

National Fish and Wildlife Foundation

NFWF/Legacy Grant Project ID: 0302.10.021489

Coral Reef Conservation Fund 2010 - Submit Final Programmatic Report (Activities and Outcomes)

Grantee Organization: Southern Environmental Association

Project Title: Improving Management of Marine Protected Areas in Belize

Project Period	06/01/2010 - 12/31/2011
Award Amount	\$85,450.00
Matching Contributions	\$85,450.00
Project Location Description (from Proposal)	Southern Barrier Reef Complex, Belize, Central America Stann Creek and Toledo Districts Gladden Spit and Silk Cayes Marine Reserve Laughing Bird Caye National Park Sapodilla Cayes Marine Reserve
Project Summary (from Proposal)	Improve management of three marine protected areas in southern Belize by increasing coordination between the enforcement and science programs to support adaptive management.
Summary of Accomplishments	Throughout the duration of the project, monthly scientific monitoring was conducted at all 3 parks (Laughing Bird Caye National Park, Gladden Spit and Silk Cayes Marine Reserve and Sapodilla Cayes Marine Reserve) co-managed by SEA. Monitoring activities included; commercial species, fish landings and spawning aggregations and for all monitoring activities, 'community researchers' (young people from the local community trained in fish and coral ID and monitoring techniques) were used on an ad hoc basis. Enforcement activities were conducted on a daily basis by the park rangers who conducted patrols of the reserves checking for infractions of Belize Fisheries laws and regulations. Enforcement activities were undertaken in the buffer zones (between the three parks) by the 'Special Enforcement' team. On the strength of 2010 commercial species data analysis which showed a decline in stocks of conch and lobster, night patrols were started within the reserves in 2011; an increase in stocks 2010-2011 may indicate that improved management, based on scientific data, has reduced illegal activities in the reserves, thus leading to an increase in commercially important stocks.
Lessons Learned	SEA's science team comprises only 2 full-time personnel and all scientific monitoring requires the use of 'community researchers' (young community members training in identification and monitoring techniques). Although the use of community researchers is considered a strength (as it teaches marine science to a broader audience and offers financial benefits to community members), it is also a limitation as monitoring activities rely on the availability of additional personnel external to the organization. One of the lessons learned is that a greater community researcher pool should exist, and as a result of this, a week-long community researcher training will be a priority for early 2012. SEA's enforcement efforts have proven that an interagency approach to enforcement is most effective. This approach allowed for a more efficient use of limited human and financial resources. Given that each agency has its own strengths, the interagency collaboration allowed for these strengths to be capitalized on at most opportune times, thereby ensuring that the Special Enforcement Team was able to successfully engage in enforcement activities within the Southern Barrier Reef Complex. Our efforts have also taught us that community support is crucial for the success of the Enforcement Program. Community members need to feel 'ownership'; it is vital that they be updated on the activities of the enforcement team and that they have a mechanism to be able to share information with the team.

Conservation Activities species	Continue to monitor spawning aggregations, fish landings and commercial species
Progress Measures	Other (All data is entered into appropriate database)
Value at Grant Completion	All data is in databases
Conservation Activities as well as the buffer areas	Continue to enforce rules and regulations in the three marine protected areas
Progress Measures	Other (All data is entered into appropriate database)
Value at Grant Completion	All data is in databases
Conservation Activities including the development of a enforcement	Conduct comprehensive evaluation of the current status of enforcement data database including improved inco
Progress Measures	Other (Database development and report)
Value at Grant Completion	A database is completed and the report submitted
Conservation Activities aggregations, landings and commercial species in order to better integrate	Conduct comprehensive evaluation of the current status of data on spawning aggregations, landings and commercial species in order to better integrate
Progress Measures	Other (Report is disseminated to partners)
Value at Grant Completion	All partners have recieved copy of report
Conservation Activities necessary trainings and for enforcement and science staff to improve integratio	Identify modifications to science and enforcement programs and provide necessary trainings and for enforcement and science staff to improve integratio
Progress Measures	Other (# of people trained and # recomendations implemented)
Value at Grant Completion	10 people trained, 50% of reccomendations
Conservation Outcome(s) comparable with the Gladden Spit Marine Reserve's 2008 level	All illegal fishing activities within the SBRC will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level
Conservation Indicator Metric(s)	Other (Reduction in illegal activities)
Baseline Metric Value	2009 enforcement records
Metric Value at Grant Completion	Baselines and targets id, 25% reduction from 2009
Long-term Goal Metric Value	2008 levels at GSSCMR
Year in which Long Term Metric Value is Anticipated	2013
Conservation Outcome(s) assessments as a result of effective management	Populations of commercial species are increased by 20% from current stock assessments as a result of effective management
Conservation Indicator Metric(s)	Other (Commercial species levels ar increased by 20%)
Baseline Metric Value	earliest baseline from each MPA
Metric Value at Grant Completion	Baselines and targets are identified
Long-term Goal Metric Value	20% increase from earliest baseline
Year in which Long Term Metric Value is Anticipated	2019
Conservation Outcome(s) sustained through good resource-use practices	Populations of fish at Spawning Aggregation Sites will be stabilized & sustained through good resource-use practices
Conservation Indicator Metric(s)	Other (Stabilization of spawning aggregations)
Baseline Metric Value	earliest baseline from each MPA
Metric Value at Grant Completion	Baselines and targets are identified
Long-term Goal Metric Value	Stablization of populations
Year in which Long Term Metric Value is Anticipated	2019



Final Programmatic Report Narrative

Instructions: Save this document on your computer and complete the narrative in the format provided. The final narrative should not exceed ten (10) pages; do not delete the text provided below. Once complete, upload this document into the on-line final programmatic report task as instructed.

Title: Improving Links between Science, Enforcement and Fisheries

Organization: Southern Environmental Association (SEA), Placencia, Belize

1. Summary of Accomplishments

In four to five sentences, provide a brief summary of the project's key accomplishments and outcomes that were observed or measured.

Throughout the duration of the project, monthly scientific monitoring was conducted at all 3 parks (Laughing Bird Caye National Park, Gladden Spit and Silk Cayes Marine Reserve and Sapodilla Cayes Marine Reserve) co-managed by SEA. Monitoring activities included; commercial species, fish landings and spawning aggregations and for all monitoring activities, 'community researchers' (young people from the local community trained in fish and coral ID and monitoring techniques) were used on an *ad hoc* basis. Enforcement activities were conducted on a daily basis by the park rangers who conducted patrols of the reserves checking for infractions of Belize Fisheries laws and regulations. Enforcement activities were undertaken in the buffer zones (between the three parks) by the 'Special Enforcement' team. On the strength of 2010 commercial species data analysis which showed a reduction in stocks of conch and lobster, night patrols were started within the reserves in 2011; an increase in stocks 2010-2011 may indicate that improved management, based on scientific data, has reduced illegal activities in the reserves, thus leading to an increase in commercially important stocks.

2. Project Activities & Outcomes

Activities

- Describe and quantify (using the approved metrics referenced in your grant agreement) the primary activities conducted during this grant.
- Briefly explain discrepancies between the activities conducted during the grant and the activities agreed upon in your grant agreement.

- **Activity 1: Continue to monitor spawning aggregations, fish landings and commercial species.**

SEA continued to implement scientific monitoring in all months (as per 2011 science calendar). Spawning aggregation monitoring was conducted at Gladden Spit and Silk Cayes Marine Reserve in all months except August - November (as these are the months when fewest fish aggregate). Survey dives recorded the species, abundance and size of all fish observed. Fish landings monitoring was conducted at Gladden Spit and Silk Cayes Marine Reserve (GSSCMR) during March – June. This is during the snapper spawning season, and the time at which the mutton snapper fishery at GSSCMR is open, but regulated under a special license scheme. All mutton snappers landed were weighed, measured and their reproductive state was recorded. A PhD student from Texas A&M University, Pablo Granados-Dieseldorff (Supervisor: Dr Will Heyman), is working on the mutton snapper fishery at Gladden Spit for his thesis, entitled: "Conservation Biogeography of Mutton Snapper (*Lutjanus analis*) in the Western Caribbean: A Dynamic Geography Approach". Fishery data consisted of fishery-dependent landing statistics (number of boats landing mutton snapper in one day, number of hours fished per fisher, abundance of landed fish, fish weight, length, sex, reproductive development, and catch per unit effort -CPUE) and fishery-independent underwater visual censuses (UVC). At the landing site, whole fish were weighted (to nearest 0.25kg) and measured (to nearest mm standard length –SL, fork length – FL, and total length – TL) by a crew of six persons. Gonads were weighed (to nearest 0.1g) and reproductive development in females were determined using standard macroscopic criteria (stage I -immature, stage II -mature, stage III -running ripe, and stage IV -spent). Gonad state in males was also determined macroscopically (either early or late development).

Commercial species (conch, lobster and finfish) were monitored (abundance, size and diversity) in all 3 parks on a quarterly basis. In 2011, this monitoring was conducted in February/March, May, September and December. (May data was unfortunately stolen from a laptop case). The method used is based on Dr Charles Acosta's Long-term Atoll Monitoring Protocol (LAMP), whereby a 30 minute timed swim is undertaken to cover the entire site. A team of 3 persons is used; one for conch, lobster, finfish. Typically 2 'community researchers' are used. At all parks, monitoring is conducted within the different zones of the park. As a 'control', and to give a comparison, sites are also monitored outside the parks. At LBCNP 14 sites are monitored (9 inside no-take area, 5 outside the reserve), at GSSCMR 12 sites are monitored (3 inside no-take area, 6 in 'general use' zone and 3 outside the reserve) and at SCMR 12 sites are monitored (all inside 'general use' zone). All data were entered into electronic databases and compared with previous years.

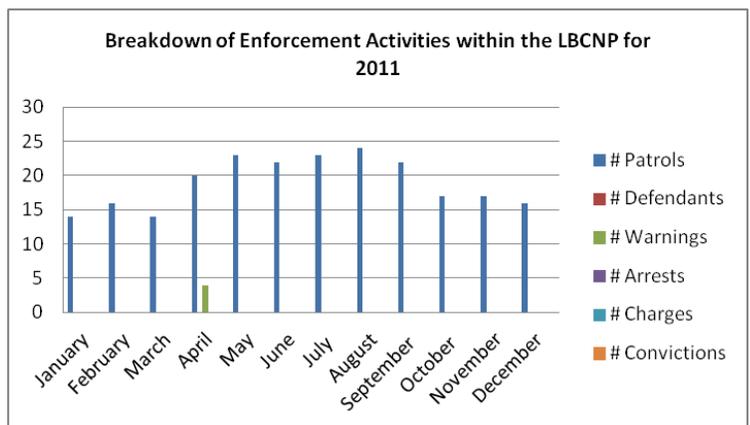
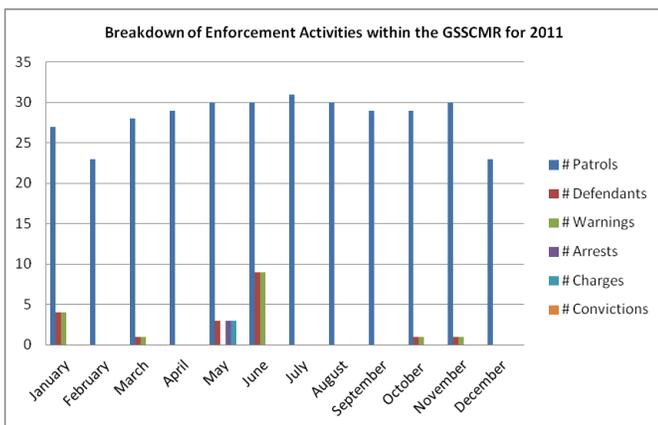


A) Dog snappers spawning at GSSCMR; B) Diver recording fish spawning activity; C) Researcher measuring a conch

Discrepancies: This activity was successfully implemented in terms of all 3 monitoring activities and there were no discrepancies between activities conducted and activities agreed upon. There is no outstanding data entry.

• Activity 2: Continue to enforce rules and regulations in the three marine protected areas as well as the buffer areas.

SEA rangers continued with their enforcement efforts throughout 2010 and 2011. Patrols were carried out on a daily basis and Belize Fisheries Department rules and regulations, as well as tourism regulations, were effectively enforced in the marine reserves. These enforcement activities yielded numerous arrests for violations of rules and regulations and attest to SEA's constant presence and impressive enforcement capability in the Southern Barrier Reef Complex.



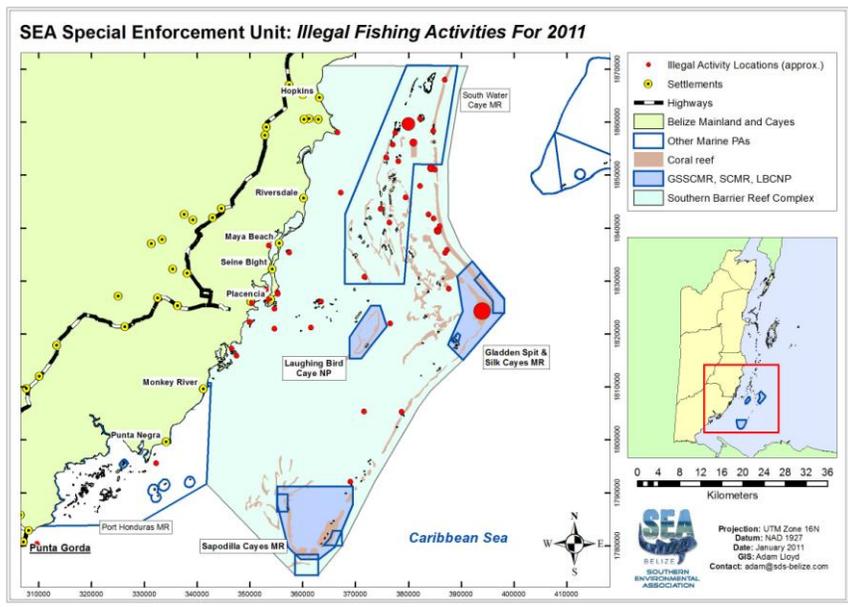
The inter-agency Special Enforcement Team continued to conduct effective enforcement within the Southern Barrier Reef Complex, i.e. the buffer zones between the reserves. Interagency patrols were conducted with support of Belize Police Department, Belize Fisheries Department, Belize Coast Guard, Belize Defense Force and Toledo Institute for Development and Environment (TIDE). Building on this strong working relationship with the different agencies, SEA was able to efficiently and effectively carry out enforcement activities, including incarceration, processing of charges for infractions committed and prosecution of offenders within the Southern Barrier Reef Complex (SBRRC). All data on the opinions or policies of the National Fish and Wildlife Foundation. Mention of trade names or commercial products does not constitute their endorsement by the National Fish and Wildlife Foundation.

patrols and infractions were entered electronically. Throughout 2011, there were a total of 179 Special Enforcement patrols, resulting in 122 defendants, 63 warnings, 59 arrests, 81 charges and 72 convictions. All data were entered into electronic databases.

Discrepancies: This activity was successfully implemented and there were no discrepancies between activities conducted and activities agreed upon. There is no outstanding data entry.

• **Activity 3: Conduct comprehensive evaluation of the current status of enforcement data including the development of an enforcement database including improved incorporation of GIS.**

SEA now has a fully operational enforcement database. This was created through a consultancy with Dr Nicola Foster, funded by the Summit Foundation (completed Nov. 2010). Dr Foster used to be the Science Program Director for TIDE (Toledo Institute for Development and Environment), a similar co-management NGO based in southern Belize, and thus was very familiar with SEA’s enforcement activities. SEA has a long time series dataset, but until now, this was in an Excel spreadsheet and was very unmanageable. Dr Foster developed a new database using Microsoft Access. As part of her contract, Dr Foster entered all enforcement data prior to 2010. The database allows SEA to conduct quantitative analysis of the Enforcement Program. Since the inception of the Special Enforcement Program in 2009, there has indeed been a reduction in the number of illegal activities occurring within the SBRC and the three marine protected areas. There was a 92% increase in enforcement efforts for 2011. This significant increase accounts for the decrease in illegal incidents (number of defendants) recorded in 2011. The zero tolerance modum of operation in 2011 led to the increase in number of arrests, charges and convictions. The database shows a 17% reduction in fishing violations compared to 2010 and a 28% reduction compared to 2009. The database is now being used to guide enforcement activities in the Southern Barrier Reef Complex and is able to provide SEA with valuable information that is being used to identify hotspots and guide enforcement activities.



This map shows illegal activities within the SBRC for 2011. This type of information is used to determine routes selected for patrolling, ensuring that the limited resources SEA has are being used efficiently, focusing on known problem areas. 112 recorded incidents are plotted on this map, but many of those have overlapping coordinates. In GSSCMR for example, the large dot represents 5 incidents that occurred in the same location. The Southern Barrier Reef Complex (SBRC) comprises 4 marine reserves – the three that SEA co-manages, plus South Water Caye Marine Reserve to the north.

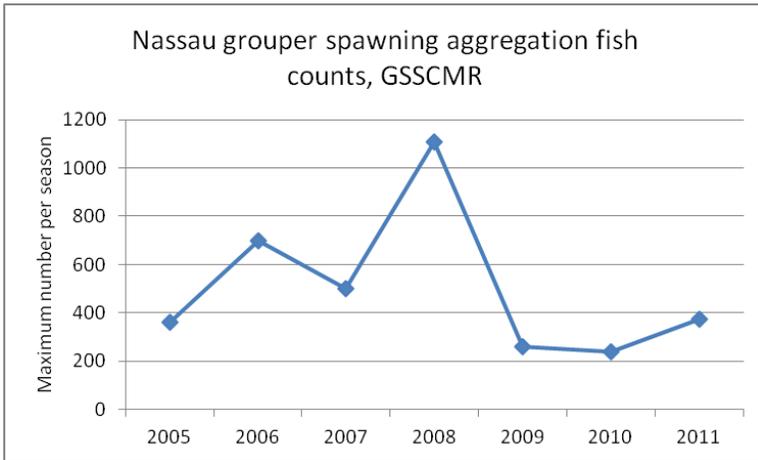
Discrepancies: This activity was successfully implemented and there were no discrepancies between activities conducted and activities agreed upon.

• **Activity 4: Conduct comprehensive evaluation of the current status of data on spawning aggregations, landings and commercial species in order to better integrate data analysis to feed into adaptive management of the marine protected areas.**

Spawning Aggregations

The Nassau grouper spawning season is December – February, and this was monitored at Gladden Spit and Silk Cayes Marine Reserve (GSSCMR) for the 2010-2011 season. In December 2010, only 8 Nassau grouper were observed on the monitoring SCUBA dives, 100 individuals were observed in February 2011, but the peak of the season was in January 2011 when 375 individuals were counted in a single dive. These numbers have been compared to previous years to show the recent historical trend. The 2011 peak count was 137 greater than the peak count recorded in 2010.

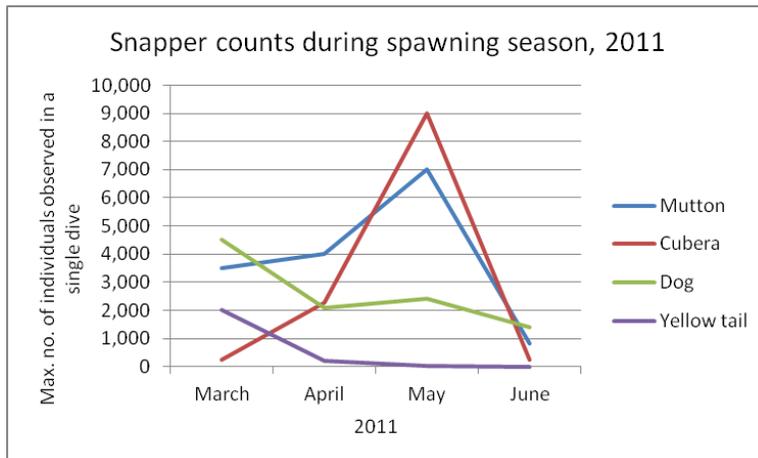
The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the National Fish and Wildlife Foundation. Mention of trade names or commercial products does not constitute their endorsement by the National Fish and Wildlife Foundation.



The snapper spawning season is March – June. Dominant species observed on these monitoring SCUBA dives were Cubera, Mutton and Dog snappers, with a large number of yellowtail snappers being observed at the beginning of the season (March). Jacks were also prevalent (Crevalle, Horse-eye, Yellow and Bar). Cubera and Mutton snappers aggregated in the largest numbers and peaked at 9,000 and 7,000 individuals respectively (both recorded in May 2011).

	Mutton	Cubera	Dog	Yellow tail
March	3,500	250	4,500	2,000
April	4,000	2,250	2,100	200
May	7,000	9,000	2,400	7
June	820	230	1,400	3

Maximum counts of snappers in a single SCUBA dive at GSSCMR spawning aggregation site, March – June 2011.



Maximum counts of snappers in a single dive recorded during snapper spawning season (March – June) 2011.

All spawning aggregation monitoring data is reported to the National Spawning Aggregation Working Group, which meets quarterly in Belize City.

Landings

For the mutton snapper landings monitoring, a total of 5,037 mutton snapper, equivalent to 12.311 metric tons, landed by 129 boats, and harvested during 2,362.5 man hours in GSSCMR were recorded April – June 2011. No mutton snapper were landed in March, but a large number of yellow snapper were landed; over 4,000 individuals were landed on 27th March 2011. For April – June, the mutton snapper numbers landed were unevenly distributed between the months: April = 8.3% of total landings, May = 51.3% and June = 40.4%. April accounted for 10.8% of the total harvested biomass, May for 57.1%, and June for 32.1%. Boat effort was also unevenly distributed throughout the fishing season, with 19.4% of the total boats landing mutton snapper in April, 56.6% in May, and 24.0% in June. Catch per unit effort (CPUE -man hours fished per day) had a similar proportion distribution (21.9% in April, 56.1% in May, and 22.0% in June). Harvest was significantly different between months (PRIMER: ANOSIM, $p < 0.001$). These data will form a component of Pablo Granados-Dieseldorff's PhD thesis. A separate summary report "Retrospective Analysis (1998-2011) Of The Mutton

The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the National Fish and Wildlife Foundation. Mention of trade names or commercial products does not constitute their endorsement by the National Fish and Wildlife Foundation.

Snapper (*Lutjanus analis*) Landings In Buttonwood Caye, Gladden Spit & Silk Cayes Marine Reserve, Belize” on the historical trends of landings and underwater visual census surveys of the snapper spawning aggregation is attached.



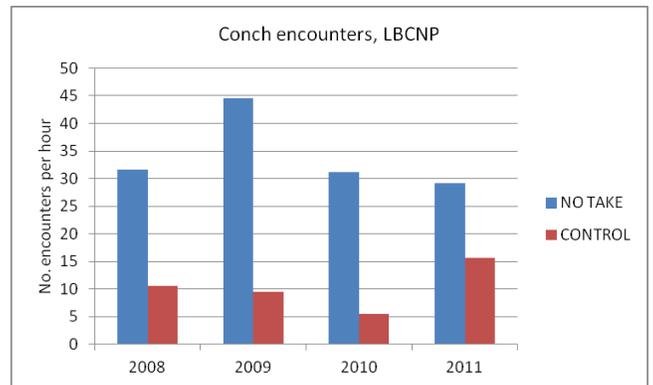
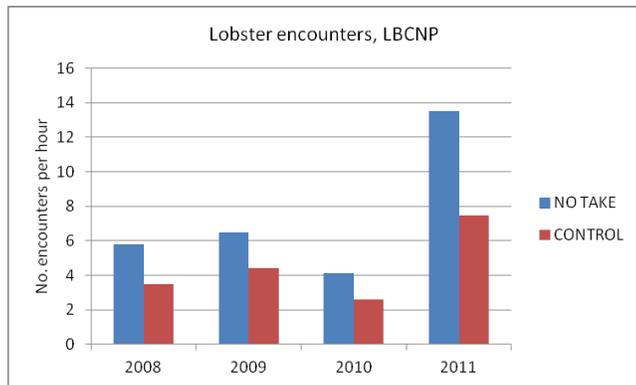
Yellow snappers landed at Buttonwood Caye landing station, 27th March 2011.

Commercial Species: Conch and Lobster

Commercial species data has been analyzed to determine a baseline for stocks, and to compare between years and within zones of each of the marine reserves. Although monitoring of commercial species by SEA (formerly Friends of Nature) extends back to 2003 in some areas, the data prior to 2008 is very inconsistent. 2008 is the first year in which monitoring was conducted 3 or 4 times in the year, and at all 3 parks. It is for this reason that the historical analysis has only been taken back to 2008.

Laughing Bird Caye National Park

The following graphs show the number of encounters of lobster and conch inside and outside LBCNP, 2008-2011.

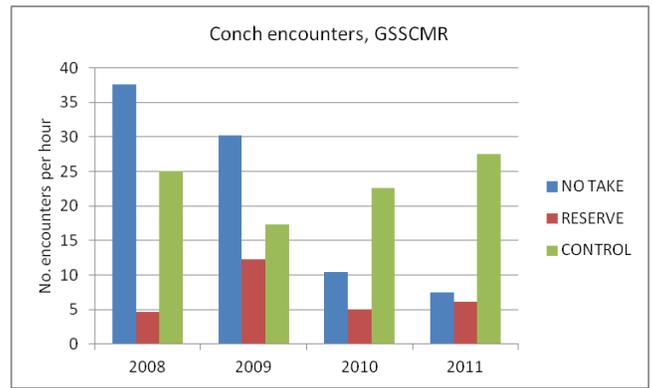
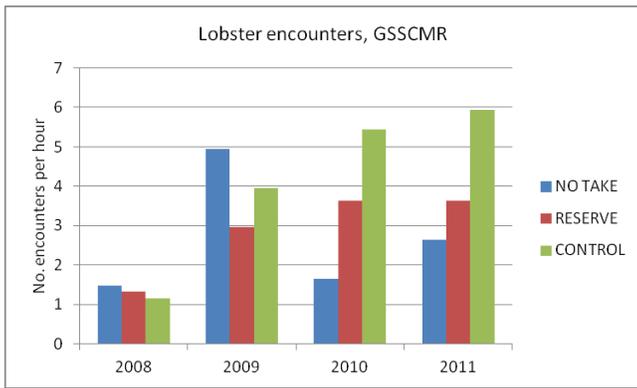


Lobster and conch encounters inside and outside LBCNP 2008-2011. ‘Control’ is outside of reserve.

For lobster encounters, all years show the same trend, with higher numbers of encounters being recorded within the park compared to the control sites. 2011 showed very pleasing results, with a more than 3 fold increase in number of lobsters within the park, and a nearly 3 fold increase in numbers outside the park. Conch also showed a similar trend with much greater numbers always being observed within the reserve. Between 2010 and 2011, the numbers of encounters inside the park remained stable, but the numbers outside the park increased nearly 3 fold.

Gladden Spit and Silk Cayes Marine Reserve

The following graphs show the number of encounters of lobster and conch in different zones of GSSCMR, from 2008-2011.

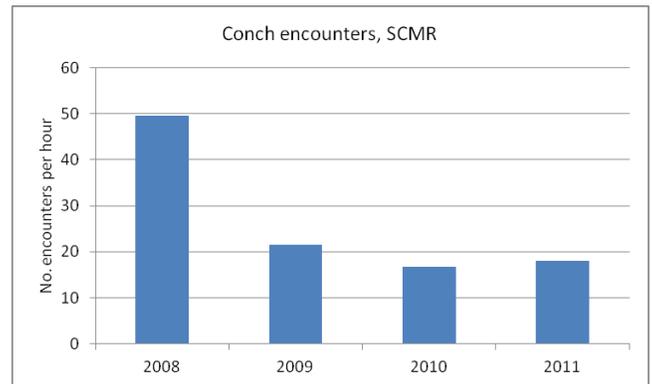
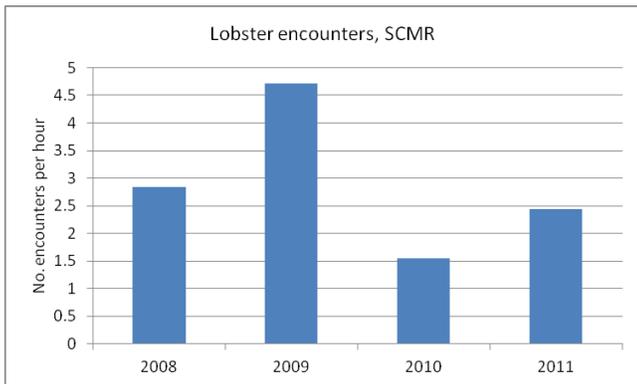


Lobster and conch encounters in all zones of GSSCMR 2008-2011. 'Control' is outside of reserve.

Lobster encounters in 2010 and 2011 showed similar trends. The number of encounters in the reserve (general use zone) remained identical between these years and the number of encounters within the no take area and outside the reserve increased. Within the no take area, there was a 1.6 fold increase in encounters 2010-2011. Lobster encounters were particularly low at GSSCMR in 2008 and in 2009 a considerable increase in encounters was recorded in all zones (peak was in no take area). It is hoped that in future years, improved management of GSSCMR will increase the numbers of lobsters within the no take area of GSSCMR to match this 2009 peak. Fewer conch were encountered in the no take area of GSSCMR in 2010 and 2011 compared to previous years. Between 2010 and 2011, a small decrease in numbers was seen in the no take area, but the reserve (general use) numbers remained stable, and outside the reserve, numbers increased.

Sapodilla Cayes Marine Reserve

The following graphs show the number of encounters of lobster and conch in different zones of SCMR, from 2008-2011.

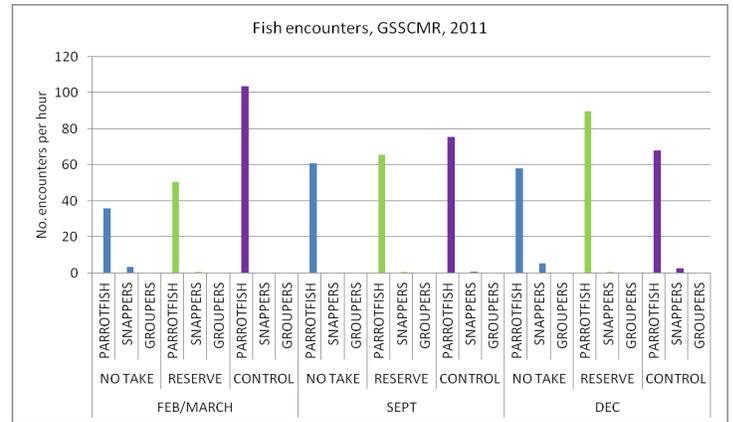
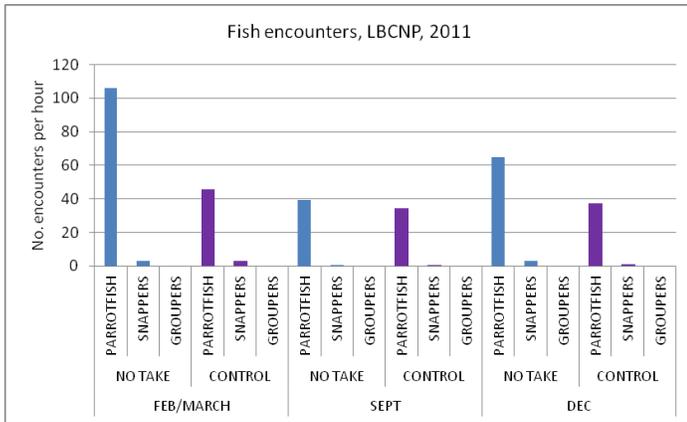


Lobster and conch encounters at SCMR 2008-2011. The entire of SCMR is considered as 'general use'.

There was an increase in number of lobsters encountered at SCMR between 2008 and 2009, followed by a decreased. 2010 surveys encountered the lowest number of individuals (1.5 per hour), but this number had increased by 2011 (2.4 individuals per hour). Conch numbers at SCMR showed a marked decline between 2008 and 2009, and in the past few years, numbers have remained stable (2011 recorded 18 individuals encountered in an hour).

Commercial Species: Finfish

Fish species recorded on commercial species surveys are snappers, groupers, parrotfish and 'others' (Hogfish, Queen Triggerfish). Although it is illegal to catch parrotfish, so they are not a 'commercial species' in the sense of a fishery, they are the reef's primary grazers. By eating the fleshy macroalgae that could overgrow bare reef substrate and juvenile corals, parrotfish are imperative for the health of the reef. The banning of landing parrotfish and other grazers (surgeonfish and doctorfish) has been in effect since 2009, and has been discussed internationally as a highly acclaimed forward-thinking management strategy of Belize Fisheries Department.



Finfish encounters in different zones of LBCNP and GSSCMR in 2011.

The dominant fish observed at LBCNP and GSSCMR in 2011 were parrotfish. It is hoped that these grazers will help reduce the macroalgal cover in this area, allowing for improved coral cover and diversity in the future. The very low numbers of snappers, groupers and other fish species is concerning and there has been a decrease in numbers in recent years. At GSSCMR, this is unlikely to change in the near future as the majority (nearly 99%) of the reserve is open to fishing in its 'general use' zone.

There does not appear to be a 'reserve effect' at GSSCMR. The results from all commercial species monitoring imply that the size of the no-take area at GSSCMR is either too small to have a 'spill-over effect' (the no-take area appears not to be able to successfully contribute to increasing the stocks of such a large surrounding area), or the general use area (labelled 'reserve' on above graphs) is simply too heavily harvested. In 2011, SEA conducted many community consultations and meetings with fishermen and tour-guides to discuss the possible expansion of the no-take area at GSSCMR. These discussions and meetings will continue through 2012. In this way, scientific monitoring data is directly being used to feed into the adaptive management process.

Discrepancies: In the grant agreement, it was stated that a consultant would be employed to conduct comprehensive data analysis on SEA's historical datasets. However, this project coincided with the employment of Dr Annelise Hagan as Science Program Director (in May 2010), and it was ascertained that there was no need to hire a consultant to conduct this data analysis as all analyses could be conducted in house.

- **Activity 5: Identify modifications to science and enforcement programs and provide necessary trainings for enforcement and science staff to improve integration of enforcement and biological data into management activities.**

Modifications to Enforcement Program

- On the strength of the 2010 commercial species data analysis which showed a reduction in stocks, night patrols were started within the reserves in 2011; an increase in stocks 2010-2011 may indicate that improved management, based on scientific data, has reduced illegal activities in the reserves, thus leading to an increase in commercially important stocks.
- The Special Enforcement team was equipped with any additional patrol and surveillance equipment that was required, including a Garmin GPSMAP 720 Marine Radar and Chart Plotter which is expected to increase the team's surveillance capabilities and provide more data that will assist in determining strategic actions.
- There was a significant change in relevant staffing with the hiring of a new Protected Areas Program Director and a new Special Enforcement Team leader. These changes have resulted in a more efficient Special Enforcement Team and have clearly had positive impacts on the level of enforcement and surveillance within the Southern Barrier Reef Complex (enforcement efforts increased by 92% in 2011 compared to 2010). This team has continued to work closely with key stakeholders and partner organizations and they continue to garner support for the Special Enforcement Program.

Enforcement Program Trainings

- Belize Fisheries Department offered three trainings in 2011: 1) Report writing, evidence handling, prosecution and convictions; 2) Case file preparations, and; 3) Night patrol procedures. Attendance at these trainings by SEA's Protected Areas Program staff has enabled greater efficiency in report writing, evidence handling, prosecutions and conviction rates. 3 SEA protected areas staff attended the report writing and case file preparations trainings and 7 staff attended the night patrols procedure training.

Modifications to Science Program

Some specific modifications were made to the Spawning Aggregation Monitoring:

- Use of on-board fish-finder: It was determined that to increase efficiency in monitoring, the survey team should only enter the water once a school of fish is indicated by the fish-finder (rather than only using the GPS position of the known spawning aggregation area). With limited dive time underwater, it is preferable to locate the fish whilst on the surface. This allows for greater and more efficient data collection whilst diving.
- Prior to entering the water, it was determined that currents should be checked on the surface (although the surface current can be different to that at depth) so that time is not wasted by swimming into the current when underwater. Preferably, it was decided that the monitoring team should talk to tourist boats in the area. During the snapper spawning season, SEA's science team enters the water just as the tourist dive boats are leaving. This modification gives the science team the most up to date information available.
- In order to get the best estimates of fish numbers, it was determined that the team must maximize the light available, and adjust the start time of the dive accordingly. For example, on an overcast day, with low ambient light levels, the evening dive should be conducted earlier compared to on a very clear day. A set dive start time cannot be used as seasonal (i.e. time of sunset) and weather variations must be taken into consideration.

Science Program Trainings

- In October 2010 a Microsoft Access database training was held by Dr Nicola Foster. At the time, Dr Foster was the Science Program Director for TIDE (Toledo Institute for Development and Environment), a similar co-management NGO based in southern Belize, and thus she was very familiar with SEA's monitoring and enforcement activities. In 2011, NFWF funds were used to hire Dr Foster as a consultant to develop SEA's commercial species database (completed April 2011). SEA has a long time series dataset, but until now, this was in an Excel spreadsheet and was very unmanageable. Dr Foster developed a new database using Microsoft Access. As part of the contract, Dr Foster entered all commercial species data 2003-2010. It is anticipated that this will greatly aid the Science Program in managing its data and generating reports.



Dr Nicola Foster – database training to science and protected areas staff, October 2010. 2 science staff and 2 protected areas staff attended this training

Outcomes

- Describe and quantify progress towards achieving the project outcomes described in your grant agreement. (Quantify using the approved metrics referenced in your grant agreement or by using more relevant metrics not included in the application)
- Briefly explain discrepancies between what actually happened compared to what was anticipated to happen.
- Provide any further information (such as unexpected outcomes) important for understanding project activities and outcome results.

All illegal fishing activities within the SBRC will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level (anticipated by 2013)

The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the National Fish and Wildlife Foundation. Mention of trade names or commercial products does not constitute their endorsement by the National Fish and Wildlife Foundation.

Progress: Since the inception of the Special Enforcement Program in 2009, there has indeed been a reduction in the number of illegal activities occurring within the SBRC and the three marine protected areas. There was a 92% increase in enforcement efforts for 2011. This significant increase accounts for the decrease in illegal incidents (number of defendants) recorded in 2011. The zero tolerance modum of operation in 2011 led to the increase in number of arrests, charges and convictions. The enforcement database shows a 17% reduction in fishing violations compared to 2010 and a 28% reduction compared to 2009.

Discrepancies: There are no discrepancies. The approved metric in the grant agreement was that “through the Special Enforcement Program SEA is expecting to see continued impact by increased enforcement activities within the buffer zones. This should include a reduction of illegal activity by approximately 25% from the 2009 levels”. Data has shown a 17% reduction in fishing violations compared to 2010 and a 28% reduction compared to 2009.

Populations of commercial species are increased by 20% from current stock assessments as a result of effective management (anticipated by 2019)

Progress: On the strength of the 2010 commercial species data analysis which showed a reduction in stocks, night patrols were started within the reserves in 2011; an increase in stocks 2010-2011 may indicate that improved management, based on scientific data, has reduced illegal activities in the reserves, thus leading to an increase in commercially important stocks.

Discrepancies: There are no discrepancies, and this objective is on track. An increase in commercial stocks (conch and lobster) has been observed 2010-2011 (possibly due to SEA using adaptive management through linking science and enforcement). It is hoped that commercial species stocks will continue to rise so that the objective will be achieved by the anticipated year of 2019. An additional management strategy in working towards this objective is SEA’s current work to increase the size of the no take area at GSSCMR. It is anticipated that an increase in size (from the present 2% of the entire reserve to a possible 15-20%) of the NTA will benefit the entire reserve by creating a ‘spill-over effect’.

Populations of fish at Spawning Aggregation Sites will be stabilized and sustained through good resource-use practices (anticipated by 2019)

Progress: Underwater visual census data for mutton snapper at the GSSCMR spawning site have shown a fluctuating trend 1998-2011 (see supplementary report “Retrospective Analysis (1998-2011) Of The Mutton Snapper (*Lutjanus analis*) Landings In Buttonwood Caye, Gladden Spit & Silk Cayes Marine Reserve, Belize”). An increase in numbers was reported 2004-2005, followed by a steady decline to 2009. A slight increase was observed 2009-2011. The mutton snapper is a targeted fishery at GSSCMR under a special licensing scheme. SEA is working towards improving licensing criteria, with the aim of ultimately decreasing the number of licenses that are issued to fish the spawning aggregation. It is hoped that this will increase the fish stocks at GSSCMR, and will enable a stable population to be maintained by 2019.

Discrepancies: There are no discrepancies, and this objective is on track. Continued monitoring of fish numbers at the spawning aggregation site (through underwater visual census), and fish landed from the mutton snapper fishery will be imperative to guide future management strategies in order to stabilize fish populations at the spawning aggregation site.

3. Lessons Learned

Describe the key lessons learned from this project, such as the least and most effective conservation practices or notable aspects of the project’s methods, monitoring, or results. How could other conservation organizations adapt their projects to build upon some of these key lessons about what worked best and what did not?

The monitoring techniques (methodologies) used to complete this project are long-standing, easy to follow, replicable, and are comparable on a wider scale. These factors are important in maintaining high accuracy data collection, especially with rapid staff turn-over as is common for many NGOs. SEA’s science team comprises only 2 full-time personnel and all scientific monitoring requires the use of ‘community researchers’ (young community members training in identification and monitoring techniques). Although the use of community researchers is considered a strength (as it teaches marine science to a broader audience and offers financial benefits to community members), it is also a limitation as monitoring activities rely on the availability of additional personnel external to the organization. One of the lessons learned is that a greater community researcher pool should exist, and as a result of this, a week-long community researcher training will be a priority for early 2012.

One of the strengths within Belize is the number of NGOs involved in co-management of marine reserves. The establishment of the Environmental Research Institute (ERI) (inaugurated in January 2010) at the University of Belize has also strengthened marine resources monitoring on a national level. ERI has recently developed two new national databases: 1) spawning aggregation monitoring and 2) coral bleaching. Monitoring for spawning aggregations and coral bleaching are conducted throughout the country at specific times, using the same techniques, allowing for accurate spatial comparisons. Inter-partner collaborations (government, NGO and academic) have been shown to be successful in Belize and have strengthened scientific monitoring and data dissemination on a national level. By contributing to these national databases, SEA's scientific monitoring contributes to data collection and reporting on a larger scale.

SEA's enforcement efforts have proven that an interagency approach to enforcement is most effective. This approach allowed for a more efficient use of limited resources, both human and financial. Given that each agency has its own strengths, the interagency collaboration allowed for these strengths to be capitalized on at most opportune times, thereby ensuring that the Special Enforcement Team was able to successfully and securely engage in enforcement activities, including incarceration, processing of charges for infractions and prosecution of offenders within the Southern Barrier Reef Complex. Our efforts have also taught us that community support is crucial for the success of the Enforcement Program. Community members need to feel 'ownership' of the program; it is vital that they be updated on the activities of the enforcement team and that they in turn have a mechanism in place to be able to share information with the team.

4. Dissemination

Briefly identify any dissemination of lessons learned or other project results to external audiences, such as the public or other conservation organizations.

SEA's results are disseminated widely through presentations and reports. In 2011, this included:

- Spawning aggregation monitoring data is reported at the National Spawning Aggregation Working Group, which meets quarterly in Belize City. This is a forum at which spawning aggregation monitoring activities and methodologies are discussed and modified and results are shared on a national level.
- Annual stakeholder meeting: SEA holds an annual meeting to disseminate the results from all its programs (Science, Protected Areas and Education and Outreach) to its stakeholders. This was held in July 2011 in Hopkins Village, Stann Creek District. Hopkins is one of the 9 stakeholder communities which SEA works closely with; transport was provided by SEA for stakeholders from other communities to attend.
- During 2011, The New England Biolabs Foundation (NEBF) funded SEA to conduct community consultations to pursue the possibility of expanding the size of 'no take area' (NTA) within Gladden Spit and Silk Cayes Marine Reserve. SEA met with their 9 stakeholder communities through community consultations; commercial species monitoring data was presented to show historical trends in different zones of the reserve. Data was discussed in terms of the need for a larger NTA to create a 'spill-over effect', in order to maintain commercial stocks in the future.
- A paper will be presented by the Science Director at 12th International Coral Reef Symposium, to be held in Cairns, Australia in July 2012. The paper is entitled "Effectiveness of Different Levels of Management on Three Belizean MPAs" and will be presented in Symposium 18: Management and Monitoring. It will present commercial species monitoring data trends and will discuss the effectiveness of the No-take Areas within SEA's parks in terms of commercial species stocks and enforcement.
- SEA prepares an "Annual Report" which reports on all program areas and a "State of the Parks Report" which focuses on scientific monitoring data.

5. Project Documents

Include in your final programmatic report, via the Uploads section of this task, the following:

- 2-10 representative photos from the project. Photos need to have a minimum resolution of 300 dpi;
- report publications, GIS data, brochures, videos, outreach tools, press releases, media coverage;
- any project deliverables per the terms of your grant agreement.

POSTING OF FINAL REPORT: *This report and attached project documents may be shared by the Foundation and any Funding Source for the Project via their respective websites. In the event that the Recipient intends to claim that its final report or project documents contains material that does not have to be posted on such websites because it is protected from disclosure by statutory or regulatory provisions, the Recipient shall clearly mark all such potentially protected materials as "PROTECTED" and provide an explanation and complete citation to the statutory or regulatory source for such protection.*