THE CONSERVATION OF MARINE AND COASTAL ECOSYSTEMS THROUGH INTEGRATED MANAGEMENT OF PROTECTED AREAS, THE COASTAL ZONE, AND FISHERIES

Prepared by Environmental Defense Fund
October, 2012

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Glossary

CIEC	Center for Ecological and Coastal Investigation, Cuba
CITMA	Ministry of Science, Technology and Environment, Cuba
CIP	Center for Fisheries Research, Cuba
CNAP	National Center for Protected Areas, Cuba
CONAPESCA	National Commission for Fishing, Mexico
EDF	Environmental Defense Fund
GEF	Global Environment Facility
INAPESCA	National Institute for Fishing, Mexico
ITQ	Individual Transferable Quota (i.e., a type of catch share for fishery management)
NPA	National Protected Area
MPA	Marine Protected Area
TNC	The Nature Conservancy
TURF	Territorial User Right for Fishing (i.e., a type of Catch Share for fishery management)
SNAP	System of National Protected Areas, Cuba

Executive Summary

With over 3,000 miles of coastline—the Cuban archipelago comprises more than 4,000 islets and keys. Cuba is the largest island in the Caribbean and virtually unmatched in biodiversity. Coastal and marine ecosystems such as mangrove swamps, sea grass beds, and coral reefs provide breeding, nursery and feeding grounds for many commercial fish species, as well as endangered migratory species like marine sea turtles, sharks and manatees. Cuba's coastal areas are also home to some of its most important economic sectors—tourism, fisheries, and energy development.

Environmental Defense Fund (EDF) has a long history of working with the Cuban government. For over ten years, both have strived to improve collaboration between the United States and Cuba regarding important environmental issues, from biodiversity conservation to oil exploration. In November 2011 the Cuban Ministry for Science, Technology and the Environment (CITMA) and EDF hosted a weeklong workshop to explore the conservation of marine and coastal ecosystems through integrated management of protected areas, the coastal zone and fisheries. The first part of the workshop took place in Cayo Coco, Cuba on November 12 and 13, 2012. The second part took place in Jardines de la Reina, Cuba on November 14 - 19, 2012. The two agencies within CITMA who organized both parts were the Center for Coastal Ecosystems Research (CIEC) and the National Center for Protected Areas (CNAP).

The workshop was held in commemoration of the twentieth anniversary of the Cuban Center for Coastal Ecosystem Research (CIEC) in Cayo Coco. This center, which is housed in the Ministry of Science, Technology, and Environment, provides much of the science that policy makers and managers use to develop environmental policies and programs for coastal areas. Their work is also aimed at ensuring that tourism and other economic development in coastal areas is environmentally sustainable.

Participants from several countries participated in the workshop, which included a seminar on Cayo Coco in Jardines del Rey and a floating workshop in Jardines de la Reina, including site visits, diving, and snorkeling. The objective of the two-part workshop was to present and exchange knowledge regarding the marine protected areas, fishery management, and coastal zone management. Eighteen presentations were given and participants had the opportunity to build relationships and plan next steps for their collaboration on marine and coastal science and conservation. One of the key projects discussed was the Tri-National Shark Initiative, spearheaded by EDF in collaboration with US, Mexican and Cuban academic and government institutions.

Most importantly, participants were able to take in the beauty of Cuba's natural environment while gaining hands-on experience and holding technical discussions regarding innovative management and conservation strategies from around the world. This workshop served to increase knowledge, awareness and create a platform for collaborative work to meet conservation and socio-economic development goals for fisheries and marine protected areas.

I. Cayo Coco Seminar and Presentations

The Cayo Coco seminar and presentations brought together a wide array of participants (See Appendix 2) from academia, NGOs and government to discuss areas of expertise in protected area management, coastal development, fishery science and management, and related topics such as ecosystem services and ecotourism.

The seminar began with a warm welcome from **Dr. Celso Pasos Alberdi** (CITMA Delegate in Ciego de Avila Province) as he invited everyone to celebrate the 20th anniversary of the Center for Coastal Ecosystems Research (CIEC), one of Cuba's oldest and most important coastal research centers. Next, all workshop participants introduced themselves and watched a film about tourism in Cuba produced by Mundo Latino. The film explored Cuba's incredible natural environment and emphasized the importance of protecting the nation's biodiversity. The film provided good context for the workshop. This is one of many films on the Cuban environment that Mundo Latino has produced, and it gave the group of diverse backgrounds a visual insight into the rich marine life and important natural protected areas that Cuba has to offer.

Maritza García, Director of Cuba's National Center for Protected Areas (CNAP) began the series of presentations by summarizing the mission of the National System of Protected Areas (SNAP): *to protect biodiversity and the national patrimony and promote sustainable development through monitoring, science, and environmental education*. She also provided an overview of SNAP as an integrated system with multiple actors. First, she explained that Cuba has 6 designated biosphere reserves, 6 sites designated under the RAMSAR Convention on Wetlands (2 shared with the Biosphere Reserves), 2 UN World Heritage sites, and a total of 253 national protected areas (NPAs). CNAP's strategic goals include increasing international collaboration, determining threats and vulnerabilities due to climate change, and improving efficacy in planning. In addition, CNAP aspires to reverse a trend of low enforcement, so that by 2013 most protected areas will be subject to better monitoring and enforcement and more stringent regulations.

Dr. Celso Pasos Alberdi of CITMA presented an overview of what scientific research is conducted in Ciego de Avila province. Ciego de Avila is 400 km from Havana and is the second least populated province in Cuba. It is a province rich in fresh and saltwater resources, and is now important for sustaining a high value for natural resources and ecotourism. Examples are the Laguna de la Leche, Cuba's largest fresh water lake and the popular white sand beaches to the north. Currently there is research being done by five universities in the province and five research centers. In eight of Ciego de Avila's municipalities there are Centers for Scientific Capacity, Technology and Environment. These centers work to build capacity and coordinate research. A good example of research is in biogas, solar and wind power. The northern coast keys were the first in the country to put in place a Research Center (CIEC) for environmental and socio-economic monitoring of the tourism developments, with the goal of reaching higher tourism standards with minimal environmental impact. These Research Centers also look at ecosystems such as coral reefs, sea grass beds, coastal vegetation, mangroves, lagoons and help CNAP with research and reporting needs.

Daniel Whittle, EDF's Cuba Program Director, presented on the history of EDF's collaborative projects with Cuban scientists and the benefits of environmental cooperation between Cuba, the United States, and other countries in the region. EDF has been working with Cuban partners since the year 2000 on a number of projects designed to advance the conservation of marine and coastal ecosystems, including scientific and fishermen's exchanges. A special focus has been on collaborating on the science and management of migratory fish populations (e.g., sharks, reef fish), essential fish habitats, and other

natural resources, including offshore oil and gas deposits. Consequently this has greatly helped in increasing knowledge about conservation and the use of innovative fishery management tools to achieve ecological, social and economic objectives in Cuba.

Dr. Rod Fujita, Director of Research and Development for EDF's Ocean Program, then discussed the goals that are currently used around the world to guide implementation of marine resources and ecosystem conservation and management programs. Dr. Fujita stated that goals are also needed for *whole* ecosystems, given the tradeoffs between the uses of ecosystem services. Protected areas, coastal zone management, and fisheries management are tools that are usually used separately to achieve a variety of goals. The cumulative impacts of many different kinds of human activities could result in ecosystem collapse if MPA and fishery managers are solely focused on goals for single services. For example, fishing most coral reef fish species down to biomass levels commensurate with maximum sustainable yield could "tip" coral reefs from healthy states to less healthy states. For fisheries, we often seek to maximize yield. But maximum yield may not be the best goal for all fisheries; for example, recreational fisheries may do best with lower yields that result in high fish densities and larger fish that enhance fishing encounter rates and the number of trophy fish that are caught. Lastly, even the best goals cannot be achieved if governance systems are inadequate. People often face incentives to overexploit resources and potential stewards of natural resources are disempowered relative to others due to the distribution of rights, privileges, and power.

To finish the introductory presentations, **Dr. Doug Rader**, Chief Marine Scientist at EDF presented a talk on the importance of ecosystem-based management (EBM) functioning as a three-pronged approach that incorporates social, economic and ecological aspects all into one. An example of where an EBM approach is needed is the south Atlantic of the United States. The main fisheries are vermillion snapper, black sea bass, grouper and golden tilefish. In this example, fishery management historically was based on command and control regulation without analyzing and considering social aspects to build stronger and more economically resilient coastal communities, or ecological aspects such as deep-water reefs that are essential fish habitat. In contrast, the incorporation of MPAs with the golden crab fishery in south Florida, managed under a catch share, is an example of EBM that has been more successful. In creating MPAs for habitat protection the golden crab is able to thrive. In addition, fishing is not managed through increasing effort limitations but is managed for meeting socio-economic goals for the fishermen and their communities. To achieve a workable EBM, scientists and the fishing sector base management upon sound science to ensure biologically sustainable fisheries, while always socializing regulation with the larger community. In this case, Cuba can view an EBM approach as based upon sustainable fisheries, protected habitats and strong coastal communities.

The group then focused on particular MPA case studies from around the world that could provide insight into what is necessary for a successful MPA with sustainable fisheries and livelihoods.

Susana Perera, specialist with CNAP gave an overview of the Global Environmental Facility (GEF) project to protect coral reef ecosystems along the southern coast of Cuba, including globally significant biodiversity hotspots. Through this project, CNAP works with several fisheries, including the important shrimp and lobster fisheries, to increase monitoring and sustainability measures. Integrated management is occurring in some areas that also have a strong fishing presence, and the government is expanding MPAs ecologically related to terrestrial and coastal protected areas. There are currently eight programs for monitoring three priority ecosystems: corals, mangroves, and sea grass beds. The project is also monitoring important wildlife species (e.g., iguanas, sea birds, and manatees). Business planning and partnerships are used for increasing MPA revenues and cost efficiencies. Productive activities like tourism and fishing will have specific management plans with target goals and objectives. For example, Cuba has a goal of eliminating gillnets and a buy-out of eight (8) fishing boats with gillnets (equivalent to15% of all Cuban gillnet fishermen) and replacement of the gear is underway. Some fishermen can get

sport fishing tourism permits with the buy-out; this is an example of efforts to develop alternative livelihoods. Other examples include training programs for MPA personnel and other stakeholders for supporting monitoring and other activities related to MPA management.

Dr. Bill Kiene from NOAA's National Marine Sanctuaries Unit offered another case study of MPA systems, one in Papua New Guinea and the other in Indonesia. In both countries there are different communities, which have different levels of interaction with their environment from subsistence to local markets, to large-scale exploitation supplying international markets, often using destructive fishing methods (such as dynamite). Results showed significant greater fish biomass increases inside the community/traditional MPAs from Papa New Guinea in contrast to those under MPAs managed under command and control systems in Indonesia. Embedded in that particular society (Papua New Guinea) is the social structure that can support a rotational system with some closed MPAs (no-take zones) and some open. When applied to a larger context, Kiene found that adaptive management is a crucial component. The incorporation of locally embedded social, economic and cultural factors is critical for creating a larger MPA, especially if there is no funding for high levels of enforcement. Kiene thus concluded that imposed command and control spatial management areas will be less likely to succeed, as was seen through the comparative case of Indonesia.

A similar case study presented by **Erica Martling** of EDF, highlighted community involvement in fishery and MPA design in the Upper Gulf of California, Mexico. The Upper Gulf of California Biosphere Reserve is an example of an MPA with poor enforcement, where illegal fishing and overexploitation are common. Over the course of the last nine months EDF followed a multi-stakeholder design process for better fishery management that included all of the local fishing cooperatives. This process began with identification of the symptoms of the socio-economic inefficiencies and poor enforcement, as well as recognizing the drivers of overfishing. Once there was a common understanding of the problem and the need for all of the actors along the supply chain to take part in the creation of better management solutions, the participation increased two-fold. Fishermen began to better collaborate with policy makers and commercial distributors resulting in community fishery management agreements that met the government's overall regulatory goals. Currently the fishery is moving towards a catch share program for the Gulf corvina species, which has already produced results that are complimentary to the MPA.

Dr. Hoyt Peckham of Grupo Tortuguero gave the example of Punta Abreojos, in Baja California, Mexico, which is an isolated fishing community on the southern end of the Vizcaino Biosphere Reserve, Mexico with 1600 inhabitants. The cooperative of Punta Abreojos owes all of its prosperity to the lobster fishery that produces 140 tons per year, sells live lobsters directly to Japan, and is completely community-run by a cooperative. In addition to financial prosperity (equivalent to 1.5 million USD per year), the cooperative is responsible for paying for all monitoring expenses including catch accounting and biological and ecological monitoring. CONAPESCA (Mexican Commission for Fishing) co-pays for enforcement of no-take zones and INAPESCA (Mexican Fisheries Science Institute) pays for and calculates stock assessments. This is made possible because strong user rights were established with the Punta Abreojos Cooperative through visionary leadership, isolation and a strong history of cooperative law. The user rights are in the form of a fishing concession that gives Punta Abreojo's cooperative exclusivity over the resources in a determined geographic area. The cooperative also invests heavily in enforcing this fishing area to prevent outside fishers from exploiting their resource. Enforcement is also conducted by CONAPESCA and PROFEPA- the enforcement arm of CONANP (Mexican Commission for Natural Protected Areas) since Abreojos is inside a NPA.

Nic Requena of EDF Belize gave a presentation on MPAs and managed access development in Belize. Similar to Mexico, Belize is also focusing on creating strong user rights for fishermen through the creation of fishing areas in Glovers Reef and Port Honduras (akin to concessions). The process in Belize began with NGO partnerships, fishermen exchanges, workshops, and design groups (including the

Ministry of Fishing), and community consultations. There is a prevalent attitude that the fishing community is ignorant and does not have capacity to manage their resources. However in 2011 the Ministry approved closed access through licensing in Glovers Reef and Port Honduras, thereby giving the local fishing community a greater stake in managing their fisheries.

As a result Community Managed Access Committees established themselves with the aim of empowering the local community of artisanal fishermen through strong leadership and transparency, vetting of licenses, widespread communication and diffusion of information, improved data reporting and a national catch shares task force. Through working together with local stakeholders and government, EDF has been able to show positive results with the fisherman licensing program and more exclusive access to the fishery for local communities, thus increasing the popularity of a rights-based, co-managed fishery management strategy for Belize.

Wes Erikson, a fourth generation groundfish fisherman from British Columbia, Canada showed how his fishery has changed tremendously in one lifetime. Erikson explained that when species started to decline in the 1980s and 1990s fishermen decided to explore catch shares. At that time, however, fishermen had many fears and concerns about catch shares, including potential job losses and privatization of a public resource. In 1991 there was a move to rights-based fishery management for halibut despite low levels of trust between fishermen. Hail and port monitoring requirements were instated, and as a result there was improved enforcement and none of the fears actually materialized. The only thing that changed was management and how fishermen *thought* about the fishery. The banks still do not recognize individual transferable quotas (ITQs) as a property right, yet to these fishermen it *feels* like a right and this shows the change in mentality and attitude that the fishermen went through with the new management. Erikson concluded that groundfish fishermen are now stewards of their resource, plan ahead, and are even taking additional measures to have the least amount of bycatch possible.

After hearing a number of case studies presentations, the group turned their attention to the planning aspects of fishery management and MPAs. **Orlando Suarez** of CITMA provided an overview of the management plan process for MPAs in Cuba. Each management plan is for five years and is adapted each year, as necessary, pursuant to monitoring and evaluation. When the protected area is first legalized there is a window of two years to write the management plan, after which they are implemented through specific Operational Plans. The Jardines de la Reina National Park is an especial MPA because it straddles two provinces, two main cabinet agencies, the Ministry of the Food Industry, including fishery, and Ministry of Tourism, and comprises five local communities. In addition, there is the important aspect of fishing inside the MPA that also needs to be considered in the management plan. In the case of Jardines, catch accounting, monitoring and size limitations are all requirements that will be stipulated in the Operational Plan, as well as no-take zones for fishing that coincide with tourism zones managed by Avalon, a private company with a diving and fishing concession in the park. Lastly, to help support the conservation initiatives, the Ministry of the Food Industry completed a series of buy-outs of fishing permits for tourism operations.

Marianne Kleiberg of The Nature Conservancy (TNC) showed how marine spatial planning could be used to help management mainly by integrating diverse strategies for marine conservation and management with multiple objectives such as tourism and recreational and commercial fishing. This type of planning occurs through a series of regulations, so zoning can include both fishing and tourism. The base information needed is: habitat type and quality, uses and values for fishing, tourism and recreation activities. Like most planning processes, it is very important to have public participation and to work directly with resource users. There are a series of compatibility analyses of all the different factors mentioned above and the result is a map showing the optimum use for each different spatial zone.

Eddy Silva, also from TNC, showed how the development of coastal tourism must be met with caution when trying to protect marine and coastal areas. Currently TNC is conducting an econometric analysis with different management variables (e.g., park fees, willingness to pay, etc.) and a cost-benefit analysis of different types of revenue schemes to determine how much investment is needed in order to achieve the desired returns. The objective is to find a point where marginal cost is equal to marginal benefit and help government use the study to adjust park fees. Additional tourism-based financing mechanisms including concessions, donations and annual operating license fees should be analyzed and introduced at the same time as entrance fees are proposed.

Pam Baker from EDF showed how integrated management can increase benefits by balancing fishing values with eco-tourism and ecosystem health. In her example she showed how sharks are critically important in marine ecosystems and fisheries. Sharks have many different values: fishing livelihoods, food source, and nature tourism. In addition, sharks are a migratory species that swim across national boundaries, resulting in fragmented governance and poor fishery management, as well as overexploitation. Right now, sharks have no value until they are landed so there is no incentive to leave them in the water for conservation. According to Baker, the big opportunity for shark conservation lies in sustaining and increasing benefits from sharks and fully assessing their value for fishing and tourism related activities. EDF aims to improve shark conservation in the Gulf of Mexico through international cooperation with the *Tri-National Shark Conservation Initiative* between Cuba, Mexico and the United States. The Cuba part of the program includes a pilot program at University of Habana to characterize shark fisheries in four ports (1 commercial and 3 private commercial/sport). In Jardines de la Reina sharks are one of the most important reasons to visit this MPA. 22 percent of surveys said that sharks were the primary attraction for the MPA, and 78% picked sharks, whale sharks, and rays as the best attraction. Sharks thus present a high value for the MPA's revenues (through diving) equaling around 22 million dollars. In Mexico, the Campeche Initiative characterizes shark fisheries, similar to Cuban program. Meanwhile in the United States, the initiative is now focused on using a catch limit and regulatory reform process with a joint EDF-industry catch share proposal.

Next, **Rafael Tizol,** director of the Center for Fisheries Research in Cuba (CIP) gave an overview of fishing in Cuba. The country is divided into 4 fishing zones. The current stock assessment methods are: census of abundance by observation, modeling, and recruitment models. CIP collects all the data to make stock assessments and analyze catch data. Stock assessments are given for all four fishing zones. Regulation of the fishing zones is done through quotas, effort controls, prohibited gear types, promotion of selective gear, minimum or maximum size limits, temporal season closures, and special use zoning. In the future CIP will study connectivity, allow for recuperation of stocks, and implement adaptive management. There has been continual regulation over time, adapting to the need for the stocks to be better protected and regulated.

To continue the theme of stock assessments, **Dr. Chris Costello** of University of California Santa Barbara showed that only 300 fisheries around the world have actual stock assessments. Ten thousand do not have assessments, and he focused his talk on how to use new methods to evaluate data-poor fisheries. One option is a cooperative database that analyzes behavior and inherent spatial exclusivity. Territorial User Rights Fisheries (TURFS) can include long-term incentives to care for resources sustainably. Spatial rights need to be designed well for this to work in both data-poor and data-rich contexts. The management of data-rich fisheries can help to better design data-poor management, based on knowing what information is crucial and where extrapolation can be used. In any case, there is a need to evaluate trade-offs in space (for example conservation versus fisheries income for MPA networks) and focus on modern methods that permit design from data-rich to data-poor, considering the opportunities for an increased number of stock assessments worldwide.

To round out the second day of presentations and to serve as an introduction to the upcoming floating workshop, **Dr. Fabian Pina** of CIEC gave an overview of Jardines de la Reina as one of Cuba's more spectacular MPAs. Established as a park in 2010, Jardines de la Reina is one of the largest in the Caribbean with 1000 square kilometers. It consists mainly of sea grasses, mangroves, coral reefs, and the associated flora and fauna. Jardines de la Reina shows the most mature trophic web in the Caribbean somehow due to the fact that there have never been any human settlements in the area. Besides the Cuban government, there are also various international NGOs working to protect Jardines de la Reina. There are three important fisheries in the MPA: shrimp, finfish and lobster. For tourism and scientific research there are prime scuba diving and fly-fishing areas that are considered some of the best in the world. Overall there are 251 identified fish species, which account for 24% of Cuban fish species. Jardines de la Reina has also proved to be very resilient so the recovery of coral reefs and sea grasses after hurricanes is better in this region than in other areas that are not protected. The ecosystem, which is also more trophically intact than other reefs, shows more resilience to lionfish (a dangerous invasive species). The total economic value of Jardines de la Reina is estimated at 4 million USD, with a net present value of 33 million USD.

II. Floating Workshop in Jardines de la Reina

The second part of this workshop was focused on experiencing the unique ecosystem and biodiversity of the Jardines de la Reina National Park, which is located in the Archipelago Jardines de la Reina off southern coast of Cuba, between Ciego de Avila and Camaguey provinces.

http://www.bedincuba.com/mapa_cuba_ciego_avila_jardines_de_la_reina.htm

Each day in Jardines de la Reina was a gift of nature. It was in this unique and uninhabited area that we were able to see first-hand the benefits of marine conservation, responsible fishery management and a well-functioning ecotourism. During the work sessions the group usually split into three smaller groups to rotate through the different diving and snorkeling spots. The most impressive species were found on our dives, including close-up encounters with predatory Silky and Caribbean reef sharks, mammoth

Whale sharks, Goliath grouper and Cubera snapper, dazzling colors of parrotfish and dozens of coral species. The teams recorded 135 fish, dozens of coral, and 14 bird species (see Appendix 2).

The platform where workshop participants gathered for discussions, dive prep and story-telling time. Dive boat from the Avalon Floating Lodge in Jardines de la Reina. (Photos by Erica Martling)

The workshop combined field explorations, real-life case studies, and relationship building to advance common interests in healthy, thriving oceans. Among other things, we learned that Cuba highly values shark viewing in its nature tourism industry, and is seeking a balance between fishing livelihoods and food security.

On board discussions with Celso Alberdi, Founder of CIEC. Visiting the mangroves and beaches of Jardines de la Reina. (Photos by Erica Martling)

During the evenings the group engaged in discussions regarding the value of marine protected areas such as Jardines de la Reina. The group was also able to learn more about how this particular protected area is managed. Avalon is officially the reserve's tour operator under contract with Marlin, a state-owned enterprise that specializes in tourism (under the Ministry of Tourism). Avalon began its operations in Jardines de la Reina in 1995. Avalon pays a yearly monetary sum to the Ministry of the Food Industry to make up for income that the commercial fishing sector would have made in the protected area (a no-take zone for commercial fisheries).


Life in Jardines varies from the smallest creatures that hover around the mangroves to those that patrol the deep blue, such as these black tip reef sharks. (Photos by Noel Fernandez)

In addition, Avalon has been commissioning ongoing research on the park's ecosystems. CIEC began this research in 1995 and since then with the compiled information that was included in the proposal for the MPA. In 2010 the MPA was officially approved and the enterprise Flora and Fauna (within the Ministry of Agriculture) was assigned the protection of the park, although the entire jurisdiction is under CNAP.[1] Avalon also makes in-kind contributions for enforcement of the MPA (fuel and transportation for inspectors' boats). This system has proven to be a good example of public-private partnership because it is clear that the enforcement and monitoring of the area could not have been carried out otherwise. The system of integrated coastal management has also helped resolve conflicts in terms of job losses. Avalon, for example, has run numerous capacity building programs to help former fishermen work in tourism.

The MPA in Jardines de la Reina is a good example of the results achieved when different top cabinet agencies collaborate in fisheries management, conservation and tourism. In addition, the management plan for Jardines de la Reina was made after many participatory workshops, which included local coastal communities of Júcaro and Santa Cruz.


Jardines has shown to be a very resilient ecosystem with thriving biodiversity despite the large numbers of invasive lionfish. (Photos by Noel Fernandez)

Currently commercial lobster fishing is allowed inside the national park, although a new management plan is being developed that will include new, and possibly more restrictive, fishing regulations. Zoning is also contemplated under the GEF program, but still needs to be discussed with the Ministry of the Food

1. Decreed law 201 says that CNAP has to oversee all National Parks and Protected Areas, even though different empresas or local governments or tourism operators may manage individual areas.

Industry. There is recreational catch-and-release fishing inside Jardines that is mainly catered towards the tourist market, but these anglers must fish exclusively with trained tour guides from Avalon.

The overall objective of the proposed new zones is to give more protection to the no-take zones inside Jardines that contain the highest natural value. CNAP plans to build buffers around these zones to help make management of the MPA easier and enforcement more effective. Most of the illegal fishing pressure comes from the village of Júcaro, despite the fact that revenue from tourism for the local community has been better than the revenue from fishing that they earned before the reserve was established. It is estimated that at least one person from each family in Júcaro works in Jardines de la Reina and/or for Avalon. The basis for tourism in Júcaro is due to port activity since all of Avalon's boats to Jardines de la Reina's floating hotel "La Tortuga" leave from this port. This has offered Júcaro residents a real incentive and motivation to care for the protected areas and increase reserves because they have benefitted economically. In addition, the local community is now involved in monitoring and enforcement of MPA regulations.


Better protection of core zones can allow large diving attractions to flourish, such as goliath grouper and sea turtles. (Photos by Noel Fernandez).

Lastly, we learned that Cuba has strict rules governing foreign yachts allowed in the country's waters (each boat entering Cuban waters requires a permit). Regulation of international marinas for boats, and marine zoning on an island-wide scale could further help prevent over-exploitation. Currently, every marina has an Environmental Impact Assessment (EIA) that determines the capacity of that marina. In addition, the new Management Plan for Jardines de la Reina will include the boat carrying capacity of the area.


Two Workshop participants enjoy lunchtime touring Jardines de la Reina. A diver checking out the beautiful coral reef below. (Photos by Erica Martling and Noel Fernandez)

III. Next Steps for international cooperation for ocean conservation and sustainable fishery management

The final part of the floating workshop, and the culmination of the week's work in Cayo Coco and Jardines de la Reina was to discuss the next steps for further collaboration between the participants, and moreover between Cuba the United States. The needs expressed by the Cuban and international participants were the following:

- Develop pilot projects in some of Cuba's fishing communities to test catch shares design.
- Design and carry out training programs regarding tools that align economic benefits with conservation, specifically addressed to each of the following audiences: decision-makers, fishery managers, tourism managers, tour-operators, directors of MPAs, scientists and fishermen.
- Hold international workshops and exchanges with managers of MPAs, scientists and fishermen to discuss successful experiences and common challenges.
- Create an online forum or blog to publish scientific findings, exchange successful experiences and discuss common challenges.
- Look at SNAP's strategic plan to outline potential collaboration projects with EDF and CNAP on MPAs.
- Work together to find and attract more international funding and support for Cuba's sustainability efforts in the Caribbean's biologically connected corridor.

The priority for EDF's Cuban partners is thus to continue collaboration at an international scale both between NGOs and the Cuban government, but also between scientists, academia and government-to-government agencies. Jardines de la Reina is an exemplary place that must continue to be protected and from which much can be learned. Cuba's objectives, as stated by Maritza Garcia at the outset of the workshop, are to increase the number of well-functioning and enforced MPAs and fisheries management throughout the whole country. The ultimate goal is to increase resiliency both of fisheries and ecosystems as well as to ensure the protection of virgin areas such as Jardines de la Reina without compromising economic development of the region.

The final agreements of the workshop were to reconvene the group within another two years to evaluate the progress that has been made in terms of reaching Cuba's objectives, as well as increasing collaboration between Cuba and international partners. The group identified two potential sites for the next workshop, Ciénaga de Zapata and/or Guanahacabibes. The evaluation of both the Cayo Coco and Jardines de la Reina workshops was very positive in terms of cross learning, knowledge application and solidifying important relationships. Both workshop participants and the gracious hosts from the beautiful province of Ciego de Avila left the workshop eager for future opportunities to collaborate and connect regarding the importance of Cuba's stunning natural resources and the critical need for protection and sustainability.

(Photo by Erica Martling)

APPENDIX 1

General Program for Workshop "The conservation of marine and coastal ecosystems through the integrated management of protected areas, coastal zones and fisheries" (Cayo Coco - Jardines de la Reina, 12th to 18th of November of 2011)

Day/ Hour	Activity	Observations
Sunday 11/13		
9:00-9:20 a.m	Welcome and presentation of the participants and an overview of the objectives and the hoped for results of the workshop	ITMA, Ciego de Avila Province
9:20-9:40 a.m	Presentation of National System of Protected Areas (SNAP)	Maritza García (CNAP)
9:40-10:00 a.m	Presentation on the benefits of the exchange and the collaboration between scientists.	Daniel Whittle (EDF)
10:00 -10:20 a.m	Presentation on developing fishery and ecosystem sustainability goals.	Rod Fujita (EDF)
10:15-10:35 a.m	Presentation on "Objectives, goals and specific programs within the framework of the GEF Project for the Archipelagos of South Cuba. Preliminary results and priorities for the development of research projects".	Susana Perera (CNAP)
10:35-11:05 a.m	**Break**	
11:05-11:25 a.m	Presentation on "Linking the management of fishing and the protection of habitats: lessons learned in the United States and elsewhere."	Doug Rader (EDF)
11:25-11:45 a.m	Development of scientific investigations in the province of Ciego de Ávila, 20 years after creation of the Center for the Study of Coastal Ecosystems.	a) Dr. Celso Pazos Alberdi (CITMA)
11:45-12:05 a.m	How to make a successful Marine Protected Area? Examples from the Indo-Pacific region and their relevance to the Greater Caribbean.	Dr. Bill Kiene (Consultant for NOAA, US Department of Commerce)
12:05-12:30 a.m	Implementation of the Management Plan for Marine Protected Areas. Case Study: Jardines de la Reina National Park	Orlando Moreno Suárez, Protected Area Specialist
12:30 – 1:30pm	**Lunch**	
1:30- 1:50 pm	Spatial Marine Plan: case studies on planning with multiple objectives that are oriented towards conservation, fishing and tourism.	Marianne Kleiberg and John Myers (The Nature Conservancy-TNC)
1:50-2:10 pm	Tourism as a sustainable finance mechanism for protected marine areas.	Eddy Silva (TNC)
2:10-2:30 pm	Presentation on "Sharks: how innovative management	Pam Baker (EDF) and Tamara

	augments economic benefits when it is integrated with healthy ecosystems, ecotourism, and the added value of food products"	Figueredo (Center for the Study of Coastal Ecosystems—CIEC)
2:30-2:50 pm	The function of MINAL in the sustainable improvement of the fishing resources in Cuba.	Rafael Tizol (CIP)
2:50-3:10 pm	Community design for the success of catch shares and MPAs in the Gulf of California.	Erica Martling (EDF-México)
3:10-4:10 pm	**Summary of the day and discussion** Facilitated discussion to determine problems, hoped for results, and challenges and opportunities related to the management of MPAs, parks, coastal regions and fisheries.	
4:20-5:00 pm	**Summary of the day and discussion (continued)** Identification of the principal problems that must be overcome to achieve sustainable financing for MPAs and the Ecosystem Services that support the MPAs.	
Monday 11/14		
9:00-9:25 a.m.	Cooperatives and other innovations for the management of fishing and food security.	Dr. Chris Costello (University of California, Santa Barbara)
9:25-9:45 a.m.	Facilitating change: the evolution of a commercial fishery in British Columbia.	Wes Erikson (Canadian Fisherman)
9:45-10:05 a.m.	Cooperativism in the Mexican fishing trade: A strategy that increases the wellbeing and sustainability of fishing communities.	Hoyt Peckham (Grupo Tortuguero de las Californias, Baja California, Mexico)
10:05-10:30 a.m.	Controlled Access in Belize: the integration of the communal management of fishing in the Marine Reserve System (a case study in progress).	Nicanor Requeña (Fishing Consultant for EDF, Belize)
10:30-11:50 a.m.	**Break**	
11:50-12:30 p.m.	Jardines de la Reina: past, present, and future.	(i) Fabián Pina Amargós, Senior Scientist, CIEC.
12:30-1:30 p.m.	**Lunch**	
1:30 -2:00 p.m.	Presentation and discussion on the case study of the Jardines de la Reina: secondary effects and economic benefits generated by the MPAs.	

2:00-2:30 p.m.	Identification of the principal problems that confront the MIZC programs. √ General presentation on the implementation of the MIZC programs in Cuba. √ Presentation of the MIZC programs in Ciego de Ávila and Camagüey.	
2:30-3:00 p.m.	Presentation of case studies from other countries. √ Priorities and necessities for the development of research projects.	
3:00-3:30 p.m.	Principal problems confronting the management of invasive species. √ Case studies on different foci for the management of lionfish. √ Analysis of opportunities for collaboration √ Priorities and necessities for the development of research projects.	
3:30-4:30 p.m.	Group discussion (brainstorming of ideas) on problems that can be solved with the integrated management of fisheries and MPAs. √ The use of innovative tools for the efficient management of fisheries in the United States and Latin America	
4:30-5:30 p.m.	**Conclusion of Workshop and next steps.** √ Summary of the priorities and necessities for the development of research projects. √ Strategies or collaboration plans √ Recommendations and agreements √ Giving of certificates √ Analysis of the program for the floating workshop	

Appendix 2
List of participants

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APPENDIX 3

Species lists for diving trips completed in Jardines de la Reina on November 16th and 17th, 2011.

Cuba Encountered Species List - Nov. 2011

Date	Species Common Name	Latin
Nov. 16	Carob. Reef shark	*Carcharhinus perezii*
	Nurse shark	*Ginglymostoma cirratum*
	Whale shark	*Rhincodon typus*
	Goliath grouper	*Epinephelus itajara*
	Cubera snapper	*Lutjanus cyanopterus*

Number of species encountered		
Fish	Day 1	91
	Day 2	36
	Total	**127**
Other	Total	**9**
Birds	Total	**14**

Yellowtail snapper	*Ocyurus chrysurus*
Lane snapper	*Lutjanus synagris*
Mutton snapper	*Lutjanus analis*
Mangrove snapper	*Lutjanus griseus*
Dog snapper	*Lutjanus jocu*
Grey snapper	*Lutjanus griseus*
Fairy Basslett	*Gramma loreto*
Black margate	*Anisotremus surinamensis*
Schoolmaster	*Lutjanus apodus*
Grey angelfish	*Pomacanthus arcuatus*
Ocean surgeonfish	*Acanthurus bahianus*
Banded Butterflyfish	*Chaetodon striatus*
Foureye butterflyfish	*Chaetodon capistratus*
Spotfin butterflyfish	*Chaetodon ocellatus*
Bar Jack	*Caranx ruber*
Blue Tang	*Acanthurus coeruleus*
Tiger Shark	*Galeocerdo cuvier*
Doctorfish	*Acanthurus chirurgus*
Bonito	*Euthynnus alletteratus*
Horse-eye Jack	*Caranx latus*
Mirrorwing flyingfish	*Hirundichthys speculiger*
Great Barracuda	*Sphyraena barracuda*
Needlefish	*Scomberesox saurus saurus*
Cero Mackerel	*Scomberomorus regalis*
Yellowfin mojarra	*Gerres cinereus*
Lionfish	*Pterois volitans*
Yellowfin grouper	*Mycteroperca venenosa*
Hogfish	*Lachnolaimus maximus*
Tarpon	*Megalops atlanticus*
Bonefish	*Albula vulpes*
Bermuda chub	*Kyphosus saltatrix*
Blue striped grunt	*Haemulon sciurus*
Spotted eagle ray	*Aetobatus narinari*
White grunt	*Haemulon plumierii*
Reef squirrelfish	*Sargocentron coruscum*
Long-Spine squirrelfish	*Holocentrus rufus*
Porkfish	*Anisotremus virginicus*
Yellow Goatfish	*Mulloidichthys martinicus*
Nassau grouper	*Epinephelus striatus*
Dusky damselfish	*Stegastes adustus*
Threespot damselfish	*Stegastes planifrons*
Bi-color damselfish	*Stegastes partitus*
Beau Gregory	*Stegastes leucostictus*
Yellowtail damselfish	*Microspathodon chrysurus*
Sgt. Major	*Abudefduf saxatilis*

	Black grouper	*Mycteroperca bonaci*
	Blue Chromis	*Chromis cyanea*
	Brown Chromis	*Chromis multilineata*
	Queen parrotfish	*Scarus vetula*
	Tiger grouper	*Mycteroperca tigris*
	Yellowmouth grouper	*Mycteroperca interstitialis*
	Graysby	*Cephalopholis cruentata*
	Creole wrasse	*Clepticus parrae*
	Greater soapfish	*Rypticus saponaceus*
	Stoplight parrotfish	*Sparisoma viride*
	Princess parrotfish	*Scarus taeniopterus*
	Rainbow parrotfish	*Scarus guacamaia*
	Striped parrotfish	*Scarus iseri*
	Redband parrotfish	*Sparisoma aurofrenatum*
	Redtail Parrotfish	*Sparisoma chrysopterum*
	Yellowtail parrotfish	*Sparisoma rubripinne*
	Greenblotch parrotfish	*Sparisoma atomarium*
	Bucktooth parrotfish	*Sparisoma radians*
	Spanish hogfish	*Bodianus rufus*
	Yellowhead wrasse	*Halichoeres garnoti*
	Bluehead wrasse	*Thalassoma bifasciatum*
	Slippery dick	*Halichoeres bivittatus*
	Squirrelfish	*Holocentrus adscensionis*
	Blackbar soldierfish	*Myripristis jacobus*
	Masked goby	*Coryphopterus personatus*
	Diamond blenny	*Malacoctenus boehlkei*
	Saddle blenny	*Malacoctenus triangulatus*
	Darkheaded blenny	
	Sand diver	*Synodus intermedius*
	Sand tilefish	*Malacanthus plumieri*
	Sharp-nose puffer	*Canthigaster rostrata*
	Porcupinefish	*Diodon hystrix*
	Trunkfish	*Lactophrys trigonus*
	Queen triggerfish	*Balistes vetula*
	Black durgon	*Melichthys niger*
	Orange spotted filefish	*Cantherhines pullus*
	Remora	*Remora remora*
	Green moray	*Gymnothorax funebris*
	Southern stingray	*Dasyatis americana*
	Rainbow runner	*Elagatis bipinnulata*
	Rock beauty	*Holacanthus tricolor*
Nov. 17	Dusky squirrelfish	*Sargocentron vexillarium*
	Smallmouth grunt	*Haemulon chrysargyreum*
	Scrawled cowfish	*Acanthostracion quadricornis*
	Trumpetfish	*Aulostomus maculatus*

	Silky shark	*Carcharhinus falciformis*
	Longsnout butterflyfish	*Prognathodes aculeatus*
	Saucereye porgy	*Calamus calamus*
	Jolthead porgy	*Calamus bajonado*
	Longfin damselfish	*Stegastes diencaeus*
	Butter hamlet	*Hypoplectrus unicolor*
	Barred Hamlet	*Hypoplectrus puella*
	Indigo hamlet	*Hypoplectrus indigo*
	Hybrid hamlet	*Hypoplectrus*
	Brown garden eel	*Heteroconger longissimus*
	Harlequin bass	*Serranus tigrinus*
	Lantern bass	*Serranus baldwini*
	Tobaccofish	*Serranus tabacarius*
	Scrawled filefish	*Alters scriptus*
	Puddingwife	*Halichoeres radiatus*
	Green razorfish	*Xyrichtys splendens*
	Rosy Razorfish	*Xyrichtys martinicensis*
	Longjaw squirrelfish	*Neoniphon marianus*
	African pompano	*Alectis ciliaris*
	Bigeye	*Priacanthus arenatus*
	Belted cardinalfish	*Apogon townsendi*
	Snow blenny	
	Redlip blenny	*Ophioblennius macclurei*
	Bridled burrfish	*Chilomycterus antennatus*
	Shy hamlet	*Hypoplectrus guttavarius*
	slender filefish	*Monacanthus tuckeri*
	Smooth tilefish?	
	Wahoo	*Acanthocybium solandri*
	White-spotted	
	Sharknose goby	*Elacatinus evelynae*
	Cleaner goby	*Elacatinus genie*
	Peacock flounder	*Bothus lunatus*
Other	Cushion sea star	*Oreaster reticulatus*
	Golden crinoid	*Davidaster rubiginosa*
	Long-spined sea urchin	*Diadema antillarium*
	Furry sea cucumber	*Astichopus multifidus*
	Three-rowed sea cucumber	*Isostichopus badionotus*
	Caribbean Spiny lobster	*Panulirus argus*
	Channel clinging crab	*Mithrax spinosissimus*
	Hawksbill seaturtle	*Eretmochelys imbricata*
	Queen conch	*Strombus gigs*
Birds	Great egret	*Area alba*
	double crested cormorant	*Phalacrocorax auritus*
	Manificent Frigatebird	*Fregata magnificens*
	Great Blue Heron	*Ardea herodias*
	Osprey	*Pandion haliaetus*

Laughing gull	*Lars atricilla*
American Redstart	*Setophaga ruticilla*
Brown Pelican	*Pelecanus occidentalis*
Turkey Vulture	*Catharses aura*
Green Heron	*Butorides virescens*
Reddish Egret	*Egretta rufescens*
Caspian tern	*Sterna cassia*
Cuban Black hawk	*Buteogallus gundlachii*
Tricolored heron	*Egretta tricolor*

Octocoral species	Deep Reef	Crest Reef
Briareum asbestinum	x	x
Eunicea calyculata coronata	x	
Eunicea calyculata typica	x	x
Eunicea flexuosa	x	x
Eunicea fusca	x	
Eunicea laciniata	x	
Eunicea succinea	x	x
Eunicea tourneforti	x	
Eunicea mammosa	x	x
Eunicea knighti	x	
Erytropodium caribaeorum	x	
Gorgonia flabellum	x	x
Gorgonia ventalina	x	x
Muriceopsis flavida	x	x
Muricea elongate	x	
Plexaura homomalla	x	x
Plexaura kukenthali	x	x
Plexaurella dichotoma	x	
Plexaurella grises	x	
Plexaurella nutans	x	x
Pseudoplexaura crucis	x	x
Pseudoplexaura wagenaari	x	x
Pseudopterogorgia americana	x	x
Pseudopterogorgia bipinnata	x	
Pseudopterogorgia acerosa	x	
Pseudopterogorgia elisabethae	x	
Pseudoplexaura porosa	x	
Pseudoplexaura flagellosa	x	
Eunicea clavigera	x	
Muricea muricata	x	
Muricea pinnata	x	
Pseudopterogorgia blanquillensis	x	
Gorgonia mariae		x
Pterogorgia anceps	x	x
Pterogorgia citrina		x
Carijoa riseii	(in mangrove roots)	
Leptogorgia euryale	x	

Stony corals	Deep Reef	Crest Reef
Agaricia agaricites	x	x
Agaricia spp	x	x
Acropora cervicornis		x
Acropora palmata	x	
Colpophyllia natans	x	
Dichocoenia stokesi		x
Diploria clivosa	x	x
Diploria labyrinthiformis	x	
Diploria strigosa	x	
Eusmilia fastigiata		x
Favia fragum	x	
Leptoseris cucullata	x	
Madracis decactis	x	
Manicina areolata	x	
Madracis mirabilis	x	
Meandrina meandrites	x	x
Millepora alcicornis	x	x
Millepora sp	x	x
Millepora complanata	x	x
Montastraea annularis	x	x
Montastraea cavernosa	x	
Montastraea faveolata	x	x
Montastraea franksi-faveolata	x	
Montastraea franksi	x	
Mycetophyllia danaana	x	
Mycetophyllia feroz	x	
Mycetophyllia lamarckiana	x	
Musa angulosa	x	x
Porites asteroides	x	x
Porites divaricata	x	x
Porites furcata	x	x
Porites porites	x	
Scolimia sp	x	
Siderastrea radians	x	x
Siderastrea siderea	x	
Stephanocoenia intersepta	x	
Dendrogyra cylindrus		
Stylaster roseus		
Mycetophyllia aliciae		
Cladocora arbuscula		