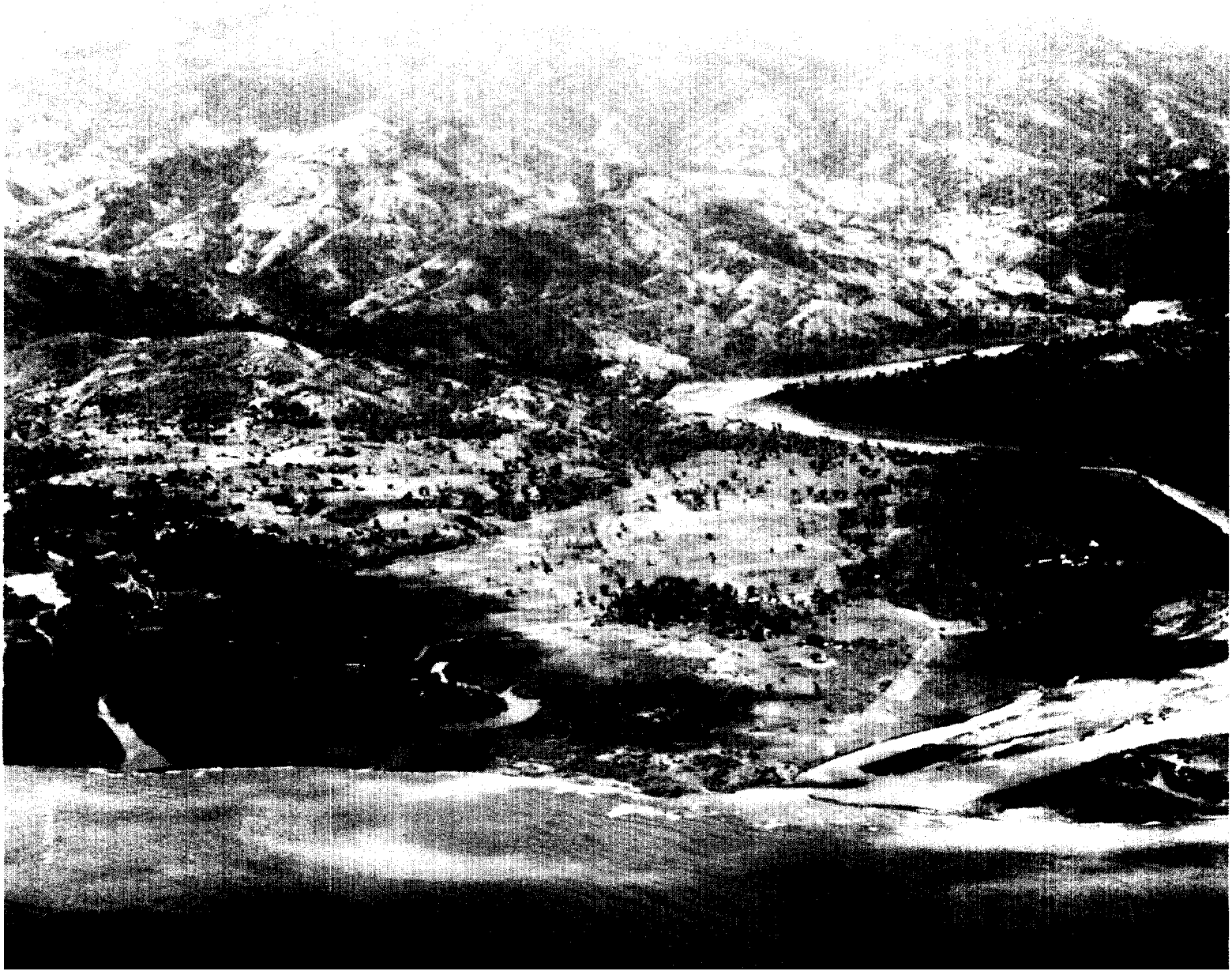
The present volume examines the status and prospects of Haiti's coastal regions and their resources. Primarily, the document contains the report and proceedings of a seminar (with working sessions) on this subject, held 10-14 December 1996 in Petionville, Haiti, as a CSI activity. Preceding the report itself is a summary of the ensemble of relevant cooperative activities carried out in 1996 by UNESCO and Haitian counterparts. During that year, UNESCO representatives worked with government officials, as well as with university and other local representatives, in assessing critical coastal matters in this island State.

Annex 1 contains an overall review paper by Chris Ninnes on integrated coastal management, giving recommendations on pertinent coastal issues. In Annex 2, a short article by José Ottenwalder reviews the coastal problems faced, in ensemble, by Haiti and the Dominican Republic – two countries sharing the same island. Brief details are included in Annex 3 on activities related to another domain, that of cultural heritage, in which UNESCO's partnership with Haitian and other counterparts, notably the specialists involved in the Project Route 2004, has developed. Finally, recognition is due to the steadfast drafting, correcting and coordinating efforts of Jean Wiener, Chris Ninnes, Marc Steyaert and others who helped make this report possible.



M. Steyaert

Table of Contents



I. Background

Introduction

During recent decades, many Small Island Developing States in particular have been subject to rapidly increasing socio-economic pressures, bringing upon their coastal areas probably the greatest impacts and changes in recorded history. These areas have served as centre stage for numerous and often conflicting human activities, such as settlements, fisheries, tourism and various other industries. Enter the need for integrated coastal management.

A first step to be taken by island countries and other nations bordering the sea, on their road toward improving the management of coastal resources, is to examine and evaluate these resources and the pressures bearing upon them. It has been in this spirit, initially, that UNESCO and Haiti have cooperated with regard to the latter's coastal situation. The last part of this section (page 2) enumerates the main actions that took place in 1996 in this context.

To launch the assessment, UNESCO, through its CSI endeavour and the Organization's office in Haiti, together with the country's authorities, Quisqueya University and the Foundation for the Protection of Marine Biodiversity (FoProBiM), initiated a pre-feasability study. Finally, a seminar (with working sessions) was held in Petionville, 10-14 December 1996. Specialists from Haiti and other countries of the Caribbean met and reviewed the situation, exchanged views and recommended measures for the study, management and preservation of the country's coastal areas. A project document, for possible financing by funding agencies, was prepared by integrating all the topics considered and recommendations made.

Environmental situation

Haiti's coastline measures approximately 1,770 kms and the island's shelf extension totals around 5000 km^2 (see relief map of Haiti on inside back cover). In general, the shelf is narrow with some exceptions, such as Port-au-Prince Bay at the south-eastern end of the Gulf of La Gonâve. The bay, with maximum depth of 120-140 m (see illustration page 13), is separated from the rest of the Gulf of La Gonâve by two shallow-water elongated sills (20-30 m deep) that link the island of La Gonâve (located in the middle of the gulf) with both the central and southern parts of the main island.

The country is characterized by fairly narrow coastal plains lying between steep mountain ranges and the coastline. In general, the mountain-slope forests are consumed at an alarming rate for charcoal production, which is a major source of domestic energy. The coastal plains have been converted to intensive agriculture, while fishing occurs only in the shallow coastal waters due to the limited capacities of the country's traditional fisheries. Uncontrolled over-exploitation of land resources on the island has caused excessive erosion and sedimentation in the watersheds and along the coast, where it affects the sustainability of the coastal resources. In addition, problems stemming from the lack of land-use planning, including for tourism development, are likely to increase in the near future.

With regard to coastal (terrestrial and marine) resources, the present situation is mixed. On the one hand, densely populated areas are for the most part severely impacted by human activities. A case in point is the relatively small Port-au-Prince Bay where human activities have caused seriously harmful effects including high sedimentation, estimated at 7,900,000m^3 since 1958 (*Haiti ECONET*, October 1995, UNDP-Haiti), and large amounts of pollution – both visual (e.g. debris) and more nefarious pollution. The most significant example of the former is

plastics of all types and, of the latter, petroleum products and sewage. A study by the Foundation for the Protection of Marine Biodiversity ('Fondation pour la Protection de la Biodiversité Marine' – FoProBiM, April, 1996) indicated that more than 98% of debris found on the beach was composed of plastics. On the other hand, areas remote from human habitation are usually in good environmental condition although still affected by debris from distant cities and villages plus siltation caused by erosion due to a high rate of deforestation.

Other problems, such as over-fishing of near-shore waters and the destruction of mangrove forests, contribute to the creation of a coastal environment that is on the verge of irreversible damage.

When facing such extenuating social circumstances as high un- and under-employment, malnutrition and insufficient education, it is difficult to expect certain sectors of the population to embrace conservation and coastal protection; here the daily order of business is survival. However, there is some legislation regulating the exploitation of the coastal ecosystem.

There is also a serious lack of trained environmental specialists in matters concerning coastal resources. Very little documentation is available on activities undertaken concerning the coastal environment in Haiti, partly owing to the paucity of work that has been done. Another negative factor is that often much of the documentation on activities performed is scattered throughout the world, due to the fact that specialists working in Haiti have taken their work with them. Environmental issues that need to be addressed in Haiti include: pollution, eutrophication, over-exploitation, loss of biodiversity and lack of education. It is therefore imperative to gather as much data as possible concerning Haiti's coastal environment in order to make informed judgements on possible interventions which will promote the sustainable use of the related resources.

Actions in 1996

A series of meetings were held in January and February in Port-au-Prince with a small group of institutions directly involved in coastal activities. It was decided that invitations should be forwarded to all concerned, including relevant environmental institutions, in order to obtain the greatest possible input into the planning of pertinent activities. An initial pre-project feasibility mission was eventually funded in order to conduct an in-country review evaluating local support for such a project, and to assess the logistics required to implement such a project as well as any technical constraints.

In March and April, the Haitian National Commission for UNESCO began a series of meetings in the country bringing together all concerned leaders from the private sector as well as from the government, the university and non-governmental organizations. The purpose was to provide adequate coordination for Haiti's coastal activities. An ad hoc national committee was formed with the following members: coordinator – Dr. Ariel Azael, Quisqueya University; secretary – Mr. Jean W. Wiener, Foundation for the Protection of Marine Biodiversity; assistant secretary – Mr. Harold Gaspar, Project Route 2004.

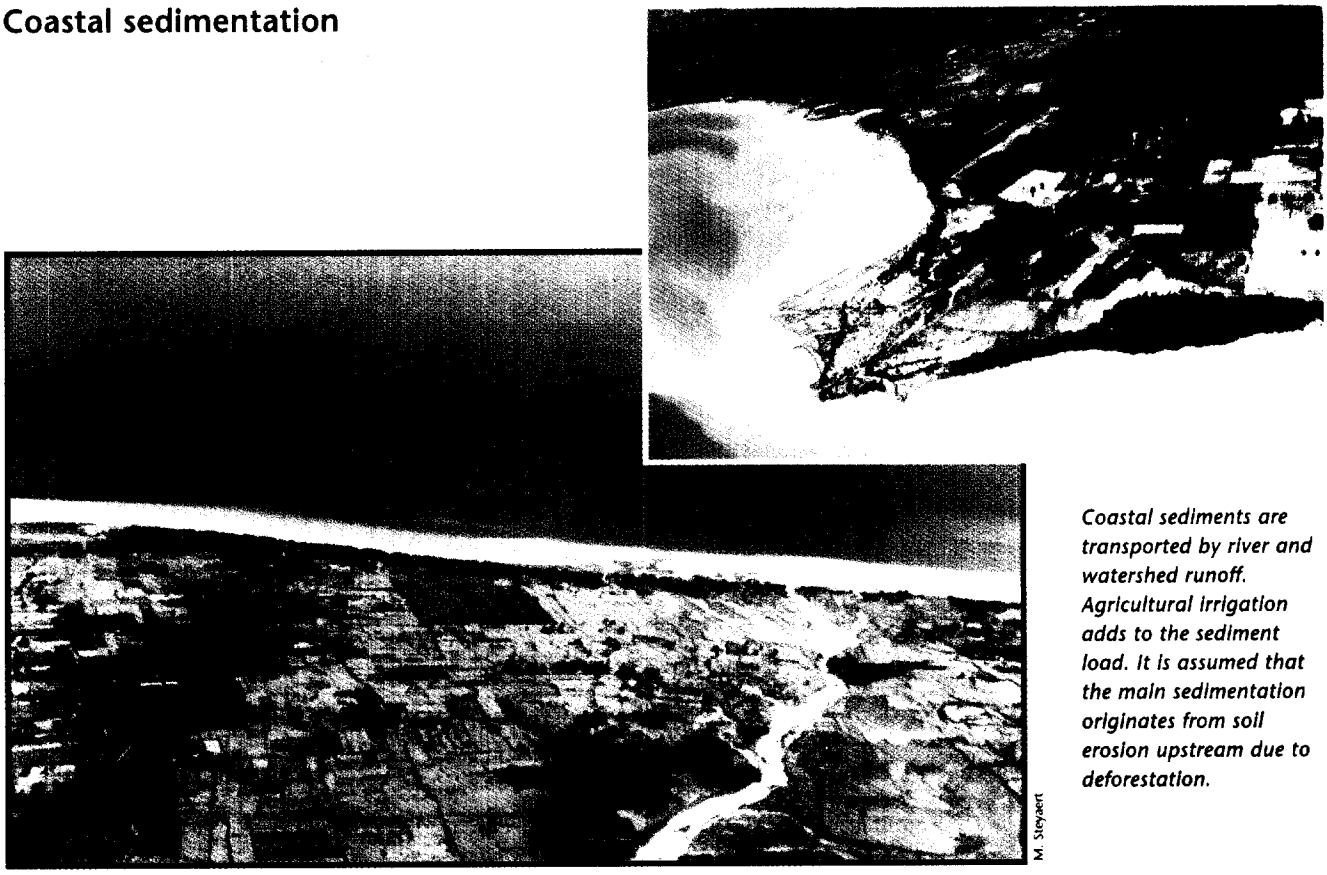
A fact-finding mission was conducted from 29 April to 1 May in Haiti by Professor Peter Burbridge from the University of Newcastle, UK. During this mission several initial recommendations were made including the possible preparation of a series of coastal data atlases for Haiti, developing an in-service training programme in coastal management and an exchange mechanism for promoting transfer of knowledge between other countries (specifically other Caribbean nations) and Haiti.

In September two consultants, Dr. Marc Steyaert and Mr. Chris Ninnes, carried out a second, more in-depth mission to Haiti in order to make a further evaluation of the present situation concerning coastal resources, local capacity and actions needed. Conclusions and recommendations arising from this visit included: limiting the proposed activities to a manageable portion of Haiti's coast, encouraging exchanges between Haiti and other countries of the region, increasing the scientific information base in order to enable better informed decisions, encouraging capacity building, and identifying the need for a seminar to be held in Haiti in order to bring together Haitian and other regional experts for a proper face-to-face exchange of information and preparation of further recommendations.

Two specialists, Chris Ninnes and Jean Wiener, carried out ground- and sea-truthing and research (literature and scientific) in November and December, with the goal of acquiring enough data and information to present at the seminar and working sessions, as well as for the preparation of a document to initiate an integrated coastal management project.

A seminar (with working sessions) was held 10-14 December in Petionville, bringing together Haitian and other regional experts. (See report in following section.)

Coastal sedimentation



M. Steyaert

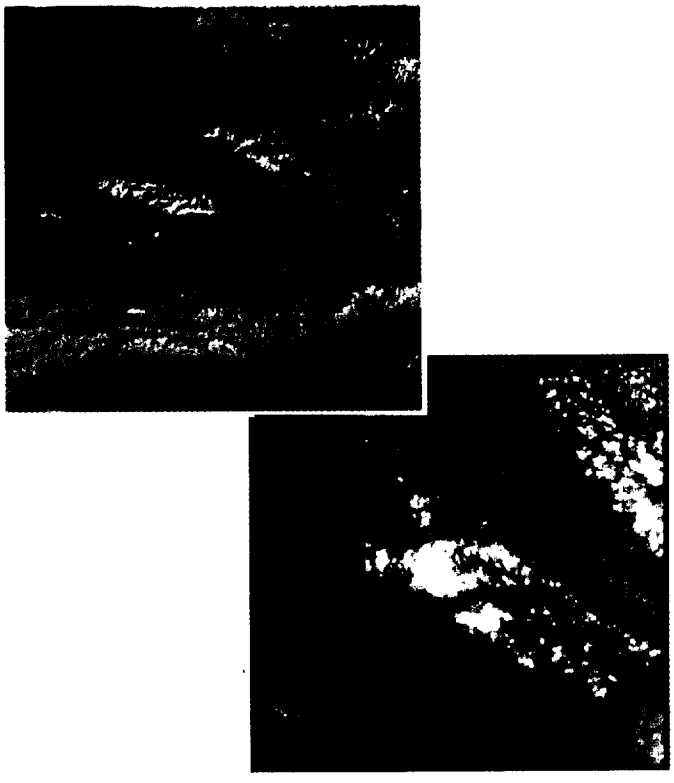
Coastal sediments are transported by river and watershed runoff. Agricultural irrigation adds to the sediment load. It is assumed that the main sedimentation originates from soil erosion upstream due to deforestation.

Remote sensing and coastal management

Features of interest to the coastal manager are often visible in satellite images. One can derive information such as spatial distribution of different habitats (submerged and terrestrial vegetation), ecological parameters (seagrass standing crop, mangrove leaf area index), changes in these habitats and parameters, and crude bathymetry.

Adjacent: Satellite images taken above the Gulf of La Gonâve, from a report (October 1996) of the Centre for Tropical Coastal Management Studies (University of Newcastle upon Tyne, UK). The report assesses the availability and suitability of satellite imagery (Landsat TM and SPOT XS), for use in support of the management of Haiti's west coast.

These images are provided by courtesy of the author of the report, Dr. Edmund Green, of the World Conservation Monitoring Centre (e-mail: ed.green@wcmc.org.uk), a partner in these efforts. Information on pertinent literature is available at: http://www.ncl.ac.uk/~ntcmweb/refs/refs_rem.htm



Artisanal fishing

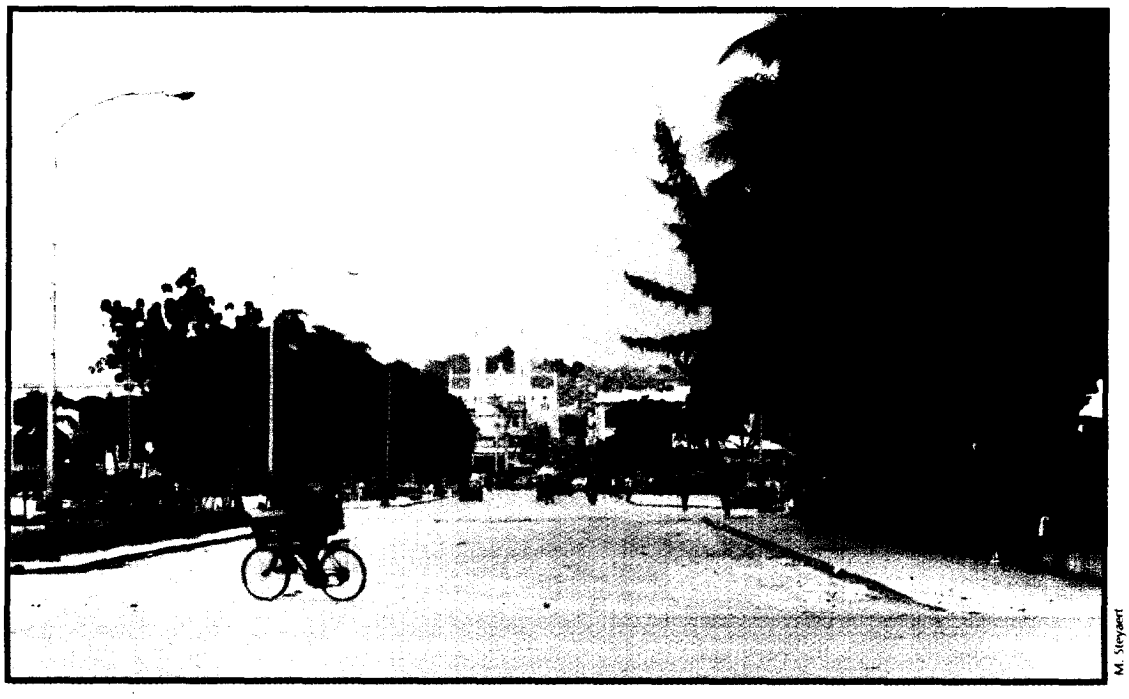
Fishing in Haiti, one source of food for the country's growing population, is limited due to: (i) depletion of stocks in shallow coastal waters and (ii) lack of capacity for deep-sea operations. Top and left: Luly villagers with traditional fishing gear. Right: Fisherman in Jacmel shows his catch.

J. Ottenwalder

A. Suzyumov

Planners, builders and property owners in Haiti and throughout the Caribbean can benefit from the experience and information accumulated by the COSALC project on coastal stability. Top: a hotel on Haiti's coast which is dangerously close to the high-water mark. Bottom: a hotel near Mayagüez, Puerto Rico with its 'feet' already in the water.

Pollution, a festering problem

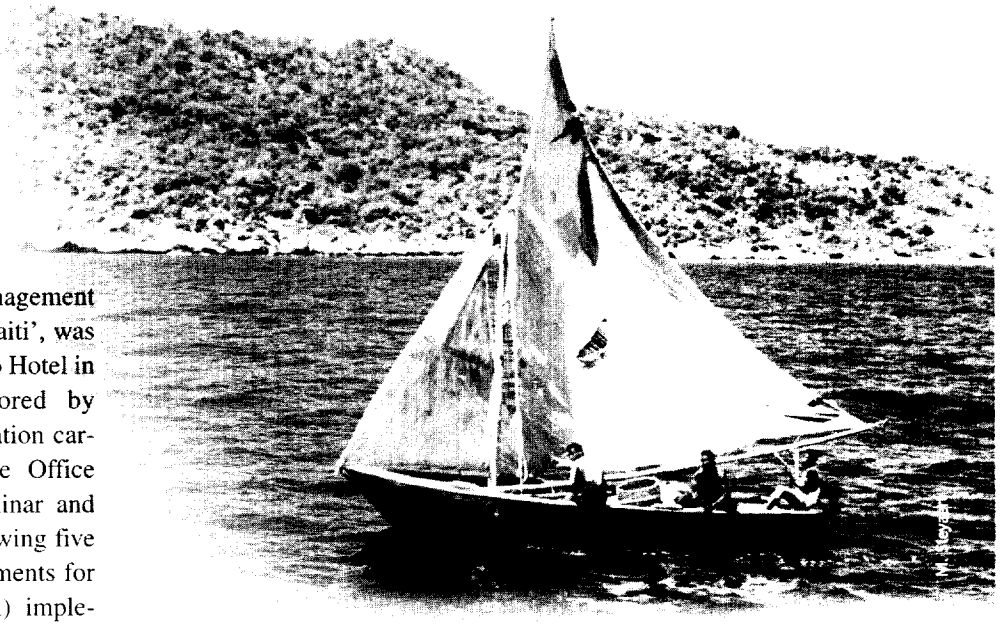


M. Steyaert

In the top photo, Marc Steyaert clicks on a scenic boulevard leading to downtown Port-au-Prince. Turning, he captures Jean Wiener directly behind him, surveying a garbage-strewn beach.

M. Steyaert

II. Seminar report



Traditional methods – a way of life for Haitian fishers.

The UNESCO Seminar on the 'Study, Management and Preservation of the Coastal Areas of Haiti', was held 10-14 December 1996 at the El Rancho Hotel in Petionville. It was hosted and sponsored by UNESCO, with much of the local organization carried out by the UNESCO Port-au-Prince Office (actually located in Petionville). The seminar and working sessions concentrated on the following five main subject areas: (i) institutional requirements for resource monitoring and management, (ii) implementation of study and management activities in the pilot area, (iii) management of the freshwater resources of the Port-au-Prince area, (iv) study of the wider Port-au-Prince area (Gulf of La Gonâve), and (v) involvement of Haiti in regional cooperative programmes to assess beach erosion and to monitor coral reefs, seagrass beds and mangroves. The Chairperson was Dr. Ariel Azael, the Vice-Chair Mr. Jean Wiener, and the Rapporteurs were Messrs. Chris Ninnes and Jean Wiener.

SUMMARIES OF PLENARY PRESENTATIONS

The Coastal Areas of Haiti:
Jurisdiction and Legal Aspects -
The Sea, the Law and the Environment
BY JEAN ANDRÉ VICTOR

Discussions revolved around the legal aspects concerning marine and coastal resources including public and private uses of these resources (fishing, navigation, waste disposal, exploitation of the sea bed etc.) as well as legal definitions of territorial seas (out to 12 miles – sovereign rights, right of peaceful navigation), EEZ (out to 200 miles – rights for exclusive exploitation of resources) and the 'high seas' (beyond 200 miles). The marine legislation in Haiti needs to be improved, especially with regard to the ratification of and compliance with international conventions. Due to internal problems in the period between 1958 and 1972 there were no conventions signed. There are general laws concerning various aspects (navigation, fishing) but enforcement is almost non-existent in most cases. However, conventions that have been ratified more recently include the Convention on Biological Diversity and the Framework Convention on Climate Change as well as the United Nations Convention on the Law of the Sea (UNCLOS). Those which have not yet been ratified include the Cartagena Convention (Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region), the MARPOL Convention (International Convention for the Prevention of Pollution from Ships), the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Haiti seems to have no clear policies concerning conventions, sponsored by the International Maritime Organization, on pollution prevention (SOLAS, COLREG, CLC, OPC Fund and OPRC)*. The government offices with an interest in coastal area resources management include: Ministries of Environment, Agriculture, Planning, Finance, Commerce and Education, and the Office of the Secretary of State for Tourism. Comments were made concerning the fact that there are many marine parks throughout the Caribbean, but none in Haiti.

The Coastal Regions of Haiti:
Cultural and Natural Environment
BY JEAN W. WIENER

The coastal resources are probably the country's most exploited and inadequately managed. Problems caused by overfishing, pollution, poverty, waste (dumping), ignorance of the laws, lack of education, and general overexploitation and neglect were discussed. It was noted that previous interventions were largely unsuccessful. All land-based activities eventually affect the

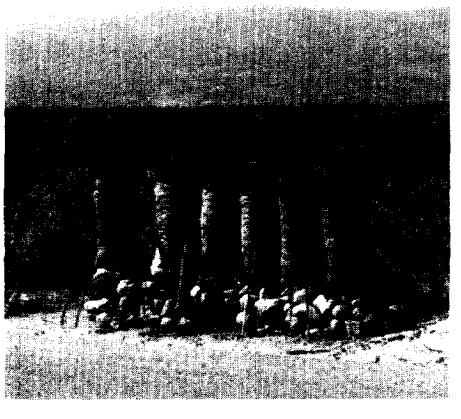
* *Acronyms: see Annex 5*

coastal waters, and near high population densities these waters are in serious trouble whereas those further away are still in fair condition, although somewhat affected by pollution from population centres and erosion. Overfishing in nearshore waters is widespread, compounded by the fact that most artisanal fishers do not have the means to fish pelagic species.

Hotels and houses contribute to human waste entering the near-shore environment, but by far the biggest problem is the absence of sewage treatment in large population centres. Engine oil also creates a considerable pollution problem. Deforestation for charcoal production and construction materials as well as inappropriate agricultural practices are the major contributors to the soil erosion process. Coastal marine resources are very overexploited. Yet how is it possible to protect these resources when they are often the only means of support for a family? The need for alternatives, protective and regulatory measures and increased environmental education was emphasized.

M. Steyaert

Charcoal is a major source of energy for the population. Extracted from the dwindling forests, it is stacked by the roadside and sold in markets.



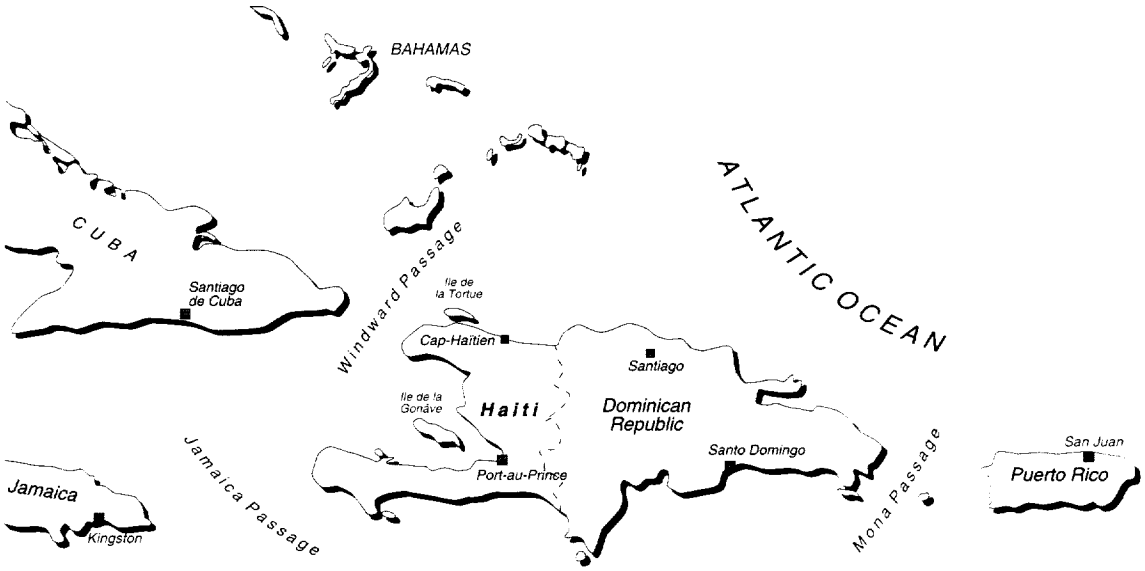
M. Steyaert

Coastal Ecosystems Management and Bi-national Cooperation

BY JOSE A. OTTENWALDER

The Dominican Republic and Haiti (forming Hispaniola) are endowed with a unique and valuable marine heritage. Several of the largest and most productive estuaries of the Caribbean Islands are found here. Examples are the mouths of the following rivers: the Barracote and Yuna, in the Bay of Samaná; the Artibonite and l'Estère, in the Gulf of La Gonâve; and the Yaque del Norte, on the Atlantic coast near the northern border between the two countries. The island is at the centre of the Antillean arc, and within the maritime jurisdiction of the two countries is an important passageway for the heavy maritime traffic passing through the region. Hispaniola's reefs, seagrass beds and mangrove habitats are among the finest in the West Indies. Historically, the social and economic well-being of both countries has been intimately linked to the health of their coastal areas. The coastal lowlands have been the focus of urban and agricultural development. About 70% of Dominican and Haitian settlements (of at least 10,000 inhabitants) and most of the industrial activity are located in the coastal regions. In the Dominican Republic tourism, almost totally concentrated in the coastal area, has become the country's most important economic activity. Marine fisheries continue to be of major importance for local consumption and exports. Many of these assets have been undervalued thus far, and the potential contribution of coastal and marine areas to the sustainable development of the two countries is only slowly gaining recognition in the official and public sectors.

Hispaniola's considerable, heavily indented coastline – 3,059 km long – is nearly comparable to the 3,200 kms circumscribing Cuba (the largest Caribbean island). The concentration of almost all the island's economic activity near the ocean results in a serious impact on the coastal and marine ecosystems. Similar pressures have been building up in neighbouring states and elsewhere in the region, causing coastal degradation and overfished or depleted stocks. The coastal policy responses of these countries vis-a-vis fisheries are moving from open-access regimes to restricted access management, and to the integration of environmental measures such as land-use planning and zoning as a means of avoiding conflicts and unwanted cumulative effects. Good coastal management offers a philosophy as well as techniques for dealing with such



Haiti and its neighbours. (Adapted from the Coastal Atlas, see Annex 3)

dilemmas. The central idea is that we benefit from an ecosystem-based approach to management, for which a long-term perspective is essential. This view requires a new concept for joint Dominican/Haitian decision-making in the light of their island-wide impacts on future generations. Good ecosystem management requires that people be considered as integral parts of the ecosystems and interlinked with the processes by which the systems function and change. Natural processes know no political borders. Because of the obvious inter-relationship of the 'Haitian and Dominican ecosystems', bi-national collaboration in the form of a major, combined undertaking is vital for the preservation of the island's coastal resources. Some of the challenges and realities faced by both countries, in their efforts to achieve these goals, are further discussed in Annex 2 of this report.

1,535 Km of Coast: an Ocean, a Gulf, a Sea and its Unique Potential
BY FLORENCE SERGILE

Haiti's ecosystems, including its resident biodiversity, are among the most diverse in the Caribbean. The varied habitats include cacti, humid forests and corals. With the increase in human population has come the usual problems, especially the degradation of species' habitats. Poor agricultural soil, steep land, and a narrow continental shelf contribute to the aggravation of these problems. There are few management plans that we know of in Haiti, and an effort should be made to prepare such plans at the Ministries of Agriculture or Environment. The last few decades have seen the addition of industrial wastes to the soil already washed down into the ocean. When managing the resources of Haiti, one must keep in mind the socio-economic concerns and specific character of the country. The habitats must be protected in order to rehabilitate them. A proposal was made to establish a biosphere reserve which would include the island of La Gonâve as well as several other areas of singular flora and fauna. These areas should include zones of multiple uses, including fishing. Haiti is at a crossroads regarding management of its ecosystems. Better and more comprehensive conservation legislation is needed, and local participation is important.

Project Route 2004: Conservation and Promotion of Historical, Cultural and Natural Resources
BY GISELLE HYVERT AND LOÏC MÉNANTEAU

The aim of Project HAI/95/010 Route 2004 is to help preserve and give a new lease on life to areas of natural, historical and cultural interest in Haiti, beginning with the northeastern region of Fort-Liberté (due to its bio-diversity and the wealth of its archaeological, historical and cultural sites). The project, sponsored by the United Nations Development Programme (UNDP), centres on the sustainable use of local resources, especially with regard to the development of cultural tourism.

Giselle Hyvert presented the broad outline of the project and the work done by the international, multidisciplinary team in north-east Haiti (collecting data on the geomorphology, hydrology, flora and fauna, fishing and farming, destruction of mangroves as well as the archaeology, history and cultural and social aspects of the Fort-Liberté region). She then called for a tighter legal framework leading to: 1) the creation of a 'Conservatoire du littoral' (coastal conservatory) to manage and protect areas of historical,

G. Cambers

G. Cambers

Above: The main street of Luly with houses leading down to the water's edge.

Adjacent: Seminar participants discuss community issues with Luly fishers.

cultural and natural interest, 2) a biosphere reserve and 3) specific laws to preserve the underwater heritage. The cultural heritage cannot be dissociated from its natural environment.

Loïc Ménanteau explained how data from a wide variety of sources (ranging from archives, descriptions by early voyagers, historical maps and aerial photographs, to satellite imagery – Landsat TM and SPOT) are all crucial in tracing the former coastline and thus locating archaeological sites in the area where the coastline has changed dramatically over the last 500 years. The understanding gained of the development of the landscape by this methodology also serves to determine where various development projects (urban, industrial, tourist etc.) may be allowed and areas which must at all costs be protected. These findings, duly sorted and sifted, are summarized in the Physiographic Map included in the Coastal Atlas published in the framework of the project (see Annex 3). Giving equal importance to land and sea, the Physiographic Map enables the authorities and developers alike to ensure responsible sustainable development.

The Luly Region: Population and Economics
BY MICHAÈLE SAINT NATUS

The people of the fishing village of Luly are generally better organized than those of other Haitian villages of the same size or larger. Several engineering projects have been undertaken by the local community, such as the paving of the main access road and the piping of drinking water. Approximately fifteen upper-class weekend houses have been built in the immediate area, and there have often been land disputes for various parcels. A reforestation project was undertaken during 1987-88 in the region of Cadine. About 200,000 seedlings were planted, and a survival rate of 87% was noted. On the other hand, there are only sporadic data concerning fishing activities, with no long-term data even though there is a local fishing cooperative and several commercial salesmen. Luly's largest market is Port-au-Prince. The local fishermen would like to have freezers and refrigerators in order to preserve their catches longer before sale. The fishing effort has been estimated at approximately 5-10kg/day/man with fishing consumption at 3.6kg/person. While there is some agricultural activity, most people do double duty as farmer-fishers, depending on the season and individual capabilities. Immigrants from other areas as far away as Les Cayes have settled in Luly. There is some tourism potential in the area, especially the Arcadins Islands. Crops in the area include watermelons, lemons and bananas, but there is relatively little livestock raised. The sale of corals and shells represents only a very small industry.

Coastal Management in the Dominican Republic
BY FRANCISCO GERALDES

The coastal area has always been under increasing pressure from fishing and other activities, but now the potential impacts of tourism must also be considered. In the 1990s, Dominican scientists started to publicize environmental problems in the press, thus encouraging a change in the opinions and attitudes of the government and general public. The Dominican navy was assigned a major role in coastal management, contributing toward the creation of the 'Green Battalion' with the navy in charge of enforcing

marine and other coastal regulations, and the army in charge of purely terrestrial matters. Both of these armed forces, however, needed training in environmental enforcement. As these servicemen are already paid, there are no costs involved in such environmental management. Research was eventually undertaken at universities in order to: (i) establish a network of monitoring sites (in the CARICOMP* project); (ii) conduct an inventory of the collection at a site at Montecristi; (iii) help the Ministry of Foreign Affairs regarding the ratification of treaties. The Fundación MAMMA and its partners have promoted conservation of the coastal environment, e.g. through the Parque Nacional del Este and Parque Submarino la Caleta. The Dominican Republic and Haiti have had similar human-induced problems regarding their coastal resources: overexploitation, pollution, and others. There are, however, perhaps more tourism-related impacts in the Dominican Republic.

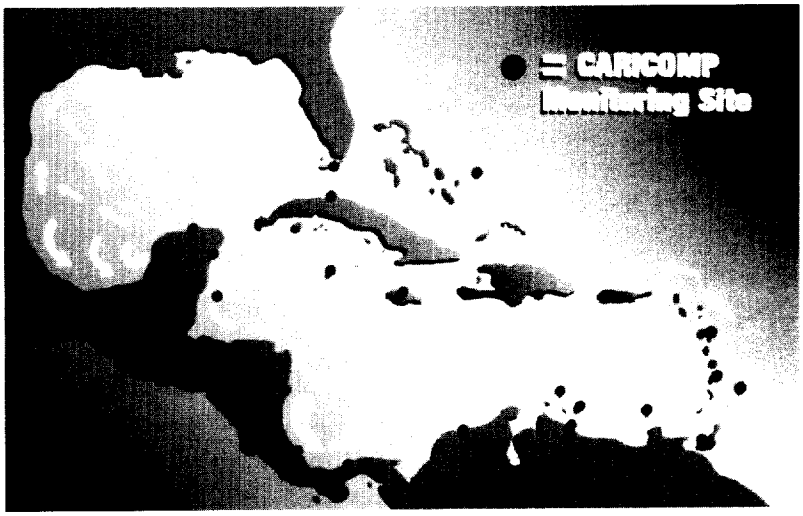
Coastal management in Jamaica
BY PETER ESPEUT

The South Coast Conservation Foundation is dedicated to integrated coastal management, especially in the area of Portland Bight (west of Kingston). There are numerous important resources in the area as well as many fishers and fishing villages. This area is one of the most overfished in the English-speaking Caribbean. As a consequence, fishers must now travel further and expend greater fishing effort. There are reefs damaged by dynamite, extensive seagrass beds damaged by seines and trawls, and an increase in water turbidity; as well, turtles are hunted considerably. The main resource users (fishers, farmers and foresters) are mostly poor and illiterate; their skills, community cohesion and environmental awareness are not developed. Access to resources in the area is open to all. A joint management approach, i.e. by the government and the people, has been followed. The government, in reality, does not have the wherewithal nor the ability to manage these resources. Groups have been formed to improve community cohesion. Two associations are in existence, one of them 50 years old and with a membership of only old men. The need was therefore felt to start another (with a situation similar to that in Luly). The fishers chair meetings, collect dues, and lease beaches from the government. Membership of the local management council counts 15 fishers, two sport fishers, an urban development corporation, the port authority, two Jamaican cooperatives, the police, coast guard, and the National Resource Conservation Authority. The local fishers are encouraged to turn in those breaking fishing regulations.

Various methods used to help reduce the harmful effect of the overall fishing effort include: (i) reduce destructive fishing methods; (ii) increase net sizes and set minimum mesh sizes; (iii) develop a fish nursery area; (iv) establish limited entry systems, such as the 'grandfather' licensing system, issue no new licenses and only one license for every three who abandon the fishery.

Coastal Productivity in the Caribbean
BY JEREMY WOODLEY

In Haiti, there is a need for a better understanding of the coastal and marine resources, of their present value in productivity and biodiversity, and the effects of past and present human disturbances. Habitats should be mapped, described, their condition assessed, and routine monitoring established in key areas. Membership in CARICOMP is completely open, requiring only a commitment to do the monitoring work and to send data to the Data Management Centre in Jamaica. The institution collecting the data is free to use them as they wish. The project can assist new members in obtaining basic monitoring equipment and, through its network, in communicating with other Caribbean marine research institutions. Shortly, it is expected that CARICOMP will form the basis, in the Caribbean, of the Global Coral Reef Monitoring Network**. This will help to establish



Map of CARICOMP coverage. Arrows indicate prevailing currents (after M.J. Shulman and E. Bermingham).

* *CARICOMP, the Caribbean Coastal Marine Productivity project, is cosponsored by the MacArthur Foundation and other USA sources, as well as by UNESCO.*
** *Co-sponsored by IOC of UNESCO, IUCN and UNEP.*

country-wide monitoring of reefs and associated systems, at a less intensive, more easily applicable level than that prevalent in the project. Other Caribbean countries share these needs, but few of them have made much progress in meeting them. Haiti has no well-equipped marine research institution and only a few marine scientists; these specialists would welcome more contact and collaboration with colleagues in neighbouring countries. CARICOMP is a regional effort by Caribbean marine institutions to assess the productivity of mangroves, seagrasses and coral reefs, and to determine the role of terrestrial influences on them. Its initial focus has been on less disturbed habitats, in order to understand baseline conditions, and to monitor for global change. The association of Haiti with this project would be of mutual benefit.

Study and Reduction of Erosion and Sedimentation in the Watersheds and on the Coast
BY ROBERT CASSAGNOL

The settlement of sediment on the continental shelf depends on the local bathymetry and prevailing currents. Most of these sediments are deposited near shore, but finer particles are carried further off shore. Some sedimentation is part of a natural process, but not the type that is produced from deforestation. Practically all of Haiti's coastline suffers from some type of sedimentation. There is a lack of local knowledge concerning the effects of deforestation on marine resources. The interdependence of resources needs to be explained. Rivers in many areas in Haiti have increased in size and sediment load. Information passed down from colonial times suggest a different use of resources. Haiti's past, as regards agriculture and deforestation, is as follows: 1700 to 1750 – sugar production; 1750 to 1800 – coffee production (systematic destruction of plains and forests); 1800 to 1850 – equilibrium re-established with local farming during early national period; 1850 to 1900 – cutting of tropical hardwoods; 1900 to present – demographic pressure has led to the over-exploitation of trees for fuel and construction material.

Underground Water in Haiti
BY YVELT CHERY

The amount of underground water is always difficult to assess, and a variety of different techniques can be used including those involving geology, geomorphology, and geophysical data. The first data were gathered in 1924, and there have been only sporadic surveys since then. An inventory of water resources in Haiti was recently conducted, and reports are available for six regions. Coastal plain regions provide more than 50% of the country's water resources because they are the most easily reached. Some are heavily exploited and are affected by salt intrusion. Most underground resources are under-exploited. No water resource conservation measures have been taken. In 1974, a law was enacted concerning the responsibility of the Ministry of Agriculture for these resources. However, several other agencies also have the same responsibility both for exploitation and conservation, and this has been causing major conflicts. A lot of information regarding water resources is available, but nothing has been published since 1991. The Ministry of Agriculture has a network of rain gauges and computer models which was put in place in 1989; however, at present it is not functioning.

Coast and Beach Stability in the Caribbean
BY GILLIAN CAMBERS

COSALC* aims to extend its programme into the Greater Antilles. The goal of the project is to improve the in-country capability to measure, assess and manage beach resources within an overall framework of integrated coastal management. In 1982 the smaller islands of the region approached UNESCO because of beach erosion and its potential impact on tourism in the area. Assessments and workshops were conducted in order to define country needs and to determine problems. In cooperation with government agencies, NGOs, community groups and schools, monitoring programmes were started in each island to measure the nature and extent of beach changes. Information from the monitoring programmes is being used to take the necessary remedial, planning and educative measures so that coastal erosion problems can be reduced in the future. Erosion is a function of natural processes as well as human intervention. Certain sand beaches have retreated inland more than 20m following hurricane events and while some recovery has been experienced, most beaches have not fully returned to their pre-hurricane levels. Coral reef degradation and die-offs, as well as sea-level rise, may be increasing beach erosion.

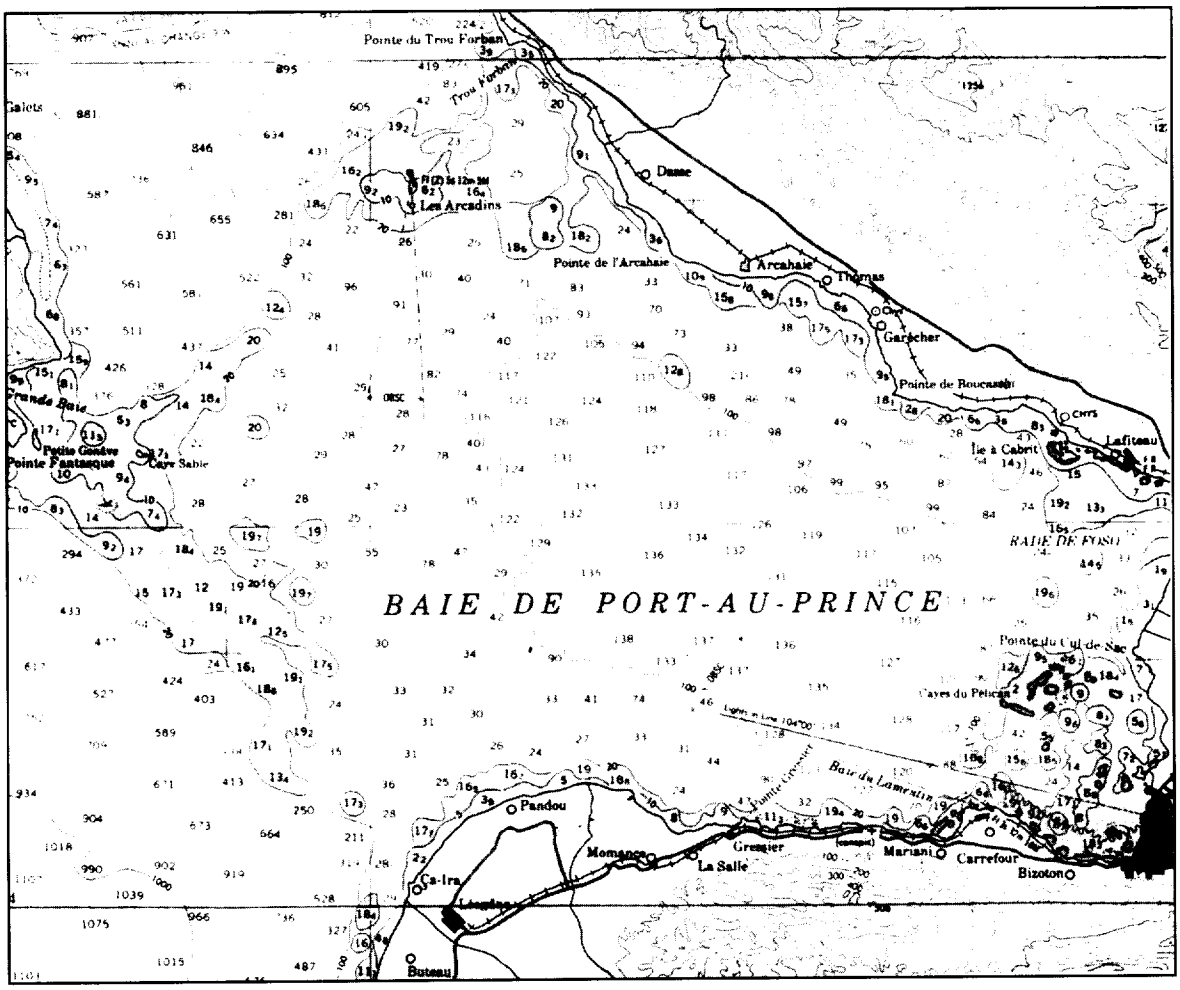
* *The COSALC project on Coast and Beach Stability in the Smaller Caribbean Islands is co-sponsored by UNESCO and the Sea Grant College Program at the University of Puerto Rico, Mayagüez.*

Hydrology and Water Dynamics of the Caribbean Sea, with Particular Reference to the Regions of Haiti and to the Bay of Port-au-Prince
BY SABRINA SANDERSON

There are very few data and information concerning Haiti's hydrology and water dynamics in the country's territorial waters. There is a 1-5°C temperature difference in the Gulf of La Gonâve area with very small changes in salinity. The average rainfall in Haiti is approximately 1300mm, with most rain occuring during the month of May. The Trade Winds (blowing at 4-8 m/sec) are usually from the northeast from December to May. Coastal winds affect general circulation patterns, especially in the Windward Passage. The circulation is affected by the following factors: (i) hurricanes, (e.g. those of 1963, 1964, 1966 and 1980), (ii) bathymetry: two shallow-water sills approach either side of La Gonâve Island and restrict circulation; (iii) hydrography: causes of potential upwelling. The tidal circulation around the bay appears to be from north to south at approximately 0.2m/sec., whereas the Caribbean average tends to be closer to 0.5m/sec. Questions were raised concerning the availability of any tide gauge records, or wind data, for anywhere in Haiti. It was also pointed out that the hydrology of the bay is such that water (and pollution) tends to be retained. Land-based sources of pollution must be addressed.

Omegalpha Outlook
BY ALEXANDRE DE LARYSSA

Haiti has certain industrial and tourism-related problems as concerns the coastal environment, with virtually no governmental institutional capacity in place. There is a need for a depository for coastal information. A definition of what is to be considered the coastal region would have to be determined. The aesthetic treatment of the coast was found to be severely lacking in Haiti. Some type of coastal management authority should be established and placed under the control of the Ministry of Environment.



Map # 26AHA26181: Gulf de la Gonâve, 20th Edition (27 May 1995); Defense Mapping Agency, Hydrographic and Topographic Agency, USA

Summaries of Group Discussions

Haiti's coasts – the pilot project

This session started with a hard-hitting summary of the impacts and degradation suffered by the coastal environment, impacts that for some resources go back to over 200 years. Some of the points raised were also confirmed from recent field work conducted in the study region. Also highlighted was the very great resource potential of the coastal region, particularly if it were better managed.

Resource inventory as an input to management and monitoring is an important starting point and, although Project Route 2004 focused more on resource inventory for tourism development purposes, the presentation clearly illustrated how modern technology can quickly and accurately provide these data. This is an approach to be adopted for the pilot project.

Within the study area, three zones were identified. A central, heavily farmed area where issues of land tenure may have already been largely settled and, within the limits of the techniques used, sustainability is not influenced by land ownership. On either side of this area are two large resources (marine and mountain) that are largely common property, open access resources, where the pressures for conservation are much reduced because of uncontrolled competition. Resolving property right issues in these zones will be fundamental to developing management and habitat restoration programs.

There is also much that is unknown in the area regarding resource use that needs to be addressed. Which areas are exploited and by whom, what are the current rates of exploitation, what are the community profiles of the resource users, and what is the socio-economic framework within which resource exploitation occurs?

Discussions also focused on the village of Luly and its potential as the location of the pilot project due to the fact that the local fishermen are fairly well organized, it is located in a 'representative' area of the Haitian coastal zone, and the area currently has the country's highest concentration of coastal tourism activities.

The project must address: over-fishing, loss of biodiversity, the stopping of sedimentation and nutrient pollution from sewage contamination and coastal erosion problems. A serious review must be made of alternative types of employment for local inhabitants in order to provide increased income and to aid in their social and economic development. Projects such as community-based tourism may be appropriate and the scope of the project needs to be defined.

UNESCO coastal projects: CARICOMP and COSALC

During a discussion regarding the identification of possible CARICOMP and COSALC sites for Haiti, it was decided to adhere to the recommendation of the FoProBiM that an initial site be established at Trou Forban. Reasons for this included a lack of equipment and of trained personnel and the fact that FoProBiM is already working in that area. It was also agreed that Quisqueya University should play a role.

Haiti's involvement in the regional programmes was agreed by everyone to be of utmost importance. The question was one of timing. It was decided that, although there is an apparent lack of trained individuals, monitoring should commence anyway in order to at least begin gathering some baseline data. A slow and cautious approach to the project was recommended. The question has been raised as to whether UNESCO could support some activities of the implementing institution, possibly through extra-budgetary funding.

Haitian counterpart institutions

Among the entities represented at this meeting, two expressed interest in participation in CARICOMP and COSALC activities: FoProBiM and Quisqueya University. The former is headed by a marine biologist, Jean Wiener, and has access to boats and diving equipment. It has office space, transport, a large team of volunteers, and wishes to work in monitoring the coastal environment.

Quisqueya University does not yet have a coastal programme, but is interested in developing one over the long term and, for this reason, would like to be associated with coastal studies.

Many institutions will need to be incorporated in an ICM programme. Questions were raised as to how best to develop these institutions and use them to their greatest potential.

Study sites

Over the next few years, FoProBiM will be working in the Arcahaie area and is also an advocate for the establishment of a CARICOMP site there. There are some small fringing mangroves, with seagrasses off-

shore of them, both of which may be important fish nurseries. Other important seagrass beds can be found at Les Arcadins. Fringing coral reefs are found in the northern part of the area.

Larger mangrove forests are found further north (Artibonite River outlet, and north-eastern Haiti) and along the southern peninsula (Ile à Vache, and Baie de Baradères). These might make good CARICOMP and COSALC sites, but are much less accessible from Port-au-Prince. Perhaps the Baie de Baradères could be worked in collaboration with volunteers from Les Cayes.

Coastal problems

The lack of scientific data relevant to the coasts was stressed. This has several important implications for the future management of the coastal environment in at least three domains.

1. *Biological*: Most marine animals, in their juvenile stages, are dispersed and develop in the surface and sub-surface waters. How currents affect their dispersal is important in the study of the life history of exploited animals.
2. *Waste disposal*: At present most wastes end up in the sea. What happens to them once they reach the sea is unknown. The planning of adequate waste disposal can only be done with a good understanding of water circulation.
3. *Run-off*: Currently river discharge has two impacts, i.e. increased sedimentation and increased freshwater input. An understanding of what happens to this freshwater is important in addressing its impact, monitoring and management.

Underground water

Freshwater is a valuable but limited resource. There is a long history to land degradation in Haiti and its influence on the freshwater resources of the country, an influence that still has a major impact on the replenishment rates of underground aquifers. It is unclear what level of ongoing monitoring is taking place, and there is a need to collect data on rainfall monitoring, river flows, pollution and salt intrusion. Problems regarding the computer modeling package were mentioned. Comments were made regarding lack of management caused by inter-agency conflicts, failure to consult the Ministry of Agriculture concerning developments that affect water resources, lack of control regarding illegal extraction and inappropriate development within water catchment areas. There are too many agencies with authority over water resources; a single agency should be identified and placed in charge.

Socio-economic development and institutional policy

The two presentations from the Dominican Republic and Jamaica highlighted very different approaches to the management of coastal resources, i.e. enforcement with inputs from the military (top down) or from the people (bottom-up). One addresses fisheries specifically and the other does not. Both seem to be developing and working although the institutional elements for implementation are very different and are, of necessity, country-specific.

There is another level of institutional policy that was highlighted – the facilitating role that the central government plays in improving resource management. This role was mentioned by several speakers and fishers in Luly, but was not well developed. In the Dominican Republic a national council plays the role of a coordinating and enforcement mechanism, whereas in Jamaica it appears that the facilitating role is currently evolving.

In Luly, the local fishers are represented by two organizations; this social cohesion lends itself to the promotion of resource management. However, there are many resource users who are not represented. The development of additional fishing organizations in the region as well as associations for the other unrepresented resource users would constitute an integral component in the development of a bottom-up approach.

It was agreed that economic development based on tourism would be a key factor in helping to manage area resources.

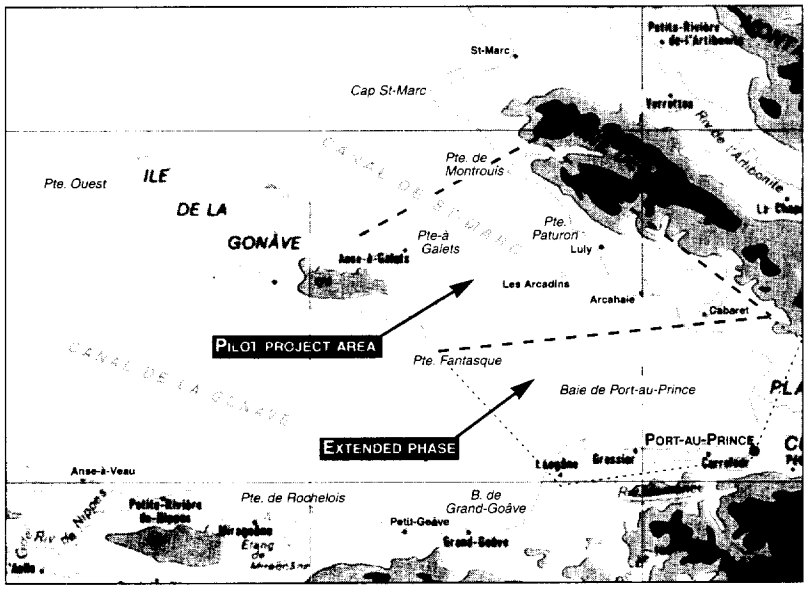
M. Steyaert

Polluted beach in downtown Port-au-Prince with the commercial port in the background.

HAITI'S COASTAL REGION AND THE PILOT PROJECT AREA

Discussion summary

The severe degradation of the country's coastal region was thoroughly reviewed and confirmed during both formal and informal sessions. The socio-economic impacts arising from overfishing, deforestation and pollution are poverty and a much reduced quality of life. Indeed, poverty itself contributes to coastal zone damage. It is also apparent that the deforestation process is one that has a long history, which should be studied in broad terms, having had significant impacts stretching back over 200 years.



Primary focal area of the proposed pilot project. At a later stage, an extended phase might also cover the rest of the Bay of Port-au Prince

The general concept behind the pilot project is to address resource overexploitation in an integrated manner within a specified area. It is anticipated that the lessons learnt and the methods developed will be useful in developing ICM in other coastal areas of Haiti. With regard to the study area, there are limited data available concerning the resource base, levels of resource use and the socio-economic framework within which their exploitation occurs.

To facilitate the collection of data, currently underway, concerning the resource base, satellite imagery is being utilized to produce GIS-based resource data atlases, which should include an assessment of development potential (particularly tourism). Another important aspect of data collection will be to review literature and to consult with national staff involved in previous project initiatives in the study area and of relevance from other areas. It will also be important to be aware of current government initiatives such as the National Council of Agrarian Reform, the Tourism Strategy and moves to ratify MARPOL 73/78, of other potentially overlapping development aid initiatives and of the wider legal framework of resource exploitation and land ownership.

The pilot project

Study Area

The location of a physical boundary for the project was discussed at length. Its landward limit is defined by the extent of the watersheds. Its linear extent is less easily defined but will fall within the commune of Arcahaie. At this stage it is difficult to be more precise as the resources to be managed and the resource users do not adhere to any political or geographic boundary. If an 'ecological' boundary is discovered, it should be used; if not, the linear extent will be limited by practical considerations but will not be bigger than the Arcahaie commune. The seaward boundary will be similarly determined. Because of the overlap of fishing operations as well as the tourism potential, the area will possibly include a portion of La Gonâve Island. The people of Luly, because of their existing social fabric, could provide a logical starting point for data gathering.

Project aims

The principal aim of the pilot project will be the achievement of sustainable socio-economic development of the inhabitants within the study area by: i) improving the management of natural resources; and, ii) promoting sustainable economic development.

Project objectives

The pilot project should focus on improving resource management and sustainable development. This will require a programme of problem-driven research to provide inputs for the management and development process. The problems resulting in economic and social underdevelopment so far identified are:

a) overfishing and possible resource limitations;
b) deforestation and resulting erosion;
c) limited investment in non-extractive economic activities;
d) pollution (sewage, solid waste and industrial);
e) property rights issues;
f) a reduction in biodiversity; and
g) saltwater intrusion into groundwater.

Project activities

These should focus on resolving issues of (i) resource management and (ii) the promotion of non-extractive development.

Data gathering
There is much that remains unknown in the area regarding resource management; this requires developing a programme of problem-driven research. This will involve both socio-economic and resource exploitation investigations and must be conducted by social and resource-oriented scientists experienced in management issues. It is essential that the project address the identified problems in a people-oriented way.

Co-management
The essence of the project should be to address resource management issues through the sharing of management responsibility with the resource user. This will necessitate a facilitating mechanism to strengthen existing resource-user organizations and to facilitate their formation when they do not exist. The development of these organizations will require considerable dialogue including, as necessary, for the provision of information concerning resource management. Dialogue, as the word indicates, must be a two-way process and will include not just resource users but also local and central government officials to ensure the necessary support. Valuable two-way experience could be gained from the exchange of information between, for example, fishermen from Jamaica (regarding institutional development) and the Turks and Caicos Islands (regarding resource use patterns).

Tourism
The study area is considered to have tourism potential (Les Arcadins, diving at La Gonâve Island, sports fishing and small-scale property development) that needs to be reviewed in the light of the government strategy for tourism. Maximum involvement of local people in tourism development is desirable.

Fisheries
Because of the limited coral reef habitat available in the area, the option of providing artificial reefs may be attractive and should be investigated. The possibility of utilizing such artificial reefs as 'protected areas' to enhance fishery recovery should also be explored with the fishers. There is also a limited commercial potential with currently underexploited deep-water demersal and nearshore pelagic resources. Their exploitation should be explored cautiously and must not introduce a significant debt burden on the fishers.

Marine scientific investigation
A serious study of the oceanography in the Gulf of La Gonâve and in the wider Port-au-Prince Bay would be important from the point of view of waste management, as well as to facilitate the assessment of impacts from run-off. Towards this end, it would be necessary to study wind patterns, tidal ranges and flows, surface and sub-surface currents, dissolved oxygen, water densities and river discharges as well as the distribution of pelagic and demersal fishes. The extension of this research to other contaminated bays should also be considered. This work will require a research vessel and the reinstatement of tide gauges with an adequate budget. The activity should be continued by a local research institution. Such an institution, versed in coastal matters, must be identified to manage and distribute the data gathered.

Forestry
Reforestation has usually been considered as a means to improve a degraded habitat. This view needs to be expanded to include the sustainable economic exploitation of forests for fuel and timber and, eventually, tourism.

Other inputs
Engineering solutions to immediately reduce coastal erosion may be appropriate. These may possibly be better tackled as a civil engineering project.

III. Conclusions and recommendations

A. General

Steps should be taken to:

- develop and increase watershed management to reduce erosion and sedimentation and, where appropriate, to re-establish degraded habitats;
- develop and increase fisheries management to improve yields to sustainable levels and to improve the collection of fisheries data;
- improve the collection of scientific data within the framework of long-term monitoring programmes;
- investigate the region's groundwater resources;
- collect macro- and micro-socio-economic data to guide future resource management;
- ensure the full involvement and participation of all stakeholders in the project design and implementation;
- investigate and monitor the origin and fate of pollutants and garbage, with particular emphasis on the Bay of Port-au-Prince, and set up a garbage and pollution control. The existing UNEP programme, based in Jamaica, addresses pollution in large bays; Haiti could join this, but at a governmental level.

B. Freshwater management

Current management of watersheds and extraction of ground water has resulted in a deterioration in the supply and quality (due to pollution and salt-water intrusion). The main problem is an institutional one, in that water management and extraction is handled by four competing agencies. It is therefore recommended that:

- management should be the responsibility of one agency which should be provided with the necessary technical and financial resources,
- data concerning water resources needs to be published, and
- the managing agency should be semi-autonomous in order to help develop laws and to provide enforcement measures.

C. Regional cooperation

Steps should be taken to encourage Haiti to become involved in CARICOMP and COSALC programmes in order to establish useful contacts and collaboration with counterparts in neighbouring countries.

D. Institutional requirements

To improve the integrated management of the coastal zone it is recognized that certain institutional developments are required. The following conclusions were drawn:

- A proposal to create an agency to implement coastal zone management was considered, at this time, to be too ambitious and costly for the country.
- Instead, an inter-ministerial council involving all those having an active interest in the coastal zone should be established. It is recommended that this council be created under the authority of the Office of the Prime Minister with the Ministry of Environment as the lead agency.
- It was also recognized that the Ministry of Environment should be strengthened by creating units for the coastal zone, watershed management and pollution control. These would be staffed by scientists, field officers and inspectors who will keep in touch with what is happening in the country.

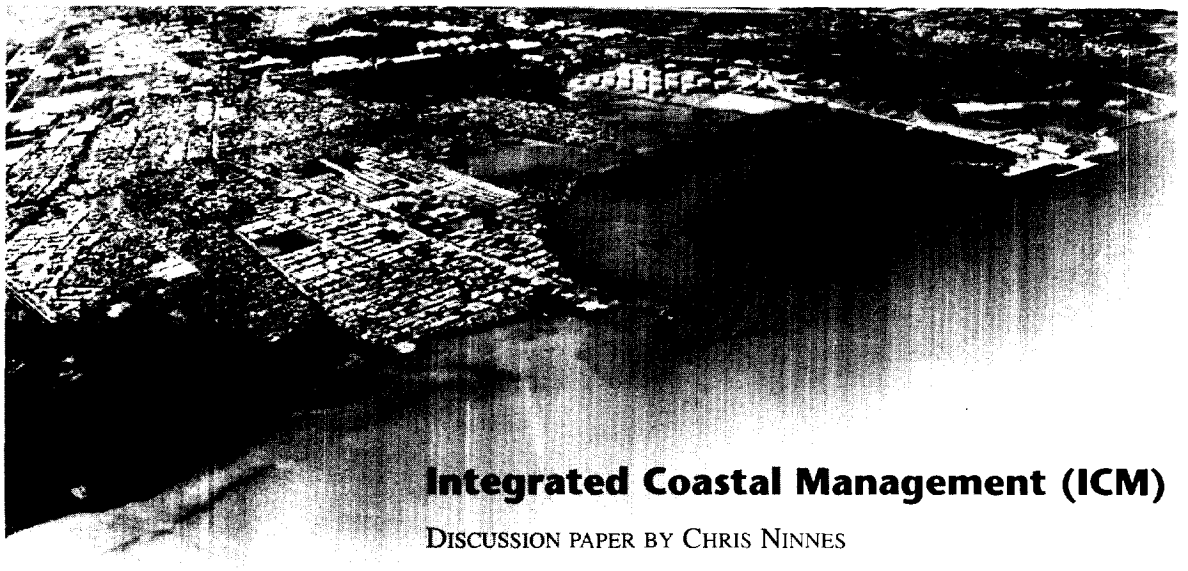
E. Training and education

A major training and education programme must accompany the implementation of project activities.

F. Implementation of the Pilot Project

(as described on pages 16 and 17)

It should be noted that, at the end of this seminar and working sessions, an agreement was reached between the Foundation for the Protection of Marine Biodiversity and Quisqueya University to cooperate in matters related to coastal and marine activities.



M. Steyaert

ANNEX 1

Integrated Coastal Management (ICM)

DISCUSSION PAPER BY CHRIS NINNES

Introduction

This paper briefly outlines basic strategies and methods that can be used to organize natural resource management within coastal zones. It describes the main economic activities of coastal zones based on living and non-living natural resources and suggests ways to organize their management within a holistic framework.

It is basic to coastal management to recognize how strongly activities in one sector or coastal region affect the activities in another sector or area. The sea is impacted by inland events such as effluent discharges in water courses, nutrient runoff from agricultural fertilizers and increased siltation as a result of deforestation. Similarly the sea also strongly affects the coastal zone. Storm events resulting in flooding or oil pollution carried into the coastal zone have considerable impact. Natural defenses (beaches, mangroves and coral reefs) are important in mitigating against storm waves and shore erosion.

The inter-relations between events in one sector and their impact elsewhere are also more subtle. Deforestation of lower hinterlands may not have an appreciable effect on coastal processes. Deforestation of upper mountain slopes exposes more fragile soils prone to erosion and greatly speeds up the flow of rainfall to the coast. This has two inter-related effects; increased erosion and a reduction in long-term water availability (both for agriculture and direct human consumption). A reduction in forest cover may also directly reduce precipitation through a reduction in both mist interception and air turbulence which promotes precipitation. Unsustainable forestry results in a reduction in economic activity, and displaced labour will migrate to other areas, either within the coastal zone or as urban migration. This results in increased pressure on other resources and the social problems of overpopulated cities.

The coastal zone – issues and problems

The coastal zone may be defined as the area at the boundary between the land and the sea and may extend inland and seaward to a variable extent, depending upon the objectives and needs of the particular programme. For the purpose of the proposed pilot project, the boundaries extend seaward to the edge of the drop-off where waters become too deep for artisanal fishing (i.e. excluding offshore large-scale commercial fishing for pelagics and demersals) and landwards to include mountain watersheds.

There are a number of underlying factors resulting in overexploitation within the coastal zone. They can be broadly classified as being results of:

- high rates of population growth;
- poverty exacerbated by dwindling resources from unsustainable exploitation of fisheries, agricultural land and forests, often as a result of the common property, open access nature of the resource;
- poverty exacerbated as a result of resource degradation from unsustainable development and pollution;
- lack of employment opportunities and/or socio-economic opportunities to avoid resource overexploitation;
- lack of awareness about sustainable resource management amongst stakeholders and policy-makers;
- lack of a cohesive, inter-departmental government approach to management and development of resources within the coastal zone.

If coastal zones are to remain productive their management requires a holistic approach. This involves developing a multi-sector management programme so that all stakeholders and all concerned government agencies are involved. The importance of broad public support for development and management measures cannot be overemphasized.

The following main uses for the coastal zone, which point to the need for an integrated management framework, can be identified:

- urban settlement (60% of world's population, fastest growth);
- industrial development (requires access to marine transport; uses sea water, is shipping-related, uses sea as raw material);
- waste disposal (sewage, industrial, pesticides, fertilizers, land-based sources of marine pollution = 75% of total);
- shore protection works (inappropriately constructed);
- ports and marine transportation (oil and gas, shipping, fisheries, military);
- land transportation infrastructure (roads, bridges and causeways often threaten intertidal habitats, but are corridors for future development);
- water supply projects (fisheries and mangroves affected);
- sea fisheries (importance often underestimated, production is more than world beef and sheep combined);
- aquaculture (shrimp etc. need clean water, free of pollution);
- coastal mangrove industries (limited);
- coastal agriculture (land conversion, pesticides and fertilizer runoff);
- coastal forestry (deforestation);
- tourism development (requires good resources, no physical or social disturbances);
- sand and coral mining (limited possibilities without threatening the resource and coastal habitats); and
- national security (customs, naval, coastal airfields).

Coastal management in Haiti

A number of management and development issues can be suggested which, if addressed effectively, would probably contribute directly to the socio-economic well-being of the coastal population and to the general sustainable economic development of Haiti. Specifically (and in no particular order), these are:

- improving fisheries management and productivity;
- increasing tourism revenue;
- introducing sustainable forestry practices;
- habitat improvement of degraded forests;
- review and improve existing agricultural practices;
- improving freshwater management;
- controlling pollution and the alteration of shores and beachfronts; and
- promoting the conservation of critical habitats and biodiversity.

The implementation of coastal resource management requires several national actions:

- a policy commitment to support coastal resource management (including setting policy goals and objectives, legal authority, an enforcement mechanism when appropriate, land tenure and property rights);
- an understanding of resource management issues and a commitment to their participatory management by coastal stakeholders;
- establishment of a government office for co-ordinating coastal affairs;
- initiating a system for review of development proposals and projects, including their environmental impact;
- accumulation of biological, technical and socio-economic information; and
- the design and development of effective planning and integrated coastal management (ICM) programmes.

ICM programmes focus on the management of the physical development process using planning procedures and government regulations. Development planners, particularly, must recognize that modifications within the coastal zone can have adverse impacts throughout the entire zone (marine and terrestrial).

Resource management (fisheries, agriculture etc.) has already been mandated to various agencies, and there is no necessity to change this. Rather, ICM should be seen as a multi-sectoral process created to improve development planning and resource management through integration, co-operation and the co-ordination of activities.

M. Steyaert

Adjacent: Mangroves in relatively healthy condition (La Gonâve Island). Below: Mangrove degraded largely by coastal water pollution (Port-au-Prince Bay).

M. Steyaert

Coastal management in the pilot project area must address the specific problems of common property and open access resources which result in overexploitation. In this context, incentives to exploit sustainably are negated because:

- there is no guarantee that setting aside resources for the future will benefit the conserver; and
- since anyone can exploit the resource there are no economic incentives to restrict exploitation (and few alternative occupations); too many people become 'locked' into exploiting the resource, promoting overexploitation.

Sustainable use should ensure that a resource will not be harvested, extracted or utilized in excess of the amount which can be regenerated. In essence, the resource should be seen as a capital investment with an annual yield; it is the yield that should be utilized and not the capital investment. The latter is the resource base, the sustaining of which assures annual yields in perpetuity.

Critical habitats and their management

The common property resources to be managed in the pilot project area are the fisheries and the forestry resources. Within these two domains are to be found a number of critical habitats that, because of their importance, require particular attention. These are:

Upland mountain forest

Because these resources are found in areas with high rainfall and steep slopes their removal does more to exacerbate erosion. These habitats also play a critical role in mist interception, another important source of water. Because of the importance of these habitats it is essential to plan for their immediate restoration through vigourous reforestation. Their future management will ideally be based on non-extractive practices.

Mid-range mountain forest

It is also important to maintain and enhance vegetation cover in these areas but their future management should be based on sustainable extraction geared to needs for fuel, building construction, furniture making and other commercial uses.

Mangrove forest

Mangroves play a prominent role in the production of leaf litter and detrital matter which provides valuable inputs of carbon into the marine environment. They also provide physical habitat for many juvenile stages of commercial fish, crabs and lobsters, nesting sites for birds and important foraging grounds for juveniles and species that feed over inter-tidal mudflats. They also provide an important buffer against storm-surge and in stabilizing shorelines. In the study area mangroves are stunted (largely because of the lack of estuarine conditions) and play a lesser role than in many areas. They are, however, important in shoreline protection and their presence along the shores of some of the more intensely farmed

coastal areas may be in recognition of this function. Management should seek to prevent destructive removal and possibly replant denuded areas.

Seagrass beds

These are found in shallow waters and are highly productive areas. The productivity stems from both their own growth and the productivity derived from the many epiphytes associated with them. Seagrass beds play an important ecological role, providing a substantial amount of nourishment, nutrients and habitat. They attract a diverse biota and are important nursery areas. They also help trap and bind sediments, but are damaged by excessive turbidity and pollution. In the study area, nearshore seagrass habitats are being severely impacted by sedimentation, and their future management will depend largely on reducing this impact.

Coral reefs

These are also amongst the most productive systems in the world, largely because of their ability to extract limited resources from the surrounding waters and because of the reefs' ability to recycle productivity within the system. Coral reefs have important economic outputs. They provide important habitats and resources for fisheries, support important tourist industries and form natural protective barriers against storm waves as well as providing beach material. They are highly susceptible to overfishing, sedimentation, pollution, discharge of large volumes of freshwater, physical damage (tourism and hurricanes) and eutrophication (from sewage and agricultural runoff). Coral reefs are not well represented along the shoreline of the study area, although they are more common around Les Arcadins Islands. The reefs that were observed demonstrated serious impacts from sedimentation; and considerable die-off had occurred. They were also characterized by an almost complete absence of common food fishes. Their future management relies on reducing sedimentation stress and improving fisheries management.

Classification of marine habitats within the pilot project area

Satellite imagery should be investigated as a means to provide resource inventory maps of the study area. Satellites collect data by measuring electromagnetic radiation. When electromagnetic radiation (generated by the sun or by the production of radar or laser waves) falls upon the earth's surface some of the energy is reflected. Surfaces also naturally emit radiation, mostly in the form of heat (infrared radiation). The reflected and emitted radiations are recorded on either photographic film or by digital sensors carried on either a satellite or aircraft. Since the intensity and wavelength of this radiation are a function of the surface, each surface is described as possessing a characteristic 'spectral signature'. If a sensor can distinguish different spectral signatures, it is possible to map the extent of such surfaces.

Unfortunately, data derived directly from satellites are not packaged with neat labels indicating that this is a coral reef or this is a rain forest. Rather, the digital data must first be calibrated by collecting field data describing specific habitats. During the computer analysis of the digital satellite data the operator will input the field data, allowing the computer to identify all other areas with a similar 'spectral signature'.

Prior to this seminar, the author of this paper undertook field work (with Jean Wiener) to collect classification data of marine habitats. Three mangrove areas and nineteen marine areas (ranging from $2m^2$ to $45m^2$) were surveyed.

Classification of data

Mangroves

In the study area mangroves were restricted to a narrow fringing band straddling the intertidal zone. Only dwarf forms of the red mangrove were observed, reflecting their largely marine habitat; in the absence of freshwater, Caribbean mangroves rarely attain appreciable heights. Mangrove height and density probably restrict their economic importance, when compared to many other regions where they are used for construction, charcoal production etc. They do, however, play an important role in shoreline stability, particularly from storm-surge.

Seagrass beds

They are found throughout the study area. Along the mainland they are restricted to shallow water (<3m), usually in front of the mangrove areas observed. Water turbidity probably prevents their colonization of deeper water. Mainland shallow-water seagrass beds would appear severely stressed by turbid water, being heavily coated by a film of sediment. In deeper waters (to 15m) the benthos was dominated by

soft muds and a range of calcareous algae. In water deeper than 12m, algae density was sparse. The muddy bottoms were characterized by the presence of many (20/sq. m) polychaete and crustacean burrows. Occasional dead and dying sponges were observed at certain sites.

A slightly deeper distribution of seagrass is found around Les Arcadins Islands, where water clarity is better. Seagrass beds were also associated with varying amounts of other marine algae, the marine algae predominating with increasing depth (<18m).

Coral reefs

Coral reefs were poorly represented along the mainland coast. One small shallow (<3m) patch reef was observed in very turbid water. The reef was dominated by various species of the green algae *Caulerpa* (which prefer a firmer substrate) and the live hard corals (orders Milliporina and Scleractinia) present were severely stressed and/or dying from sediment load. Interestingly, the reef also had a number of soft corals (order Gorgonians) present; such were not observed elsewhere during this period of field work.

A small fringing reef was surveyed at Trou Forban to 45m. Water clarity was good and the reef was in excellent condition.

Several reefs were also surveyed at Les Arcadins Islands. These were found in waters down to 12m and were dominated by hard corals and algae.

General observations

Throughout the marine classification work, habitats were characterized by an almost complete absence of medium to large food fish species. For many species (e.g. grouper and snapper) juveniles were also absent. This is highly indicative of overfishing and the uncharacteristic absence of juveniles suggests recruitment failure may also have occurred. A solitary lobster was observed at Trou Forban and six on a small patch reef to the north of Les Arcadins (four were immature juveniles, cephalothorax length = 35mm). Conch were generally absent apart from one site to the south of Les Arcadins where a number of juveniles were observed. No mature conch were seen.

Apart from shallow reef habitat around Les Arcadins and the fringing reef at Trou Forban, no other healthy reefs were observed. In fact, there appears to be a general lack of reefal habitat throughout the study area.

Future development and management inputs

Tourism development

Because of the extremely limited presence of coral reefs and large fish it is unlikely that significant dive-related tourism will develop. The Caribbean is valued as a diving destination and the pilot study area would not compete alongside other destinations (and possibly other areas in Haiti not yet observed).

Fisheries Management

The limited amount of habitat available for many commercially important fishes and lobsters (despite there being a reasonable abundance of seagrass beds commonly used for foraging) does suggest that habitat enhancement could play an important role. Artificial reefs composed of vehicle and truck bodies could significantly enhance fish production. Port-au-Prince has an abundance of suitable material whose removal would also have beneficial aesthetic, health and road traffic spin-offs. Trials with artificial lobster habitats may also prove beneficial.

As artificial reefs would add new habitat it may be possible to encourage fishermen to not fish certain reefs establishing small protected areas for possible stock enhancement. This is an issue worthy of discussion.

Mr. Ninnes was a UNESCO Consultant in Haiti: he also collaborated with the Centre for Tropical Coastal Management Studies, University of Newcastle-upon-Tyne, UK.

UNESCO's CSI and the Newcastle Centre are cooperating to further develop training materials on the utilization of satellite imagery in addressing coastal problems. The Centre is producing a 'Remote-Sensing Handbook for Tropical Coastal Management', to be published in 1998. A tool in this venture is the UNESCO WinBILKO software, available with training modules at: http://www.ncl.ac.uk/~ntcmweb/bilko/bilko.htm

The Newcastle Centre cooperates with various other partners in studies, funded by the UK's Department for International Development, to determine the potential economic benefits of remote-sensing technologies. Special emphasis is on the development and management of economically less-favoured countries (including those of the Caribbean region). Project activities are described at the Newcastle website: http://www.ncl.ac.uk/~ntcmweb/remote/ijrscasi.htm

Hispaniola: a joint heritage

BY JOSÉ A. OTTENWALDER

Priorities in bi-national cooperation for the conservation, integrated management and sustainable development of the coastal regions of Haiti and the Dominican Republic

Hispaniola is the only Caribbean island shared by two different independent states (the Dominican Republic and Haiti). It supports the largest human population (15 million) of any single West Indian island. Even as a single island, Hispaniola alone genuinely reflects the Caribbean microcosms of cultural, social, political, economic and language dissimilarities that characterize the region's history, with resulting fragmentation of their societies. However, both countries share the same biodiversity, the same ecological nature, the same island ecosystem. They also share the adverse effects of natural disasters that occur not uncommonly in the region (e.g. hurricanes, earthquakes, floods), causing considerable economic losses and human mortality in both countries. The vulnerability of local economies and populations to the effects of tropical storms (which have increased in frequency and intensity during the last decades) is often aggravated by the reduced security of natural buffers due to mismanagement of coastal areas and watersheds.

Although larger in surface area than the average neighbouring islands, Hispaniola is, on the other hand, not exempt from the economic predicaments and development challenges currently facing small islands in the Caribbean and elsewhere. Both countries are in urgent need of long-term development programmes addressing the multiple-root problems and pressures affecting terrestrial and marine environments. Development and implementation of island-wide land use planning and management strategies for marine and coastal areas are urgently needed. For the achievement of these goals, approaches must not be restricted to the land-water interface, but should include all land-based sources of disturbances generated by human activities inland (e.g. deforestation, watershed erosion, sedimentation) that are modifying natural conditions, creating degradation and reducing the productivity of coastal ecosystems. Furthermore, the adoption of ecological boundaries as a planning tool for biodiversity conservation and development planning should not be overlooked.

Coastal resources are an important part of the economic patrimonies of the Dominican Republic, Haiti and, in general, all the islands in the region. Two of the most significant income-generating industries, tourism and fisheries, depend on them directly. Their wise management, therefore, is essential if the Dominican Republic and Haiti are to meet both economic and ecological goals. Despite the fact that the two countries have co-existed relatively well on Hispaniola, and will continue to do so in the future, little collaboration for environmental management has been attempted and achieved up to now. Again, the environmental issue is a converging point. However, environmental considerations have not been traditionally recognized as a perceptible element in the priority programmes of the two countries. It is obvious that formalization of bilateral trade and commercial exchange agreements are also likely to happen, considering current trends of globalization and the formation of regional and hemispheric markets. It should be difficult to ignore the many valid justifications to incorporate environmental considerations and issues as part of trade and other potential agreements.

J. Ottenwalder

Deforested and drying watershed on the south coast, between Côte de Fer and Grosse Caye.

Many development projects and programmes are currently being planned or implemented in both countries in response to increasingly demanding socio-economic pressures by urban and rural populations. National environmental strategies providing a policy-institutional framework for biodiversity resource conservation and sustainable development are still lacking. Available information is inadequate and often outdated for the development of sound conservation and sustainable development action. Reliable ecological assessments are an important component of ecosystem management implementation strategies. Local resources and capacities are, however, limited. Comprehensive, area-specific marine management and planning are essential for maintaining the long-term ecological integrity as well as productivity and economic benefit of coastal regions. The effectiveness of management actions to protect coastal and marine environments cannot be assessed without scientific analysis and knowledge. Accordingly, comprehensive protection strategies should incorporate scientific principles. Close interaction among scientists and decision-makers is vital (GESAMP, 1990 & 1996)*. Serious consideration of environmental concerns and issues has been neglected often in the past as a result of failures to recognize these principles, and in the absence of suitable environmental policies and knowledge. Timely access to, as well as widespread availability and use of, scientific data would be of significant importance to both countries for conservation of the natural resource base, sustainable economic growth and continuing social stability. Effective negotiation and collaboration between the two countries is hampered by the lack of a common island-wide agenda and strategy approach identifying mutual environmental concerns and benefits.

Opportunities for immediate collaboration and exchange are at hand. Although incipient, some experiences in coastal management are available in the Dominican Republic. A draft territorial organization of the Dominican coastline has been produced by the Government's National Planning Office (ONAPLAN). A Coastal-marine Administrative Council was created by decree for environmental regulation in coastal areas. A master plan and strategy for tourist development areas has also been drafted. A number of marine protected areas are already established. An integrated coastal management (ICM) plan for Juan Dolio-Guayacanes, a tourist sector along the south-central coast, east of Santo Domingo, was developed, and funding has been allocated from the Carribean Environment Programme (United Nations Environment Programme) to extend it. Several ICM plans, involving the most significant coastal regions of the country (Samaná Bay and Peninsula, a proposed biosphere reserve, and the national parks Montecristi, Los Haitises and Jaragua) are currently being completed under the Dominican Republic UNDP-GEF Coastal Biodiversity Conservation and Management Project, executed by the Technical Secretariat of the Presidency's National Planning Office, through the local UNDP mission. Government agencies of the natural resources subsector, provincial and municipal authorities, national and regional non-governmental organizations, academic institutions, local communities, grassroots organizations and users are participating in the preparation of these proposed regional coastal management plans.

The following should be considered as priority needs and actions: development of national sustainable development strategies and policies addressing the existence of binational considerations; strengthening of environmental legislation and policies; establishment of legal advisory and enforcement capacity on environment; building the capacities of institutions and professionals; promotion of broad participation, constituency building, and education on conservation and resource management; preparation of territorial management plans; realization of coastal-marine environment baseline studies; preparation and/or strengthening of ICM plans; adoption and application of ecosystem principles to management and policy; implementation of environmental impact assessment procedures; development and implementation of water resources assessments, watershed protection, water management plans; improvement of sewerage and water treatment technology and regulations; development and implementation of effective pollution control and monitoring; control of beach erosion; reduction of sand use in construction; improvement of fishery and other marine resource surveys, assessments and management plans, including those concerning endangered species.

Dr. Ottenwalder is National Coordinator of the Dominican Republic's Coastal-Marine Biodiversity Project, sponsored by UNDP-GEF.

* *GESAMP: Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (sponsored by IMO, FAO, UNESCO, IOC, WMO, WHO, IAEA, UN, and UNEP); (i) 1990. Report of the Twentieth Session, Geneva, 7-11 May 1990.* GESAMP Reports and Studies, *(41), 32 pp. (ii) 1996. The Contributions of Science to Coastal Zone Management.* GESAMP Reports and Studies, *(61), 66 pp.*

Cultural heritage conservation – a management must

The safeguarding of cultural heritage is an important factor to be considered in the management of a country's resources, both coastal and inland. On this premise, UNESCO has actively sought to assist Member States in projects to inventory sites of cultural and natural heritage, and to establish measures to protect them for the benefit of present and future generations. Such sites, in addition to their value as sources of national pride and cultural identification, provide practical assets as drawing cards for international tourism and for the recreation of local inhabitants.

This annex includes, mainly, an introductory text and some sample illustrations from the Coastal Atlas of North-east Haiti (*Atlas côtier du Nord-est d'Haïti*), published in French as a product of the Project Route 2004*. In the framework of this UNDP-UNESCO project, UNESCO cooperated with the Government of Haiti during 1995-96 in the recruitment of experts from various countries and domains: geographers, legal advisers, architects (specialized in landscapes, cities, historic buildings and museums) as well as experts in archaeology, museology, economics and administration, and a Chief Technical Adviser.

Generally speaking, the interest and participation of the Organization in actions for the conservation of Haiti's cultural landmarks have spanned at least two decades. Specifically, technical and financial assistance was accorded to the work of restoring the La Ferrière Citadel and the Sans-Souci Palace, two 19th century buildings located on the country's north coast and inscribed in the UNESCO-sponsored World Heritage List.

A specialist has been engaged by UNESCO to carry out a feasibility study towards the launching of a project, the major objective of which would be to establish a national system for the inventory of cultural heritage. The study's initial steps are to identify Haiti's resources and needs, as well as the existing documentation on the subject in question, and to set up a schedule for the short-, medium- and long-term implemention of the inventory.

Division of Cultural Heritage,
UNESCO

* *For a brief description of this project, see summary of the presentation by Mme. Giselle Hyvert and Mr Loïc Ménanteau (on page 9). For details on the Atlas, contact Mr. Ménanteau at the address in the List of Participants (Annex 4).*

From engraving of Bay of Fort-Dauphin (now Fort Liberté, Haïti), by M. Ponce, Paris, 1791 (BNF, Cabinet des Estampes et de la Photographie ancienne), included in the Coastal Atlas

Coastal Atlas of North-East Haiti: Environment and cultural heritage of the Fort-Liberté region

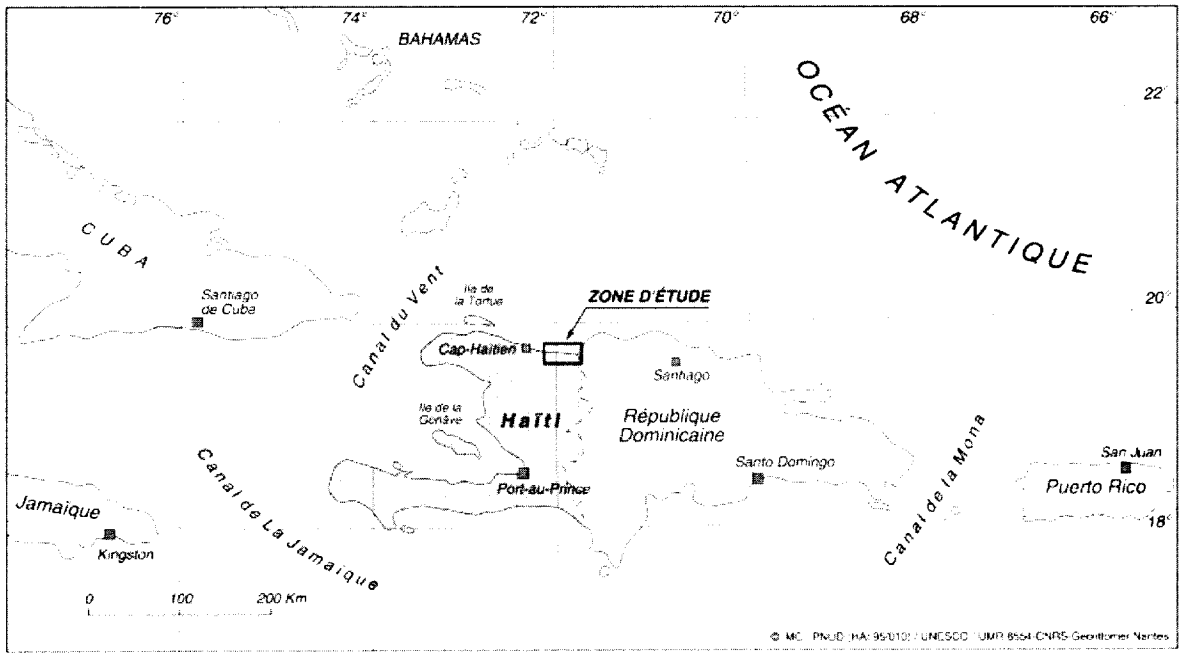
EDITORS: DR. LOÏC MÉNANTEAU[1] AND PROF. JEAN-RENÉ VANNEY[2]

PROJECT COORDINATORS: HAROLD GASPARD[3] AND GISELLE HYVERT[4]

The *Atlas côtier du Nord-est d'Haïti : Environnement et patrimoine culturel de la région de Fort-Liberté* (published in French by UNDP with support from a number of partners) describes by means of imagery and text, distributed equally over some sixty pages, the natural, cultural and historical environment of part of the Atlantic facade of Haiti, which constitutes a real regional entity centred on the Bay of Fort-Liberté. The vast extension of the coastal plain of northern Haiti, rising from the near ocean to the lower foothills which close it to the south, justifies a review of the main aspects of our present knowledge: hydrological types and cycles, from marine waters to running waters; various components of the environment, from soils and their vegetal cover to land and aquatic fauna; cultural geography and historical settlement patterns, especially of the Bay and the town of Fort-Liberté. The analysis of landscapes and their problems is fully integrated, both in time and in space, in the iconographic documents. The Atlas comprises figures in the texts, fifteen tables, four photographic plates, and numerous maps, both early (some twenty 18th century maps and plans) and contemporary (four SPOT images). The nature of the illustrations, at once polymathic and diachronic, is explained by the place of the region in world history and in the natural history of a remarkable environment under constant and increasing threat from all sides. The physiographic map of the littoral (three plates at scale 1/50,000) sums up the dominant features of the geography where five areas, divided into sub-regions, are distinguished and described. The Atlas was conceived and put together as a register in which each piece, from the earliest to the most recent, contains the material indispensable to understanding and undertaking the defense of the present, the preparation of the future and the safeguarding of the past of a singular region which must preserve an environment and a heritage acquired in the course of its successive geographic stages.

1. *Geographer, CNRS researcher (see address in Annex 4)*
2. *Chair of Geography of the Sea, Sorbonne (University of Paris IV), France*
3. *Director of Cultural Heritage (Haitian Ministry of Culture) and Coordinator of UNDP Project 'Route 2004'*
4. *(Former) Technical Adviser (UNESCO), UNDP Project 'Route 2004'*

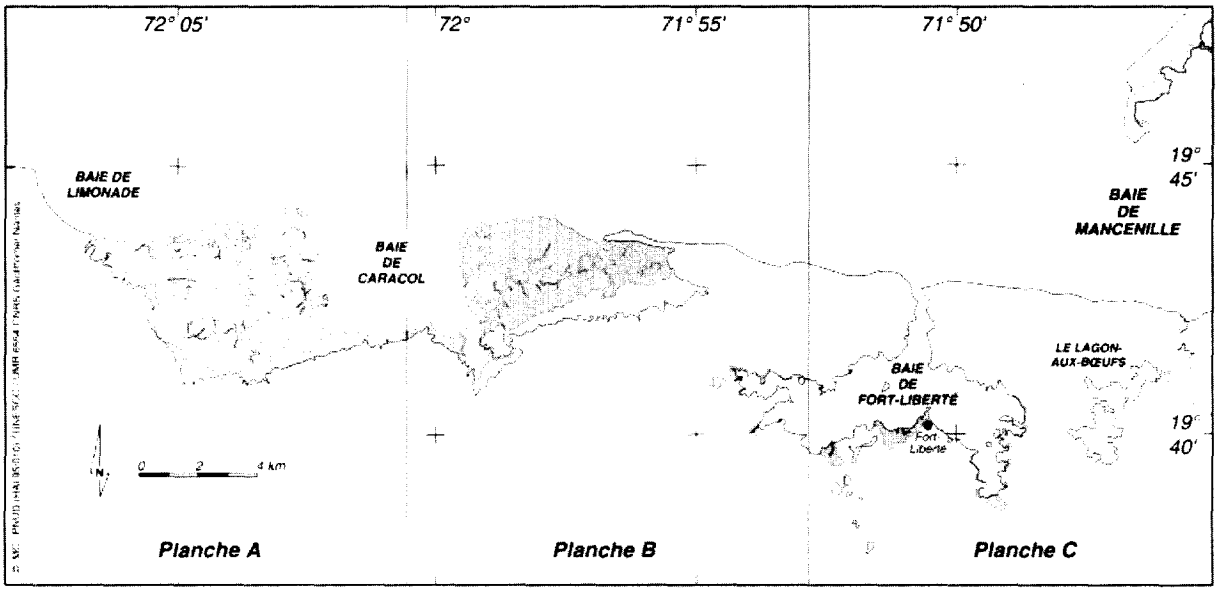
Map of Hispaniola and surrounding islands ("Zone d'étude" = area under study)



Some examples taken from the Atlas

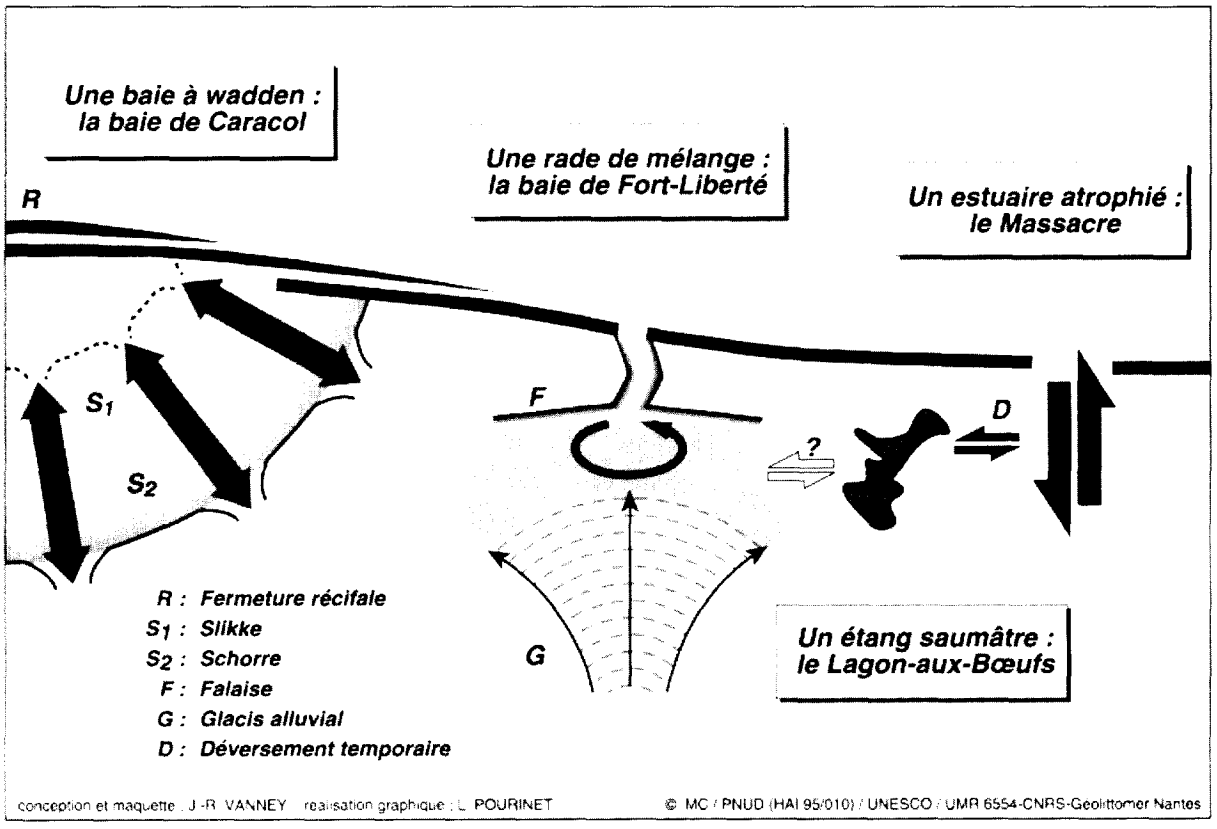
To be cited as: MÉNANTEAU L. & VANNEY J.-R. (coord. scient.), 1997. *Atlas côtier du Nord-Est d'Haïti. Environnement et patrimoine culturel de la région de Fort-Liberté.* Port-au-Prince/Nantes. Ed. Projet "Route 2004". Ministère de la Culture (Haïti)/PNUD, iv+62 pp.

LA CARTE PHYSIOGRAPHIQUE

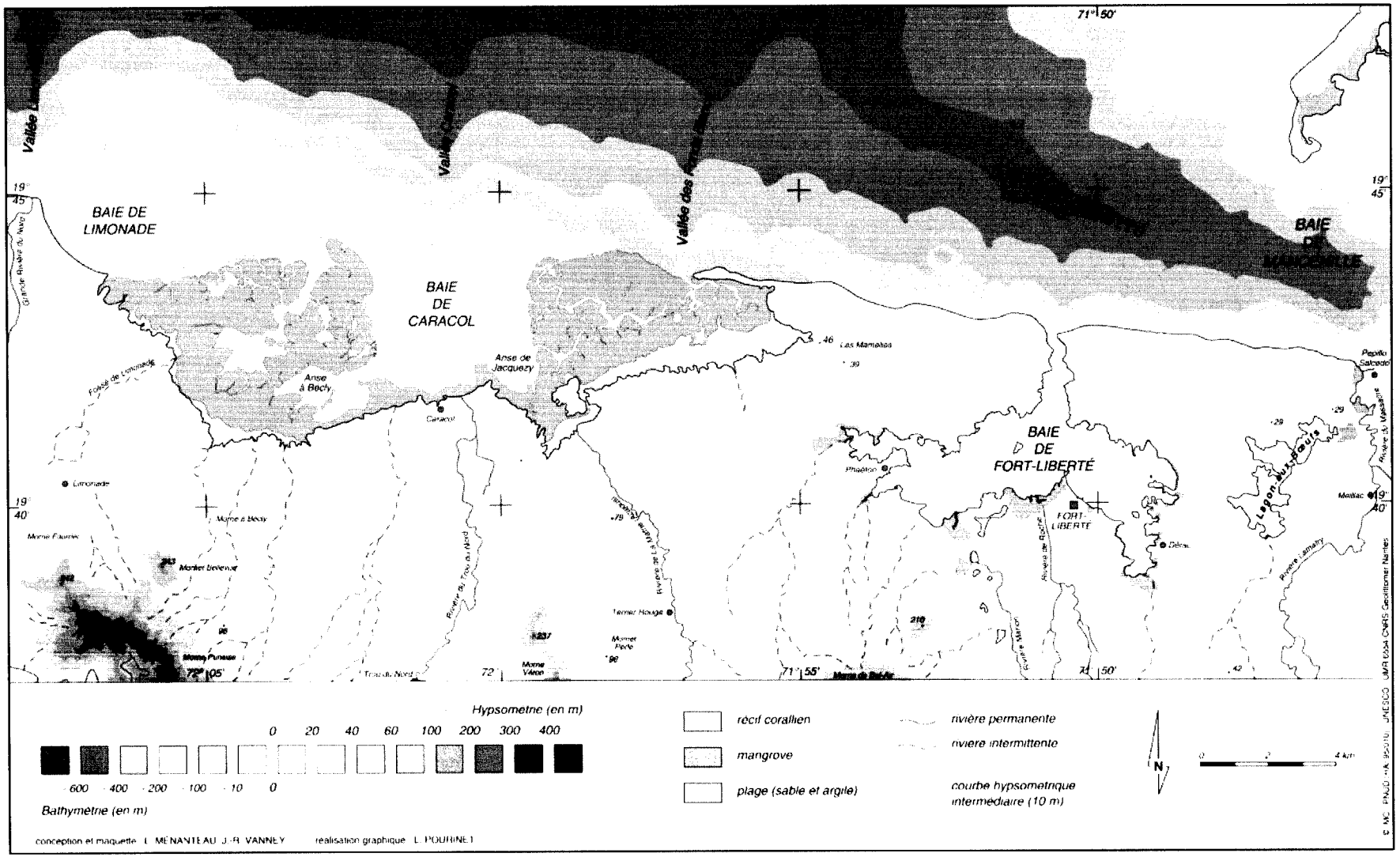


La carte physiographique du littoral, en trois planches au 1/50 000, résume les traits dominants de la géographie où cinq provinces, subdivisées en sous-régions, sont différenciées et commentées.

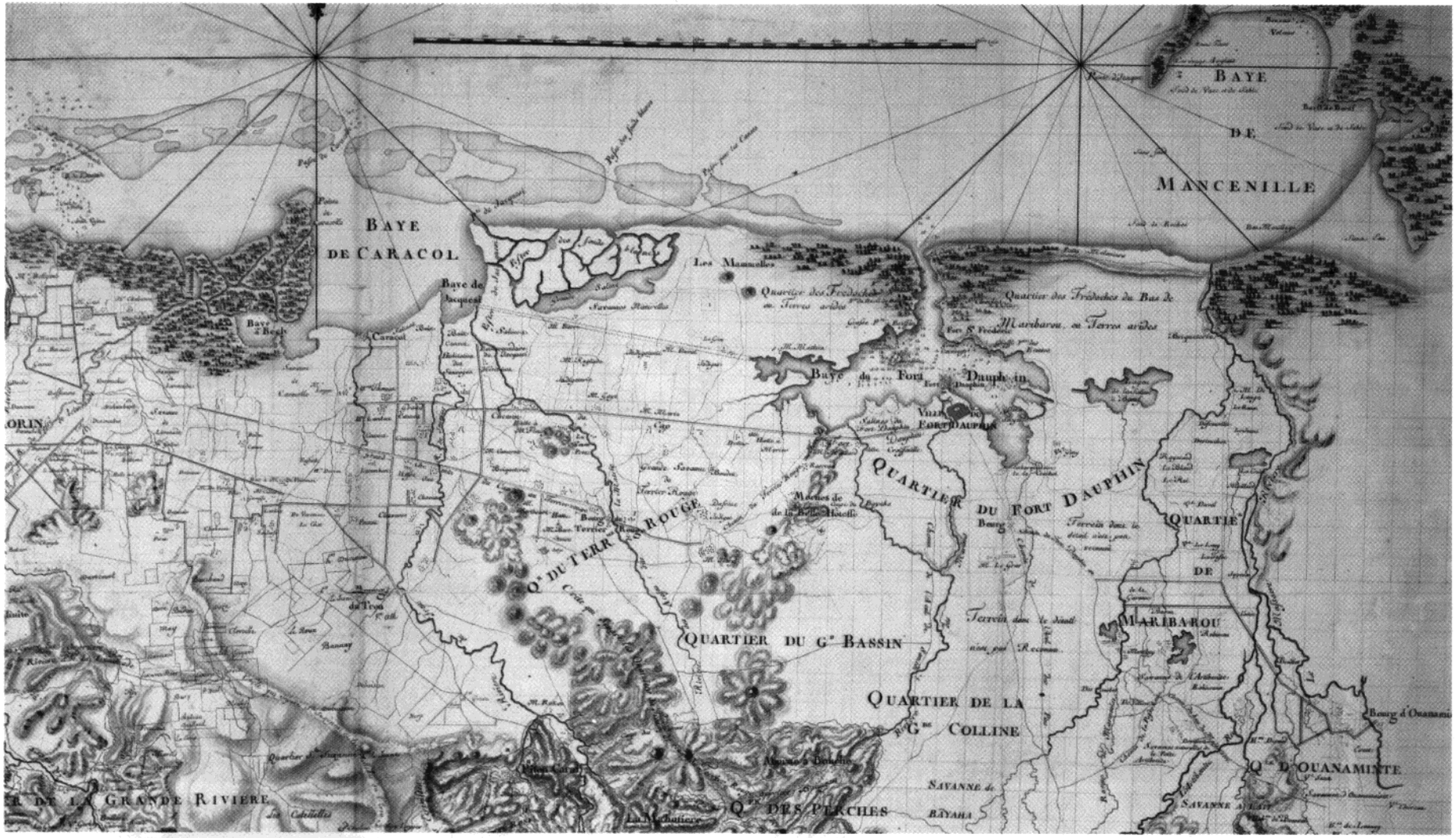
LES QUATRE TERMES ÉVOLUTIFS DE L'HYDROLOGIE



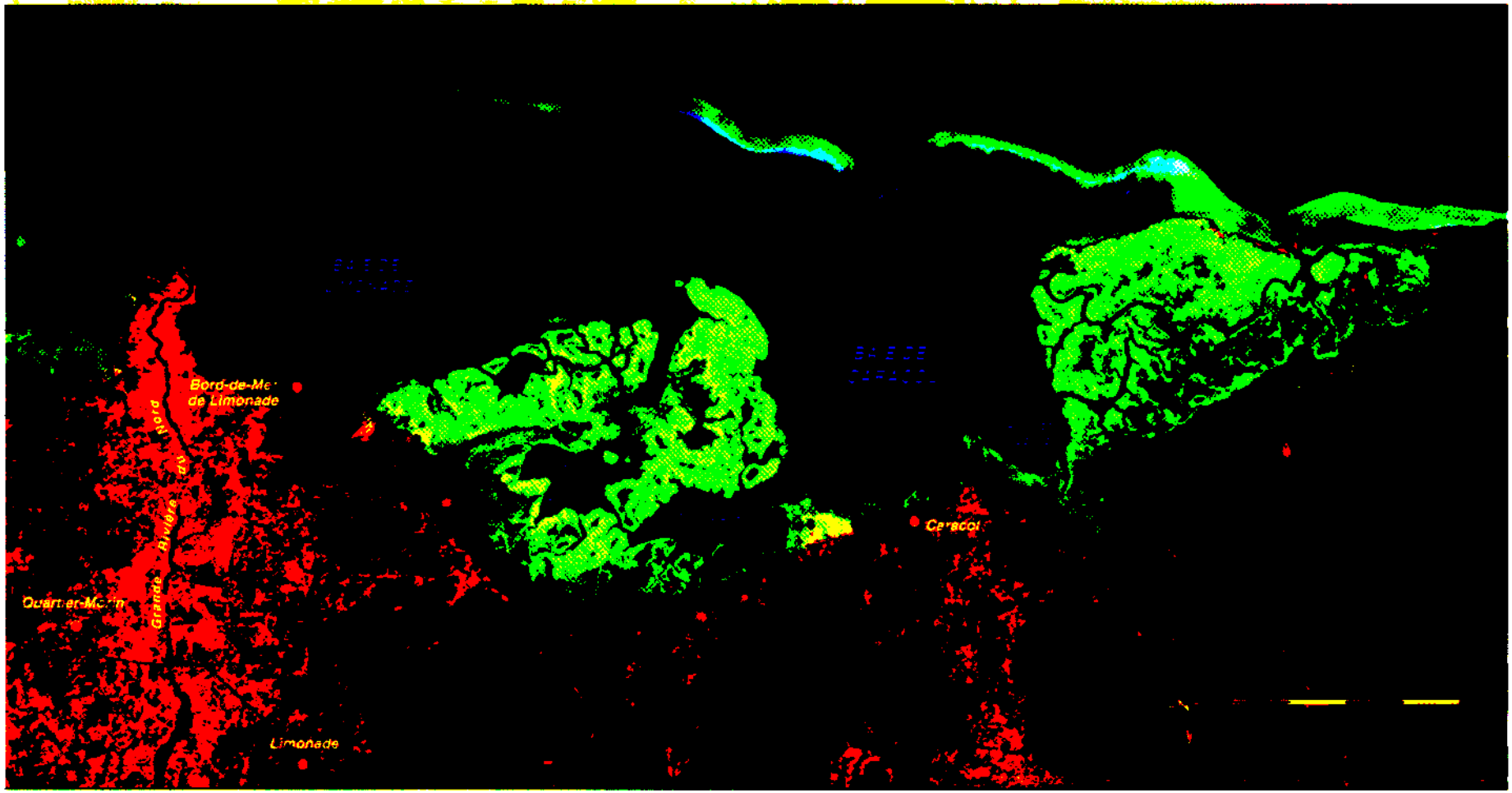
LE RELIEF TERRESTRE ET SOUS-MARIN



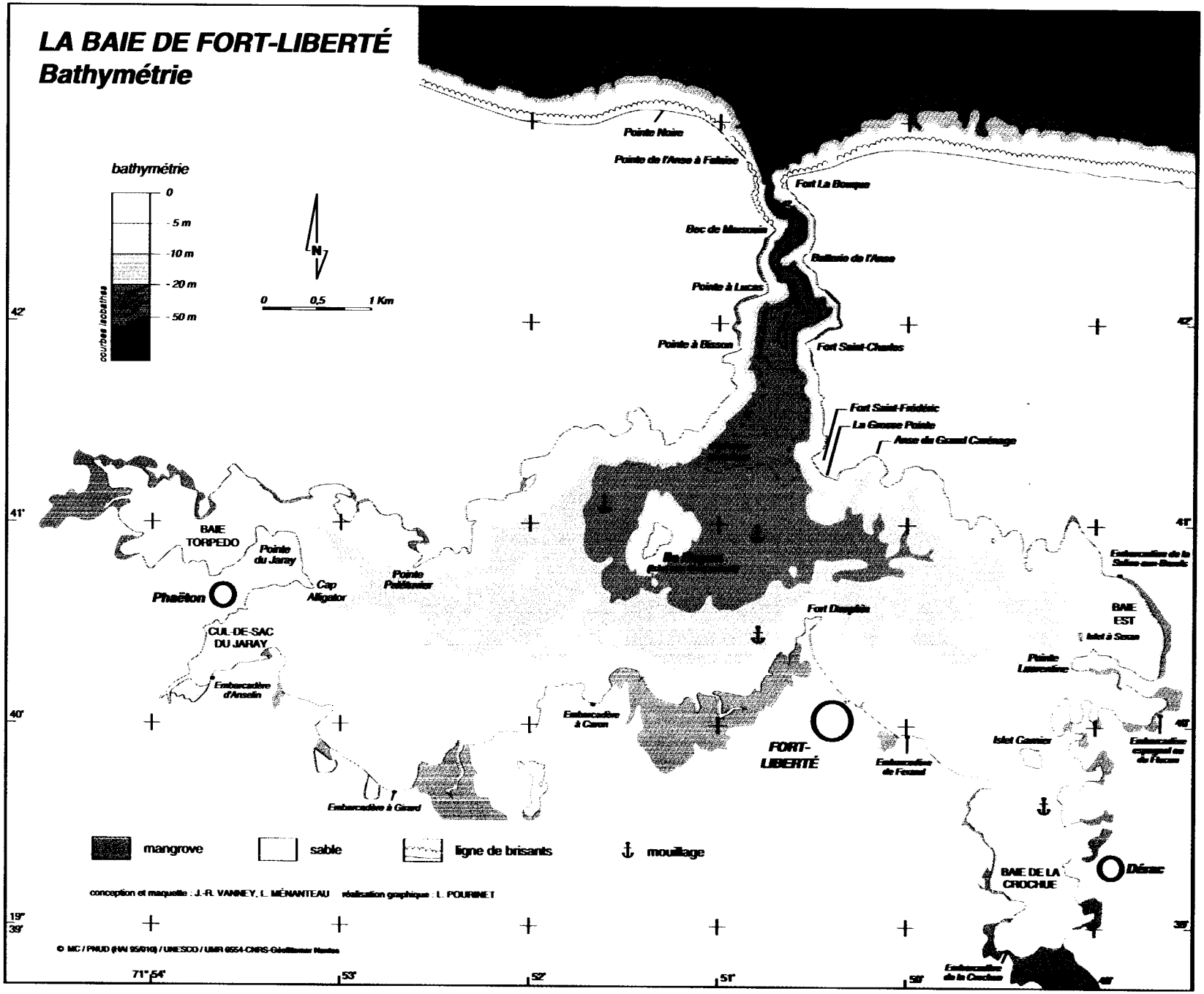
Reproduction partielle de la Carte de la Plaine du Nord de Saint-Domingue, depuis la Baie de l'Acul jusqu'à celle de Mancenille. XVIII ème siècle. BNF. Dép. Cartes et Plans. Doc. MARIEN 92.



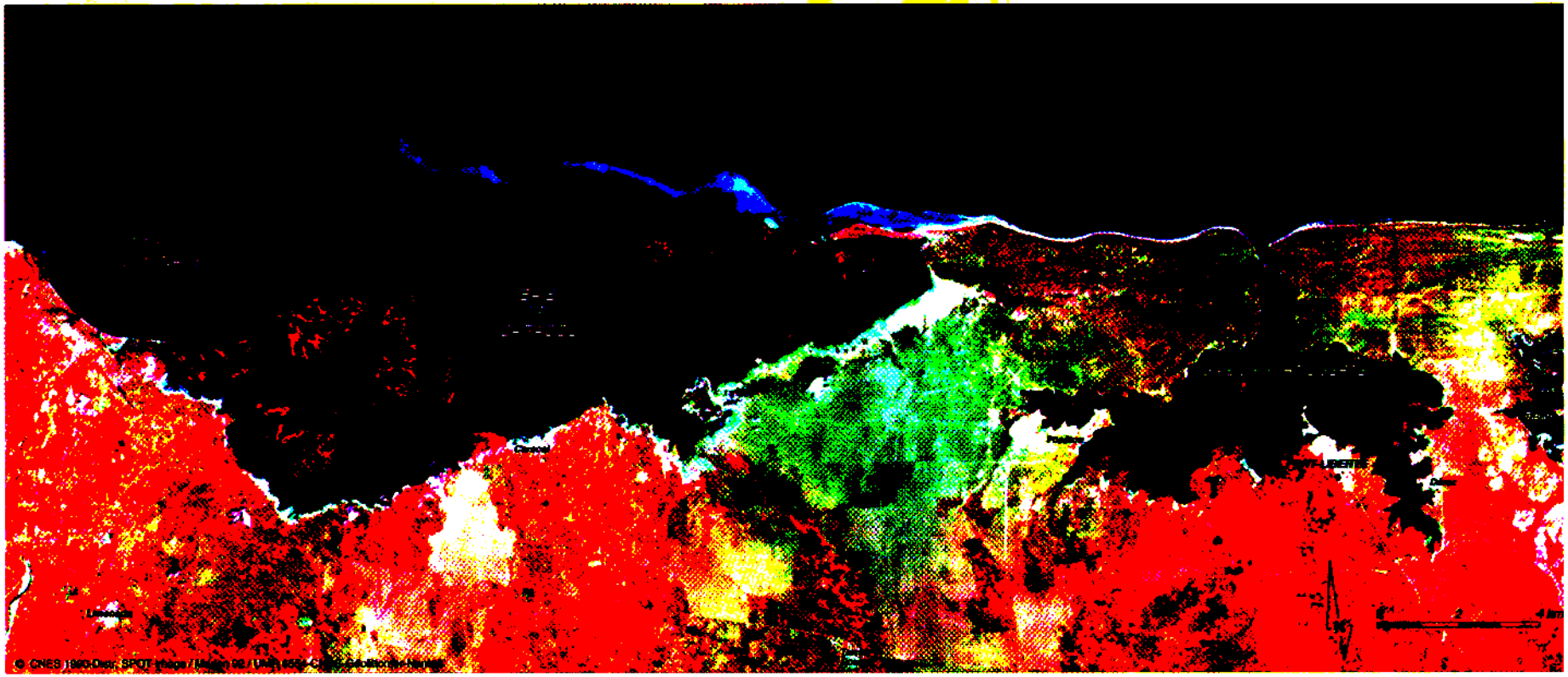
RÉCIFS CORALLIENS ET MANGROVES DE LA BAIE DE CARACOL



Extrait d'une image en mode multispectral (XS) du satellite SPOT 2 (scène 643-310/5), acquise le 16/08/90. Traitement : Y.-F. THOMAS et L. MÉNANTEAU

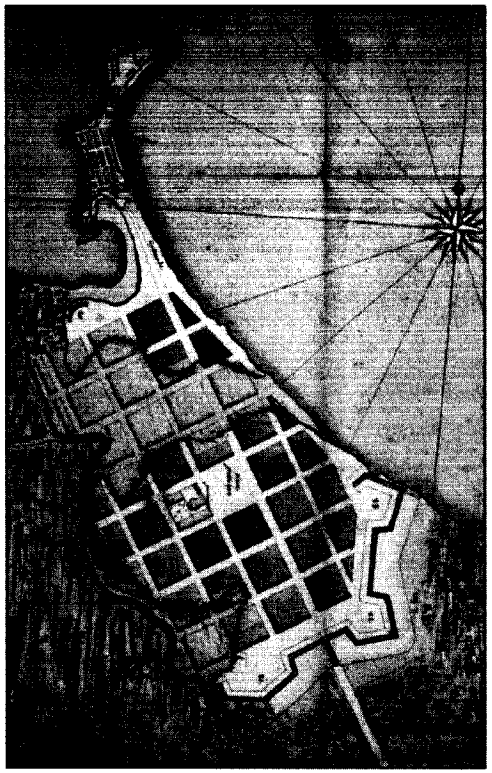

LA BAIE DE FORT-LIBERTÉ
Bathymétrie
bathymétrie
courbes isobathes
0
- 5 m
-10 m
- 20 m
- 50 m
N
0 0,5 1 Km
Pointe Noire
Pointe de l'Anse à Foliase
Fort La Bouque
Bec de Mancenille
Baillaire de l'Anse
Pointe à Lucas
Pointe à Bisson
Fort Saint-Charles
Fort Saint-Frédéric
La Grosse Pointe
Anse du Grand Cuminage
BAIE TORPEDO
Pointe du Jaray
Cap Alligator
Phaëton
Pointe Pallisseur
CUL-DE-SAC DU JARAY
Embarcadère d'Anselin
Fort Dauphin
BAIE EST
Islet à Sucre
Pointe Lamentine
Embarcadère à Caron
FORT-LIBERTÉ
Embarcadère de Fessard
Islet Cormier
Embarcadère à Girard
BAIE DE LA CROCHUE
Désac
Embarcadère de la Crochue
mangrove
sable
ligne de brisants
mouillage
conception et maquette : J.-R. VANNEY, L. MÉNANTEAU réalisation graphique : L. POURINET
© MC / PNUD (HAI 95/010) / UNESCO / UMR 6554-CNRS-Géolittoral Nantes
42'
41'
40'
39'
71°54'
53'
52'
51'
50'

LE NORD-EST D'HAÏTI VU DU CIEL

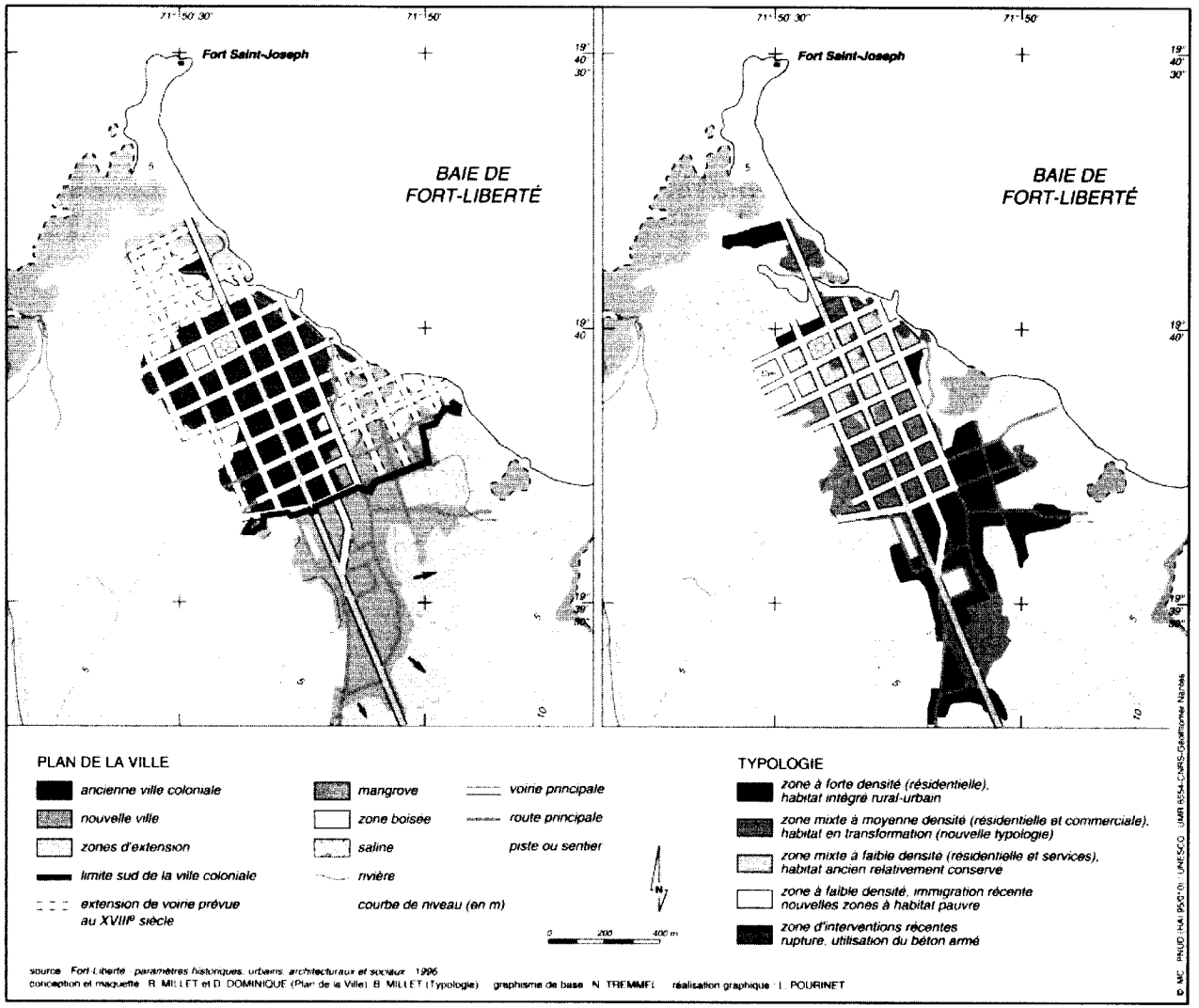


Extrait d'une image en mode multispectral (XS) du satellite SPOT 2 (scène 643-310/5), acquise le 18/08/90. Composition colorée (Rouge = XS3, Vert = XS2, Bleu = XS1). Traitement : L. MÉNANTEAU

LA VILLE DE FORT-LIBERTE : PLAN ET TYPOLOGIE



"Plan de la ville de fort Dauphin représentant le progrès de l'établissement de la ville. Le lavis en rouge marque les maisons faites ou commencées. Le premier de l'année dernière, il n'y avait qu'une maison bâtie".
Au fort Dauphin, Delalance, le 8 février 1732.



List of Participants

CANADA

Alexandre de Laryssa
Omegalpha, Canada
301, Chemin Beauséjour
Crabtree (Québec)
Canada, J0K 1B0
Tel: (1-514) 754 2019
Fax: (1-514) 754 3014

THE DOMINICAN REPUBLIC

Francisco Geraldes
Fundación MAMMA
Centro de Investigaciones de Biología Marina
Universidad Autónoma de Santo Domingo
P.O. Box 2488
Santo Domingo, The Dominican Republic
Tel: (1-809) 686 3250
Fax: (1-809) 687 0721
(1-809) 593 0029 (pm)
E-mail: cibima@aacr.net

José A. Ottenwalder
Coordinador Nacional, Proyecto Biodiversidad Costera GEF-UNDP/ONAPLAN
Programa de las Naciones Unidas
para el Desarrollo /y
Oficina Nacional de Planificación
P.O. Box 1424, Mirador Sur
Santo Domingo, The Dominican Republic
Tel: (1-809) 534 1134, 534 1216
Fax: (1-809) 530 5094, 431 3507
E-mail: biodiversidad@codetel.net.do
http://www.gef.biodiversidad.do

FRANCE

Loïc Ménanteau
Chercheur au CNRS
Géolittomer-Nantes – UMR 6554
Faculté des Lettres et Sciences Humaines
Université de Nantes
B.P. 81227
44312 Nantes Cedex 3, France
Tel: (33-2) 40 14 10 99/13 08
Fax: (33-2) 40 74 60 69
E-mail: menanteau.l@humana.univ-nantes.fr

HAITI

Ariel Azael
Université Quisqueya
Blvd. Harry Truman, BP 796
Port-au-Prince, Haiti
Tel: (509) 22 9002, 22 0314, 22 8718
Fax: (509) 23 7430
E-mail: virreu@acn2.net.

Sylvie Bajeux
Permanent Secretary
Haitian National Commission to UNESCO
23, Avenue Marie Jeanne, BP 1347
Port-au-Prince, Haiti
Tel: (509) 23 07 47
Fax: (509) 22 07 47, 23 52 61

Yvelt Chery
Ministry of Agriculture
Damien, Route Nationale #1
Port-au-Prince, Haiti
Tel: (509) 22 0561, 22 1867, 22 3457

Giselle Hyvert
Project HAI/95/010 Route 2004
United Nations Development
Programme (UNDP)
18 Ave Ducoste, BP 557
Port-au-Prince, Haiti
Tel: (509) 23 1400, 22 1219
Tel/fax: (509) 22 8511, 23 9340

Michaèle Saint Natus
Université Quisqueya
BP 796
Port-au-Prince, Haiti
Tel: (509) 22 9002, 22 0314, 22 8718
Fax: (509) 23 7430

Florence Sergile
Ministry of Environment
Port-au-Prince, Haiti
Fax: (509) 45 7360
Also:
Department of Natural Sciences
Museum Road
University of Florida
Gainesville, FL 32611-2035, USA
E-mail: fsergile@flmnh.ufl.edu

Jean André Victor
Environmental Monitoring and
Coordinating Unit
United Nations Development Programme
18 Ave Ducoste, BP 557
Port-au-Prince, Haiti
Tel: (509) 23 4705
Tel/fax: (509) 22 8511

Yves André Wainright
Minister of Environment
181, Avenue Jean Paul II
Haut de Turgeau
Port-au-Prince, Haiti
Tel: (509) 45 7572
Fax: (509) 45 7360

Jean W. Wiener
Fondation pour la Protection de la
Biodiversité Marine
P.O. Box 642
Port-au-Prince, Haiti
Tel: (509) 45 2335
Fax: (509) 46 2510, 45 2335
E-mail: jwiener@compa.net

JAMAICA

Peter Espeut
South Coast Conservation Foundation
91A Old Hope Road
Kingston, Jamaica
Tel: (1-876) 978 9286 or 927 7980
Fax: (1-876) 927 3754
E-mail: pespeut@infochan.com

Jeremy Woodley
University of the West Indies, Jamaica
Centre for Marine Sciences
University of the West Indies
Mona, Kingston 7, Jamaica
Tel: (1-876) 927 1609
Fax: (1-876) 977 1033
E-mail: woodley@uwimona.edu.jm

UNITED KINGDOM

Chris Ninnes
Marine Resource Assessment Group
47 Prince's Gate
London SW7 2QA, UK
Tel: (44-171) 594 9887
E-mail: c.ninnes@ic.ac.uk

UNITED STATES OF AMERICA

Sabrina Sanderson
At time of seminar/workshop:
Affiliated with the Department of Geological
Sciences, University of South Carolina
Columbia, SC 29209, USA

Address at time of publication:
236 Tioga Dr.
Rochester, NY 14616, USA
Tel: (1-716) 621 4689
E-mail: sabrinasanderson@classic.msn.com

PUERTO RICO

Gillian Cambers
Sea Grant College Program
University of Puerto Rico
P.O. Box 9011, College Station
Mayagüez, Puerto Rico 00681-9011
Tel: (1-787) 832 3585
Fax: (1-787) 265 2880
E-mail: g_cambers@rumac.upr.clu.edu

Robert Cassagnol
F-10 Calle España, Oasis Garden
Guaynabo, Puerto Rico 00969
Tel: (1-787) 720 4310
E-mail: linette@caribe.net

UNESCO

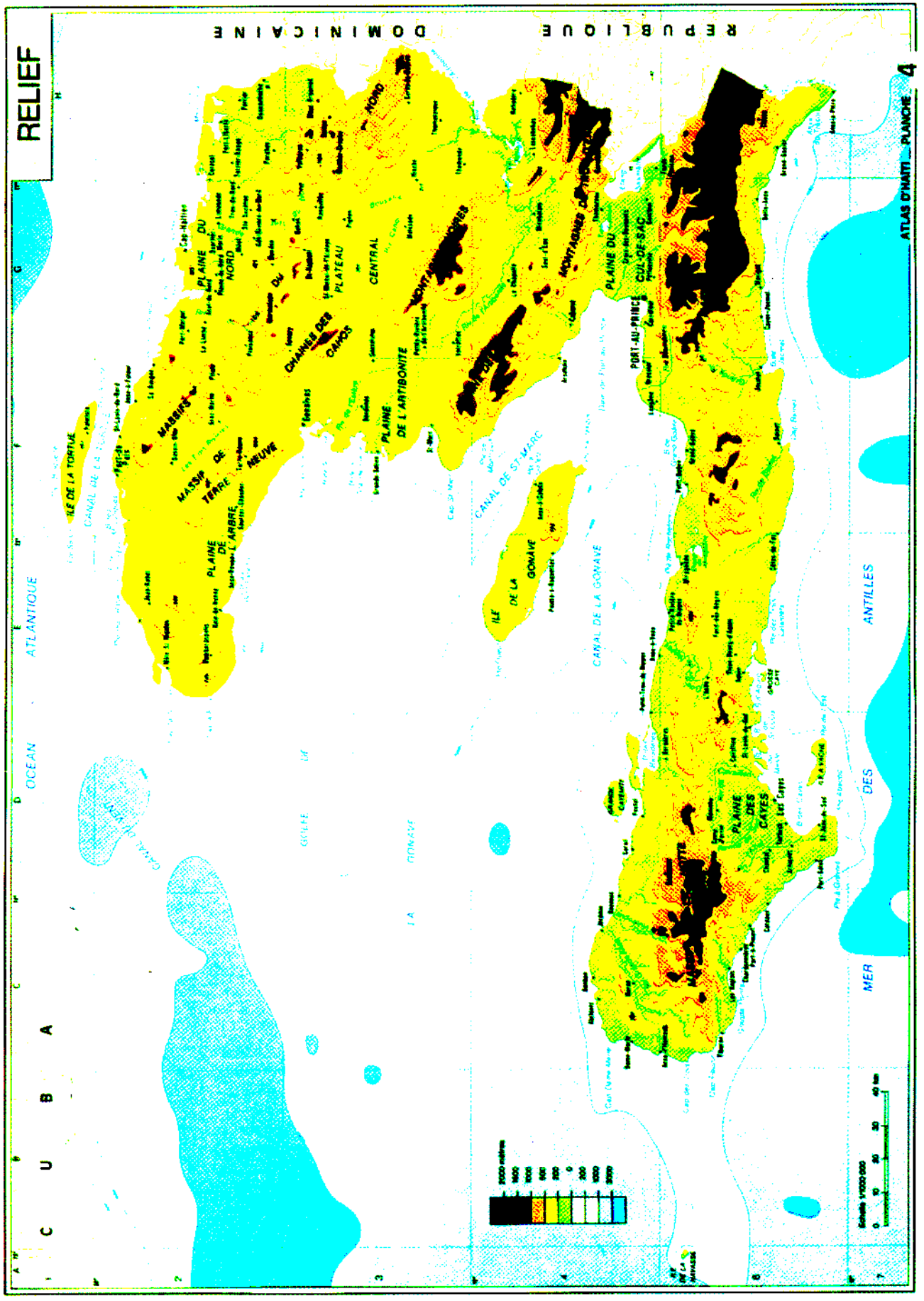
Agustín A. Larrauri
(At time of seminar)
Representative of UNESCO to Haiti
UNESCO-Haiti Office
19 Delmas, 60 Musseau par Bourdon
Petionville, Haiti
Tel: (509) 579 429, 578 040, 578 233
Fax: (509) 578 158
E-mail: unescohai@acn.com

As of 1 June 1997:
Director, Division of Decentralization and
Field Coordination (BRX/DFC)
UNESCO, 7 Place de Fontenoy
75352 Paris 07 SP, France
E-mail: a.larrauri@unesco.org

Marc Steyaert
Consultant (SC/CSI),
UNESCO, 1 Rue Miollis
75732 Paris cedex 15, France
Fax: (33-1) 45 68 58 08
E-mail: csi@unesco.org

List of acronyms

CARICOMP	Caribbean Coastal Marine Productivity project
CLC	International Convention on Civil Liability for Oil Pollution Damage
COLREG	Convention on the International Regulations for Preventing Collisions at Sea
COSALC	Coast and Beach Stability in the Smaller Caribbean Islands project
CSI	Environment and Development in Coastal Regions and in Small Islands platform
EEZ	Exclusive Economic Zone
FoProBiM	Foundation for the Protection of Marine Biodiversity (*in French*: Fondation pour la protection de la biodiversité marine)
GEF	Global Environment Facility
GIS	Geographic information system
ICM	Integrated coastal management
IOC	Intergovernmental Oceanographic Commission of UNESCO
IMO	International Maritime Organization
IUCN	World Conservation Union
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto
OPC	Oil Pollution Compensation
OPRC	International Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft
SOLAS	International Convention for the Safety of Life at Sea
SPOT	Satellite-based earth observing system (*in French*: Système Pour l'Observation de la Terre)
TM	(Landsat) Thematic Mapper
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme



Source: *Atlas d'Haïti, 1985.*
Centre d'études de géographie tropicale,
CNRS, Université de Bordeaux III.
Coordination: Christian A. Girault