Baseline Assessment of Angaur Conservation area

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INTRODUCTION

The use of Marine Protected Areas (MPAs) as a conservation tool has been utilized throughout Palau, as well as Micronesia and the rest of the world. As MPAs provide many benefits, the success of these protected areas also depends on the biological monitoring efforts that provide the necessary information that natural resource managers need. Information regarding the status and trends of marine resources allows for resource managers to adaptively manage their protected areas as well as assessing the progress of protected areas in meeting its desired objectives.

In July 2005, the state of Angaur located in the southern part of Palau (6° 54’ 21N, 134° 7’ 47E), passed an act to establish a marine conservation zone in order to protect the southwestern reefs of Angaur state (Figure 1). Due to the limited fringing reefs in Angaur state, and increasing fishing pressure, the state legislature passed a law to prohibit any kind of fishing activities for any marine flora and fauna within the Angaur conservation area for a period of two years.

In March 2014, the Governor of Angaur state requested the Palau International Coral Reef Center to conduct a baseline survey of the Angaur conservation area. The objectives of this survey were to: determine the size, density and biomass of commercially targeted fish populations; survey edible macro-invertebrates; and to determine the benthic coverage of the Angaur conservation area. The results from this assessment will serve as baseline information of the marine resources currently within the Angaur conservation area and will be used for future monitoring and management purposes.

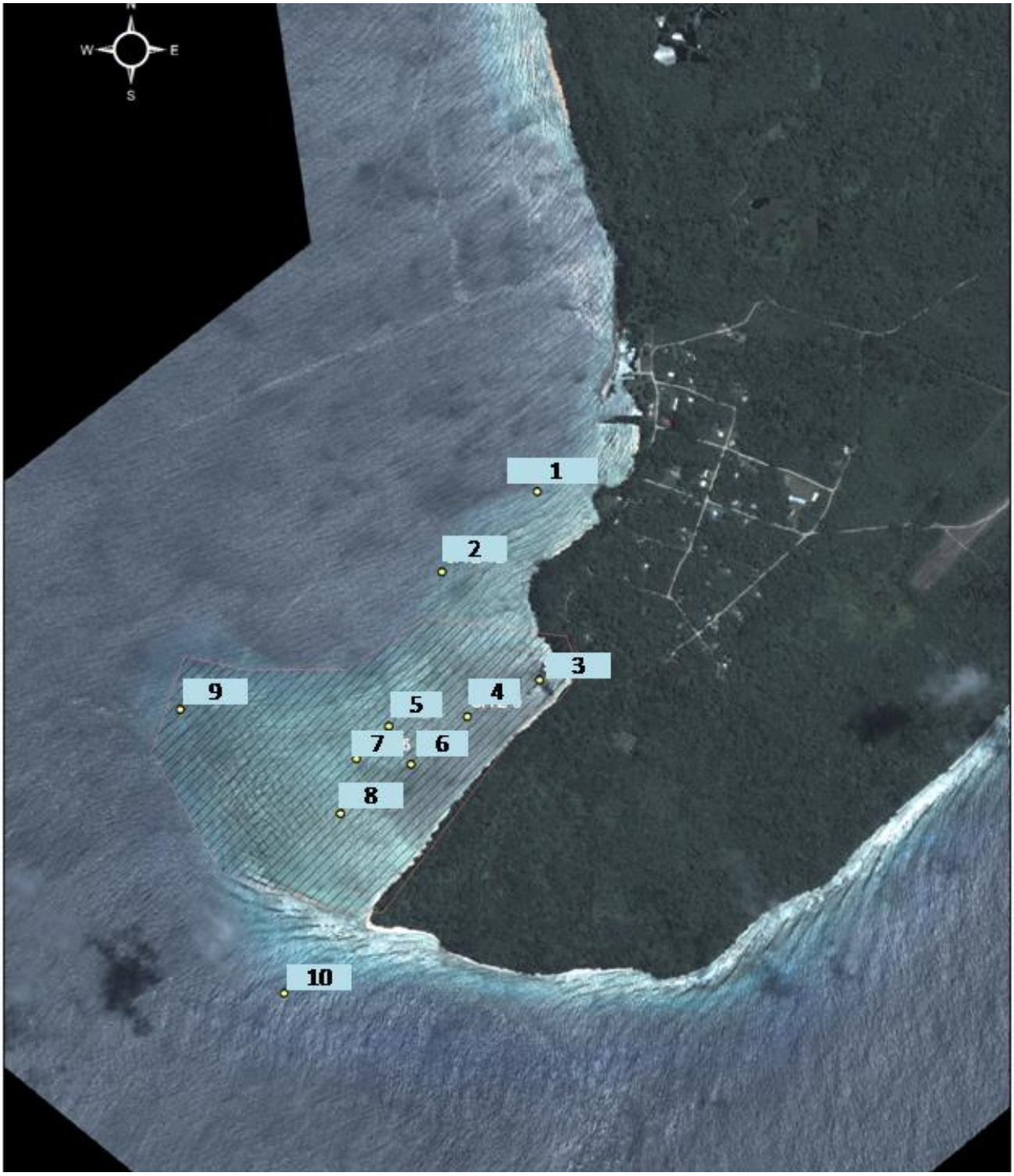

Figure 1. Survey sites within the Angaur conservation area and its surrounding reefs.

METHODS

This study was conducted in the Angaur Conservation Area (Figure 1) from March 3-5, 2014. Coral-reef assemblages were surveyed at a depth of 2-5 m and a total of 10 randomly selected sites were surveyed. At each site three 30 m belt transects were laid on the reef to examine commercially targeted fish assemblages and macro-invertebrates as well as the benthic composition and coral diseases. Commercially targeted fish species were surveyed on 30 x 5 m (total area per transect = 150 m^{-2}) belt transects, where the length of each fish was estimated to the nearest centimeter. Edible macro-invertebrates were identified and recorded along a reduced belt width of 30 x 2 m (total area per transect = 60 m^{-2}) and coral diseases were recorded along 30 x 1 m (total area per transect = 30 m^{-2}) within each site. Benthic coverage including coral coverage were surveyed by taking photos of the entire 30 m transect using a 1 m^2 photoquadrat with a wide angle camera.

In the laboratory, benthos were analyzed using CPCe (Coral Point Count with excel extensions) in which five random points from each quadrat were used to determine coral cover, which was identified to the genus level. The size, density and biomass of commercially targeted fish populations were estimated and calculated, where size was recorded in centimeters, and biomass was calculated using the length-weight relationship, $a(L^{\wedge b})$, where L= length in

centimeters, and a and b as constants obtained from fish base. In the laboratory, all data were entered into Microsoft (MS) excel spread sheets and later analyzed using MS excel.

RESULTS

Fish

Fish Biomass

Fish biomass in the seagrass habitat was 1,811.3 (g) 150 m^{-2} (Fig.2), while the reef flat habitat had a mean fish biomass value of 6,706.6 (g) 150 m^{-2} (Fig.2). Biomass in the outer reef habitat was the highest with a mean value of 11, 512.4 (g) 150 m^{-2} (Fig.2).

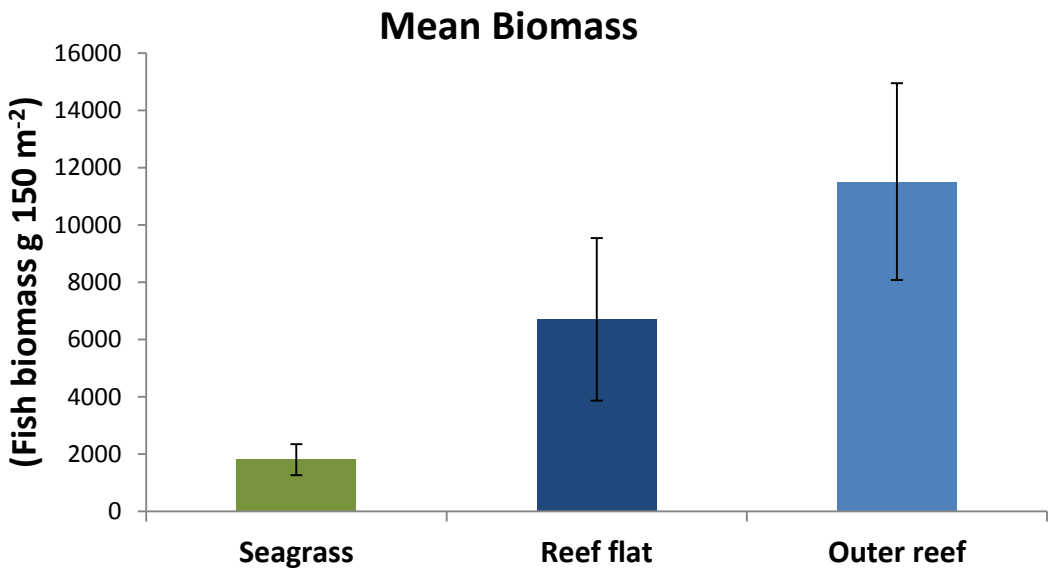

Figure 2. Mean fish biomass in the seagrass, reef flat and outer reef habitats in Angaur Conservation area.

Fish density

The mean density of fish for the seagrass habitat was 11.9 fish per 150 m^{-2}, compared to the reef flat that had mean fish densities of 28.8 fish per 150 m^{-2} (Fig.3). The outer reef habitat showed similar values of fish densities with 21.3 fish per 150 m^{-2} (Fig.3).

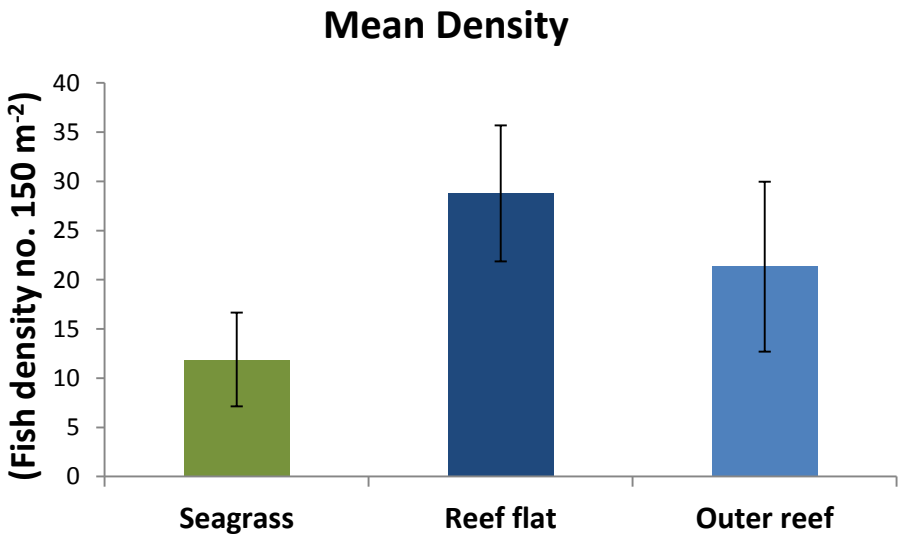

Figure 3. Mean fish density in the seagrass, reef flat and outer reef habitats in Angaur Conservation area.

Invertebrates

Invertebrate densities in the seagrass habitat was 1 individuals per 100 m^{-2} while the reef flat and outer reef habitats showed similar mean values of 1 individuals per 100 m^{-2} and 2 individuals per 100 m^{-2}, respectively (Fig.4).

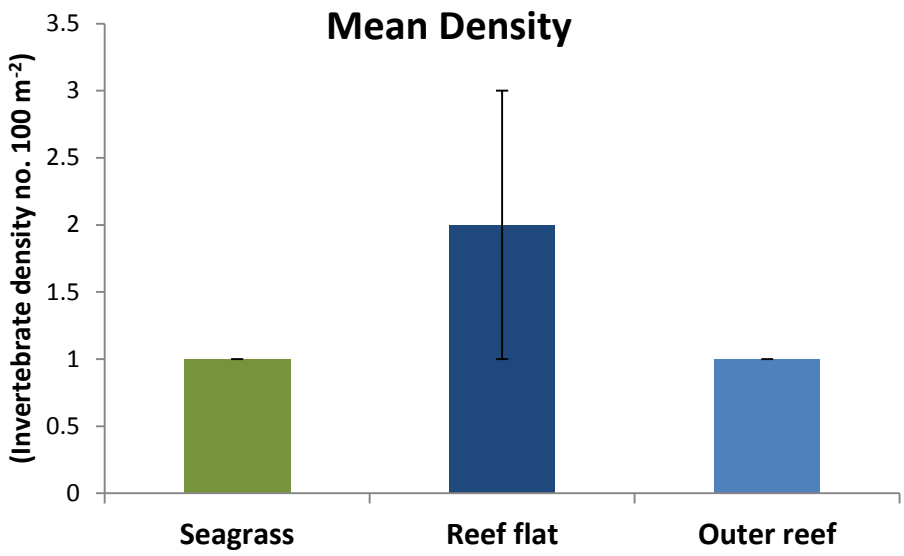

Figure 4. Mean density of invertebrates in the seagrass, reef flat and outer reef habitats in Angaur Conservation area.

Benthos

Benthic composition in the seagrass habitat consisted of coral cover (1.4%), Sand (22%), Rubble (4.7%), and Turf (6.6%). The main seagrass species with the highest percentages within the seagrass habitat were Thalassia hemprichii (59.3%) and Cymocodea rotundata (2.2%) (Fig.5). In terms of the benthic coverage in the reef flat habitat, benthic composition was mainly comprised of coral cover (7.3%), carbonate (20%), Sand (26%), Thalassia hemprichii (5.2%) and Turf (41%) (Fig.5). In the outer reef habitat, benthic coverage mainly consisted of coral cover (11.1%), Crustose Coralline Algae (3.5%), Carbonate (55%), Sand (1.8%) and Turf (28%) (Fig.5). 5.5% of the total coral coverage surveyed in the Angaur Conservation Area showed signs of coral disease.

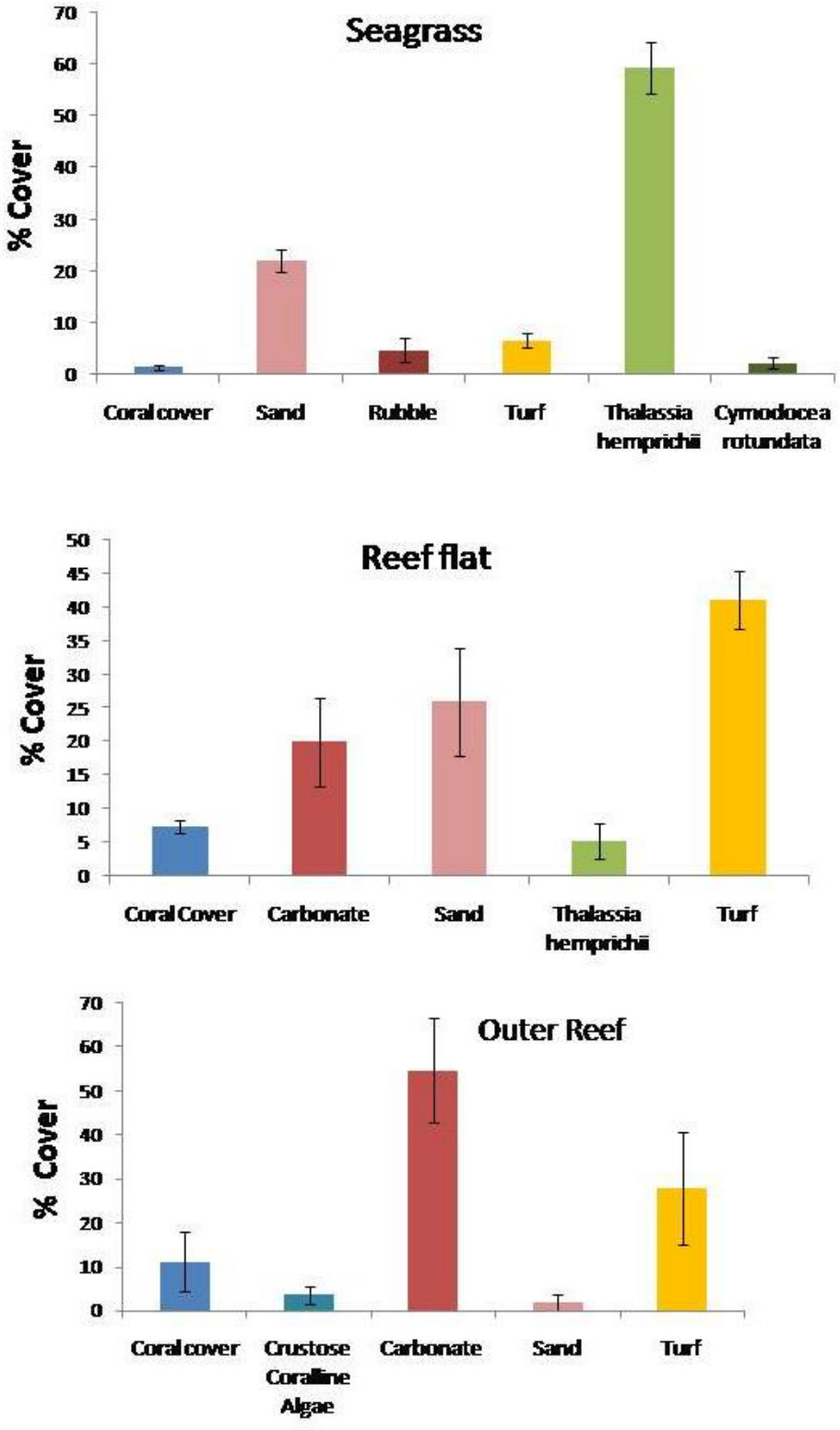

Figure 5. Benthic coverage in the seagrass, reef flat and outer reef habitats in Angaur conservation area.

DISCUSSION

Observations in the Angaur Conservation Area showed various results of fish biomass in the sea grass habitat (1,811.3 (g) 150 m^{-2}), the reef flat habitat (6,706.6 (g) 150 m^{-2}), and the outer reef habitat (11, 512.4 (g) 150 m^{-2}) (Fig. 2). Fish densities were relatively similar in the seagrass habitat (11.9 fish per 150 m^{-2}), reef flat (28.8 fish per 150 m^{-2}), and outer reef (21.3 fish per 150 m^{-2}) habitats (Fig. 3). In terms of invertebrates, densities of invertebrates in the seagrass and reef flat habitats had mean values of 1 individuals per 100 m^{-2}, with the outer reef having a mean value of 2 individuals per 100 m^{-2} (Fig. 4). Lastly, coral coverage in the seagrass habitat was less than 5%, with coral coverage in the reef flat and outer reef habitats ranging from 5-11% (Fig. 5).

The results presented in this report are baseline information that will be used by management in tracking the progress of the Angaur Conservation Area. These results have the potential to change overtime, given that standard monitoring protocols as outlined in this report are consistently applied overtime. In addition, continuous biological monitoring of marine protected areas is critical in order to ensure that changes and trends are captured and utilized by natural resource managers. It is recommended that for future biological assessments of the Angaur Conservation Area, a control site with similar habitats is established for the purposes of assessing the effectiveness of the conservation area as well as tracking the status, trends and

changes in the marine resources. Lastly, monitoring protocols or procedures must be carried out by trained individuals and repeated overtime to obtain the desired results of marine protected areas.

REFERENCES

Twelfth Olbiil era Ngeaur. “APL No. 12-14 OEN Bill No. 12-03: An act to establish a marine conservation zone to protect the southwestern reefs of the State of Angaur, to regulate activities within such marine conservation zone, to provide for penalties for violations of this Act, and for related purposes”. (July 2005).