PALOLO DEEP MARINE RESERVE:

A survey on the current status of the reserve

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1. INTRODUCTION

The Palolo Deep Marine Reserve known for its unique shape, the “deep”, was established as a marine reserve in 1974 under the National Parks and Reserve Act. The reserve is a fringing reef comprising a total area of 137.5 hectares located at the northeast of Apia harbor. The proximity of the reserve to Apia town has attracted many tourists as well as local people to the reserve for recreational activities such as snorkeling, scuba diving as well as for researching.

The general habitat zonation in the marine reserve has been well explained in previous surveys. These habitat zones contained four reef flats (western, eastern, inshore, seaward), transverse ridge and the main deep (Lovell *et al.*, 1994). Furthermore, the inshore and western reef flat has been described to have the least coral coverage due to sandy dominate substrate, proximity to the shore and adjacent to the river mouth. Whereas, the western flat experience deepening through erosion which leaves the area a disturbed unconsolidated environment. In contrast the eastern reef flat is sheltered by the deep with a high rubble substrate providing good diversity and high coral coverage and the south deep and the transverse ridges are characterized by a large coral coverage of *Acropora* species to name a few.

Although this habitat zonation has been well described and identify from past surveys, the reserve is experiencing changes over time due to natural phenomenon such as climate change with the issue of global warming expressing the theory of sea level rise, changing tide pattern, and high rate of rainfall. Anthropogenic activities in the vicinity of the reserve such as the recently growing numbers of coastal development activities and constructions, poor land management around rivers, breakage of corals from snorkeling to name a few have major impacts on the reserve.

The current marine biodiversity survey assesses the current health of corals, fish abundance, algal growth, the presences of the crown-of-thorn starfish and targeted macro-invertebrates. This report discusses the current situation of the reserve based on the area that was surveyed.

2. SURVEY OBJECTIVES

1. To assess the current health status of corals, fish and other marine biodiversity in the Palolo Deep Reserve;

2. To determine the presence of the crown-of-thorn starfish and its impact on the corals in particular.

3. METHODOLOGY

3.1 Description of the surveyed area

- *Inshore reef flat (Transect 1)*

The inshore reef flat has been described as comprising of two habitats: one of a largely sandy substrate with reduced biota to the southwest of the southern deep and near the shore; the other a more diverse area resulting from its proximity to the southern deep and the presence of a more stable rubble substrate (Figure 1).

- *Eastern reef flat (Transect 2 & 3)*

The eastern reef flat is sheltered by the deep. The eastern reef flat supports a good diversity and coral cover on the northern part of the deep and an impoverished fauna seaward as shown on Figure 1 (Lovell *et al*., 1994).

MAP OF SURVEYED AREA

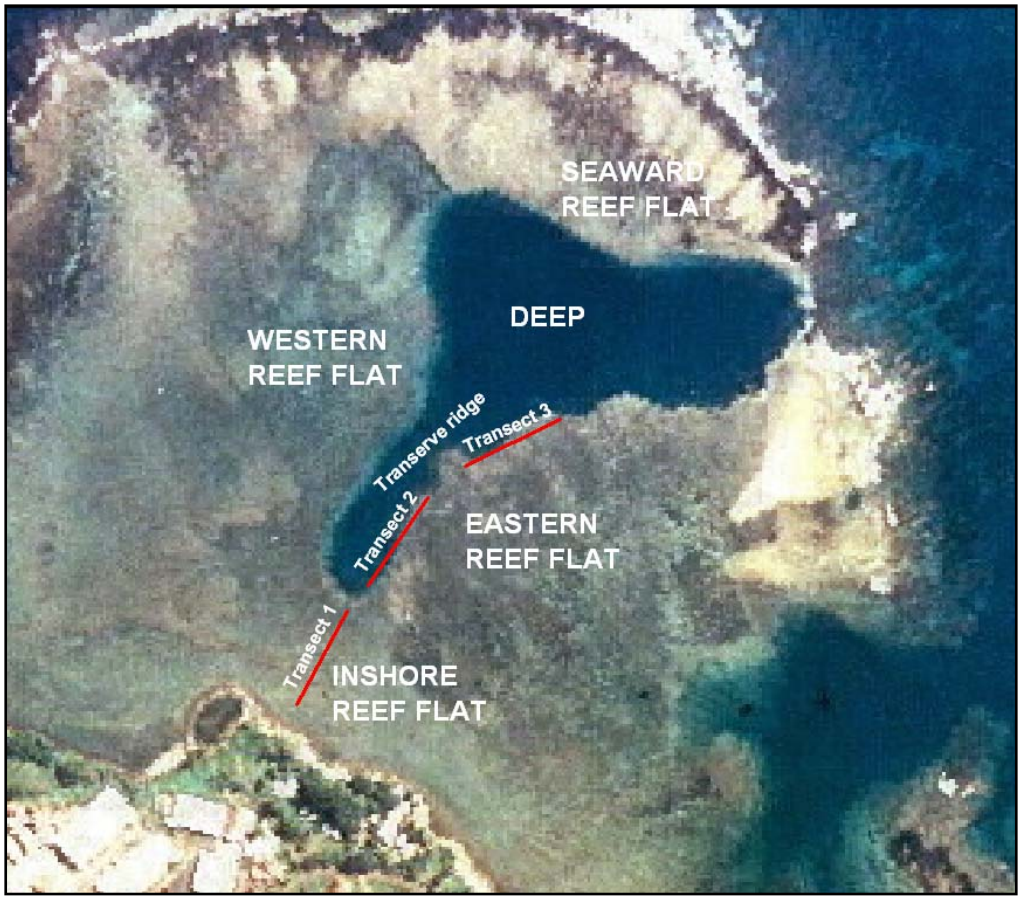

Figure 1: General habitat zonation identified in the Palolo Deep Reserve and the Transects that were laid out.

3.2 Field Method

3.2.1 Belt Transect

Fish abundance & Macro-Invertebrates

Three 100 meter transects were laid out along the length of the surveyed area with 10 meter in between. Counts of the target marine life was done on a 10 meters interval for each transect. Two observers snorkeled and scuba dived along the transect counting identified targeted reef fish and macro-invertebrates at a 2 meters width. All data collected was recorded onto a monitoring belt form (Appendix 1).

3.2.2 Photo Quadrats

Coral health

The status of coral health was done by laying out a 100 meter tape measure where a 1 m^2 PVC quadrat was placed at every 20 meter interval. Photographs of each interval were taken and later analyzed using the CPCe software, Each photographed quadrat was marked onto the Global Positioning System in order to locate the same area for future monitoring.

4. RESULTS

Three 100 meter transects were marked onto the GPS as permanent sites to be monitored annually to note changes within the reserve.

4.1 Coral health

The total coral cover (live plus dead corals) estimated for the area surveyed was 37% (± SD 50.21%). Of this amount, only 26% (± SD 30.6%) is represented by live hard corals and 11% (± SD 19.6%) are classified as dead corals (Figure 2). The most abundant live coral species observed were mainly *Porites sp.* and *Porites rus* (16%). Other coral species that were recorded consisted of the *Acropora* (5%), *Heliopora* (2%) and *Pocillopora* (2%).

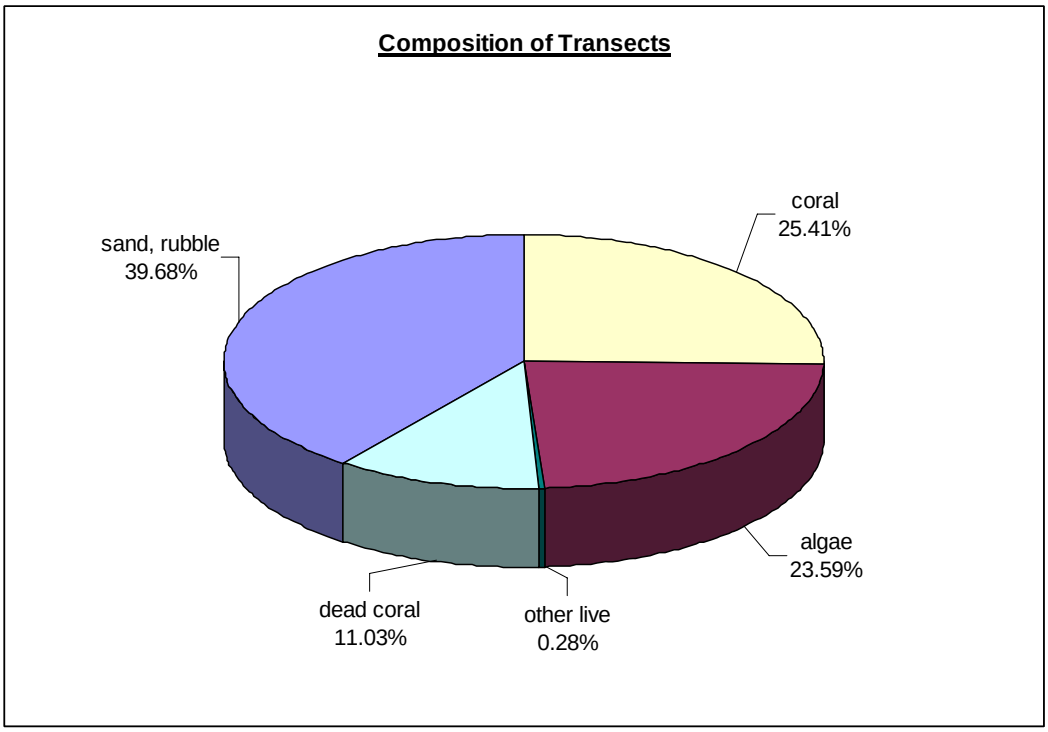

Figure 2: Graph of categories identified within the surveyed area. Figures are given in percentage.

The percentage of live corals were higher around the eastern reef flats where the average estimates were 44% around transect 2 and 30% around transect 3. Transect 1 estimated an average of 7% live corals. Macro-algae were the dominant species within the inshore reef flat hence the small percentage of live corals. *Porites rus* was the only coral species observed within transect 1. *Porites sp.* and *Acropora sp.* were the dominant species recorded in transects 2 and 3, although other species such as *Heliopora sp.* and *Pocillopora sp.* corals were also noted.

4.2 Fish abundance

The average count of targeted fish species observed within the surveyed area was estimated at 286. Fish species from families Acanthuridae (surgeonfish, unicornfish, tangs) – 48% and Scaridae (parrotfish) – 10% were the dominant species recorded (Table 1). Other targeted fish species that were recorded included during the survey were from families Pomacanthidae & Chaetodontidae (angelfish & butterflyfish) – 6%, Labridae (wrasse) – 9%, Siganidae (rabbitfish) – 4%, Serranidae (grougper) – 5%, Lethrinidae (emperor) – 3%, Haemulidae (sweetlips) – 0.2%, Holocentridae (soldierfish) – 14% and Mullidae (goatfish) – 1%.

Although the survey looked at identified targeted species, there were other fish species that were observed in abundance such as the damselfish, triggerfish and pufferfish to name a few. Inventories of fish species present within the reserve were done in past surveys eg, Lovell *et al.* 1994.

Table 1: Fish families recorded throughout the surveyed area. Fish families are arranged from the most abundant species observed to the least.

Fish Family	Rank	Fish Family	Rank
Surgeonfish, Unicornfish, Tang	1	Emperor	6
Parrotfish	2	Goatfish	7
Wrasse	3	Sweetlips	8
Soldierfish	3	Trevally	9
Butterflyfish/Angelfish	4	Snapper	9
Rabbitfish	4	Mullet	9
Grouper	5		

4.3 Macro algae

The total algal cover estimated within the surveyed area was 24% (± SD 21%). Of this, 10% of the unidentified algae were classified as macro algae, 7% were *Sargassum sp.*, 5% was *Padina sp.* and 0.4% was coralline algae.

4.4 Macro Invertebrates

Holothurians and sea urchins were observed in low abundance. No crown of thorn starfish, giant clams or other targeted shellfish was observed during the survey.

5. DISCUSSION

Toloa (1999) and Lovell *et al.* (1994) compiled an inventory of all fish species observed in the reserve and noted that there was an increase in the abundance of fish counts from 1994. However, this survey only recorded targeted fish species that were considered in demand for food on a subsistence level thus would be an indicator on the level of exploitation. It is therefore reasonable to say that this survey will not give an indication on the current abundance of fish species. However, it was documented that surgeonfish and parrotfish were the dominant fish species observed within the surveyed area. These fish species is mostly caught by fishermen and to note that they were observed in abundance suggest that the reserve is functioning.

The higher percentage of live corals compared to dead corals suggests the area surveyed was in good condition with minimal impacts. This could be said true around the eastern reef flat where there was higher diversity and growth of corals compared to the impoverished inshore reef flat which is exposed more the stronger wave actions, freshwater runoff and re-suspension of sediments. The eastern reef flat is more protected due to the deep which shelters the area from stronger wave actions and sedimentation.

Macro algae were mostly encountered around the inshore reef flat (32%). The algal growth recorded around the other surveyed sites was averaged at 10 – 14%. No edible seaweed was recorded during the time of survey. The inshore zone is mainly characterized as an impoverished area being heaving exposed to near-coastal effects which occur through freshwater runoff and re-suspension of sediments due to wave action. This makes it an unstable substrate in which the macro algae such as the *Sargassum sp.* and *Padina sp.* were dominant species.

Holothurians and sea urchins were the only macro-invertebrates recorded present during the time of monitoring. The absence of other targeted invertebrates such as the giant clams and trochus that are heavily exploited could suggest that they have not established well within the reserve.

There were no records of the crown-of thorn starfish suggesting no current threat to the health of corals from these starfish.

6. CONCLUSION

Overall, the Palolo Deep reserve seems to support a healthy diversity of fish and coral species with minimal impacts from anthropogenic activities and natural phenomenon. This could be assumed from the high percentage of live corals that were recorded during the survey. However, future monitoring of the area should be done in order to determine whether this is true and to allow for comparison to monitor the changes occurring within the reserve.

7. RECOMMENDATION

- To continue to monitor the reserve on an annual basis to determine changes of the marine biodiversity as a result from either natural causes or anthropogenic activities.

- To monitor other physical parameters such as the rate of sedimentation and water temperature in future monitoring.

8. ACKNOWLEDGEMENT

We would like to thank the staff of the Division of Environment and Conservation for supporting our work. We would also like to greatly acknowledge Mr. Jack Laban who manages the Palolo Deep reserve.

9. REFERENCE

Lovell, E.R and Toloa, F. 1994. ***Palolo Deep National Marine Reserve: A survey, inventory and information report***. Apia, Western Samoa: SPREP.

Toloa, F. 1999. ***Palolo Deep National Marine Reserve Samoa Marine Survey: Current status 1999***. Apia, Western Samoa.

10. APPENDIX 1: Belt Monitoring Form

Belt Transect Form

MARINE BIODIVERSITY MONITORING REPORT FORM

DIVISION OF ENVIRONMENT AND CONSERVATION

Recorder(s)	Date	Time
		Start: End:

1.SITE DESCRIPTION

Site/Reef Name: **Transect #:**	**GPS Reading:** Starting pt: Latitude _____ Longitude - _____ Ending pt: Latitude _____ Longitude - _____
Type of Habitat (Please circle) Lagoon; Crest; Slope; Flat; Drop off Other:	**Depth Range:** Minimum _____ m Maximum _____ m

2. FISH DATA

Fish families	*0 – 10m*	*20 - 30m*	*40 - 50m*	*60 - 70m*	*80-90m*	*90-100m*	*Comments*
Surgeonfish/Unicornfish							
Parrotfish							
Butterfly/Angelfish							
Wrasse							
Rabbitfish							
Groupers							
Emperors							
Snapper							
Sweetlips							
Trvally/Jacks							
Soldierfish							
Goatfsh							
Mullets							

2. INVERTEBRATE DATA

Invertebrates	*0-10m*	*20-30m*	*40-50m*	*60-70m*	*80-90m*	*90-100m*	*Comments*
Holothurians							
Sea Urchins							
Crustaceans							
Bivalves							
COT							
Giant clams							

3. OTHER OBSERVATIONS