The Effect of a Marine Reserve on Populations of Commercially Important Fish Around Utila, Honduras.

Mallalieu, I.L., Speight, M.R., and Box, S.J. (2009)

Rationale

Marine Protected Areas (MPAs) are increasingly being advocated as useful fishery management and conservation tools, and it is predicted that a well managed MPA will contain a higher abundance and biomass of species, providing vital spillover of adults and juveniles to neighbouring fisheries. This project aimed to assess the state of the local fishery on Utila, Honduras, as viewed by local fishers, and to determine whether the protected area Turtle Harbour Marine Reserve was having a beneficial impact on fish biomass. We predicted that if Turtle Harbour were having a beneficial effect it would contain a greater biomass of fish than unprotected sites, and may well have a different or more diverse species composition.

Methods

•Local fishers on the Cays were interviewed about the location of their fishing grounds, their views on the protected area, and the species most commercially important to them.
•The belt transect method of UVC was used to estimate abundance and size of a number of parrotfish, grouper and snapper species at various sites around Utila (See Figure 1. for location of survey sites). Length was converted into weight which gave measures of biomass in g100m^{-2}. A GLM was constructed to determine whether fish biomass varied with site (either north or south of Utila, inside or outside of Turtle Harbour).
•Benthic surveys were carried out along the same transect tape as the fish survey (in which the substrate directly below the tape is recorded at 0.5m intervals). Percentage live coral cover was included as a covariate in our GLM.
•Pisces Conservation software was used to conduct Principal Components Analysis (PCA) – to show which species are correlated with one-another and which sites are the most species rich, and to conduct non-metric Multidimensional Scaling (nMDS) analysis which clusters sites according to their similarity in species composition.

Figure 1. Map of Utila showing the locations of the sites we surveyed, Turtle Harbour Marine Reserve and the Cays. Image edited from GoogleEarth.

Mean total biomass at sites along the north and south sides of Utila, and inside and outside Turtle Harbour Marine Reserve
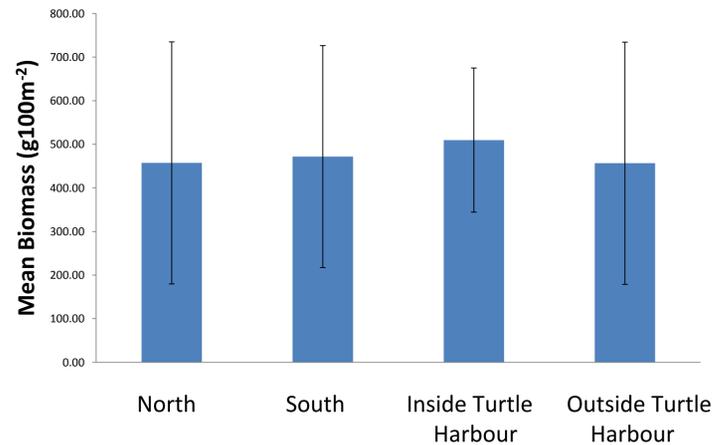

Figure 2. Bar chart to show mean biomass, and their associated standard error at different sites around Utila.
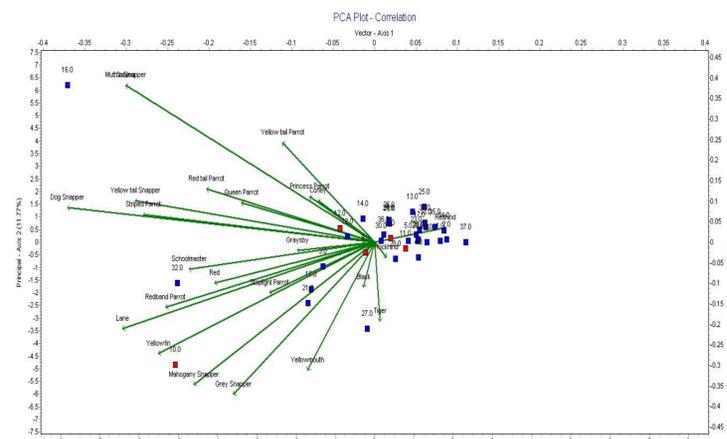

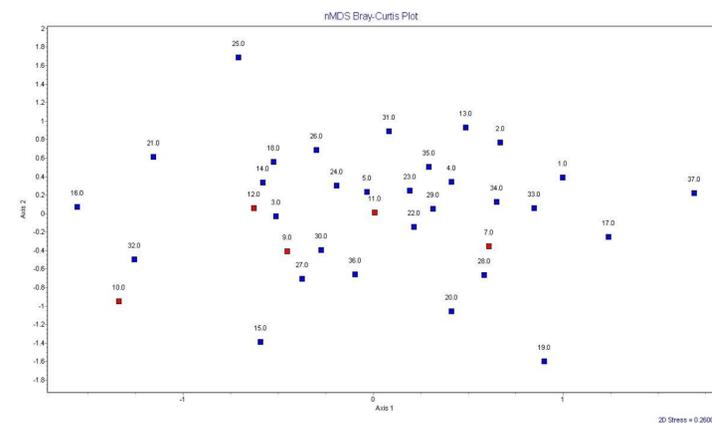**Figure 3.** PCA plot; red blocks are sites within Turtle Harbour, blue blocks are all

Figure 4. nMDS plot; each block represents one site, those coloured red are in Turtle Harbour, those coloured blue are all other sites outside of Turtle Harbour.

Main Results

•The interviews with the local fishers revealed that more and more often fishers are having to fish further off shore to make substantial catches, and most believed that fish abundance in the waters surrounding Utila had rapidly declined over the past decade or so. Many admitted to fishing along the north shore (including within Turtle Harbour – the MPA), particularly when weather was rough.

•When the GLM was run for total biomass (that of all the species surveyed) we found no significant differences in biomass between sites on the north of Utila and sites on the south, or between sites inside Turtle Harbour Marine Reserve and sites outside it (p-values all >0.05).

•When the biomass was partitioned between parrotfish, grouper and snapper we found that grouper have a significantly higher mean biomass at sites along the north shore than on the south shore (p=0.006). However the difference was not significant between the protected and unprotected sites.

•There were no significant differences in biomass for snapper or parrotfish at all.

•The PCA plot shows that the majority of sites around Utila contain few species, while some sites are quite species-rich. Of the sites in Turtle Harbour (in red) only site 10 appears to contain most of the species surveyed, and the other sites seem to be no more speciose than those sites outside the protected area.

•The nMDS plot shows little to no clustering of sites, suggesting that there are not great differences in community composition around Utila. The sites within Turtle Harbour (in red) are spread fairly evenly across the plot.

A pair of schoolmaster snapper

Conclusions

•Local fishers recognised the need for stricter law enforcement of the protected area, and many understood the possible benefits a protected area could bring in terms of increased biomass of target species.
•However the results from our GLM indicate that we have no reason to reject the Null Hypothesis that there is no variation in biomass between sites.
•The output from the PCA and the nMDS analyses suggest that Turtle Harbour Marine Reserve does not have a different community structure from sites which are legally open to fishing, and nor is it more species rich.

•Our results therefore indicate that in its current state (low levels of both enforcement of, and compliance with, the laws) Turtle Harbour Marine Reserve is not effectively protecting populations of either the commercially important grouper and snapper, or the less valuable parrotfish.

Catch of the day including yellowfin grouper, schoolmaster, yellowtail snapper, and a juvenile reef shark.

Photos by Christina Cloos.