Biological Surveys of Three MPAs and their Reference Sites in Chuuk Lagoon, Chuuk State, Federated States of Micronesia

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INTRODUCTION

In recent years, there has been a move by coastal communities around the world to designate areas for conservation or protection. In Micronesia, there has been similar efforts made by the islands to protect their nearshore marine resources from overharvesting. Because most protected areas in Micronesia have been designed to preserve or recover locally important ecological species, managers of these sites want information that can help them to make educated decisions towards achieving specific objectives. Valuable information to assist them can be extracted from data collected through monitoring activities by local resource agencies and communities. At the regional level, data collected in Micronesia can provide a larger picture of the dynamics of ecological communities throughout the islands, as well as assist in the regulation of regionally connected species.

In 2006, the 5 jurisdictions within the Micronesia region launched the Micronesia Challenge, a commitment to "effectively conserve 30% of nearshore marine and 20% of the forest resources across Micronesia by 2020". Today, there are over 150 Protected Areas in the region, from small community-based sites to areas that encompass entire islands and surrounding reefs. Some protected areas were established and are enforced through traditional means, while others have been created through legislation and are policed by trained officers on salary. Although there is a recognized need for accurate information on the state of these areas, there is no complete information on how much monitoring has been conducted to provide managers with useful information. For a number of these areas, little monitoring has been done, due to limited resources and manpower. Periodical surveys to collect useful data require specialized methods and skilled individuals.

In an effort to ascertain the overall capacity of monitoring protected natural resources in Micronesia, PICRC set out to get a perspective on what sites and how the protected areas in the region are being monitored and whether the data collected was being stored and utilized. Additionally, the team aimed to ensure that all the jurisdictions were applying the 'minimum standard' methods for conducting ecological surveys in the region based on the methods agreed upon during the 2nd MC Measures Workshop in February 2010. With these goals in mind, the team set out to the various islands of Micronesia to calibrate techniques and assist in filling any training gaps needed by each jurisdiction. Outlined in the following trip reports are results of the survey activities and lessons learned, which can be used in the future to help resource agencies and communities to design and implement their monitoring activities.

METHODS

Study Sites

Survey was conducted between August 8 and 11 in Chuuk Lagoon (Fig.1).

Fig. 1. Image of Chuuk Lagoon. Image taken from Google Earth.

Three MPAs (Fonemu, Fananang and Ununum) and adjacent reference sites were surveyed for this work. Fonemu is a fringing reef surrounding a small island (0.2 ha) [1] in Chuuk Lagoon (Fig. 2). It was closed in unknown year[2] to all form of fishing and extractive activities. Fananang MPA is also a fringing reef around the small island (0.2 ha) [3] in the lagoon (Fig. 3). In an unknown year[4], it was designated as an MPA and extractive activities were restricted. Ununum is a fringing reef adjacent to the big (2 km) [2] volcanic island of Uman (Fig. 4). It was closed in a unknown year[5] to all form of fishing and extractive activities. For each MPA, we selected a reference site that had similar characteristics but was open to fishing without any form of restrictions.

[1] Estimation based on Google image.
[2] Information not provided by Chuuk Conservation Society.
[3] Estimation based on Google image.
[4] Information not provided by Chuuk Conservation Society.
[5] Information not provided by Chuuk Conservation Society.

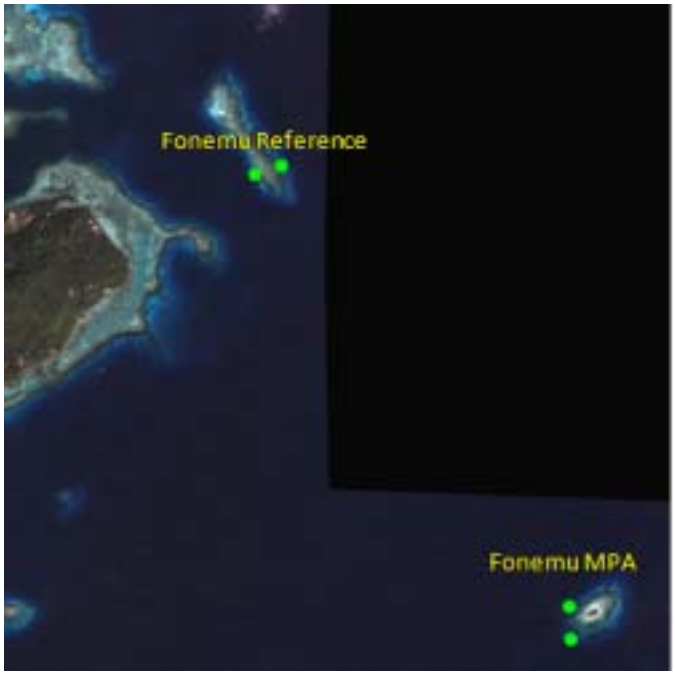

Fig 2. Image showing location of Fonemu and reference sites marked by green dots.

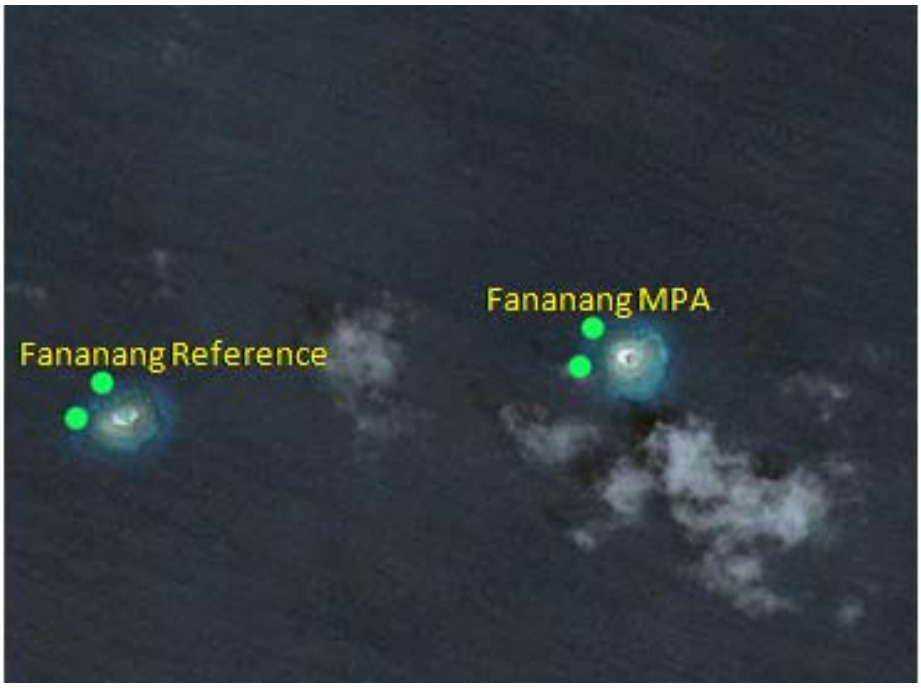

Fig. 3. Image showing location of survey sites at Fananang marked by green dots. Image taken from Google Earth.

Fig. 4. Image showing location of survey sites at Onunum marked by green dots.

Benthic and Fish Surveys

Within the MPA of Fonenu and Fananang and their reference sites, 2 stations were established. For Ununum MPA, 3 stations were established in the MPA and its reference site. In each station, 5 50 x 5 m belt transects were surveyed for fish size and density. Commercially targeted macro-invertebrates were also surveyed along the five transect, using a reduced belt width of 2 m. Benthic cover and richness was estimated by photographing 50, 0.50m^2 quadrats on every meter of the transect tape. The photograph were analysed using CPCe from 5 random points in each quadrats.

RESULTS

Benthic Assemblages

Mean coral cover at Fonemu MPA was 30.4% compare with the reference site, which had a coral cover of 11.1% (Fig.5a). At Fananang MPA, coral cover was 25.6% inside the MPA and 12.0% outside of the MPA in the reference site (Fig.5b). Coral cover at Onunun and its reference site were not significantly different with coral cover at 7.7% and 6.3%, respectively (Fig.5c).

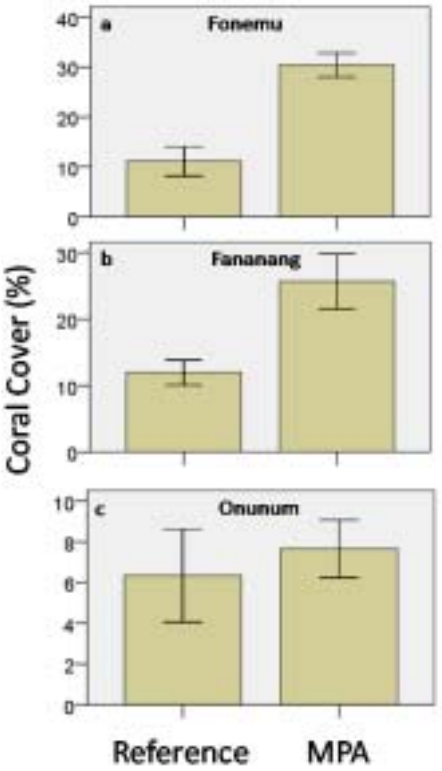

Fig. 5. Coral cover at reference and MPA site at (a) Fonemu, (b) Fananang, and (c) Onunum. Error bars indicae standard errors.

Coral Richness was significantly higher in Fonemu and Fananang MPAs compared with their reference sites (Figs.6a and 6b). At Onunum, there was no significant difference in coral richness between the MPA and reference site (Fig. 6c). The density of coral recruits was higher at Fonemu compared with its reference site (Fig. 7a). In Fananang and Onunum, there was no significant difference in recruit density between MPAs and reference sites (Figs. 7b and 7c).

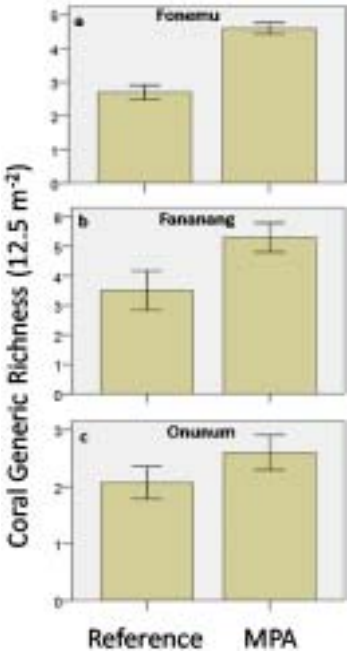

Fig. 7. Coral generic richness in MPA and reference site at (a) Fonemu, (b) Fananang and (c) Onunum. Error bars indicate standard errors.

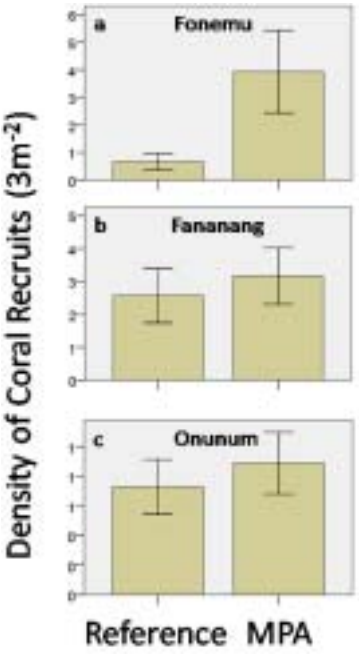

Fig. 8. Density of coral recruits in MPA and reference site at (a) Fonemu, (b) Fananang and (c) Onunum. Error bars indicate standard errors.

The densities of invertebrates in all the sites surveyed were very low with none of the sites having a density higher than one (Figs. 9a, 9b and 9c).

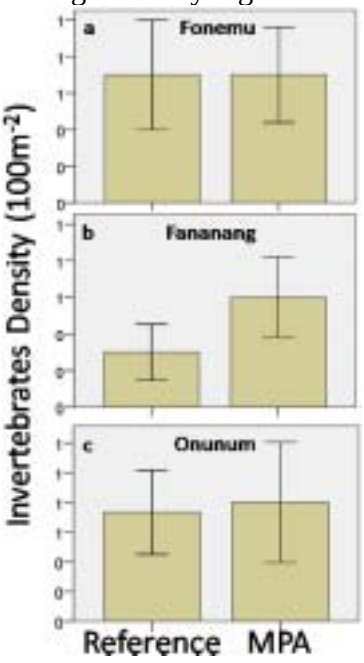

Fig. 9. Density of invertebrates in MPA and reference site at (a) Fonemu, (b) Fananang and (c) Onunum. Error bars indicate standard errors.

Fish Assemblages

Fish density at Fonemu was twice as much in the MPA compared to its reference site (Fig. 10a). The difference with biomass was even greater with the MPA having 7 times more biomass inside it than in the reference site that was open to fishing (Fig. 11a). Fish species richness was also significantly higher in the MPA at Fonemu than the reference site Fig. 12a). In Fananang, there were no significant differences in both fish density and biomass in the MPA compared to its reference site (Fig. 10b and 11b). Only species richness showed significant difference with more species in the Fananang MPA than the reference site (Fig. 12c). Fish density, biomass and richness were not significantly different at Onunum MPA compared with its reference sites (Fig. 10c, 11c, and 12c). Onunum MPA and it reference sites also had the lowest density and biomass of fish compared with the other two MPAs surveyed.

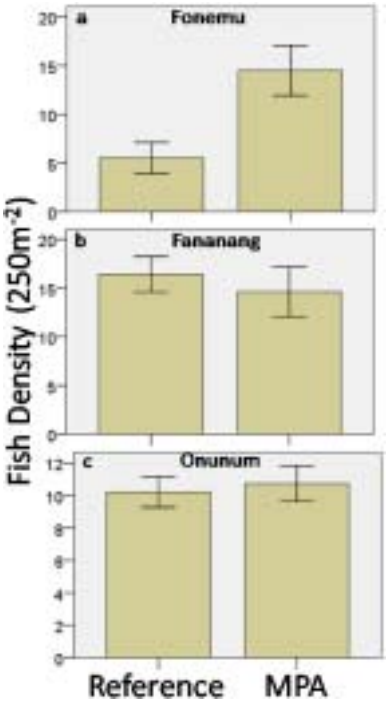

Fig. 10. Fish density in MPA and reference site at (a) Fonemu, (b) Fananang and (c) Onunum. Error bars indicate standard errors.

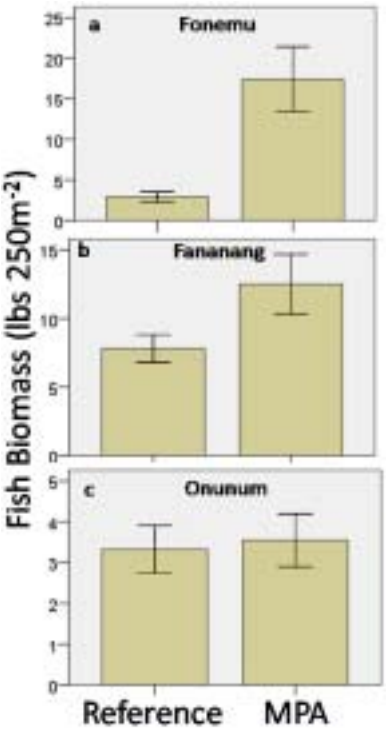

Fig. 11. Fish biomass in MPA and reference site at (a) Fonemu, (b) Fananang and (c) Onunum. Error bars indicate standard errors.

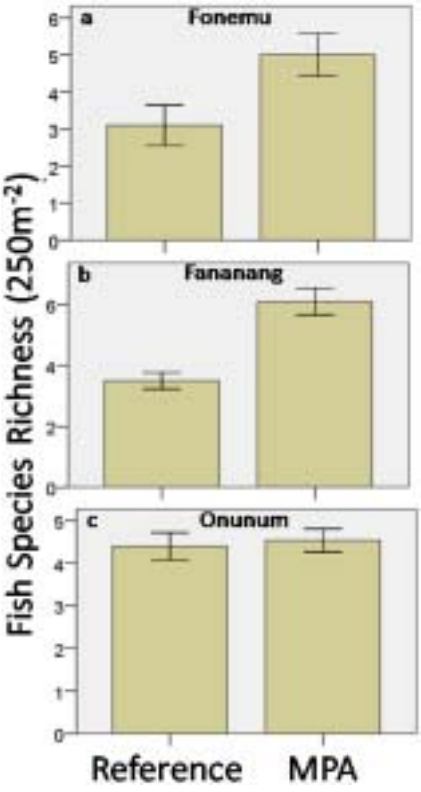

Fig. 12. Richness of fish species in MPA and reference site at (a) Fonemu, (b) Fananang and (c) Onunum. Error bars indicate standard errors.

DISCUSSION:

The MPAs at Fonemu and Fananang had good coral cover while their reference sites had lower coral cover. The MPA and reference sites at Onunum had very low coral cover. During the surveys at Onunum, we found big strands of dead branching corals. While we are not sure what caused the coral mortality, monitoring is needed to follow the recovery process. Closing Onunum to fishing would help in the recovery process for the corals at the site.

The density of coral recruits was low in all the sites surveyed. This is a concern, especially for Onunun, which is covered with many areas of dead corals. Recovery of Onunun needs healthy coral recruitment. The MPAs at Fonemu and Fananng while having healthy coral cover still needs coral recruits in the long-term.

The high fish density and biomass at Fonemu compared with its reference site indicates that the MPA at Fonemu might be working. At Fananang, while there were no significant difference in fish density between the MPA and reference sites, the biomass was higher in the MPAs. This indicate that the MPA might be having an effect and that as time progress, we might be able to see the difference in fish density. At Onunum, the fish density and biomass were very low. This might be an indication of the length of time the MPA has been established or the size of the MPAs.

The results of the surveys presented in this report are snapshots in time. Monitoring is needed to evaluate trends over time and determine how the MPAs are working. It is important for monitoring over time to have consistent methods. Therefore, we recommend that a targeted fish species list be created so that different people will count the same fish. We also recommend that people who do surveys be trained so that data between different observers can be compared.

The size of the MPAs as well as the area covered by the three MPAs in Chuuk lagoon are very small when we look at the size of Chuuk Lagoon. Even if the MPAs are full of fish, they are still a small part of the overall lagoon. Therfore, consideration needs to be given to increase the number of MPAs or increase the size or both. Since Chuuk reefs are owned by the communities, efforts should focused on getting several communities together to designate MPAs because if it is only one community, the reef they owned is too small.

Finally, while efforts on MPAs should continue, consideration should also be given to watershed and water quality issues. Effective conservation of Chuuk marine resources needs to address watershed and water quality issues because if they are not addressed, they will affect the habitats negatively. Coral populations and coral recruitment cannot persists if water quality continue to deteriorate. So to have effective MPAs, part of the efforts need to focus on issues outside of the MPAs.