

Status of sea cucumber populations inside and outside a Marine Protected Area in Ngardmau State, Palau



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Executive Summary

Sea cucumbers are important resources both ecologically and commercially. Due to high demand of sea cucumbers throughout the world, overharvesting is an issue faced by all sea cucumber fisheries because of their sedentary lives. In 2011, Palau witnessed one of these overharvesting events in three states Ngardmau, Koror and Ngarchelong. Four years after the massive harvesting in Ngardmau, the State Government requested that the Palau International Coral Reef Center (PICRC) assess the populations of sea cucumbers within the areas where the overharvesting occurred. Since the last survey in 2012, the Ngardmau MPA has witnessed a 12% increase in sea cucumber density from 102 m^{-2} (2012) to 115 m^{-2} (2014). Within the reference site, which is open to fishing, there is still a decline in mean density from 12 m^{-2} (2012) to 6 m^{-2} (2014). The total count of sea cucumbers within the MPA has risen from 2,552 (2012) to 2,866 (2014) but in the reference site, reduced population are seen from 295 (2012) to 134 (2014). The results of our survey show that there is a possibility of a slow recovery within the MPA but there is still declining populations in the reference area, which is open to fishing. With this data, managers must make decisions to maintain our natural resources for long-term commercial benefits without negatively impacting the fisheries that Palauan communities depend on for their well-being.

Introduction

Sea cucumbers play an important role in coastal ecosystems throughout the world as they help decompose organic matter on the ocean bottom, contributing to the recycling of nutrients. Sea cucumbers also play an important role in bioturbation, allowing mixing of air into the sand. Sea

cucumbers are important part of the seagrass ecosystem, which act as a buffer between the coast and the inner reef.

In order to have a thriving sea cucumber population, there should always be enough individuals in a particular area to ensure healthy reproduction rates. Sea cucumbers reproduce mostly through broadcast spawning (PICRC Technical Report 12-01), therefore, it takes many individuals to participate in the broadcast spawning for a sustainable population. A recent study published in the Journal of Geophysical Research also states that Sea Cucumbers can help counter the effects of ocean acidification and also the ammonia that it produces also serves as fertilizers, providing needed nutrients for coral growth (Schneider K., et al., 2012).

Not only are sea cucumbers important for the ecosystem, they are also a valuable commodity. Many countries harvest sea cucumbers for food and medicinal use, therefore there is a high demand for them, especially in Asian countries. In Palau, many communities rely on sea cucumber for income and food. Currently, one of the most popular and sought after species are *Actinopyga* spp. locally referred to as, *Cheremrum*. There are 6 species of *Cheremrum* known and all six are found in Palau including one endemic species as depicted in the Pacific Island Sea Cucumber and beche-de-mer identification cards. Even though *Actinopyga* species are of medium economic value they are still being heavily harvested.

As increase in demand and profits for sea cucumber occur around the world, massive overharvesting periods occur. In 1994, Palau passed legislation to ban the export of sea cucumber through the Marine Protection Act of 1994. The species banned in this act were the valuable species of that time and now there is an increased demand for the species not covered

by the Marine Protection Act of 1994, *Cheremrum* and *Mermarch* (*Bohadschia* sp.). In 2011, an overharvest of sea cucumbers occurred in the states Koror, Ngardmau and Ngarchelong. Due to limited monitoring and understanding of where the sea cucumbers were collected, state governments and community members became concerned. This event led to the national ban on the export of sea cucumbers in 2012.

The government of Ngardmau requested PICRC to conduct a survey to assess the impact and recovery from the harvesting in 2011. The objective of the survey was to assess the population of edible invertebrates mainly the *Actinopyga* genus or *Cheremrum* in the coastal waters of Ngardmau, to determine how they were impacted from the massive harvesting and if there are signs of recovery after three years.

Methods

The surveys were conducted in the same areas that were surveyed in 2009 and 2012 (Figure 1). The surveyed areas were Ngermasech, which is the Marine Protected Area (MPA), and Ngerikerker, the reference site, which is an area open to fishing.

Each area, Ngermasech and Ngerikerker, has 5 stations and within those 5 stations we used a belt-transect. The belt-transect length was 5x25m with surveyors observing sea cucumbers within 1m of each side of the transect. This would give us an area of 50 m² for each transect and a total of 250m² for each station. The observer identified commercially harvested sea cucumber species and measured their length using a standard ruler. Once all the data were

collected it was entered into an excel spreadsheet and pivot tables were created to compare species density, total number of sea cucumbers, and calculate the standard deviation.



Figure 1. Map showing the locations of the sites that were surveyed.

Results

The primary sea cucumber species surveyed were *Actinopyga spp.* or *Cheremrum* in 2014, the average density of *Cheremrum* in the MPA was 115 per 50m² compared to 102 per 50m² in 2012, and 131 per 50m² in 2009. As for Ngerikerker, the 2014 survey shows an average density of only 6 per 50m², compared to 12 per 50m² in 2012, and 99 per 50m² in 2009.

The population of *Cheremrum* has increased from 2,552 to 2,866 but it has not reached the pre-harvesting number (Figure 3). As for Ngerikerker, the 2014 survey shows a decline from 295 in 2012 to 134; both of these are way below the pre-harvesting population in 2009 which stood at 2,445 (Table 1).

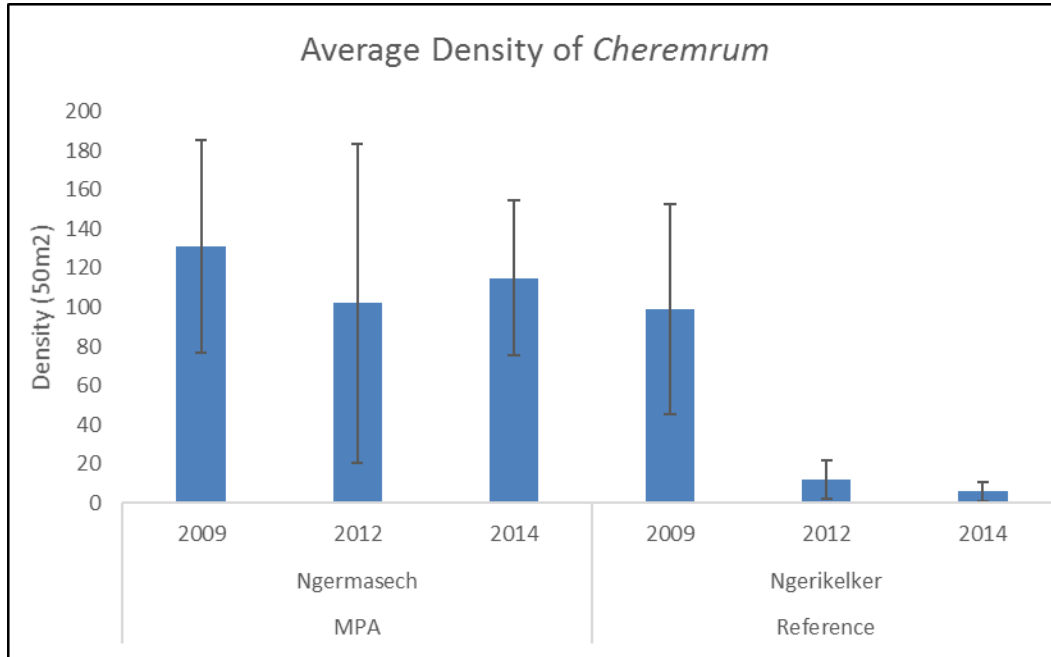


Figure 2. Average Density of *Cheremrum*

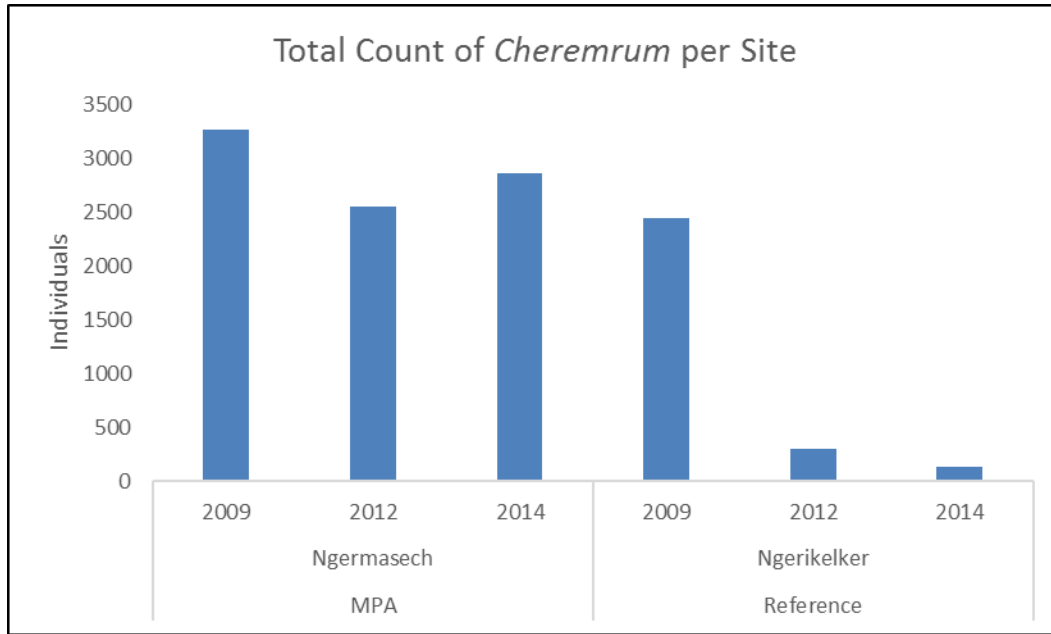


Figure 3. Total Count of *Cheremrum* per site

Table 1. Total count of *Cheremrum* per site for 2009, 2012 and 2014

Site	2009	2012	2014
Ngermasech (MPA)	3,269	2,552	2,866
Ngerikerker (Reference)	2,445	295	134

Discussion

The result of the survey illustrates the benefits of an MPA. The MPA has worked well in protecting the population of *Cheremrum*, and in fact there is a gradual increase in population in 2014 (Figure 3). Whereas in Ngerikerker, there is a decline in *Cheremrum* population for the past couple of years after the massive harvesting that occurred in 2011 (Figure 3). This may be

due to some factors such as slow reproductive rates compared to a more rapid harvesting rate for local consumption, or maybe the current population is not enough to support their broadcast spawning. The lack of recovery can even be caused by some other ecological factor such as sedimentation caused by runoffs, change in water temperature or insufficient time to recover from the 2011 overharvesting event. Though the reference site is not showing any signs of recovery, the Ngermasch MPA has high densities of sea cucumbers which may provide seeds necessary for recovery of the dwindling populations of sea cucumbers in Ngardmau.

Continued monitoring is highly recommended in order to determine whether given enough time, the populations would recover. Studies show that even a four to seven year closure of a site is not enough time for full recovery of sea cucumber populations so the monitoring program needs to continue longer than seven years (Uthicke et al, 2004; Friedman et al, 2004).

Palau is continuing to develop rapidly and with rapid growth resource management must be a top priority. Managers must make decisions for long-term benefits of a resource which is vulnerable to fisheries without causing negative impacts to the environment or a complete collapse of the fishery. Resource managers need scientifically backed data to make informed and educated decisions for a more sustainable future.

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References

- Golbuu Y, Andrew J, Koshiha S, Mereb G, Merap A, Olsudong D, Silil B, Victor S. Status of Sea Cucumber in Ngardmau State. PICRC Technical Report 12-01. Palau International Coral Reef Center. Koror, Palau.2012
- SPC. Pacific Island Sea Cucumber and beche-de-mer identification cards. Norwood Industries PTY.LTD, Australia.2004
- Schneider K., Silverman J., Woolsey E., Eriksson H., Byrne M., Caldeira K., Potential influence of sea cucumbers on coral reef CaCO₃ budget: A case study. Journal of Geophysical Research: Biogeosciences 116. One Tree Island Research Station. University of Sydney. 30 January 30 2012.
- Richard C.Brusca, Gary J. Brusca. Invertebrates^{2nd} edition. Sinauer Associates, Inc., Publishers. Sunderland, Massachussets.2003
- Uthicke S. Overfishing of holothurians: lessons from the Great Barrier Reef. In: Conand C. Purcell S. Uthicke S. Hammel J-F Mercier A. (eds.) FAO Fisheries Technical Paper No. 463, RomeFAO.425p.2004