Support for the Establishment of Effectively Managed Platform Sites as Foundations for Resilient Networks of Functionally-Connected Marine Protected Areas

Meso-American Reef – Belize, Guatemala, Honduras, and Mexico

FY07 Annual Report

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID), under the terms of Award No. LAG-A-00-99-00045-00. The contents are the responsibility of The Nature Conservancy and do not necessarily reflect the views of USAID or the United States Government.

TABLE OF ACTIVITY STATUS

Activity Number	Activity Title	*Status*
Support for the Establishment of Effectively Managed Platform Sites as Foundations for Resilient Networks of Functionally-Connected Marine Protected Areas **Meso-American Reef – Belize, Guatemala, Honduras, and Mexico**		
Objective 1	**Build resilience into the MAR network through improved understanding of resilience principles and their application to management**	
1.1	**Determine conservation status of Nassau Grouper SPAG sites in the MAR region**	Mixed Performance
1.2	**Evaluate the location of resilient reefs in relation to existing MPAs and their zoning patterns and propose needed changes**	Mixed Performance
1.3	**Integrate connectivity information and models into Caribbean-wide and MAR ecoregional planning and application of circulation model to fish species in the MAR region**	On track
Objective 2	**Improve the management and effectiveness of three platform MPAs strategically selected within the MAR network.**	
2.1	**Improved Management of Gladden Spit Marine Reserve**	
2.1.1	*Maintain monthly monitoring of fish spawning aggregation at Gladden Spit*	On track
2.1.2	*Revision of management plan and implementation of conservation strategies for Friends of Nature.*	Delayed
2.1.3	*Disseminate results of fish landings data for mutton snapper to local communities*	On track
2.2	**Improve the management of Sian Ka'an Reserve, Mexico**	
2.2.1	*Spawning aggregation site validation in Sian Ka'an*	Mixed performance
2.2.2	*Develop measures of success for the remaining conservation targets in Sian Ka'an*	Delayed
2.2.3	*Support the implementation of the land use zoning plan (OET) to control development densities along the beaches and dunes of Sian Ka'an.*	On track
2.3	**Improve the management of Cayos Cochinos, Honduras**	

2.3.1	*Continue process of establishing buoys for internal zonification of the protected area; tie demarcation process with financial sustainability proposal*	On track
2.3.2	*Revise the limits and current zoning of the protected area and provide support for the re-definition, when applicable of the limits.*	On track
2.4	**Socio-economic modeling and monitoring for the three platform sites**	Completed
Objective 3	**Establish a "virtual" Learning Center that convenes training courses, promotes exchanges, and facilitates coordination among the four MAR countries.**	
3.1	**Development and production of promotional video for increasing public awareness of the importance of spawning aggregations**	Delayed
3.2	**Selection of training tools and developing rules of engagement to be used by MARLC and for MAR Fund as criteria for grant funding**	Completed
3.3	**Exchanges of research and management experiences and consultation process for developing guidelines for whale shark observation tourism in Mexico, Honduras and Belize; and assessing regional needs for applying best practices**	Completed
3.4	**Development of guidelines to apply gender equity approach in marine protected areas work.**	Mixed Performance
3.5	**Introduction to TNC resilience model**	Delayed
Objective 4	**A MAR ecoregional plan is adopted and implemented that reflects agreement by key conservation partners (local and international NGOs, government agencies and donors) on priority programs and activities, with the sharing of scientific and program data**	
4.1	**MAR ecoregional assessment: Stakeholder analysis for the development of conservation strategies, and validation of identified conservation portfolio through stakeholder participation.**	Completed
4.2	**Dissemination of ecoregional assessment results through publications and distribution of ecoregional plan**	Mixed Performance
4.3	**Development of a MAR region projects and initiatives matrix**	On track

Support for the Establishment of Effectively Managed Platform Sites as Foundations for Resilient Networks of Functionally-Connected Marine Protected Areas in the Mesoamerican Reef
Belize, Guatemala, Honduras, and Mexico

FY2007 GCP Progress Report

1. Project Background

The Mesoamerican Reef, the second largest coral reef system in the world, stretches for 625 miles along the coastline of Belize and parts of Mexico, Honduras and Guatemala. Lying just below the surface of the Caribbean Sea, the Mesoamerican Reef represents the best example of coral reef and mangrove diversity in the Atlantic realm. The reef is home to 66 species of coral, spiny lobsters, green moray eels, reef fish and a wide variety of other sea life including whale sharks – the largest fish in the ocean. Closer to land, sea turtles and Central America's largest population of endangered manatees find shelter in mangrove habitats and sea grass meadows.

Although it plays an essential role in marine habitats and local communities, the Mesoamerican Reef is showing alarming signs of distress. Burgeoning tourism has invited additional coastal development and souvenir seekers to the reef. Forest clearing for agriculture has removed natural water filters, allowing silt, fertilizers and additional pollution to reach the sea. Growing intensity and frequency of fishing, especially at fragile fish spawning aggregation sites (SPAG), is taxing the ecosystem. Global climate change has accelerated coral bleaching, a phenomenon threatening reefs with extinction.

Fortunately, considerable opportunities exist for conserving the Mesoamerican Reef. Each of the neighboring nations continues to promote sustainable development as part of its voluntary commitment to the Convention on Biological Diversity. Having established a strong presence in the region resulting from groundbreaking science, used to shed light on the natural phenomena surrounding fish spawning aggregations, the Conservancy has included the Mesoamerican Reef in its goal to conserve a measurable amount of each of the Earth's major habitat types by 2015. The Mesoamerican Reef is one of only three marine sites already identified for inclusion in the 2015 goal, which testifies to its significance.

Within this vision, The Nature Conservancy is working in collaboration with a coalition of stakeholders from the public and private sectors to achieve specific conservation objectives in the near term. Through the Global Conservation Program these include:

- A MAR ecoregional plan is adopted and implemented that reflects agreement by all key conservation partners (local and international NGOs, government agencies and donors) on priority programs and activities, adoption of conservation best practices, and sharing of scientific and program data.

- Four MPA platform sites, one in each country, are well managed by local partners and serve as examples of effective conservation and management for other protected areas within the MAR regional MPA network.
- All high priority reef fish spawning aggregation (SPAG) sites throughout the MAR are identified and monitored, and stocks of target fish species are stable or increasing at priority SPAG sites.
- Bleaching resistant areas of suitable sizes, scales, and distribution to replenish corals within the MAR system are identified and protected.
- The technical, managerial and marine science skills of at least 2,000 people are enhanced and result in improved MPA management, new economic opportunities for fishers and their families, more effective community leaders and conservation activists, and improved scientific understanding by both private and public stakeholders.

2. Overall Assessment of Progress and Management Issues

The Nature Conservancy has made significant progress on its core objectives for the MAR. In collaboration with key conservation partners and stakeholders, we achieved the following during the past year:

1) Completed a Rapid Reef Assessment to evaluate the location of suspected resilient reefs in relation to the current MPA system. Results have been used to set priorities in the ecoregional assessment and MAR Strategic Plan.
2) Management of four platform sites further consolidated. By supporting biodiversity monitoring (including SPAGs and coral reefs), improving management capacities, and implementing conservation plans, TNC and partners have made significant progress on management effectiveness.
3) Completed an ecoregional assessment and plan using a systematic, science-based approach to conservation. This was an inter-institutional planning process, facilitated by TNC, in which many organizations and government agencies participated. The assessment analyzed current levels of biodiversity in the major reef and associated environments. It also included an analysis of the threats to biodiversity and developed strategies to mitigate threats throughout a portfolio of priority conservation sites.
4) A strategic framework for developing the MAR Learning Center has been completed. In addition, the MAR team evaluated 60 potential training tools and decided to conduct an initial test of six, which will be developed as virtual modules.
5) An initial nursery habitat analysis in Placencia Lagoon, Belize, has been completed. This will enhance our understanding of the role and value of coastal ecosystems and their relationship with major biological processes, such as SPAGs. This will help to ensure that all habitats which are important to the full lifecycle of target reef fish species will be considered for protection. Another similar study is currently underway in Sian Kaan, México.
6) In early 2007, the TNC MAR team worked together to develop an action plan to guide TNC's investments in the MAR over the next few years and to serve as a framework for program monitoring and evaluation. The action plan is based on the conservation targets and threats identified in the MAR Ecoregional Assessment, The action plan focuses on

those particular elements of the Ecoregional Assessment for which TNC plans to provide leadership.

Other important achievements made this year were:

1. A Memorandum of Understanding (MoU) was signed with the World Bank-GEF Targeted Research Project on Coral Reefs that allows both organizations to ensure that the project's research will be used for management proposes. An annual workshop for scientists and MPA directors within the MAR region, as well as use of TNC's ConserveOnline platform, will help create a learning community on connectivity throughout the region. The MoU also establishes that, in the future, TNC will help to "translate" scientific materials into awareness materials on the topic of connectivity and MPA management.

2. In 2004, a conservation audit of TNC's Mesoamerican Reef Program was completed. Participating TNC, WWF and WCS staff analyzed the program's design and methodology. Important recommendations regarding program actions emerged from this process. These findings have significantly influenced the program's work. A follow-up audit was conducted in early 2007 to review the progress made on recommendations from the 2004 audit. This audit also reviewed the current realities of the Mesoamerican Reef region in order to identify potential recommendations for continuing to improve the program's work. This audit included partners from new initiatives and projects in the MAR area, including WWF and FUNDARY in Guatemala.

   The main recommendations included:
   a. Keep the adaptive management approach developed by the team.
   b. Review the implementation structure and coordination with country offices in order to improve efficiency.
   c. Focus the work of the Learning Center on priority training activities in coordination with others.
   d. Use the CAP method to inform the Ecoregional Assessment with viability information for conservation targets.

3. TNC, in coordination with the MAR Fund, held a coordination meeting with 23 participants from 12 NGO and regional projects that have made significant investments in the MAR at the regional level. The workshop identified at least 25 opportunities for synergies or occurrences of duplication of effort. All participants agreed to coordinate on specific topics and activities to avoid duplication of effort and create opportunities to coordinate new initiatives. A follow-up committee was created to coordinate activities between the organizations and publish materials for distribution among all participants, as well as to governments and donors to keep them informed on this initiative.

3. Implementation Report

Objective 1: Build resilience into the MAR network through improved understanding of resilience principles and their application to management.

Activity 1.1: *Determine conservation status of Nassau Grouper SPAG sites in the MAR region*

Results Anticipated in FY07:

- Report for the regional status of the conservation of Nassau grouper with a chapter for each country
- Case study for Caye Glory
- List of potential appropriate strategies for the long-term conservation of the Nassau Grouper along the Meso-American Reef

The case study for Caye Glory has been completed. It presents an historical perspective of the Nassau grouper spawning aggregation at Caye Glory, Belize, an aggregation exploited for over 80 years. Data was collected during interviews with key stakeholders in the fishery, and through literature and archival research, to document the factors that have influenced the history of the Caye Glory spawning aggregation. This provides the background to evaluate its current status and to identify implications for the management of other spawning aggregation sites, particularly in the Mesoamerican Barrier Reef System. Although the Caye Glory aggregation has been known about for some time, this study concludes that its demise is the result of the relatively recent success of Belize's fishing industry, coupled with the unwillingness or inability of the government to implement effective and timely management of Belize's marine resources. The establishment of a strong export market for marine products, followed by the extraordinary financial achievements of Belize's fishermen's cooperatives, attracted more fishermen to the industry. It also provided them with the capital to purchase new technology and fishing gear with which to more easily and effectively exploit the Caye Glory spawning aggregation. These same technologies also enabled greater exploitation of Nassau grouper throughout the reefs, during the entire year, by an ever increasing number of fishermen. Unsustainable fishing of Nassau grouper during spawning aggregations at Caye Glory and other sites, combined with the daily removal of Nassau grouper outside spawning aggregations, led to the decline and near destruction of the Nassau grouper population in Belize. The results of this case study have been shared with the Belize Spawning Aggregation Working Group, the Belize Fisheries Department and others working towards the conservation, management and protection of fish spawning aggregations in Belize and the region.

A report on the status of the Nassau grouper in Belize was produced in 2006. The report encompasses the period 1998-2006, and is based on data generated by the Belize Spawning Aggregation Working Group. We have not yet been able to identify a consultant to write the status reports for Mexico and Honduras. For both countries, this activity was going to be carried out by a Nassau grouper expert in the region. However, several members of the expert's team were reassigned and he was unable to begin the study. TNC has discussed the project with another Nassau grouper expert in the region, who is currently a professor at the University of Yucatan (UADY), Mexico. He has expressed interest in carrying out this important study, and

so it is hoped that this activity will be carried out in FY08. Following completion of the regional report, strategies for conservation of the Nassau grouper along the MAR will be developed.

Activity 1.2: *Evaluate the location of resilient reefs in relation to existing MPAs and their zoning patterns and propose needed changes.*

Results Anticipated in FY07:

- Location of suspected resilient reefs, and their relation to the current system of MPAs, available as input to ecoregional plan and local management actions.

The rapid reef assessment of sites in the MAR region was completed in December 2006. Using the Atlantic and Gulf Rapid Reef Assessment (AGRRA) protocol, a total of 478 randomly selected sites were surveyed in the MAR region.

Amigos de Sian Ka'an was in charge of this task in Mexico, completing a total of 155 sites. Even though the surveys were interrupted by the strong storm and hurricane season that affected the area in 2005, the remaining sites (Central and Southern Sian Ka'an, Xcalak and Banco Chinchorro) were surveyed between August and December 2006. In Honduras and Guatemala, through administrative support from partner Honduras Coral Reef Foundation (HCRF), the rapid reef survey started in June 2006 and was completed in August 2006 with a total of 66 sites. The field campaign was completed with the survey of sites in Omoa-Puerto Cortes and Bahia de Tela. In Belize, a consortium was created with WWF to conduct the assessment of 150 sites.

A consultant processed the data compiled from the site assessments to make it AGRRA-ready, and produced three databases (for Mexico, Honduras and Guatemala). A basic statistical exploratory analysis has been conducted on the data. We are currently developing an index of resiliency that will include metrics on live coral cover, fleshy and crustose coralline algae cover, total herbivore fish biomass and Diadema urchin abundance, recruits density, and bleaching prevalence. We are working in coordination with a reef ecologist from WWF on this task in an effort to develop a unified vision of reef resiliency for the MAR, which was originally a goal for FY07 that we now expect to reach in 2008.

Once we have agreed on the appropriate set of reef resilience indicators, we will then evaluate the location of those reefs in relation to the current system of MPAs. This evaluation will tell us whether or not resilient reefs are currently being protected by being located in MPAs, and a proposal will be made to make changes to provide adequate protection. Also, zoning patterns will be inspected to evaluate if the suspected resilient reefs are located in the no-take zone so changes can also be proposed if necessary. A scientific workshop then will be organized to discuss the results of the evaluation.

Activity 1.3: *Integrate connectivity information and models into Caribbean-wide and MAR ecoregional planning and application of circulation model to fish species in the MAR region*

Results Anticipated in FY07:

- Results of running the circulation model provide better understanding of connectivity with the MAR system, and input into identifying priority sites for MPAs as well as other resource management actions.

The distance and direction of egg and larval dispersal have considerable influence on the demography and genetic structure of marine species. Larvae may be diluted and dispersed by currents while actively moving, which make their in situ study very difficult. Stochastic modeling approaches were applied through a contract with the University of Miami to study the influence of physical and biological processes on larval trajectories and population connectivity. The main focus of the models was to explore the exchange of individual coral reef organisms. Although the final report is still pending from the contractor, they have been able to successfully run simulation models for the dispersal of several reef species in the MAR. Preliminary results have been presented at scientific meetings such as the Gulf and Caribbean Fisheries Institute (GCFI).

The University of Miami adapted a circulation model to examine fish egg and larval dispersal along the MAR. The Regional Ocean Modeling System (ROMS) provided the spatial and time evolution of circulation and passive transport of fish eggs in the vicinity of the reef ecosystems along the coasts of Mexico, Belize, Guatemala, and Honduras. The model included the barrier reef, reef lagoon, and adjacent oceanic waters, as well as bottom topography (bathymetry) at 1 Km resolution. The horizontal resolution of the simulation was 2 Km (grid cell size). Both the state of the ocean (temperature, salinity, currents, and tides) and the surface fluxes (wind, rain, solar, irradiative heat fluxes) were accounted for in the model simulation of oceanic and coastal waters.

This modeling system was used to estimate the spatial probability of successful reef organism egg and larvae dispersal, also know as the dispersal kernel. Ocean general circulation models were coupled with various stochastic schemes tracking individual larvae within the Mesoamerican Reef seascape. Results suggest that both diffusivity and time scale are critical in estimating dispersal distances; estimates of population connectivity are sensitive to mortality and to ontogenetic vertical migration; larval behavior is essential to ensure self-recruitment and becomes significant for subsidies only with increasing pelagic larval duration; and the mortality function is a key component for connectivity estimates, in particular for species with plasticity in pelagic duration.

Results of this study served as an input for the ecoregional assessment, specifically during the portfolio selection.

Objective 2: Improve the management and effectiveness of three platform MPAs strategically selected within the MAR network.

Activity 2.1: *Improved Management of Gladden Spit Marine Reserve*

Activity 2.1.1: Maintain monthly monitoring of fish spawning aggregation at Gladden Spit

Results Anticipated in FY07:

- Data collected through underwater visual surveys during FY 07 enrich analysis and understanding of the status of this spawning aggregation and improve its conservation.

Monitoring of the spawning aggregations at Gladden Spit has been a major component of the monitoring program led by Friends of Nature (FoN) and has been conducted monthly for the last thirty months, using the standardized monitoring protocol developed.

The MAR Program has continued to support FoN in improving the management of Gladden Spit and Silk Cayes Marine Reserve (GSSCMR). The GSSCMR is one of the best-known, and consistently monitored, spawning aggregation sites in the region. The level of commitment and capacity of local staff has enabled FoN to collect a comprehensive dataset for this important multi-species reef fish aggregation site. This year, the spawning aggregation was monitored a minimum of seven days per month, from the full moon to the last quarter. The FoN monitoring team (which includes at least one community researcher) did underwater dives twice daily during monitoring periods. The team carried out the assessments using the Underwater Visual Survey Protocol developed by TNC and adapted by the Spawning Aggregation Working Group and the Meso-American Barrier Reef System Project. The data has been entered into the recently completed spawning aggregation database developed jointly by TNC and the Belize Spawning Aggregation Working Group.

FoN has been monitoring the spawning aggregation site and has recorded monthly counts of multiple species including Mutton, Dog and Cubera snappers, Nassau, Yellow-fin and Black groupers, as well as multiple species of jacks. At least 28 different species of fish have been observed, eleven of which have been observed spawning at Gladden Spit. Monitoring took place each month, with the exception of July due to inclement weather. Monitoring of grouper species has focused primarily on Nassau grouper, which have shown the highest cumulative numbers at GSSCMR. Nassau grouper numbers appear to peak around the February moon, with the highest monthly numbers occurring approximately seven to ten days after the full moon. Nassau grouper numbers have remained fairly stable over the years, with maximum observed numbers averaging around 350 fish yearly (a peak of 700 fish was observed in 2006). It is important to note that Nassau grouper have not been observed spawning at Gladden Spit, which may indicate that this species prefers to spawn below safe observational depths as noted at another site in Belize. The other major grouper species observed at GSSCMR have included Black and Yellow-fin grouper. These two species exhibit behaviors similar to the Nassau grouper, but have been observed in lower numbers.

Unlike groupers, the major snapper species observed at Gladden Spit seems to have a less distinct spawning season. Dog snapper, for example, have been observed spawning almost every month of the year. The three major snapper species seen spawning at GSSCMR are the Dog, Cubera and Mutton snappers. Maximum counts for these three species have stayed fairly stable over the monitoring period, with the maximum yearly counts averaging 7,750, 13,150, and 12,750 for Dog, Cubera and Mutton snappers respectively. It is notable that while the peak month for these three species appears to fluctuate, the majority of the fish are present May through August, which are the months most associated with Whale Shark visitation in the GSSCMR. Further statistical analysis of this data is needed to measure management effectiveness.

These individual species counts have been incorporated into the National Spawning Aggregation Working Group Database managed by the Fisheries Department, which allows for basic analysis and data reports. These data, particularly for the Nassau grouper, are currently being used by the Working Group to provide evidence of a declining national population that needs greater protection. The data for Nassau grouper has shown that perhaps protection of the SPAG sites alone is not sufficient to maintain a sustainable fishery. A final report on the status of the spawning aggregations will be completed in FY08.

Visual counts for commercially important species including conch, lobster and finfish have been conducted within GSSCMR during the past year. The data gathered in 2006 have been compared to data from 2003. Low densities of these commercial species show that illegal and/or over-fishing is still a threat to the reserve. This will be addressed in the coming year with a more thorough monitoring and enforcement regime. Although commercial species data has been collected fairly consistently over the past four years in GSSCMR, a consistent schedule for monitoring must be developed along with standardized methodologies. In order to be able to fully integrate observed data with management activities, further training is needed in data management and analysis. Efforts are already underway to synchronize methodology and sampling periods for commercial species with the Sapodilla Cayes, which uses the Long Term Atoll Monitoring Program (LAMP) methodology and follows the monitoring schedule used for Gladden Spit. Additionally, efforts are being made to adopt a similar system for data management as used for data collected in the SCMR.

Activity 2.1.2: Revision of management plan and implementation of conservation strategies for Friends of Nature.

Results Anticipated in FY07:

- A revised management plan completed for Gladden Spit, reflecting data from implementation of the conservation area planning exercise and Fisheries Department and community input.

Friends of Nature is currently in the process of merging with the Toledo Association for Sustainable Tourism and Environment (TASTE) to form a new organization, the Southern Environmental Alliance (SEA). The mission of SEA is to provide coordinated, efficient and participatory management for three marine protected areas in southern Belize, including GSSCMR, Laughing Bird Caye National Park and Sapodilla Cayes Marine Reserve. In light of

this development, FoN has requested that we conduct a much more comprehensive conservation action planning exercise after the amalgamation has been completed to address the revision of the management plan for GSSCMR and feed into a much larger strategic plan for SEA.

Activity 2.1.3: Disseminate results of fish landings data for mutton snapper to local communities

Results Anticipated in FY07:

- Analysis of fish landings data collected to date for mutton snapper at Gladden Spit.
- Production of educational material handouts/posters for distribution among fishermen that fish mutton snappers at Gladden Spit.

The MAR program provided support to FoN for the collection of catch-per-unit effort (CPUE) and fish landings data for the mutton fishery at Gladden Spit. FoN and the University of Belize worked with students from the university's Natural Resources Management Program to undertake the fish landings data collection, and in turn, students used the data and experience as part of their project theses for graduation. In this way, the organization was able to get reliable data collectors who collected quality data, and the students had information they were able to use in their course work. There was very little data for the month of April as the fishers did not show up to fish the aggregations as anticipated, perhaps due to the Easter holidays and/or the weather. Most of the data collection took place in May and June. The data have been compiled and are being analyzed as part of the commitment to produce educational material for distribution among fishermen that fish the mutton snappers at Gladden Spit. A draft booklet was finalized in August 2007, and will be printed and disseminated in FY08. Additionally, this year Nicanor Requena, Technical Coordinator and Regional Fisheries Advisor, with colleagues from WCS, the Fisheries Department, University of York and Kevin Rhodes, have put together a manuscript on the mutton snapper fishery at Gladden Spit, analyzing multi-year CPUE and fish landings data. It also provides management recommendations for the mutton snapper fishery at the spawning site. The manuscript is currently being reviewed for publication in the journal *Coral Reefs*.

The analysis and production of scientific information took longer than expected. Therefore, we have not finalized the production of the education materials associated with it. We expect to have them ready for distribution by October 2007.

Activity 2.2: *Improved Management of Sian Ka'an Biosphere Reserve*

Activity 2.2.1: Spawning aggregation site validation in Sian Ka'an

Results Anticipated in FY07:

- 4 to 6 new spawning aggregation sites validated in southern Sian Ka'an and other areas in Quintana Roo.

We originally proposed to continue the validation of SPAG sites in Sian Ka'an and expected to validate four to six new sites, including at least two outside the Reserve, on the Quintana Roo coast. The activity was going to be carried out through a sub-award with partner Amigos de Sian Ka'an (ASK). However, ASK had significant delays in submitting financial reports for various grants. In December 2006, TNC's Southern Mexico Program made the decision to halt all funds

to ASK, and put a hold on signing any new grants, until they had submitted all pending financial and technical reports and these had been approved by TNC. Although we knew this would impact our SPAGs conservation work planned for December 2006 – June 2007, we felt that this was critical in order to fulfill our responsibility to monitor the conservation contracts and grants we hold with our partners and consultants, and to ensure the timely delivery of technical and financial reports from ASK. ASK has now submitted all pending reports and we began disbursing new funds to ASK in May 2007. The SPAGs season ended in June 2007, but although ASK did turn in a proposal to do validation for that one month, the budget they submitted was so high that we decided it was best to cancel the activity for FY07. No SPAG validation work was carried out in Sian Ka'an this year.

On the other hand, spawning aggregation site validation was expanded this year to the Banco Chinchorro Biosphere Reserve and the Xcalak Reefs National Park. For each site that is validated, data is available regarding location, site description, species spawning at the site, approximate number of individuals, and behavior patterns. The work at the Banco Chinchorro Biosphere Reserve is being carried out by the management of the Reserve and 14 local fishermen. Site validation supported by this grant began in May 2007. Some of the key accomplishments to date include:

- 7 SPAG sites verified;
- 3 SPAG sites validated; all had been previously identified as SPAG sites through interviews with fisherman;
- 4 new SPAG sites validated

The work in Xcalak was led by Dr. Felipe Eloy Sosa Cordero from Ecosur. Some of the key findings and accomplishments to date include:

- 6 SPAG sites monitored: Xahuayxol, Tankiláh, Hobná-Xcayal, Punta Gavilán, El Blanquizal-Santa Julia and the site located in front of Xcalak
- A decline was observed in the number of SPAGs, including sites that had been previously characterized as SPAGs, such as “El Blanquizal-Santa Julia”
- Irregularities were observed in the aggregations. For example, at the site “El Blanquizal-Santa Julia,” a small number of Nassau groupers was observed unexpectedly late in the season (March 2007).
- A SPAG site for blue tang, a fish species of ecological importance, was observed in the Tankiláh site in May 2007. This was the first reported sighting of this species in Quintana Roo.
- During this study, several techniques for monitoring SPAGs were compared, and the recommendation which emerged is that innovative techniques, such as hydrophones, should be used concurrently with conventional monitoring (scuba diving).

It is expected that Ecosur will submit their final report for the work done in Xcalak by the end of October 2007. The contract with Banco Chinchorro was extended through December 2007, therefore a final report will be available in January 2008.

Activity 2.2.2: Develop measures of success for the remaining conservation targets in Sian Ka'an

Results Anticipated in FY07:

- Monitoring plan for Sian Ka'an, Sian Ka'an Reefs, and Uaymil. This plan will provide information on the selected indicators to begin systematic monitoring efforts. Some of the information that will be included is: indicator definition and justification for selection, method, frequency, timing, required resources, information analysis and interpretation, and responsible parties. Indicator information will be included in monitoring section of Excel CAP workbook.
- Updated Sian Ka'an Excel CAP workbook with information on viability, threats, strategies and indicators.

A consultant was hired by TNC in June 2007 to develop measures of success for Sian Ka'an. The consultant has done an extensive review of existing literature and has consulted with key experts in the region to identify key ecological attributes for each of the conservation targets. These key ecological attributes will help define and assess the conservation targets' viability or integrity. Measurable indicators have also been identified for each key ecological attribute. The consultant held a meeting with the CAP planning team (ASK, TNC, CONANP) in Cancun in August 2007 to review and validate this information. Stresses and sources to the conservation targets, as well as critical threats, were also reviewed and updated during this meeting. The consultancy was to be completed by the end of September 2007. However, several meetings that had been scheduled with the CAP planning team for the end of August had to be postponed until September due to Hurricane Dean. For this reason, the consultancy will be extended through November 2007.

Activity 2.2.3: Support the implementation of the land use zoning plan (OET) to control development densities along the beaches and dunes of Sian Ka'an.

Results Anticipated in FY07:

- All EIAs reviewed and recommendations submitted to SEMARNAT;
- All construction projects monitored;
- All violations of the OET reported to PROFEPA;
- Updated land tenure database for Sian Ka'an.

A land use zoning plan (OET) coordinator for Sian Ka'an has been working in CONANP to ensure adequate implementation of the OET. During the year, the coordinator reviewed all of the environmental impact statements submitted by private land owners and made recommendations to the Ministry of Environment (SEMARNAT) regarding viable projects. The Sian Ka'an land tenure database is being updated continuously. Also, the coordinator monitored all new constructions to ensure that they abide by the OET and reported any violations to PROFEPA, Mexico's Environmental Protection Agency.

Activity 2.3: *Improved Management of Cayos Cochinos Natural Monument*

Activity 2.3.1: Continue process of establishing buoys for internal zonification of the protected area; tie demarcation process with financial sustainability proposal

Results Anticipated in FY07:

- At least 8 buoys installed along key areas for external limits (internal limit buoys are less expensive than external limit ones, depending on results of the zoning exercise, more buoys could be installed).

During this fiscal year, HCRF has provided maintenance to the buoys installed to demarcate the southern boundaries of the protected area. They have established a program which ensures the periodic inspection of the buoys. Additional materials have been purchased to maintain the buoys previously installed and to prepare to install new buoys for internal zoning. Ten new buoys were installed within the protected area where different fishing banks are used by local fishermen. It is worth noting that local fishermen and local leaders participated in the identification of these demarcated sites. Sites were separated into zones to establish a rotation system whereby some sites will be closed to fisheries once a year to provide time for recovery of the fish populations. Also, six new buoys were installed to identify diving sites, to be used as mooring buoys for vessels inside the protected area and to be able to identify channels and risk areas for navigation.

Activity 2.3.2: Revise the limits and current zoning of the protected area and provide support for the re-definition, when applicable of the limits.

Results Anticipated in FY07:

- Increase the level of protection in Cayos Cochinos Marine Natural Monument (e.g. the extension of the southern limit up to three miles from the coast that is already being protected by national legislation, or increase the levels of current use restrictions of the actual zoning)

An area of special importance has been identified at the southern limit of the protected area due to its connectivity with the mangroves on the mainland in front of Cayos Cochinos (Laguna El Cacao). Some species spend part of their life cycle in the mangroves, and as they migrate from the mangroves to the reef, many are caught by the industrial fleet operating between the coast and the southern limits of the protected area.

HCRF personnel held meetings with the community leaders of Nueva Armenia, Rio Estaban and Sambo Creek to identify these sites of special importance and to evaluate the risks to the identified sites. HCRF and the community leaders then wrote a draft presidential decree to declare the identified area as part of the Cayos Cochinos protected area buffer zone, and sent it to the President of Honduras with a letter urging him to issue the decree.

A meeting of the Committee for the Management of Cayos Cochinos, including representatives of the communities and the President of Honduras, was convened in March 2007. The President of Honduras offered his support for approval of the buffer zone, and at the same time, instructed

the commander of the Honduran Navy to control the operations of the industrial fleet on the southern border of the protected area in order to stop fishing inside the border.

In June 2007, a meeting was conducted in Tegucigalpa with the Minister of SERNA and representatives from HCRF, including the Executive Director and the President. The Minister of SERNA committed to give his continued support to the process of declaring the buffer zone of Cayos Cochinos. The strategy will be to get a Presidential Decree, and a meeting between the Minister of SERNA and the President of Honduras is expected to occur early in 2008.

Activity 2.4: *Socio-economic modeling and monitoring for the three platform sites*

Results Anticipated in FY07:

- A socio-economic dynamic predictive model for each platform site developed.
- Training modules for site managers on indicator framework, predictive model and socio-economic monitoring system developed.
- At least 15 people trained in the model and monitoring program

Three socio-economic models were developed, one for Cayos Cochinos, one for Gladden Spit, and one for Sian Ka'an. These models will serve as decision-support tools for Marine Protected Area management in the MAR region and support the design of conservation strategies that maximize social and economic benefits for fishing communities in the region. The models will simulate the dynamic relationships between fishing for various species, resource abundance and tourism in the three MPAs. The model simulations will shed light on the benefits of different scenarios to stakeholders in terms of income and income distribution, as well as the biological viability of the marine resources within the MPAs.

Training workshops on MAR socio-economic dynamic modeling were conducted in Honduras, Belize and Mexico in September and October 2006. During the workshops, first draft dynamic models for Cayos Cochinos, Gladden Spit and Silk Cayes, and Sian Ka'an Marine Reserves were presented to TNC partners and staff. The overall objectives of the workshops focused on introducing participants to the concept of dynamic modeling for conservation purposes, providing participants with a solid foundation in the use of the Stella program for dynamic modeling and calibrating the base dynamic models developed by the consultants specifically for the individual MPAs with local knowledge from the site-based teams. These objectives were successfully met in the workshop. Twenty people from local partner organizations were trained in the use and improvement of the model. Training modules and a training manual were also produced.

Objective 3: Establish a "virtual" Learning Center that convenes training courses, promotes exchanges, and facilitates coordination among the four MAR countries.

Activity 3.1: *Development and production of promotional video for increasing public awareness of the importance of spawning aggregations*

Results Anticipated in FY07:

- DVD with underwater video footage completed and ready for dissemination

Reef fish spawning aggregations are key biological events that until recently have never been fully understood, nor have they been documented. Because of TNC´s experience with SPAGs, it is in a unique position to be able to capture these events on video to share with the general public to increase awareness and garner support for the conservation and sustainable management of these spawning aggregation sites. Therefore, TNC has contracted a professional filmmaker to incorporate and edit existing footage and provide additional underwater video footage of reef fish spawning aggregations.

It was very difficult to find a professional contractor in Belize able to produce this video, which resulted in some delay in beginning this activity. Fortunately, we found and hired one in September 2007 and the activity is currently underway. We expect to have the final version of the video by early November 2007.

Activity 3.2: *Selection of training tools and developing rules of engagement to be used by MARLC and for MAR Fund as criteria for grant funding*

Results Anticipated in FY07:

- An inventory of training tools available to the MAR Fund and wider community
- A procedure for measuring the impact of tools application and a list of criteria for MAR Fund to grant their funds.
- Tools and procedures communicated to the region's communities via listservers and posted on the TNC MAR and MAR Fund websites.

The MAR Program and MAR Fund agreed to work cooperatively to strengthen the MPAs in the region. Both organizations committed to jointly develop a training program and to grant scholarships for MPA personnel to receive training, according to the students' needs. The training program will include traditional training courses, workshops and community exchange of information, and virtual modular courses based on existing manuals. Scholarships for MPA personnel will be granted as a follow up to the "UNEP Caribbean Environment Program's Training the Trainers Program," which the MAR Program is supporting.

A document on how to focus our training efforts to best support the strengthening of MPAs was produced. This document also proposes a list of criteria for the MAR Fund to use when evaluating potential grants for training purposes. Sixty publications (including courses and manuals) were identified as potential tools based on previous reports by consultants Matthew MacPherson and Lucy Gallagher-Freymuth. Using this list of tools, the Learning Center has selected 25 that will serve as a basis to decide which six tools will be further developed into self-training virtual modules.

The Learning Center Coordinator has led the review to identify the first set of six tools which will be the initial modules for the virtual Learning Center, in coordination with service providers from Tecnológico de Monterrey and the University for International Cooperation in Costa Rica.

Activity 3.3: *Exchanges of research and management experiences and consultation process for developing guidelines for whale shark observation tourism in Mexico, Honduras and Belize; and assessing regional needs for applying best practices.*

Results Anticipated in FY07:

- Draft guidelines for whale shark best management practices
- A regional action plan which will be delivered to stakeholders of the three countries for further use in policy making.

The MAR Program, WCS and FoN held a workshop in November 2006 entitled "Whale shark tourism management: exchanging information, networking and developing guidelines for best practices in the Mesoamerican Reef Region" to address the rising importance and potential impacts of whale shark tourism in the region.

The meeting brought together 31 stakeholders from SE Mexico (5), Belize (21), Honduras (5) and Guatemala (1), including researchers, marine protected area managers, tour operators and representatives of natural resources governmental agencies and conservation NGOs. Eleven participants were women. A review of whale shark research and tourism from each of the three feeding sites in the MAR provided the basis for assessing the effectiveness of current site-based tourism guidelines and identifying commonalities which could be used to draft a regional whale shark tourism charter. The biophysical characteristics of each site and aggregation are remarkably different, which has led to differences in approach to research and tourism management. Participants agreed on basic common guidelines governing human and boat interactions with whale sharks, yet differed broadly on several issues that they deemed site-specific; these included the appropriate numbers of permits to allow for visitors, guides and boats, as well as whether to give a blanket recommendation for snorkeling only versus a mix of snorkeling and diving. Encounter guidelines from Mexico and Belize are well-formulated, having been through an iterative improvement process over the past few years. Consequently, much of the formulation of guidelines and use of best practices will assist Honduras in the development of its regulations for whale shark tourism. Several recommendations were gathered to augment research, policy-making and management in the region, and all participants agreed on the creation of a regional whale shark committee to provide a mechanism by which to articulate or facilitate the decisions.

This workshop represented the first regional meeting to address whale sharks as a shared non-consumptive economic resource. The results from this meeting and the follow-on activities will likely be applicable to other regions of the world where whale sharks are becoming an increasingly important element of marine tourism. The MAR Program has incorporated whale shark conservation into our 10 year strategic plan. Five strategies were identified that have been compiled into one results chain which works towards the protection of whale sharks through reduction of inappropriate tourism activities. A monitoring plan was also developed.

Activity 3.4: *Development of guidelines to apply gender equity approach in marine protected areas work.*

Results Anticipated in FY07:

- A module for the application of gender equity in MPAs
- Guidelines to apply gender equity in the MAR program

A set of guidelines was produced in alliance with the Mesoamerican Regional Office of the World Conservation Union (ORMA/IUCN) for institutional strengthening of civil society organizations and for working with organizations to make the necessary changes to incorporate, promote and facilitate the creation of more equal relations between human beings. IUCN is internationally recognized for its experience in promoting gender equity in conservation and sustainable development around the world

The guidelines were written with the purpose of supporting gender equity in the management activities of TNC's MAR Program and its partners in the MAR Region, through regulations and principles which promote equal access to work opportunities, as well as criteria to ensure that the integration of women into their work is valued, with an emphasis on human resource management, coordination, training and publications.

This document was completed in December 2006. However, TNC could not find a contractor who was able to develop the virtual modules during FY07. At this moment we have found and selected a service provider who will carry out this and other modules. A virtual module for the application of gender equity in MPAs will be completed in FY08

Activity 3.5*: Introduction to TNC resilience model*

Results Anticipated in FY07:

- Procedures for applying the resilience model in the Caribbean incorporated in the Learning Center program.

TNC has developed a coral reef resilience model which is being used to identify and prioritize areas of relevant long-term sustainability throughout the MAR region. The MAR Program is implementing the practical application of the model, and providing MPA managers and practitioners with knowledge on the use of the resilience toolkit is a key element of this work.

Although TNC has conducted important work in developing and applying the resiliency model and concept, the topic is so new that much of the science is still under development. The science needs to be reviewed with partner organizations and practitioners, and the concept must be validated. In FY08, the MAR Program will present the resilience model in the region and pre-identify key areas with resilience conditions. Two training sessions are planned, the first of which was planned for August 2007 in Cancun, Mexico but had to be postponed due to Hurricane Dean. We have re-scheduled the workshop for October 23-24, 2007, with 15 confirmed Mexican participants. The second session will be planned in Belize during the third quarter of FY08 with 12 to 15 science professionals from the Mesoamerican region. Procedures for applying the resilience model will be incorporated in the Learning Center program in FY08.

Objective 4: **A MAR ecoregional plan is adopted and implemented that reflects agreement by key conservation partners (local and international NGOs, government agencies and donors) on priority programs and activities, with the sharing of scientific and program data;**

Activity 4.1: *MAR ecoregional assessment: Stakeholder analysis for the development of conservation strategies, and validation of identified conservation portfolio through stakeholder participation.*

Results Anticipated in FY07:

- Final portfolio, strategies developed for main threats and for implementation of portfolio of sites.

This assessment of the Mesoamerican Reef was the second iteration of a planning exercise for this ecoregion. The first ecoregional plan was developed by WWF in 2002. The recent process took advantage of the information gathered during the previous planning exercise, incorporated new information, and facilitated the participation of local scientists, government officials, and key stakeholders. Moreover, the development of the portfolio of sites was based on a decision-support tool (Marxan) to help identify proposed sites that meet the conservation goals.

The ecoregional assessment (ERA) was based on the Conservation by Design process developed by TNC, and started with the definition of the planning area and its stratification. Next, priority conservation targets were identified for which geographic distribution information was available. Conservation targets included ecosystems or habitat types (reefs, mangroves, seagrasses, manatee habitat, estuaries and coastal lagoons, sandy beaches, and whale shark feeding areas) and species occurrences (sea turtle and crocodile nesting sites, and reef fish spawning aggregation sites).

The threats analysis focused on the threats to the conservation targets, including the sources of stress, the severity and the reach of the threats; examples include habitat reduction, community structure and composition changes, reductions in population size, and physical-chemical alterations. The threats analysis identified the following as main threats: global climate change, inadequate aquatic tourism practices, urban development and tourism infrastructure development, sewage discharge, and solid waste accumulation. Other important threats include sedimentation, agrochemical and pesticide discharges, over-fishing and the use of inadequate fishing practices (use of spear gun, trawling, and scuba fishing). Lastly, the threats of navigation (e.g., boats speeding, anchoring in reefs, and spills) and the development of transportation infrastructure were identified. Using this threats analysis, objectives and strategies were developed and prioritized. Out of a total of 56 strategies, 20 were identified as priority, including facilitating civil society participation in the MPA administration process, promoting the declaration of new MPAs in Mexico and Honduras, promoting changes in MPA legislation and the harmonization of policies for the management of fisheries, mangroves and land use plans.

More than 75 persons from the four countries in the MAR and other regions participated in the series of workshops. About 35% of the participants were women.

The MAR Program now is developing a strategic plan based on the 20 priority strategies identified in the ERA.

Activity 4.2: *Dissemination of ecoregional assessment results through publications and distribution of ecoregional plan*

Results Anticipated in FY07:

- A CD or DVD with all geographic information, data, maps and workshop reports
- MAR stakeholders and practitioners apply the ecoregional plan to their local actions

The results from the ERA have already been applied by MAR stakeholders and practitioners in two instances. The first one was by the Mesoamerican Reef Fund, which utilized the portfolio of priority conservation sites developed in the MAR ERA as a guideline to identify priority marine protected areas for funding. Additionally, the Central American Maritime Organization's Gulf of Honduras project will use the environmental information from the MAR ERA to inform their development of recommendations for port safety and environmental navigational hazards.

The production of the DVD is delayed pending MAR Team document revision. This delay is attributable to the fact that results analysis took longer than expected, primarily due to the ample stakeholder participation in the process.

Activity 4.3: *Development of a MAR region projects and initiatives matrix*

Results Anticipated in FY07:

- Improved coordination and synergies among the activities of key organizations working in the MAR region.

The activity started late in the fiscal year due mainly to difficulties in harmonizing agendas among different organizations selected to participate. Last May, together with the MAR Fund and with additional support from AVINA Foundation, TNC hired a consultant to carry out the process.

A first workshop was held in August 2007 in Guatemala City. A total of 22 participants from 13 organizations working in biodiversity conservation in the Mesoamerican Reef were present. The workshop identified at least 25 opportunities for synergies or occurrences of duplication of effort. All the participants committed to ensuring coordination on specific topics and activities to avoid duplication of effort and to create opportunities for coordination of new initiatives. A synergy matrix was created as a result of the workshop.

A follow-up committee was created with eight representatives from the group in order to coordinate activities between the organizations and publish materials for distribution amongst all participants, as well as to governments and donors to keep them informed on this initiative.

A final written report of the activity will be available by the end of October 2007.