"State of the Park Report"- Gladden Spit Silk Cayes Marine Reserve

Introduction

Gladden Spit Silk Cayes Marine Reserve (GSSCMR) was declared in 2000. The GSSCMR was declared in part due to the importance of Gladden Spit as a site for spawning aggregations. Over the past few years a significant volume of data has been collected on the resources contained within the park. In 2003 Friends of Nature (FoN) began to conduct regular biological monitoring within the park. The goal of this report is to begin to evaluate the monitoring data that has been collected to date, with the ultimate objective of integrating findings into the park's management. This report was also written to assess monitoring gaps and make adjustments to monitoring methods to better aid in management decision making. Although this report is not completely comprehensive, it is meant to offer a glimpse into the strengths and weaknesses of the current monitoring program so as to make improvements to monitoring and management in the future.

Caye Bird Species

Middle Silk Caye is a known nesting location for sea birds including Laughing Gulls (*Larus atricilla*), Osprey (*Pandion haiaetus*) and Bridled Terns (*Onchoprion anaethetus*). At this point it is necessary to implement a basic bird monitoring program similar to one currently being used at the Sapodilla Cayes Marine Reserve. This monitoring would focus on conducting weekly monitoring during the nesting season to count nests and eggs at Middle Silk Caye. Consistent monitoring is necessary and will include improved methods for data collection and data management. Bird identification books are needed and it is recommended that efforts be made to train biologists, rangers and other data collectors in basic identification and monitoring techniques. In addition to monitoring nesting birds it is recommended that a yearly bird census be carried out at the GSSCMR. It is recommended that this census be conducted in a similar manner to the "Christmas Bird Count" currently conducted throughout Belize. However, as opposed to having the count around Christmas time it is recommended that the count be conducted during the migratory season either in October or March. This type of census will require greater training in bird identification, but would provide valuable information about both resident and migratory birds who use the GSSCMR.

Commercial Species

At the GSSCMR a number of surveys have been conducted to specifically monitor the status of commercially important species. The GSSCMR is a very important site for commercial fishing, especially for fishermen from Sarteneja, who make up the majority of fishermen who use the reserve. One of the major management goals for marine reserves throughout the country of Belize is the maintenance of commercial fish stocks, making solid scientific data on commercial stocks extremely important. One of the goals of FoN is to be able to determine the impacts of both extraction and management on these commercial stocks. During 2007 rangers received a number of comments and commendations from fishermen that it seemed that there was a noticeable increase in product within the reserve. At the GSSCMR commercial species monitoring has focused on conch, lobster and finfish, following Dr. Charles Acosta's Long Term Atoll Monitoring Program (LAMP) (Acosta). Monitoring is focused at 12 strategically chosen sites. These sites include a variety of habitats including back reef, fringing reef and fore reef.

They were also chosen to include areas within the no-take zone and general use zone with control sites located outside the reserve. (See map in Appendix 1.) Commercial species monitoring at the GSSCMR began in 2003 and has continued on a fairly regular schedule since then. However, it is important to note that due to high levels of staff turnover there are certain inconsistencies in the data collection including variable sampling periods and some uncertainty as to the accuracy of site locations. Despite these setbacks a preliminary appraisal of the data collected to date is presented here.

Conch
Queen conch (Strombus gigas) is a major fisheries export for Belize. In addition to Queen conch, the GSSCMR is home to a variety of other non-commercially exploited mollusks such as milk conch (*Strombus costatus*). In 2003 a comprehensive monitoring program for conch populations was established. Based on Charles Acosta's Long-term Atoll Monitoring Program (LAMP), this monitoring strategy focuses on 12 sites chosen strategically throughout the reserve. At each site timed swims are conducted and for each conch encountered basic measurements are taken including shell length and lip thickness. These measurements allow for comparison across sites and time periods of conch abundance (calculated as catch per unite effort (CPUE)), size distribution and give indication as to the status of conch stocks. In 2007 30m x 4m transects were also used in order to calculate the density of conch found at each site.
        Results-
Figure 1 shows the CPUE for conchs found at each site. As expected the CPUE is generally much lower in the no-take zone which would indicate a much higher number of individuals found there. The interesting comparison is between the reserve and control locations. Although further statistical analysis is necessary, there does not appear to be substantial differences in conch abundance between the reserve and control sites.
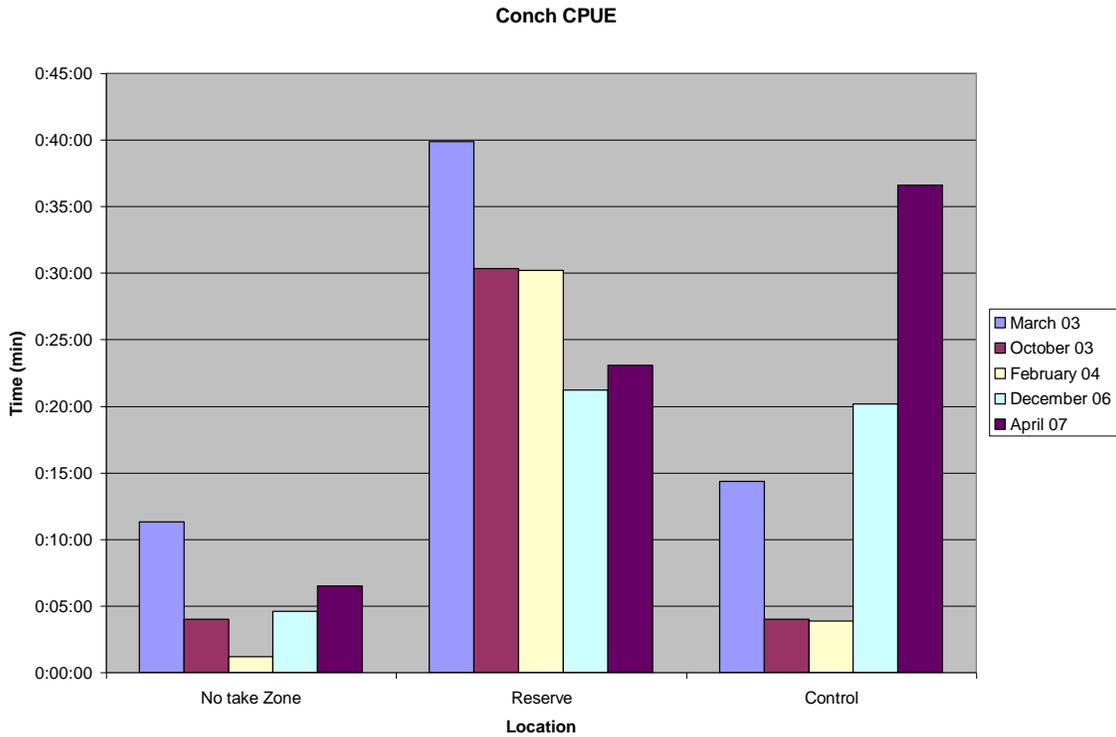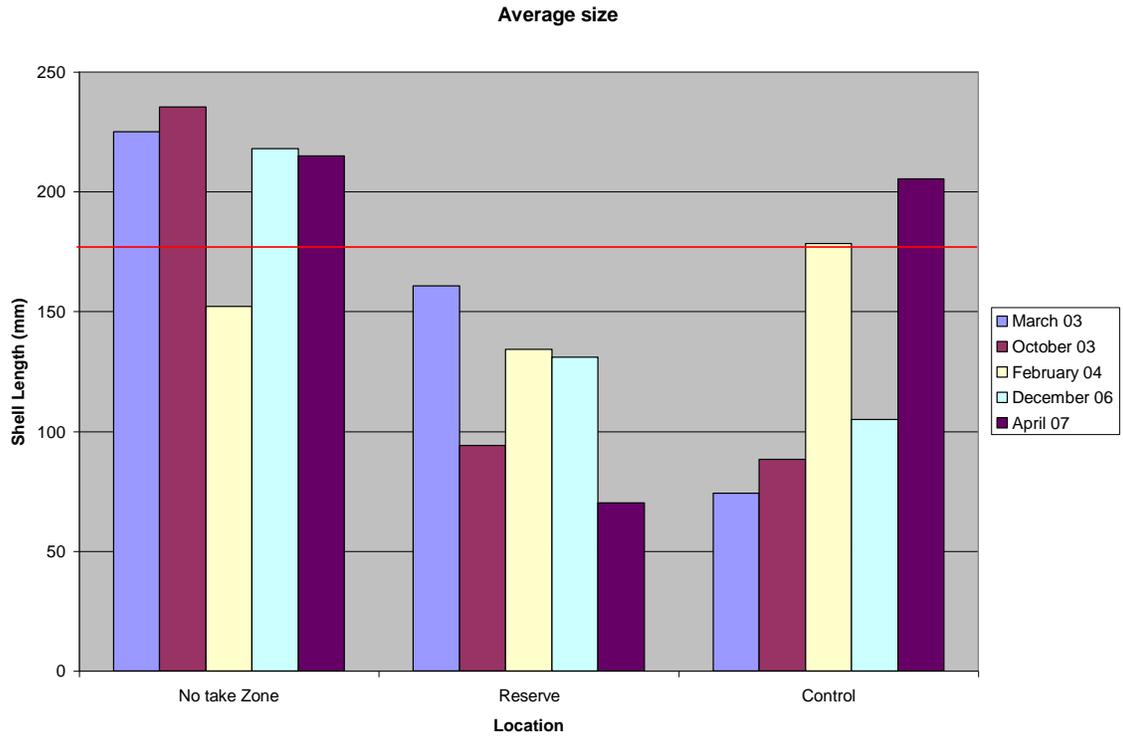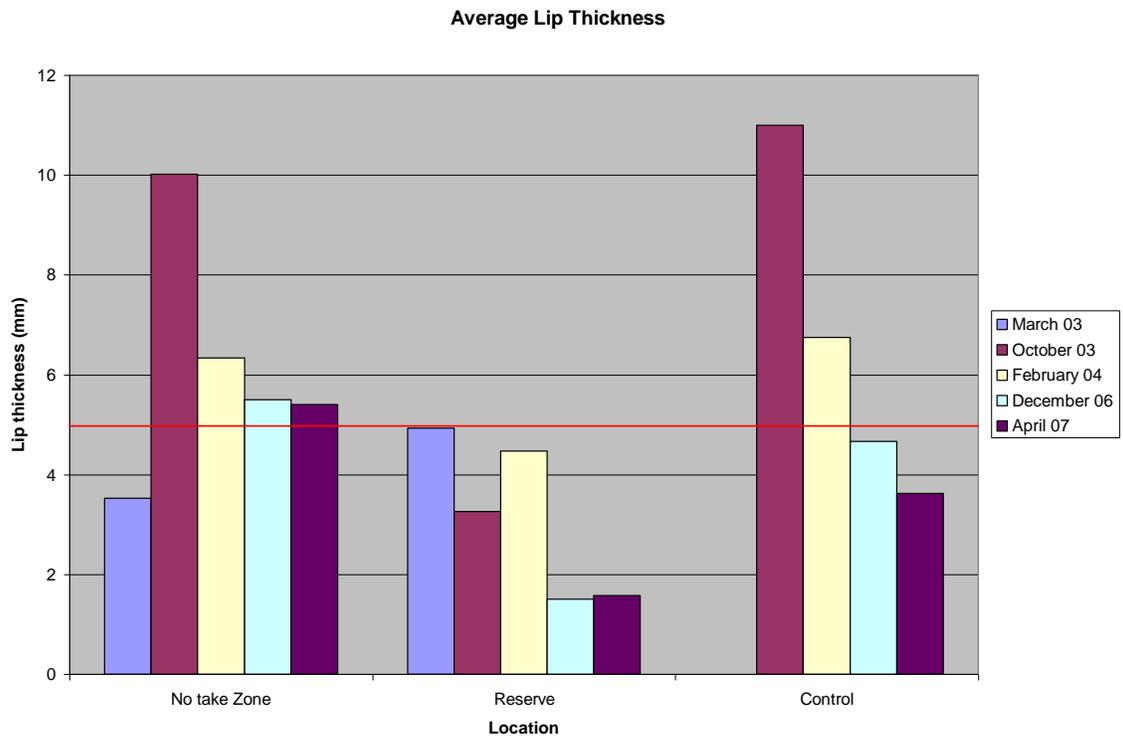
Figure 1

Figure 2 shows the average size of the conch encountered at each of the locations. The red line on Figure 2 illustrates an average shell length of 178 mm, the legal size for harvest according to Belize Fisheries Regulations. It is thought that individuals of this size have likely reached maturity. It takes approximately 3-4 years for conch to reach maturity and a mature conch is usually identified by a shell flare with a lip thickness of 5mm (Gascoigne & Lipcius, 2004). Recent research has suggested however that even individuals with a lip thickness of 5mm may not actually be sexually mature (Gascoigne & Lipcius, 2004). Figure 3 shows the average lip thickness for each location. Again it is not surprising that the no-take zone should have larger more mature individuals. What is slightly surprising is the fact that the there appears to be little or no difference in size between the reserve zone and the control zone. One might have expected to see larger conch in the reserve zone due to the increased enforcement presence.
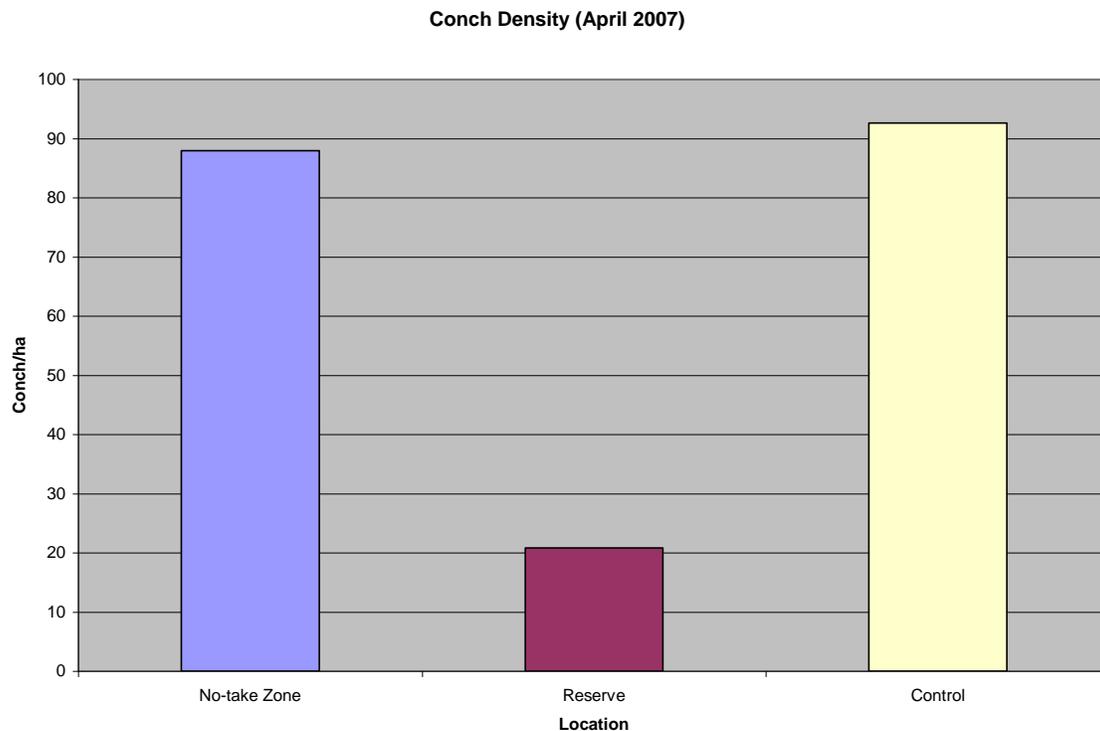
Figure 2

Average size

Figure 3

Average Lip Thickness

Figure 4

Conch Density (April 2007)

In addition to shell length and lip thickness the actual density of mature conchs is also an important indicator for population viability, as it is thought that at densities of less than 50 individuals/ha, successful reproduction is not likely (Stoner & Ray-Culp, 2000). In April 2007 transects were carried out at each commercial species site to determine conch density. Although only one sampling was done the average densities are presented in Figure 4 below. As the figure indicates density was high in the no-take zone. The high average density in the control zone is likely due to the extremely high conch density at the site located near Little Water Caye where the rangers are known to deposit confiscated under size conch. The density at this site is two times that of any other location.

Evaluation and Recommendations-

Although the monitoring to date as yielded valuable results a number of considerations must be taken into account for 2008. Statistical analysis is necessary to determine if the changes in conch size and abundance between the three sites is indeed significant. It is also important to note that the site with the most dense conch populations is a site located near Little Water Caye where rangers typically dump confiscated undersize product, this likely artificially inflates conch abundance at the site. The location of commercial species sites at Gladden is also of interest. The majority of the sites are located in patch reef areas which tend to have lower conch densities. Although Gladden has a number of conch nursery areas and a specified conch restoration zone, none of the commercial species monitoring sites are located in these areas. It is recommended that at least one site be added in one of these known areas. Future monitoring should

continue to include density at least once per year as it can offer valuable insight into population viability. Continued and consistent monitoring of conch populations should provide important data for the improved management of this important fisheries resource.
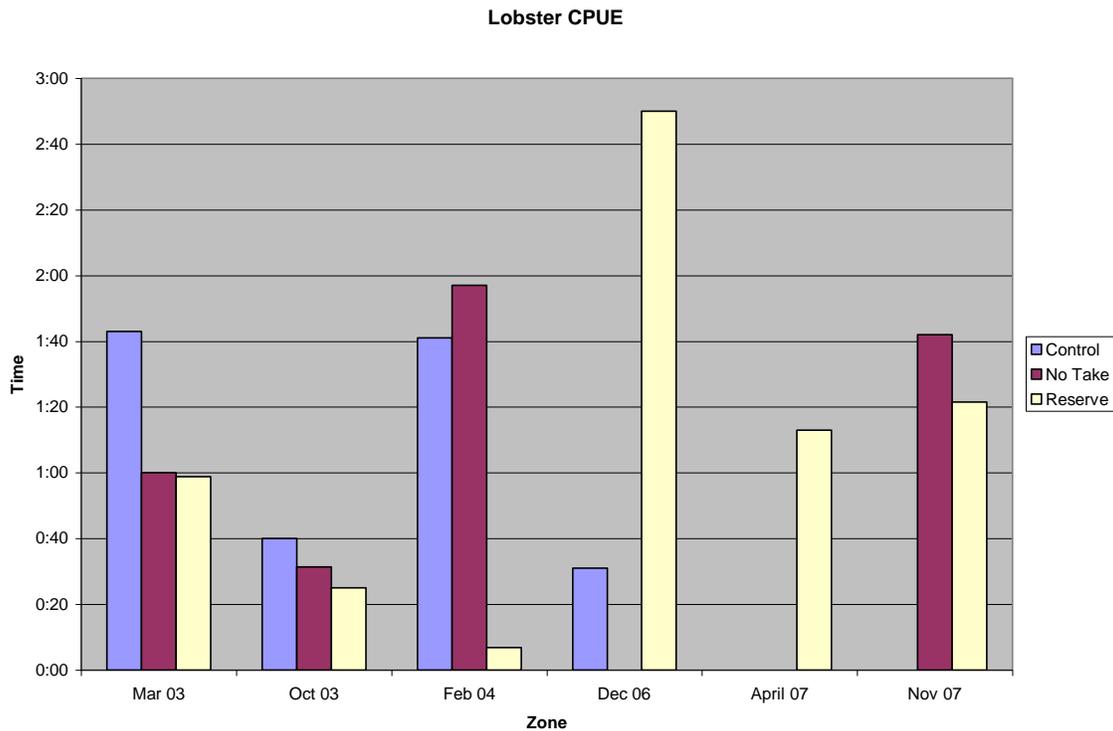
Lobster
Spiny Lobster (*Panulirus argus*) and to a much lesser extent Spotted Lobster (*Panulirus guttatus*), are the major lobster species facing commercial exploitation within the GSSCMR. Like Queen Conch, lobster is an important part of the commercial fisheries of Belize. Because of its importance to the local economy it has been monitored on a somewhat regular basis by the Fisheries Department. Most lobster fishermen at the GSSCMR use hook sticks to remove lobster. Monitoring of lobster populations at Gladden began in 2003 using the method from Charles Acosta's Long-term Atoll Monitoring Program (LAMP) and focusing on 13 sites strategically located within the reserve. At each site timed swims were conducted and each lobster encountered was evaluated for sex, egg presence and carapace length.

Results-

Figure 5 uses catch per unit effort (CPUE) to estimate the abundance of lobster found in the GSSCMR within the no-take zone, within the reserve and outside the reserve at control sites. In these graphs CPUE is represented as the number of minutes required to encounter one individual, so the lower the bar (fewer minutes) the more individuals were encountered. The graph illustrates a great deal of fluctuation in lobster presence within the reserve over the sample period. Further statistical analysis will be necessary to determine if there are any trends to the data. It is important to note that the sample size for these monitoring events is exceedingly small, which likely contributes greatly to the variations shown below.

Figure 5

Lobster CPUE

Additional data was collected about the size and sex of lobsters encountered, however due to inconsistencies in data collection the sex distribution data did not seem to be of value. Lobster size was estimated by measuring the carapace length, measured from the back of the carapace to between the eyes for each individual. Figure 6 shows the size distribution for lobsters encountered. Again the data appears to be patchy but this is likely due to the small sample size. Statistical analysis on this data is pending.

Figure 6

Spiny Lobster Average Size
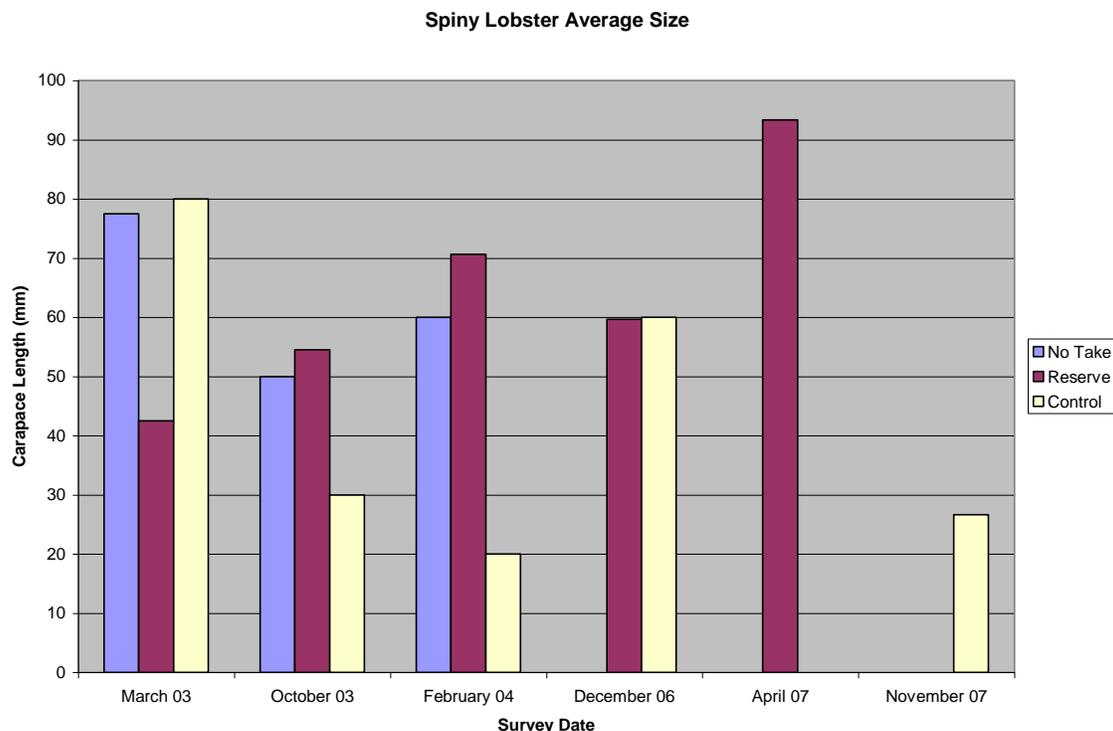
Evaluation and Recommendations-
This is one of the first attempts to try and synthesize the data collected over a five year period and much time and energy has been spent trying to organize and make sense of the existing data. Because there was no centralized database for commercial species data and no truly standardized methods, comparison between years is slightly tenuous. FoN and TASTE are currently working to develop a standardized database for this data to prevent these problems from continuing in the future. Despite this fact the data presented above is of use to managers and offers insight into a number of improvements that could be made to the monitoring protocol and data analysis to provide more accurate and useful information about the lobster populations.

Overall data collected to date appears patchy. This is likely due in part to the behavior of lobster themselves. However, there are some concerns about survey technique, consistency and accuracy. Lobster can be cryptic and require a trained eye and careful searching to locate. There are discrepancies within the data set with key measurements such as sex and size being excluded for a significant number of recorded sightings, efforts should be made to ensure that both sex and carapace length are recorded for

each individual. Additionally, there has been a significant amount of turnover in biological staff and this can lead to alterations in survey methodology and even in the survey sites. Efforts are currently underway to try to better standardize the survey methodology to ensure that data sets are comparable. Finally, statistical analysis of the data is necessary.

Finfish

Like conch and lobster finfish make up an important commercial export from the GSSCMR. A wide variety of fish including snapper, grouper, barracuda, hogfish and other species are fished within the reserve. In order to get a better picture of the actual status of the commercial fish populations within the GSSMCR monitoring has again followed Charles Acosta's LAMP protocol. This focuses on conducting timed swims for a specified species list. These swims allow researchers to calculate catch per unit effort (CPUE) similarly to how a fishermen might look for fish to spear. At GSSCMR the specified species list has varied slightly depending on the researcher responsible for carrying out the survey. Acosta's original species list includes: Nassau grouper (*Epinephelus striatus)*, Hogfish (*Lachnolaimus maximus)* , Queen Trigger (*Balistes vetula)*, Black Grouper (*Mycteroperca bonaci)*, Mutton Snapper (*Lutjanus analis)*. However, sampling at LBCNP includes the majority of snapper (Lutjanidae*)* and grouper (*Serrinidae)* species, barracuda (*Spyraena barracuda)* and a number of jacks (*Carangidae)*. In 2007 all species of parrotfish were added to this list. For each fish of from the specified list an estimate of size is made to allow comparisons of CPUE and size between sites.   As with all of the commercial species monitoring this monitoring protocol is carried out at 12 strategically selected sites within the reserve.

       Results-

Analysis on finfish data is pending. Due to the nature of the finfish data no analysis has been conducted to date. This will be further discussed below.

       Evaluations and Recommendations-

As mentioned above the analysis has yet to be completed for the data collected to date on commercial fish species. After a number of discussions with a number of local organizations who use this monitoring methodology it was unclear exactly how to use the data collected to date. The key characteristics that are of importance to managers such as fish density were difficult to calculate due to the monitoring protocol. In general at the GSSCMR parrotfish make up the vast majority of fish from the specified list. It was common that only one or two other fish might be encountered at each site. This made it difficult for researchers to conduct any rigorous comparisons between sites. The reason for low numbers of valuable fish species like grouper and snapper is as likely due to the methodology as to the actual density of fish within the reserve.

FoN is currently working with partners TASTE, TNC, WCS and others to look more closely at how commercial species data for finfish is collected. Managers need to carefully evaluate the information necessary for management is being sufficiently collected. It is suggested that the species list be finalized and made comparable to that at the SCMR and LBCNP. In addition to revaluating the species list it is necessary to develop improved methods for data analysis including statistical analysis. FoN is hoping that this will be completed early in 2008 with the development of an improved commercial species database and systems for basic statistical analysis.

Spawning Aggregations

Gladden Spit is one of the most active spawning aggregations within the country of Belize. Dog (*Lutjanus jocu)*, Cubera (*Lutjanus cyanopterus)* and Mutton (*Lutjanus analis)* Snappers are the most predictable and most well known fish which spawn at Gladden. However over twenty-one species of fish are known to have engaged in spawning related behaviors at Gladden Spit and over ten species have been observed actually spawning. Although thirteen important spawning sites for the Nassau Grouper have been closed to fishing in Belize, the spawning aggregation at Gladden remains open for fishing by traditional fishermen with special licenses. The Gladden Spit site is also a well know aggregation for whale sharks (*Rhincodon typus)* who gather during the months of March-June to feed on fish spawn. The important economic, cultural and natural value of this location and the spawning aggregation necessitates careful monitoring of the site. Data has been collected on the spawning aggregation site at Gladden Spit from 2003. Although a number of papers have been written about the spawning aggregation site a comprehensive review of the data collected to date has not been completed, but is planned for early in 2008.

Snapper Landings

As noted above Gladden Spit is an active spawning aggregation fishery during the months from March-June. Special regulations have been developed by Friends of Nature and the Fisheries Department to ensure that fishing at this sensitive location is closely monitored. This includes the granting of special licenses to traditional fishermen, careful enforcement of fisheries laws and the prohibition of night fishing. Due to these regulations the vast majority of fish targeted by local fishermen are mutton snapper, not the cubera and dog snapper which are the major attraction for whale sharks. In order to further regulate the spawning aggregation fishery FoN has conducted yearly landings data collection in order to get a better picture at the species, sizes and sexual maturity of fish caught at the spawning site. This has included stationing volunteers at the fishermen's camp at Buttonwood Caye, responsible for monitoring fishermen's catch. The volunteers count, measure, weigh and assess gonad state for each fish.

Results-

The results presented here are taken from an analysis done for a report for the Nature Conservancy, prepared by Mr. Dwight Neal in September 2007. Figure 7 below shows a comparison of size distribution for Mutton Snapper between May 2006 and May 2007. This graph seems to illustrate that there was a small increase in number and size between the two years. However, preliminary statistical analysis indicated that this difference was not significant.

Figure 7

Comparison of Mutton Snapper Size Distribution
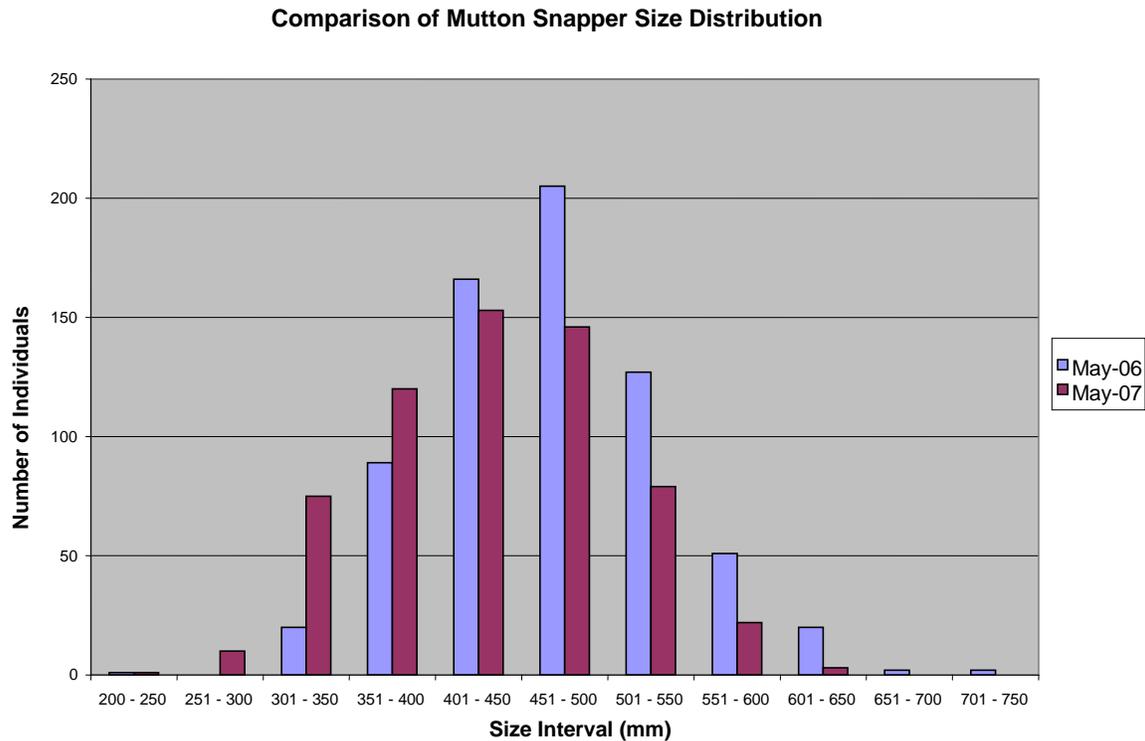
Recommendations and Evaluation-
To date landings data collection has been fairly successful. Although there have been notable difficulties in retaining a core team of volunteers to carry out the analysis over an entire year of sampling, the data collected appears to be in good order. Landings data collection will continue in 2008 and it is hoped that a more comprehensive analysis of the data can be undertaken, including more careful examination of the data collected about gonad state. Further statistical training and analysis will be helpful in order to ensure proper management of the spawning aggregation fishery. Additionally, there is some interest in attempting to tie the data collected during the landings survey to underwater visual survey data collected during spawning aggregation monitoring.

Whale Shark
As mentioned above whale sharks (*Rhincodon typus)* gather to feed on fish spawn at Gladden Spit. This aggregation of whale sharks is temporally regular and has been the basis of a booming tourism industry. Because of the unique aggregations of whale sharks data on their activity at GSSCMR is of critical importance. Although, FoN in collaboration with the Whale Shark Working group has developed a series of rules and regulations for tourism activities relating to whale shark sightings. In accordance with the tourism rules FoN has kept detailed records on whale shark tourism. These records should be expanded to include more detailed information on shark populations. The Placencia Tour Guide Association (PTGA) is currently working to train tour guides in photo identification techniques for whale shark identification. Efforts should be made to work with the PTGA and other scientists working on whale sharks in order to improve knowledge about their behavior and biology.

Coral Reef

Gladden Spit Silk Cayes Marine Reserve protects important coral reef ecosystems, one of the most continuous and well developed sections of the Belize Barrier Reef System. GSSCMR protects back reef, reef crest and fore reef sections, along with fringing reef around the Silk Cayes. The coral reefs within the marine protected area are rich in biodiversity, and as mentioned above include one of the most active spawning aggregations within Belize. In order to assess the health of these ecosystems Friends of Nature has conducted monitoring according to the Mesoamerican Barrier Reef System's Synoptic Monitoring Program (MBRS SMP). In order to paint a good picture of the status of the reefs at GSSSCMR eight MBRS sites have been identified for monitoring. These sites include back reef, shallow fore reef and deep fore reef locations. (See map in Appendix 2.) This monitoring focuses on key areas such as benthic cover, coral health, and reef fish. An initial analysis of these activities is presented below.

Benthic Cover
Benthic cover is a description of what different components make up the reef. By understanding changes to the percentage of live coral cover, algal cover, gorgonians, sand and other benthic indicators, managers are able to track changes in reef health. Shifts in dominant cover type from live coral to algae may indicate changes in coral health, predation or nutrient availability. The MBRS SMP uses a point intercept method to estimate coral cover at different sites. This focuses on laying 30m transects and then recording benthic components at 25cm intervals along the length of the line. At each site between four and six transects are run for point intercept analysis.
   Results-
Six surveys have been conducted at eight coral sites within Gladden Spit Silk Cayes Marine Reserve between 2003 and 2007. These sites include a mixture of back reef, shallow forereef and deep forereef.   Figure 8 shows the average benthic cover for each of these habitats. As you can see from the graphs there are some differences in cover between the three habitat types. Further analysis is necessary to determine if these differences are significant. Additional plans for analysis will be discussed below.

Figure 8

Average Benthic Cover by Reef Type
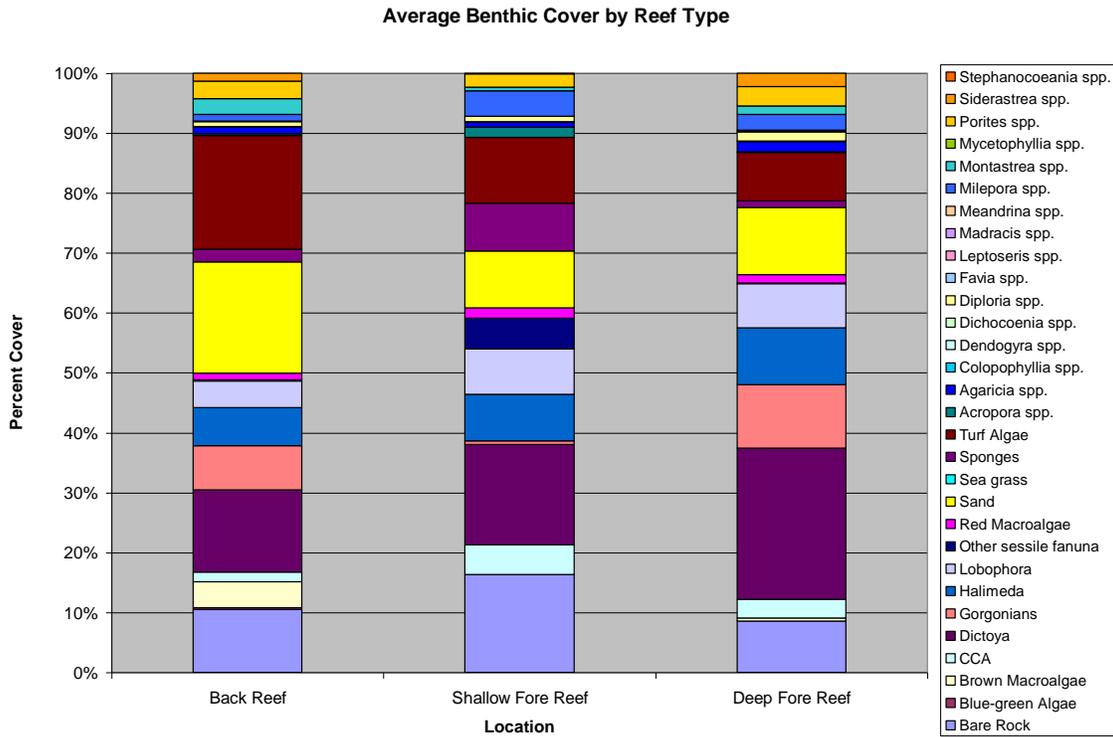
In terms of cover the coral cover at the three sites was about 10% for back reef and shallow fore reef sites and closer to 13% for deep fore reef sites. Algal cover was much higher close to 50% at back reef and shallow fore reef sites and 55% at deep fore reef sites. These live coral and algal compositions seem to indicate that reefs at Gladden are not in very good shape. In addition to the benthic cover, figure 9 shows the average species composition for the three habitat types. As would be expected there were apparent differences between species composition at each of the three habitat types. These differences seem to follow the expected understanding as to which corals are more common at specific depths and habitat conditions. Further analysis will be carried out in order to determine if these differences are indeed significant.

Figure 9

Coral Species Composition
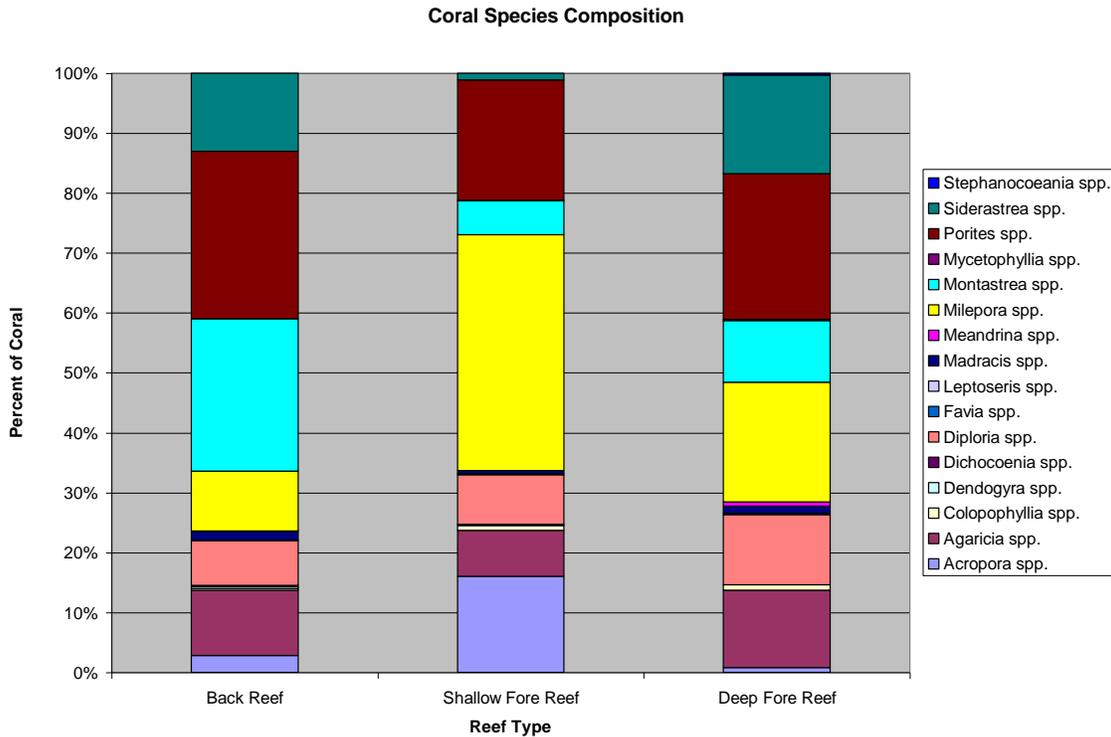
Recommendations and Evaluation-
Although comparing habitat averages is of interest, the greater interest for analysis with the MBRS data is to determine if there have been significant changes in species and benthic cover between the sites and habitat types. FoN is currently exploring avenues to further capacity to carry out this analysis. There are a couple of major constraints to including more detailed analysis of this data to date. Firstly, for the past four years the data has been housed in the existing MBRS database, however due to a high level of turnover, the data had not been checked since monitoring began. This led to a number of entry errors which needed to be corrected prior to any evaluation of the data. In addition, high turnover has led to some inconsistencies in data collection. Although all data was collected according to the MBRS protocol, there are some questions about the site integrity. A preliminary review of the data indicates significant changes in percentage cover between sampling periods. It is unclear if this is due to data collection methods or an indication of fluctuations in ecosystem health. Efforts to further standardize sampling and to develop more extensive written records of all monitoring are currently being developed to combat these problems. Finally, additional training in data analysis and statistics is necessary to develop a more detailed understanding of benthic cover and its changes. FoN is working with a number of partner organizations to improve its capacity for data analysis.

Coral Health
In addition to benthic cover the MBRS SMP method allows for analysis of coral health. This includes tracking of bleaching, disease and average size for the coral colonies encountered on the transects. When following the MBRS SMP protocols at each coral site at least 50 individual corals are measured and assessed for bleaching, disease and

percent mortality. The data collected from these 50 corals is then used to assess the overall coral health at that site.

Results-

Like the benthic cover data further statistical analysis is necessary to make comparisons in coral mortality over the period from 2004-2007. The data presented here is taken from the MBRS surveys conducted at Gladden. Figure 10 shows the average mortality for the major corals encountered at Gladden in the different habitat types. The results indicate that there are much higher levels of mortality in the shallow fore reef and back reef sites. As would be expected the larger reef building corals *Montaestrea spp.* had the highest overall mortality.

Figure 10
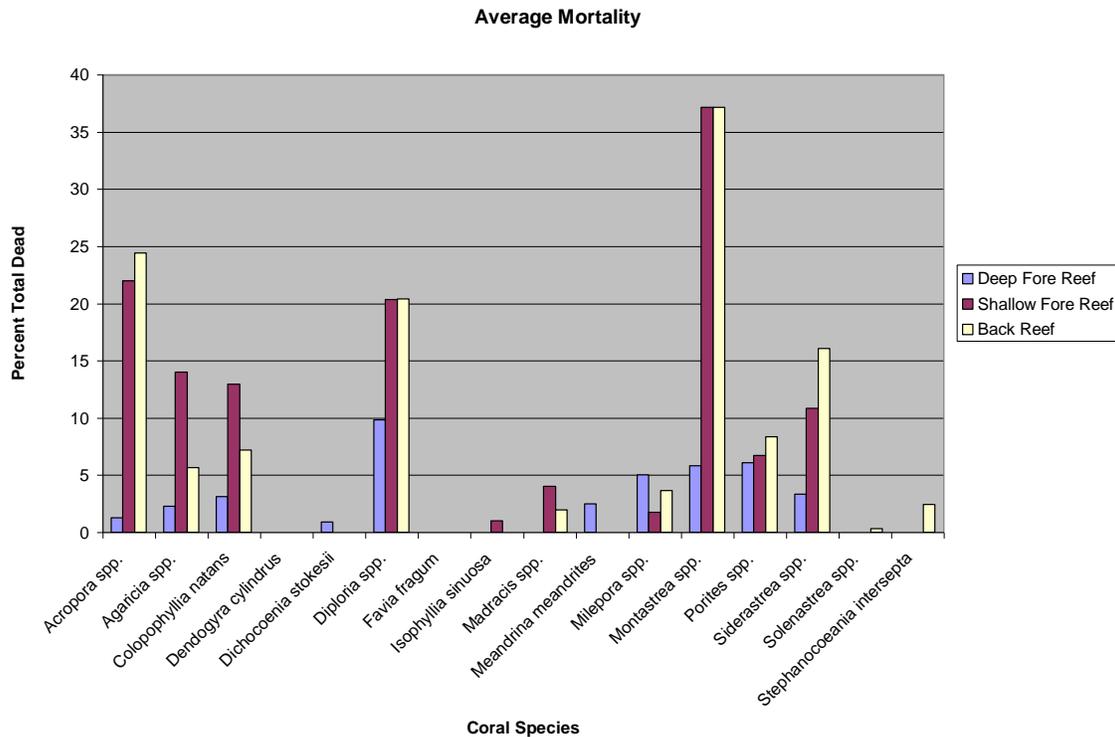
In addition to overall mortality data was also collected on coral bleaching. Figure 11 shows the average incidence of bleaching in corals sampled at each location. This graph gives an idea of the what percent of corals sampled showed some type of bleaching stress (Pale, Partially Bleached, Bleached). It is important to note that a number of species which show high bleaching are represented by a very small sample size. In reality further analysis is necessary to determine bleaching trends.

Bleaching Incidence
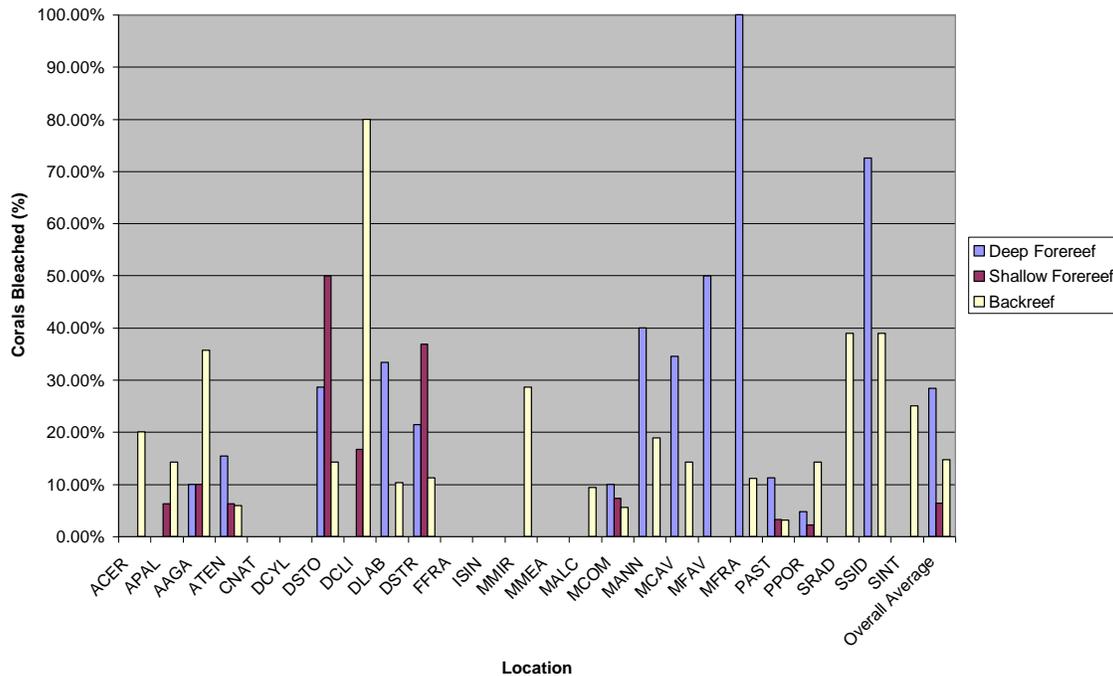
Evaluations and Recommendations-
Like benthic cover, further analysis and statistics are required to track any changes in coral health over the survey period. In addition, further sorting of the data will allow for more analysis of bleaching incidence and severity along with other diseases. It is hoped that this analysis will be carried out in the coming months. Efforts are currently being made to ensure more consistent data collection in the future to ensure that information about coral health, bleaching and disease can be more integrated into management activities.

Reef Fish
The MBRS SMP method also includes a methodology for monitoring reef fish. This methodology consists of running 6-8 30 m x 2 m belt transects at each of the MBRS sites. The researcher then records the number and size of fish from a specified species list. This methodology allows managers to calculate density and biomass for a specified list of species.
Results-
Analysis on reef fish data pending. See description below.
Evaluation and Recommendations-
The data on finfish collected to date has been entered into the MBRS SMP online database. However a number of questions remain about the way that this data was entered and time constraints made it impossible to organize and then analyze the data in time for inclusion within this report. Again, FoN is currently working with partners to improve data collection on reef fish populations. It is possible that this may include developing a more comprehensive system to characterize and evaluate population size and species composition.

Sea Grass

Currently there is no active monitoring occurring on sea grass in the GSSCMR. There are large pastures of sea grass within the reserve. Given the importance of this habitat for juvenile conch, lobster and fish it is strongly recommended that sea grass monitoring is begun at the reserve. Either MBRS or Sea Grass Net methodologies would be appropriate for this monitoring. The main factors of interest in regard to sea grass habitats at the GSSCMR are: biomass, density, species composition and associated species. It is recommended here that at least two sites for sea grass monitoring be established within the GSSCMR in order to provide managers with greater information about the status of these important habitats.

Diseases and Other Natural Phenomenon
Currently there are no established monitoring programs which target diseases or other natural phenomenon. Coral health and disease are specifically targeted under the MBRS project and analysis of these results is pending. It is highly recommended that managers work together to develop an emergency response plan for disease, bleaching and hurricanes. In order for managers to react appropriately do these threats it is vital that a mapping project be undertaken within the GSSCMR. This program should seek to ground truth the existing habitat maps for the GSSCMR generated by the Coastal Zone Management Authority and Institute. A good understanding of the locations and current status of the reef will allow managers to properly address outbreaks of disease and other threats to the reef.

Water Quality
There is no water quality monitoring currently occurring at Gladden Spit Silk Cayes Marine Reserve. Discussions are currently on going to develop a basic water quality monitoring program for the park, similar to the system that was developed for the Sapodilla Cayes Marine Reserve. In addition, efforts are underway to develop links between the work that Tim Smith is conducting in the lagoon and water quality issues at Gladden, Laughing Bird and along the coast. It is hoped that this program can be initiated in mid-2008, although it will be necessary to identify additional finances for this program.

Meteorological Data
No meteorological data is currently being recorded. It is recommended that rainfall and temperature data be collected daily at Gladden.

Recreational Activities

Information on recreational activities is collected by the rangers at Gladden daily. This information includes the number and type of guests as well as information about their activities within the park.
    Results-
Unfortunately due to time constraints it was not possible for visitation data to be thoroughly included in this report.
    Evaluation and Recommendations-
Visitation data about the GSSCMR is currently being well collected. It is hoped that FoN will continue to work to improve its ability to utilize this data for management purposes. This will include developing more comprehensive reporting systems for visitation data.
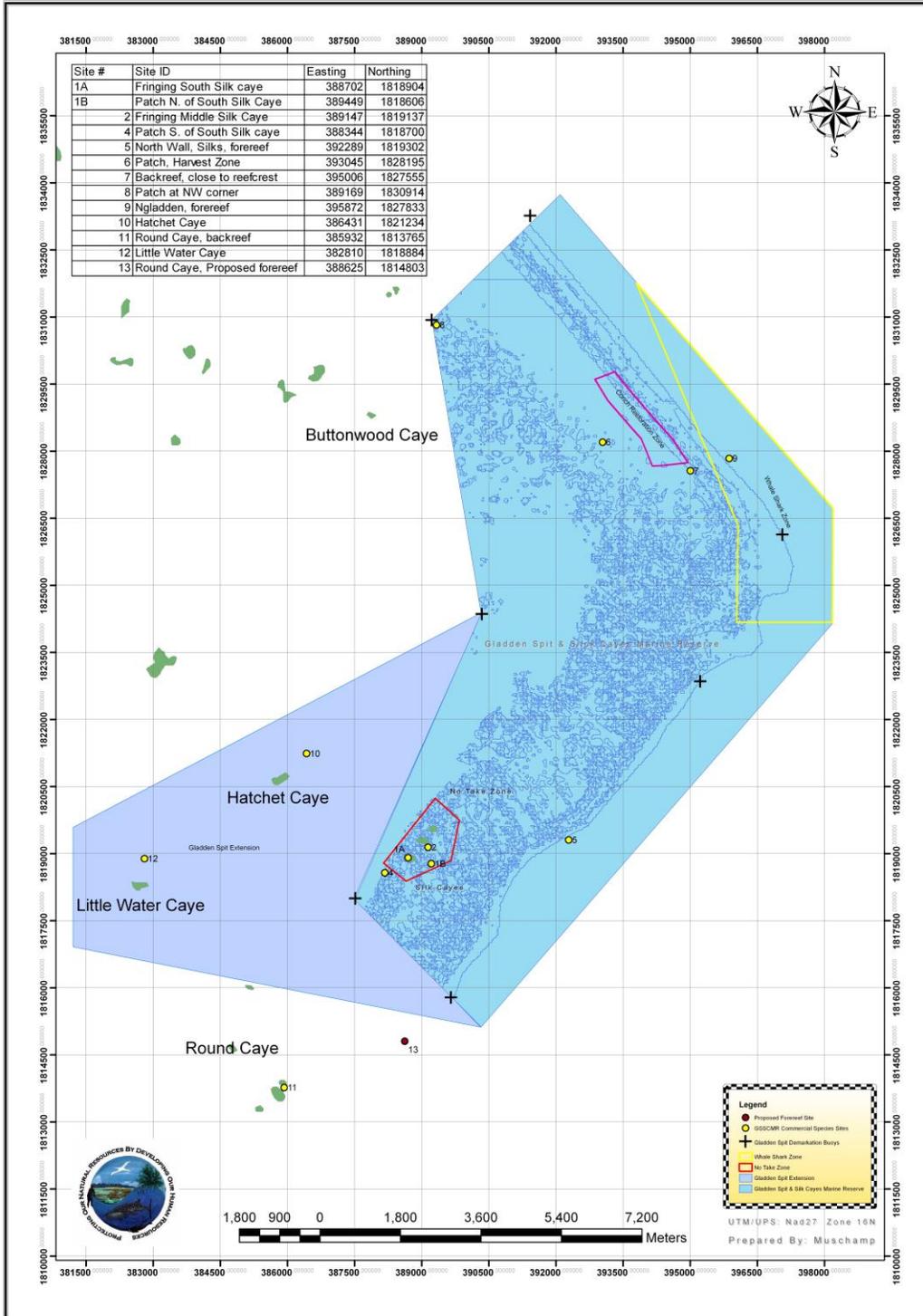

Conclusion

Overall there has been a concerted effort to collect valuable data about the status of the resources at GSSCMR. All staff who have contributed to data collection and analysis should be commended on their efforts to contribute to the existing information about the marine reserve. One of the major set backs to these efforts has been the high levels of turnover for biologists. This coupled with the lack of a written plan for monitoring has made data collection sporadic. This has also left a number of gaps (many of which have been highlighted here) in the data that has been collected. A concerted effort should be made to try and formalize the monitoring plan for Gladden Spit Silk Cayes Marine Reserve so as to ensure more consistent data collection. Along with improvements to the data collection methodologies additional statistical analysis of the data presented here is essential to determining the significance of these findings. Biologists and technical staff should be trained in basic statistics so as to ensure better integration of monitoring activities and management actions. This report highlights a number of actions that should be taken in the future so as to improve current information about the marine reserve. It is hoped that this report will represent the continuation of FoN's efforts to try to improve links between science and management.

References

Acosta, C. A. Field Protocol for monitoring coral reef fisheries resources in Belize. *WCS*, 1-8.

Gascoigne, J., & Lipcius, R. N. (2004). Conserving populations at low abundance: delayed functional maturity and Allee effects in reproductive behaviour of the queen conch *Strombus gigas*. *Marine Ecology Progress Series, 284*(284), 185-194.

Stoner, A. W., & Ray-Culp, M. (2000). Evidence for Allee effects in an over-harvested marine gastropod: density-dependent matine and egg production. *Marine Ecology Progress Series, 292*, 297-302.

Appendix 1

Gladden Spit & Silk Cayes Marine Reserve Commercial Species Map

Site #	Site ID	Easting	Northing
1A	Fringing South Silk caye	388702	1818904
1B	Patch N. of South Silk Caye	389449	1818606
2	Fringing Middle Silk Caye	389147	1819137
4	Patch S. of South Silk caye	388344	1818700
5	North Wall, Silks, forereef	392289	1819302
6	Patch, Harvest Zone	393045	1828195
7	Backreef, close to reefcrest	395006	1827555
8	Patch at NW corner	389169	1830914
9	Ngladden, forereef	395872	1827833
10	Hatchet Caye	386431	1821234
11	Round Caye, backreef	385932	1813765
12	Little Water Caye	382810	1818884
13	Round Caye, Proposed forereef	388625	1814803

Appendix 2