

Executive Overview: PUNTACANA Coastal Marine Project

Prepared for Grupo PUNTACANA
Board of Directors
Punta Cana, Dominican Republic



Prepared by:
PUNTACANA Ecological Foundation

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Executive Summary

The following report provides an overview of the **PUNTACANA Coastal Marine Project** since its initiation in November 2004. The report seeks to analyze the project in order to insure the achievement of desired outcomes, maximize overall benefit to Grupo PUNTACANA and to insure the long term success and sustainability of the project. This report also provides recommendations for the continuation of the project.

The PUNTACANA Coastal Marine Project has been successful in stabilizing and restoring various beaches that are critical to the businesses of Grupo PUNTACANA. The beaches of PUNTACANA Resort & Club (North and South) have been stabilized from erosion and enormously improved. The reconstruction of the Tortuga Bay (formerly Tortuga Villas) beach has been completed and the process of long-term stabilization has been initiated. This beach represents considerable economic value to the company as a high value boutique hotel will open in December 2005. Construction of the breakwater and spar structures of Corales Cove has been initiated and conditioning of Corales Cove beach has begun. Construction of a beach stabilization structure in Corales #5 to mitigate effects of erosion has been completed. A water quality monitoring program has been implemented and actions taken to improve coastal water quality have had considerable positive impact on the coastal ecosystem. Additionally, an extensive reef characterization and standardized monitoring program has been initiated that will provide necessary data for decision-making to improve the health of the coral reef.

The restoration of the reef has been initiated in the first phase of the project due largely to improvements in the quality of the coastal waters, adjustments in management practices on La Cana Golf Course and temporary reductions of reef fishing by local fisherman. A preliminary monitoring and habitat characterization program has also been implemented by a multidisciplinary team of biologists and oceanography. Additionally, the REEF CHECK monitoring methodology has also been implemented in collaboration with national and international experts.

Work remaining from Phase I is expected to be completed by March 2006. This work includes completion and strategic placement of concrete stabilization structures, improvement of hydrodynamic conditions of reef lagoon through removal of sediment materials, and continued beach nourishment with offshore banks of sand. The placement of concrete reef structures, sediment removal, and beach nourishment are dependent on the arrival equipment necessary (loading structure and dredge) to complete the work. Once remaining work is completed, the beaches of Punta Cana will once again be in a stable condition and will only require regular maintenance on a yearly basis according to a well-designed plan.

Phase II of the PUNTACANA Coastal Marine Project must continue to emphasize improvements in the overall environmental health and quality of the coastal zone ecosystem to maintain and build upon successes achieved to date and insure the long-term success of the Grupo PUNTACANA and its related businesses. The development and implementation of a Coastal Management Plan, which includes continued monitoring and restoration of the coral reef and coastal zone, will be critical to the long-term success of the project and will help insure the maintenance of the beaches. **The project must also develop a plan for securing external funding sources to supplement the investment of Grupo PUNTACANA.**

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Introduction

In November 2004, the PUNTACANA Ecological Foundation (PCEF) presented the Board of Directors of Grupo PUNTACANA a proposal to address the declining health of the coastal marine ecosystem. Various studies and on-going monitoring conducted over more than a decade had confirmed the severe degradation of the coastal marine ecosystem of PUNTACANA, including the following problems: severe beach erosion, death of corals and degradation of coral reef health, disappearance of fish and coral species, proliferation of algae on the coral reef, and deteriorating water quality.

The Ecological Foundation proposed the initiation of the PUNTACANA Coastal Marine Project with three primary objectives:

1. Beach reconstruction and stabilization
2. Reef restoration
3. Coastal water quality improvement

A multidisciplinary team was proposed consisting of an oceanographer, 2 biologists, 1 civil engineer, and several technical assistants that would conduct a variety of interventions meant to stabilize beaches, improve the water quality of the coastal zone, and improve the hydrodynamic of the reef lagoon. The proposed interventions required the construction of various beach stabilization structures, the restoration and expansion of existing mangrove patches, the purchase and operation of a dredge, strategic placement of concrete stabilization structures, implementation of a water quality monitoring program, and the creation of fish and coral nurseries. In addition, a breakwater and beach construction project was proposed for Corales Cove in the Corales development, to be executed by the PUNTACANA Engineering Department.

In November 2004, the Grupo PUNTACANA Board of Directors approved Phase I of the project, with a total budget of \$1.54 million dollars, plus an additional \$2 million dollars for the Corales Cove Beach and Breakwater construction. **(Please see Appendix 1.)**

Section 1: Beach reconstruction and stabilization



Rough surf of Corales Cove in August 2005 prior to construction of breakwater.

Breakwater and Beach Construction of Corales Cove

After a study produced and design proposal conducted by coastal engineering firm Moffet & Nichols, the PUNTACANA Engineering Department contracted Parsons Company to construct a breakwater at Corales Cove and coordinate the construction of the beach. The project includes the creation of a breakwater that extends parallel to the beach, construction of two spar structures that will protect the Corales development from beach erosion, and the deposition of 6,000 m³ of sand on the beach. This work will help create a premier beach in the Corales development by improving the conditions and quality of the beach in Corales Cove. The construction of the breakwater has begun and the project will be completed in February 2006.



Corales Cove breakwater initiated in November 2005.



Eroded beach of PUNTACANA Resort & Club in November 2004 with approximately 3 foot (1 meter) elevation difference of eroded area.



Eroded beach of PUNTACANA Resort & Club in November 2004.



Groin structure and interventions have added approximately 33 feet (10 meters) in coastal and submerged sand area.

PUNTACANA Resort & Club (North and South)

The PUNTACANA Resort & Club hotel had been degraded by severe sand erosion and the appearance of a thick, muddy sediment material in select areas that had replaced the sand of the submerged beach. The north beach, extending from La Cana restaurant to the hotel activities center, is approximately **636 feet (194 meters)** in length. The south beach, extending from the activities center to playa yauya in front of the Ecological Reserve entrance, is approximately **742 feet (226 meters)**. Both beaches have had an average area of 33 feet (10 meters) of beach added both in coastal and submerged sand area.



Removal of coconut trees and removal of roots greatly improved quality of beach.



Groin structure assists in beach stabilization and becomes an attraction for tourists.

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Mangrove patch with exposed coconut roots and limited sand in November 2004.



After mangrove has been fortified with new plantings, considerable sand accumulation in December 2005.



A thatch structure for massage area has been built next to the newly restored beach adjacent to mangrove patch.



The circular groin structure on the south beach of PUNTACANA Resort & Club has become one of the best sites for tourists.



View of beach of in November 2004. Coconut roots are exposed and there is a lack of quality sand.



The same beach in November 2005 with guests from the hotel bathing.



View from the massage structure.



A circular groin structure was built to imitate the original coastline that had eroded over the last decade.



The circular groin has been instrumental in stabilizing the beach and accumulating sand in the south beach of PUNTACANA Resort & Club.



The quality of the beach adjacent to the Ecological Reserve in the south part of PUNTACANA Ecological Reserve has been vastly improved.

Several key activities have led to the overall stabilization of both the north and south portions of the PUNTACANA Resort & Club beach. The removal of all coconut trees on the border of the beach, the creation of a straight rock groin structure on the north side of the beach, the creation of a circular groin structure on the south end of the beach, and the creation of a mangrove nursery that has supplied over 2,500 seedlings (250 planted) for the improvement and expansion of existing mangrove patches that accumulate sand have resulted in the recovery and stabilization of the PUNTACANA Resort & Club beaches.

The sediment material remains in certain areas of the submerged beach and will be removed through dredging. The beach of the PUNTACANA Resort & Club will also be nourished with 15,000 m³ of sand to be pumped from offshore sand banks. Both of these activities are dependent on the arrival of the Ellicott dredge, expected in January 2005. Additionally, 270 concrete stabilization structures will be positioned in key areas in front of the PUNTACANA Resort & Club beach to protect the beaches from wave action, to allow sand accumulation, and create habitat for beneficial fish species.



A groin structure was built between Corales #3 & #4.



The placement of concrete stabilization structures and the conclusion of the groin structure was recommended to allow for sand nourishment.

Residences at Corales

Erosion of sand at Corales residences #3 and #4 had necessitated measures to stabilize the beaches. With considerable consulting from the property owners of both residences, a straight rock groin structure was built between the two residences and intersecting beaches. This action has slowed erosion to an acceptable level.

The placement of 70 concrete structures in front of Corales residence #4 and the conclusion of the groin structure on the beach between the two residences were recommended to allow sand nourishment and to mitigate the wave action impacting the beach. These actions are pending approval from the respective property-owners. Additionally, the construction of the spars in Corales Cove are expected to help reduce erosion in this area.

Tortuga Bay

The beaches of Tortuga Bay (formerly Tortuga Beach Villas) had been completely eroded of sand, exposing 1,230 feet (400 meters) of bare limestone coral rock with a width 82.5 feet (25 meters). A circular groin, extending from the fifth green of the La Cana golf course to allow sand accumulation was created and exposed coral rock was cut to create catchments for sand nourishment. In addition, four straight groin structures were built to encourage sand accumulation and prevent future erosion. The beach was then nourished with over 19,700 cubic feet (6,000 m³) of mined sand. These actions have led to the stabilization and reconstruction of the beach.



Previously existing beaches had been eroded to bare limestone rock.



6,000m³ of mined sand was deposited to restore previous beach.



Exposed rock was cut to create catchments for sand nourishment.



1,230 feet (400 meters) of beach have been restored in Tortuga Bay.



The Tortuga Bay beach still requires planting of coastal vegetation and mangrove seedlings, the placement of 110 concrete structures, and the pumping of 6560 cubic feet (2,000 m³) of offshore sand to complete the reconstruction of the beach. Additionally, since this is a constructed beach, there will be a continued process of stabilization over the course of several years that will require regular maintenance and sand nourishment.

A circular groin, extending from the fifth green of the La Cana golf course and four straight groin structures were built to encourage sand accumulation and prevent future erosion.



Bare rock extending to Playa Serena has been recovered as beach.



From the circular groin structure of the fifth hole of La Cana golf course to Playa Serena a stretch of 1,230 feet (400 meters) of beach has been reconstructed.



The reconstructed beach extends from the lawn of the Tortuga Bay hotel to water, adding approximately 82.5 feet (25 meters) width of beach.

Section 2: Reef Restoration

Concrete stabilization structures

Concrete structures will be placed in strategic areas of the Punta Cana coast. The structures will serve as habitat for beneficial reef fish, will serve as coral recruitment sites, and most importantly will protect the shoreline and beaches from wave action, preventing erosion and allowing for sand accumulation.

Currently 450 reef structures are being constructed. A reef loading structure is also under construction that will be used to place the structures near the shoreline and insure minimal impact on the reef. Studies designating the precise placement of the reef structures have been conducted and approved. The placement of all 450 reef structures is expected to be completed by March 2006.



450 concrete stabilization structures will be placed in strategic locations to protect beaches from wave action and allow sand to accumulate.



A nursery of over 2500 red mangrove seedlings has been established, with over 250 seedlings planted.



Unhealthy mangrove patch in 2001 has undeveloped roots, lack of foliage, and poor sand recruitment.

Improved water quality and beach conditions have improved foliage, root structure, and sand accumulation capacity of the same mangrove patch in December 2005.



Mangrove Restoration

The restoration of the mangroves on the north and south beaches of PUNTACANA Resort & Club has been a key activity in controlling beach erosion and accumulating sand. Over 2500 seedlings have been generated in a nursery from local existing mangroves and 250 seedlings have been planted. Improved water quality and selective pruning has vastly improved the health of existing mangrove patches and improved surrounding beaches.

PUNTACANA is one of the few, if not the only hotel development in the Caribbean that has an established mangrove restoration project. The work from this pilot project has been submitted to the Latin American Congress of Botany to be held in Santo Domingo in 2006.



Counterpart International has conducted three workshops on techniques for recovering reef fragments.

Coral transplantation & growth

Coral transplantation is a methodology that seeks to recover broken pieces of reef and transplant them to suitable habitats, encourage coral recruitment, and create suitable habitat for beneficial fish. Counterpart International has completed three workshops on creation of “Coral Gardens” and 4 coral transplant sites have been created with over 40 coral transplants established. This project is still in experimental phase while techniques are perfected but has shown success in coral growth and has potential as an educational activity for tourists.



4 coral transplant sites have been created while techniques in experimental project are perfected.



Improved water quality has begun to improve coral health in certain areas of Punta Cana reef.

Reef fish repopulation

Fish nurseries have been proposed as a means to repopulate herbivorous fish species that reduce algae on the reef and encourage coral growth and development. This must be complemented by regulatory activities that reduce fishing pressures on the reef and should be included in a Coastal Management Plan in Phase II of the project.

A fish nursery has been established at the Marina PUNTACANA to exhibit for visitors. Though water quality and turbidity at this site is not ideal for fish growth, it represents a possible educational activity for tourists. Three additional nurseries will be constructed in strategic areas. A noted increase in fish populations has occurred due to reduced fishing pressure and will make efforts to establish fish nurseries more effective in



Healthy reef species are key to the recovery of the Punta Cana coral reef.



Improvement in coral reef health will continue as the health of the ecosystem is restored.



Improved water and beach quality has led to the unexpected return of the Hawksbill Sea Turtle.

Hawksbill Sea Turtles

Improvements in water quality and beach stabilization has also led to the unexpected return of egg-laying hawksbill turtles (*Eretmochelys imbricate*) on beaches where they had not been reported in various years, including in front of the Cocotal building in the PUNTACANA Resort & Club south beach. In September 2005, 34 baby turtles were found on the beach and released in the reef lagoon. The return of sea turtles could be carefully developed into a tourist attraction for the PUNTACANA Resort & Club.



In September, 34 neonatal sea turtles were found on the south beach of PUNTACANA Resort & Club.

Section 3: Coastal water quality improvement

Water quality monitoring

A water quality monitoring program has been implemented on over 81 monitoring sites (residual potable and coastal waters) to insure that nutrient levels, onshore contaminants, and overall coastal water quality parameters have been greatly improved since November 2004. This program has enormously improved water quality throughout the coastal zone.

Additionally, considerable effort and progress has been made in working with the managers of La Cana Golf Course to lessen the impact of irrigation of residual waters on the coastal zones.

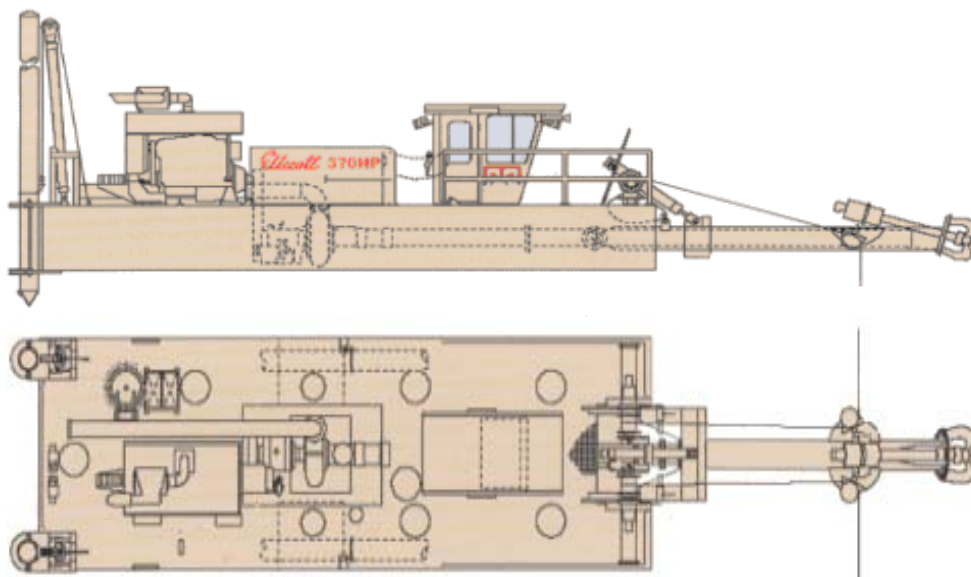
Monitoring and habitat characterization

A standardized monitoring program was developed to study physical parameters of the reef, to characterize benthic morphological associations, and to document spatially and temporally the environmental changes of the coastal marine ecosystem. Data from this research will help determine the root causes of coral reef degradation and help make informed decisions that will ultimately improve the health of the coral reef. This aspect of the project represents one of the first attempts in the Dominican Republic to document these features through standardized procedures over a sustained period of time.

Dredge purchase

A careful study of the cost/benefits of purchasing or renting a dredge was conducted and the conclusion was taken to purchase the dredge for the short term needs of restoring the coastal ecosystem and the long term maintenance and nourishment of beaches in Punta Cana and to maintain the channel of the PUNTACANA Marina.

An Ellicott “Dragon” Modelo Series 370HP is currently being fabricated and will be shipped to Punta Cana on October 31. Depending on delays in Dominican customs, the dredge should be functioning by January 2005.



The Ellicott “Dragon” Modelo Series 370HP is currently in port in Haina, Dominican Republic; in review by Dominican customs.

Improvement of the hydrodynamic conditions of the reef lagoon (dredging)

The dredging of carefully selected areas will improve the flow of water within the fore reef zone, remove undesirable or damaging offshore accumulation of sediment, and restore the flow of suspended sand sediments towards the shoreline beaches. Selective dredging is vital to restoring the hydrodynamic conditions of the reef lagoon and to restore and maintain the quality of the beaches of PUNTACANA.

The dredge will also improve the quality of the sand on the beach areas by removing thick muddy sediment of the PUNTACANA Resort & Club and be utilized to pump sand from offshore banks to nourish existing beaches. Additionally, Playa Serena, the undeveloped beach between Tortuga Bay and Casa Club, has significant sediment accumulations that have impacted water quality and movement in the reef lagoon. Careful dredging of the area will restore the hydrodynamic conditions of the reef.

Studies of areas requiring dredging have been conducted and a plan for sediment removal has been completed. Offshore sand banks for nourishing beaches have been identified and tested for correct sand requirements.



Significant sedimentation accumulations in Playa Serena have impacted water quality and movement in the reef lagoon.



Sediment removal will restore hydrodynamic conditions in the reef lagoon.

Section 4: Phase II Proposal

Recommendations

The continued improvement of the health of the coastal marine system, and in particular the coral reef, is a critical factor in the long-term success of both the Coastal Marine Project and the Grupo PUNTACANA development as a whole. Now that beaches have been stabilized, the protection and restoration of the coral reef needs to become the primary focus of the project. Healthy coral reefs maintain and replenish beaches, protect coastal properties and houses against storm events and hurricanes, and facilitate key economic and tourist activities such as recreational fishing, diving, and boating.

The continued improvement and restoration of the health of the PUNTACANA coastal marine system will depend on three critical factors: 1. Scientific monitoring and research that provide tools for informed decision-making. 2. Careful management and regulation of activities within the PUNTACANA coastal marine zone ecosystem based on scientific data. 3. On-going maintenance of beaches and restored coastal ecosystems such as mangroves and sea-grass beds.

In order to insure the long-term success and sustainability the PUNTACANA Ecological Foundation proposes the following actions:

1. Develop state-of-the-art monitoring and research program that provides key information and tools for informed decision-making with the world-class University of Miami Rosenstiel School of Marine and Atmospheric Science
2. Develop Coastal Management Plan for PUNTACANA Coastal Marine Ecosystem utilizing decision-making tools and related data
3. Seek declaration of co-management of coastal marine ecosystem with Dominican Secretary of Environment and Natural Resources
4. Develop educational and outreach program to promote the project nationally and internationally.
5. Develop fundraising program for the project, maximizing relationship with University of Miami for this purpose.

Required Personnel

1. Hire one fulltime Project Coordinator, as part of the Ecological Foundation, to oversee all relevant aspects of the project (**Please see Appendix 2.**)
2. Renew contract of current oceanographer to oversee dredging, placement of reef structures, and other activities related to beach restoration.
3. Contract University of Miami- Rosenstiel School of Marine and Atmospheric Science to develop monitoring and research program and development of decision-making tools (**Please see Appendix 3.**)
4. Contract consultants and laborers on an as-needed basis to conduct the following:
 - a. Supervision of dredge operation.
 - b. Tasks related to beach maintenance and replanting coastal vegetation
 - c. Coordination and placement of reef structures.
 - d. Technical advice on mangrove restoration methodology

Proposed Budget

To be presented at Board of Directors meeting in Punta Cana in December 26-27, 2005.

Appendix 1: Proposed Budget

Budget presented to Grupo PUNTACANA Board of Directors November 2004. “Breakwater and beach construction “Corales Cove” was decided to be executed by PUNTACANA Engineering Department at a total cost of \$2m. The remaining \$1.54m would be executed by the PUNTACANA Ecological Foundation.

Beach reconstruction and stabilization	Moffatt & Nichols	Phase 1
• Breakwater and beach construction “Corales Cove”	Cost: \$ 1.4 m Time: 6 months	Cost: \$ 1.4 m Time: 6 months
• Beach restoration “Residencias de Corales”	Cost: \$ 200,000 Time: 3 months	Cost: \$ 100,000 Time: 3 months
• Beach construction “Villas Tortuga”	Cost: \$ 1m Time: 5 months	Cost: \$ 120,000 Time: 4 months
• Restoration “PC Resort & Club”	Cost: \$1 m	Cost: \$ 140,000
> South	Time: 7 months	Time: 4 months
> North	Cost: \$ 1 m Time: 7 months	Cost: \$ 140,000 Time: 4 months
-Playa Serena	Under study	
Reef restoration		Cost: \$ 400,000
• Artificial reefs construction		Time ^a : 6 months
• Coral transplantation & growth		Cost: \$ 80,000 Time ^a : 5 months
• Reef fish repopulation		Cost: \$ 50,000 Time ^a : 6 months
Coastal water quality improvement		Cost: \$ 400,000
• Dredge purchase		Time: --
• Improvement of the hydrodynamic conditions of the reef lagoon (dredging).		Cost: \$ 64,000 Time: 8 months
TOTAL	\$ 4.6 m	\$ 2.894 m

The execution time will depend on the atmospheric conditions and environmental permits.

* “Time” refers to the execution stage. Processes of growth and repopulation become evident in one year. It requires 5 years to achieve natural conditions.

Appendix 2: Project Coordinator Qualifications and Duties

Job Description Coordinator of Coastal Marine Project (PCM)

Action	Description	Result
Define	Technical, scientific, and operational objectives of PCM and the methodology to realize them	Clear definition of the goals and objectives of the Project and the
Identify	Local needs related to the PCM (Training, Capacity-building, Environmental Management, Research, Monitoring, Education Programs, Ecological Conservation and Restoration, National and international collaborations, necessary funding)	Report on the needs of the PCM with support from necessary individuals and departments.
Develop	Mechanism for management of information and data related to PCM	Clearly established guidelines for use of information
Implement	Plan for documenting PCM by all means necessary (data collection, photographs, drawings, maps, GIS)	Database of information related to the PCM
Investigate	“Best Practices” for projects, interventions, and experiments related to Coastal Marine Zones	Archive of “Best Practices” for Coastal Marine Projects
Create	Education y research plan for PCM integrating internal departments (Ecological Foundation, Hotel, Golf Course, Environmental Quality Control, Engineering, Public relations)	Implementation of action plan for PCM with appropriate individuals and departments.
Supervise	Work of PCM including workers, specialists, scientists, consultants, contractors	Timely and efficient completion of all necessary work
Incorporate	Education and research plan of PCM with programs and projects of national and international institutions (NGO, universities, government)	Mutually beneficial collaborations with diverse institutions PCM
Develop	Management Plan for coastal marine area of Punta Cana, including fishing, recreational activities, structural interventions, biology with all necessary actors related to coastal marine zone	Creation and implementation of management plan for Punta Cana
Manage	Budget for PCM	Efficient management of PCM budget
Coordinate	Administrative needs of PCM , including requests for purchasing, personal y materials, creation of inventories of materials	Efficient administration of PCM
Execute	Contracts for specialists, , technicians, and companies for PCM according to budget	Successful and timely completion of duties and realization of payments
Produce	Weekly and monthly reports related to PCM	Creation of updated archive of PCM
Assist	Application for external funds by PCM	Obtain external funding
Research	External funding opportunities (events, fundraisers, donations)	Obtain external funding
Coordinate	Creation of publicity materials for PCM (presentations, bulletins, brochures, posters)	Create necessary materials
Divulge	Information, reports and studies through appropriate channels of communication in accordance with the rules for use of information about PCM : articles, publications, Internet, journals	Increase public profile and scientific credibility of Ecological Foundation and PCM
Present	Findings from PCM in conferences, meetings, and workshops nationally and internationally	Sharing of information in accordance with rules of use of information
Develop	Education program with schools, high schools, universities and local stakeholders (homeowners, visitors to hotels, etc).	Creation of education program related to PCM

Appendix 3

Analysis of Coral Reef Decline in Punta Cana: Identification of Proximal Causes and Potential Corrective Steps

**A Proposal Submitted by the
Rosenstiel School of Marine and Atmospheric Science
University of Miami**

August 30, 2005

<i>PI</i>	John W. McManus, PhD
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<i>Co-PI</i>	Larry Brand, PhD

Project Dates: September 1, 2005 to October 31, 2007

Objectives

1. Using a collaborative research approach between the University of Miami and Fundación Ecología PUNTACANA, to improve local research capacity while providing for a greater overall understanding of the ecology and management factors in the area.
2. Broadly map underwater ecological habitat types in the Punta Cana area.
3. Identify the ecological health of these habitats and the linkages among them and with neighboring ecosystems bordering the Punta Cana area.
4. Determine the spatial patterns of nutrients in the Punta Cana area and how they vary over time, their potential sources, and the roles they play in maintaining the dominance of seaweed over coral on the reef slope and seagrass over sand on the reef flat, and which may be impacting overall local ecosystem health.
5. Determine the distribution and ecological impacts of fishing throughout the Punta Cana reef area, and associated perceptions of stakeholder groups, building on the 2004 University of Miami scoping report.
6. Identify and assess the policy instruments and management institutions relevant to the Punta Cana reef ecosystem, highlighting current capabilities as well as the potential to implement ecosystem-based management.
7. Provide recommendations for future research and action on a longer-term, larger geographic scale, including the potential need for, and scope of, physical oceanographic studies, hydrological analyses, social research and activities, economic analyses, and policy development activities.
8. Develop proposal document, high quality reports, published works, presentations and other educational and promotional materials that will serve as basis for future fundraising efforts and long-term sustainability of project and as educational materials for students, local stakeholders, national and international media, government agencies, and other institutions.

Project Description

Overview

The coral reefs of Punta Cana show signs of once having been covered with dense corals and packed with many species of colorful fish. Currently, much of the coral has been displaced with dense beds of seaweed. Fish are small and very sparse. Earlier studies by the University of Miami (AGRRA survey and Socioeconomic Scoping Study) and others have highlighted that there is clearly a problem with severe overfishing. Additionally, there is a possibility of a problem with nutrient pollution from sources either local to, or distant from, the immediate area. Based on prior experience in similar situations, researchers at the Rosenstiel School have previously proposed that a sustainable solution would necessarily involve a broad-scale watershed approach, involving

- 1) activities leading to a reduction of fishing pressure in the many communities from which the fishers originate,
- 2) action to improve water quality in the large underground river system and along a stretch of coastline up-current from Punta Cana, and
- 3) stakeholder involvement which would improve compliance with protective regulations.

The full-scope of the activity would require a study of at least six years, to allow for the completion of critical research, implementation of adaptive management, and proper evaluation of social, economic and ecological impacts of the actions taken.

The present study represents an initial step toward the larger activity. This project is focused on an initial phase of an integrated social-ecological evaluation of the Punta Cana Reef Ecosystem, and is designed to clearly specify the existing geographic patterns of ecological habitats and of nutrients and fishing activities that impact these habitats. It will further provide initial insights into the legal and institutional structures that must be accounted for in the search for sustainable solutions to the ecological problems.

The study consists of four components: general ecology, nutrient ecology, fisheries analyses, and policy analyses. All data from this study will be put into an advanced online geographic information system (GIS), based on Data Navigator South Florida (www.ncoremiami.org).

General Ecology

A combination of Ikonos satellite data analyses and underwater surveys will be used to produce a map of the major habitat types in the Punta Cana Reef Ecosystem. While airplane-borne hyperspectral and lidar mapping would provide hundreds of times more useful information at much higher resolutions (at costs beyond the present budget), the Ikonos satellite data will suffice for purposes of initial mapping at linear accuracies of less than ten meters.

Each habitat type will be evaluated with regard to ecological health. The composition of species will be studied with respect to life cycles (including mobility and needs for other habitat types at various life stages), thus yielding information as to the interrelationships among the habitats and their potential dependencies on influxes of larvae from ecosystems outside the local reef.

Nutrient Ecology

A monitoring program will be developed that will identify the geographic patterns of nutrients across the reef areas and along the shore, as well as their variability over time. The study will involve establishing a system of sampling areas, to be sampled for nitrogen and phosphorous in various ecologically important forms at regular intervals throughout the two years of the study. Analyses of the various ecological habitat types will be used to infer potential changes in the nutrient content of the waters as they flow across portions of the reef area. The study will broadly identify major sources of nutrients from land locally, and major sources from above and below the Punta Cana area.

Fisheries Analyses

Shore-side surveys and periodic inventories of fishing activities will be used to estimate the impacts of fishing on the reef ecosystem over time and space. Because the limited scope of this project will not permit full analyses to be conducted at each potential landing site for Punta Cana fish along the coast, the study will rely heavily on fish population parameters from other reef areas around the Caribbean for some key analyses.

In addition to the estimations of catch by species and size categories, the surveys will identify the communities in which the fishers are based, in preparation for expanded activities involving stakeholders in education and planning activities. Consumption and trade of fishery products at local scales will be estimated through the household survey instruments.

Policy Analyses

The study will include an analysis of policies and regulatory instruments and institutions relevant to the Punta Cana Reef. In most countries, the policy instruments governing coral reefs are complex and overlapping, with conflicts of purpose and areas of need for improved coverage. Similarly, the responsibility for maintaining coral reef health is often divided among several local, provincial and national agencies, with overlaps, conflicts, and gaps to be filled. This study will be an initial investigation into the existing environmental policy arrangements relevant to Punta Cana, in collaboration with Grupo PUNTACANA and Fundación Ecología PUNTACANA, with the intent of identifying current capacities and gaps, as well as to provide preliminary guidance into the types of policy design principles that could improve the governance of the Punta Cana Reef Ecosystem. Structured interviews and participatory institutional mapping with key government personnel and informants from stakeholder groups will be conducted in close collaboration with local institutions including Fundación Ecológica.

Project Deliverables

This project will result in a final report that will detail all research findings and make recommendations for local action based on those results. A “Data Navigator Punta Cana” will be created, a decision support tool consisting of GIS layers with the data from this study combined with data from a broad range of other sources, such as prior studies and data from various satellite and other international archives.

The project will develop a polished proposal document with initial findings that can be used to secure funding from external sources such as private corporations or sponsors, foundations, international funding agencies, or other sources to be identified to support future fundraising efforts and the overall long-term sustainability of the project.

The project will produce high quality reports, published works, presentations and other educational and promotional materials for students, local stakeholders, national and international media, government agencies, and other institutions.

In addition to the reports, promotional and educational materials, decision support tool, and the proposal documents, the research will involve a very tight collaboration between researchers from the University of Miami and those from the Fundación Ecología. This collaboration will both greatly improve the capacity of the two teams to conduct the study, and also result in well-trained personnel who can locally continue and expand upon key aspects of the research.

Timeline

ACRES TimeLine		2005		2006				2007	
Tasks		Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2
General Ecology									
	Satellite analyses								
	Underwater mapping								
	Ecological health analyses								
	Internal/external dependence analyses								
Nutrient Ecology									
	Establishing monitoring stations								
	Monitoring and nutrient analyses								
	Nutrient data analyses								
	Analyses of habitat influence on nutrients								
Fisheries Analyses									
	Establish survey sites								
	Conduct regular monitoring								
	Data analysis								
Legal/Institutional Analyses									
	Obtain legal/institutional information								
	Conduct analyses								
Integrative Information System									
	Establish framework								
	Incorporate existing online data								
	Incorporate Ikonos maps								
	Incorporate field data								
	Put online								
Prepare Final Report									