



# **Before and After in Belize: Testing a Marine Reserve**

## **2012 FIELD REPORT**

### **Background Information**

Lead PI: John A. Cigliano

Project scientists: Dr. John A. Cigliano and Dr. Richard Kliman

Report completed by: John A. Cigliano

Period Covered by this report: May-August 2011

Date report completed: 2013-01-02 10:08:27

Research site: Sapodilla Cayes Marine Reserve

Research site latitude / longitude: 16Q364181 1781378

Protected area status: UNESCO World Heritage site

Dear Volunteers,

We would like to thank you for a wonderfully successful field season! As you know, this was an important year for the project: this was the third year that we surveyed the queen conch aggregations in the reserve after the zones and regulations were enforced. The data you collected on density and size structure will be compared to data collected before enforcement to determine if the Sapodilla Cayes Marine Reserve is successful at protecting and replenishing the queen conch populations.

Some highlights of this season included finding more lipped individuals at several sites, finding individuals AGAIN at Northeast Caye, which didn't have conch before enforcement, and finding spawning females in the Preservation Zone! Spawning in shallow water is a rare and very significant result, one that provides hope for the queen conch in the SCMR. So, thanks again for a great season. We would not have been able to accomplish the goals we had for this year without your help.

Sincerely,

John

## **SECTION ONE: Scientific research achievements**

### **Top highlight from the past season**

This year, the third year after enforcement began in the reserve, we continued to find subadult and adult individuals in the shallow aggregations: this is the second consecutive year that we have these age groups at sites. We also found conch again at Northeast Caye, a site that did not have conch before enforcement. And most exciting, we found spawning females in the Preservation Zone. All these taken together suggest that the enforcement is having a positive impact.

### **Reporting against research objectives**

Long-term Objectives:

Objective B1: Determine the effectiveness of SCMR in protecting and replenishing queen conch populations.

We made significant progress towards this objective. This was the third season of post-enforcement data, to go along with 4 seasons of pre-enforcement data on density and size/age structure. Evidence suggests that the reserve is having a positive affect: we have observed more subadult and adult individuals than previously observed, conch are at Northeast Caye, and spawning is occurring in the Preservation Zone (PZ).

The observation of spawning in the PZ is significant because this is the first observation of spawning in a shallow site. Previously, we observed egg-laying only at deep-water sites and postulated that these deep-water sites were the only spawning sites in or adjacent to the reserve.

Objective B2: Provide information for adaptive management of the marine reserve.

We continued to work closely with the Belize Department of Fisheries and the NGO that manages the reserve - first the Toledo Association of Sustainable Tourism and Empowerment (TASTE) and then the Southern Environmental Association (SEA). We continue to present our findings and share our raw data with both SEA and Fisheroes and will continue to do so.

Objective B3: Build capacity in all stakeholders to ensure the long-term effectiveness of the reserve.

This objective is the one we had not made as much progress towards as we would have liked. We have worked with SEA and Department of Fisheries as mentioned above. We have also had Fisheries officers and members of TASTE with us on our teams.

However, we were very interested in working with the University of Belize to help build capacity in their students, who will be the next generation of conservation scientists and managers. We reached out to the Belmopan and Toledo campuses of UB but we were never able to get a program going because of the lack of funding.

Specific Objectives:

Objective S1: Stakeholder Perception and Support of the SCMR.

This was not a difficult objective to meet. There was already broad and generally strong support for the reserve. We helped maintain and, where needed, build support by giving formal and informal presentations, and by interacting with the community. While we were in Punta Gorda, we ate meals at local restaurants and interacted with the community whenever we could.

Objective S2: Map queen conch aggregations and habitat within the reserve.

We have mapped 9 shallow-water aggregations throughout the reserve, both in the protected and unprotected areas by the end of the first season. In 2011, we added an additional 9 deep-water sites.

Objective S3: Conduct surveys as part of a long-term monitoring effort of queen conch populations and as part of a Before-After-Control-Impact (BACI) study to determine the effectiveness of the reserve in protecting queen conch populations.

We have 4 seasons of pre-enforcement data and three seasons of post-enforcement data in both protected (Impact) and unprotected (Control) sites.

Objective S4: Conduct long-term monitoring of queen conch populations.

This was the 7th season of surveys of queen conch populations; we have collected data on abundance, density, and size/age structure.

Objective S5: Determine if the populations of queen conch are reproductive.

We have determined that spawning occurs in one shallow-water aggregation in the reserve. However, we are finding more adult conch in the shallow-water aggregations (see above) so spawning might eventually occur in other aggregations. But since conch require a minimum density of ~50 adults/hectare for reproduction to occur, it might be several years before we see reproduction in the shallow aggregations. Fortunately, we have observed spawning in a deep-water site.

Objective S6: Determine the extent of demographic connectivity of the reserve with surrounding areas through post-settlement migration (spillover effect) and larval dispersal (dispersal effect) and the overall level of self-recruitment of queen conch populations within the Sapodilla Cayes and Port Honduras region.

We continued to tag conch. The analysis of the tagged data is preliminary but it appears that currently there is little to no spillover from protected to unprotected areas. This might change if densities in the protected sites increase. We continued to sample the age/size structure of queen conch veligers (young) from 6 different nursery aggregations and on the forereefs of the associated reef cuts. Analysis is preliminary but we have found very young veligers (1-5 days old; Stage I and II) over the nursery habitats. This, along with a lack of older, pre-competent and competent veligers over the fore-reefs, strongly suggests that self-recruitment is a significant source of the conch in the reserve.

Objective S7: Develop a strong collaborative relationship with local stakeholders and the Fisheries Department to help build capacity in the community.

See Objective B3.

Objective S8: Conduct educational outreach activities with local stakeholders

See objectives B2 and B3.

## **SECTION TWO: Impacts**

### **Partnerships**

Belize Department of Fisheries: We worked with the Dept. by providing data and results to inform management decisions. We are worked with the Dept. "on the ground" in the reserve. A Fisheries officer accompanies us on our surveys. We also worked closely with the reserve manager.

SEA: This is the NGO that is responsible for co-management of the reserve. We have worked with them from the beginning to design the research program to address their needs to better manage the reserve. We share information with them, helped them with revisions of reserve zonation and management plans, and worked with them in the field.

University of Belize: We attempted to develop a partnership from the start of the project. We met with administration and faculty at the main campus in Belmopan and also the campus in the Toledo District. UB students have accompanied us on teams as Fellows.

ReefCI: A local NGO that is also working in the SCMR. We collaborated with them on deep-water surveys and tagging. Before we could run SCUBA teams, ReefCI tagged conch for us in the deep sites. Some of the sites we surveyed with our SCUBA team had been identified by ReefCI as possible spawning sites

## **Contributions to conventions, agendas, policies, management plans**

- **National or regional**

Department of Fisheries: We have shared our data and results through reports and presentations. No changes were made to the reserve design or management last year.

- **Local**

SEA: We continued to report our findings to SEA. No changes were made to the reserve design or management last year.

## **Actions or activities that enhance natural and/or social capital**

We removed Lionfish when encountered at our sites.

## **Conservation of Taxa**

*Strombus gigas*, queen conch. Listed in Appendix II of CITES as a species of special concern. This is due to depleted populations from overfishing. The queen conch is culturally and economically significant to Belize and other countries in the Caribbean. It is the second largest marine export in the Caribbean behind the spiny lobster (*Panulirus* spp.) and also supports a significant artisanal fishery in Belize. Its ecological significance is not well known. It is a large grazer in marine seagrass beds so it likely plays an important role in nutrient cycling and in structuring the primary producer community and it is an important prey species for predators such as rays, spiny lobsters, and sharks. It is not listed on the IUCN Red List. Populations of queen conch have declined significantly and are considered over or fully exploited throughout its range. It is considered commercially (and likely ecologically) extinct in Jamaica and Bermuda. Evidence suggests that queen conch populations are already responding to reserve enforcement (see above)

## **Ecosystem Services**

Provisioning: One of the major objectives of the reserve is to replenish queen conch populations in unprotected areas where fishing is allowed. Unfortunately, we have found no evidence that spillover is occurring. And, we do have data that suggests that fishing effort has been displaced to an area just north of the preservation zone that has led to a significant decline in queen conch density. However, spillover might occur as density increases.

## **Impacting Local Livelihoods**

We hire individuals from the local community to be our boat drivers, dive master, and cook. We rent boats and cabanas at the field site from locals and eat in local restaurants when in PG, where we stay in hotels out by locals.

## **Local community activities**

We meet with local stakeholders to report our results and often have local community members with us in the field. We are well known in the community.

## **Dissemination of research results**

### **Scientific peer-reviewed publications**

We have a manuscript in review reporting on our pre-enforcement surveys.