

National Biodiversity Strategy and Action Plan (NBSAP) Project: Assessment of Capacity Building Needs for Biodiversity and Participation in Clearing House Mechanism for Vanuatu

Background

The Vanuatu Environment Unit is undertaking a capacity building add-on to the National Biodiversity Strategy and Action Planning Project. One priority within this work has been to assess capacity to conduct research, assessment and monitoring of biological resources and their ecosystems to which they are part of. An inventory of recent and current research, assessment and monitoring programmes have just recently been done by the project. A report is currently in preparation following this stock take.

Biodiversity monitoring is important to enable the government to make appropriate decisions on the use of particular species and habitats. Thus it is important to build up a body of knowledge resources and habitats, and the impacts of human activities and natural disasters. The biodiversity project supports the implementation of the Crown of Thorns (COT) clean up and establishment of monitoring sites at Santo as a case study to learn of the capacity building needs that are required to effectively and efficiently carry out coral reef monitoring.

Introduction



Like other Pacific island countries, Vanuatu is an archipelago consisting of more than 80 islands stretching 1300 kilometers from north to south in the western Pacific Ocean. The combined land area is 120 km² with a maritime exclusive economic zone that covers 680 000 km².

Melanesian dominates the Population with a growth rate of at least 2.8 % annually according to the 1989 Census (statistics office, 1994). The livelihood of the people is very much depending on the type of natural resource availability. According to the last Population Census, 79 % of which live among the coast. For these people marine resources is an important source of income as well as protein source for their family diet. Marine Resources such as Trochus (*Trochus niloticus*), Bech Der Mer Species, Giant Clams and Reef Fish are some of the heavily target species. Biologically these marine resources have complicated life cycles and require good reef condition for successful reproduction to sustain their respective kind. However if reef conditions are not these important coastal resources are at great risk of sustaining their species thus prone to over-exploitations.

The Fisheries Department Research Team has been conducting stock assessment surveys in selected islands of Vanuatu in past years. In 2003 the team did stock assessments for trochus green snail and Bech Der mer for Malampa, part of Shefa and Sanma Province. After the work was done the

group sited large numbers of Crown of Thorns at Million Dollar Point and Aore Island in Sanma Province. These were the first sites ever discovered by the team to be under threat of coral reef destruction by COT. The issue was discussed with the Environment Unit for a possible clean up campaign and Funding was made available from the National Biodiversity Project. A weeklong clean up campaign was carried out and a total of 315 COT's were collected and burned. Parties Involve were, Fisheries Dept Research and Extension staff members, Island Power Dives, Banban Youths.

Methods and Activities involve in Clean Up

Consultations

When Crown of thorns were discovered by the stock assessment team on Aore and Million-Dollar Point in September 2003, the team consulted Sanma Fisheries Extension Office for some awareness programs.

The respond from the Fisheries Extension officers was fast and in a week later COT awareness programs were conducted in a number of areas including, Banban, Mango area and Vanuatu Police Force barracks. Additionally consultations were also made with Allan Power Scuba Dive Company concerning the issue and they were willing to be part in any clean up campaign. Awareness programs were also conducted in schools and the Luganville Youth Trop in Center.

Coral Reef Check Survey Method and COT Cleaning Method.

Reef Check is a survey method to determine the percentage of life and dead soft and hard corals as well as percentage coral cover in a particular reef. It also covers some invertebrate surveys and in this case the team focuses on Trochus (*Trochus niloticus*) Green Snail (*Turbo marmoratus*) and Bech Der Mer species and Crown of Thorn Star fish (COT).

Reef Check Method

At least three, preferably four, 20M transects in each area should be carried out, and the position marked on the map. If it is not possible to do more than two transects on each dive, data can be combined from surveys a week apart.

The surveyor swims along the line, and stops every half a meter (50cm) to record what type of cover is on the seabed. ONLY WHAT IS DIRECTLY UNDER THE LINE IS RECORDED. At each stop, the surveyor holds the tab or mark down against the reef and records what is directly under the line.

Figure 8 – The line used for the Sea Bed Cover survey.

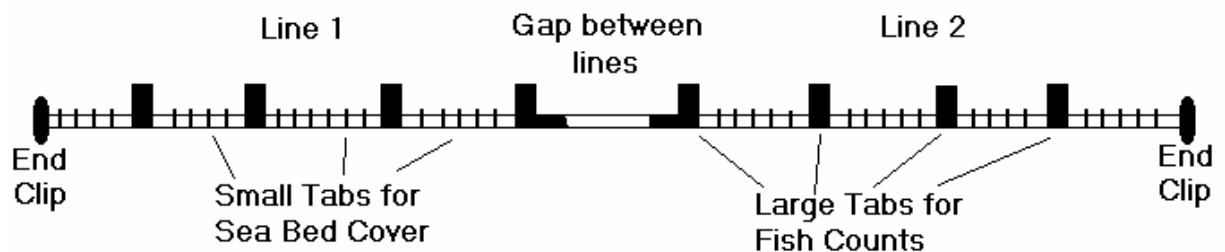
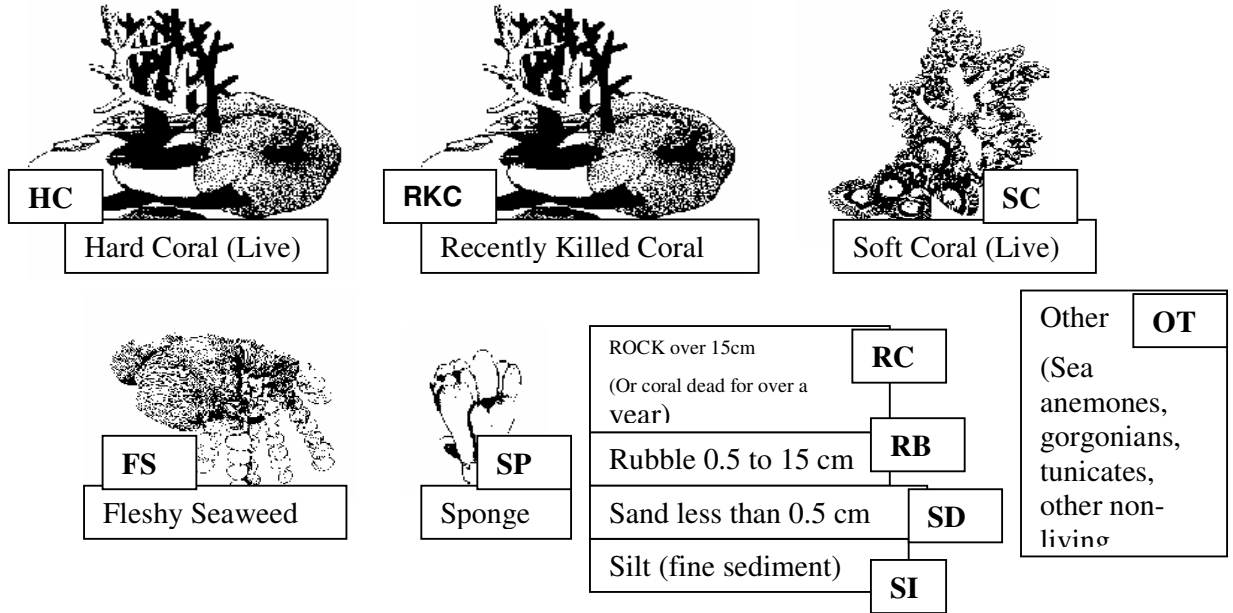


Figure 9 – Sea Bed (Substratum) categories to record:



Invertebrate Survey

Using the same transect Line, an imaginary 5M “corridor” lying over the line transect is surveyed, At least three, preferably four, 20M transects in each area should be carried out, and the position marked on the map. Target invertebrates, Trochus, Green Snail, Giant Clams, Bech Der Mer and Crown of Thorns.

Invertebrate Categories to Record



Trochus (T)



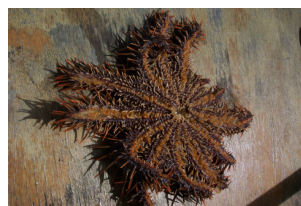
Giant Clam species



Green Snail



Bech Der Mer Species



Crown of Thorn

Crown of Thorn Harvest Method

Given the hostile nature of working in the water the number of divers was limited to 8. Each diver was given a metallic spear with a wooden end.

Arriving on the site, the divers were set to dive in line perpendicular to the reef crest (reef slope) with strong divers at the deeper end and weaker ones at the shallow end. The 8 Divers snorkel at a speed of 5m/minute and look for COT.

Holes and crevices are hiding places for crown of thorns therefore divers were advised to dive into such areas and carefully observe.

COTS were caught by using the metal spear to penetrate through the body and hold the spear away from your body while ascending.

Divers were also advised to catch one COT at a time. A fiberglass boat carries the catch with a captain and a Crew on boat to assist the divers in offloading their catch. For the safety of other divers, they were also told to swim back to the boat when they make a catch. The boat was following 10 meters behind the group.



Fig: x- One of the team members with 3 COT on

For both sites; i.e. Million Dollar Point and Aore, clean up work was done both in the morning and in the afternoon. (8:00 am – 5:00 pm). Morning dive starts from 8:00 am to 12 mid-day while afternoon dive is from 2-6 PM.

COT Disposal Method

The number of COT collected for each dive were taken ashore by boat and then burned in an open fire so that all the body parts are burned into ashes. The COT's could not be buried in the sand or thrown away to rot because the spines will be a threat for beach users as well as locals fishers.



Fig: x- shows the members of the team putting more COT into the burning fire.

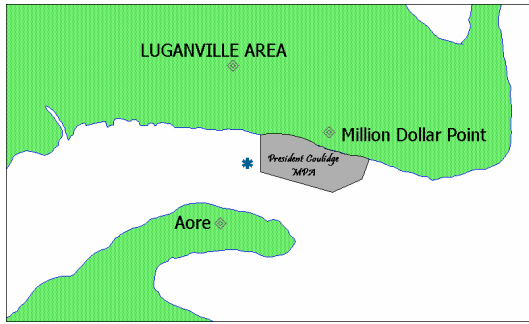
The team has to ensure that every body parts of all COT's has burn down into ashes and that the fire will cause no harm to the nearby vegetation then the group can leave the place. The fire has to be strong to burn all the animals otherwise partly burned COT will give out an unpleasant smell.

Site Description

Map Showing Million Dollar Point (DP)

Million Point- Known for its popular president Coolidge dive site. At the end of the II world war, the American dump all their ammunition at this point that

worth millions of dollars and that is how this area was named. Until today each year tourists come in from various corners of the world to dive the area and see for themselves this massive war relics.



Until now Corals and other living organisms have established themselves on the surfaces of these remains creating some beautiful scenery for the divers as well as serving as important

habitats for fishes and invertebrates. The Reef composed of fringing reefs, supports vast diversity of both hard and soft coral species forming a gentle slope. This provides an important fishing ground for local artisanal fishers as well as those living in nearby area.

The coastline is still covered with vegetation and some areas of nice fine sandy beaches creating an environment for weekend recreational activities. The total population of people living around the area is approximately 300 consisting of people coming from various islands of Vanuatu. Additionally there are people coming from other parts of Luganville to fish or swim in the area.

Trochus niloticus, Giant clam species and Bech Der Mer have been harvest in the area by locals and sold to buyers for income.

Aore Island



Referring to map x, Aore Island and Luganville coast form the harbor that receives both domestic and international vessels coming from various parts of the Pacific. Aore Island itself has a population of 400 people. Farmers who own very large cattle farms on the island employed the majority of these people. The reef consists of some fringing and patch reef systems also supporting a

vast diversity of hard and soft corals. Living among these coral are a greater diversity of fish species and marine invertebrates. The coast is protected by sandy beaches providing good swimming spots for the locals as well as people coming from Luganville mainland. Apart from that the area shown in picture x provides a good fishing ground for local artisanal fishers from Aore Island and People coming from the mainland either by boat or canoe.

Results

Table 1: shows number of Crown of Thorns Collected by the clean up team

Site Name	Date	Time	Dive number	Tide	No. Of Divers	No. Of COT Collected	Average COT size
Million D P	4/05/04	9:00 am-1:00 pm	1	Low	10	0	0
Million Dollar Point	4/05/04	3:00 pm – 5:00 pm	2	High	10	49	24.75
Aore Island	5/05/04	8:00am-1:00 pm	1	Low	10	87	29.6
Aore Island	5/05/04	3:00 pm – 6:00 pm	2	High	10	100	29.6
Million DP	6/05/04	3:00 pm-5:00 pm	4	High	4	53	24.75

Cot Surface area estimation

The following results is just an estimation of the potential Coral Reef damage that can be cause by Crown of Thons in a particular time interval assuming that they are all feeding and moving along in the same rate. The bottom surface area is calculated based on the assumption that Crown of Thorn's have a spherical shape. Therefore Area = πr^2 (m²)

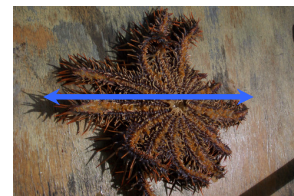


Fig x: shows COT basal diameter

Table 2: This Table shows the estimate area of Coral Reef Damage that can be caused by COT per site per time interval.

Site Name	Total number of cot collected	Number of COT measured	Average Basal Diameter (cm-m)	Average Feeding Surface Area per COT (m ²)	Estimated Area of Reef Damage/time interval (m ² /T)
Million DP	102	20	24.75 –0.2475	0.05	5.1
Aore DP	187	20	29.6- 0.296	0.07	12.6

Sample Calculation

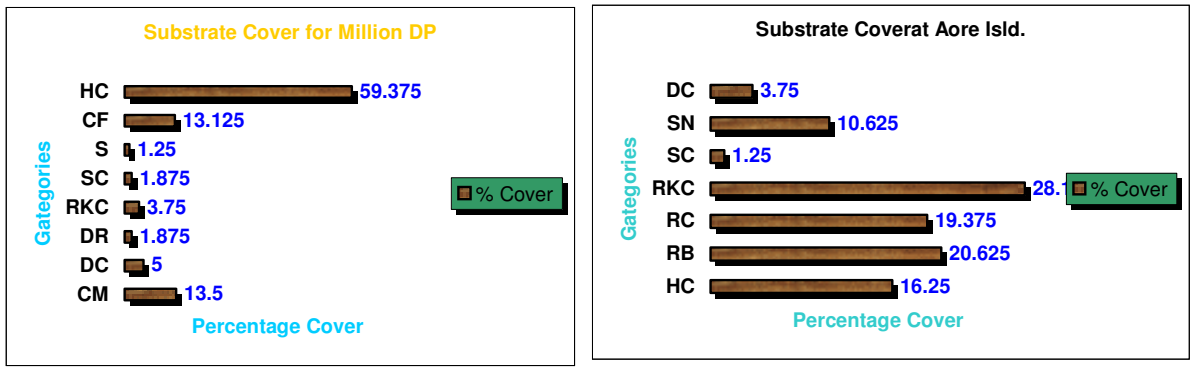
$$\text{COT av.basal area (Million DP)} = \pi r^2 = 3.14 \times (0.2475/2)^2 = 0.05 \text{ m}^2$$

Therefore the amount of coral that can be damaged by the collected number of COT at Million DP = Average basal feeding surface area/COT x Total Number of COT collected

$$= 0.05 \text{ m}^2 / \text{COT} \times 102 \text{ COT}$$

$$= 5.1 \text{ m}^2 / \text{time interval}$$

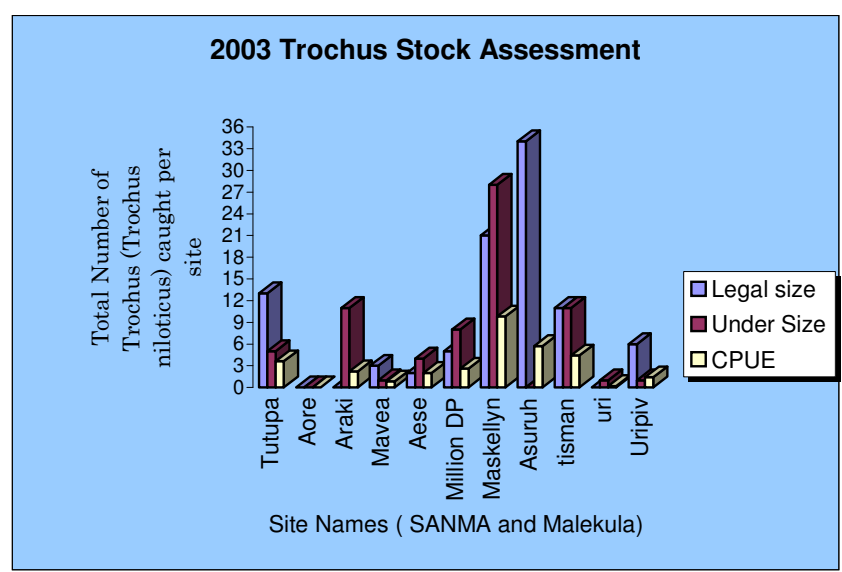
Reef Check Results



Million Dollar Point has a fringing reef system that has a gradual slope and stretches to about 400 meters. This site has a higher percentage cover of Living Corals of 74.75 % as shown in the chart. Living Corals are represented as HC – Hard Corals, SC – Soft Coral and CM – Massive Corals. Dead Corals (DC – Dead Coral and RKC – Recently killed Corals) were present in small percentages as shown in the chart of 8.75 %. Coral Fragments (CF), Sand (S) and Dead Rock (DC) covers 16.25% of the total substrate cover. Therefore the Reef in this particular site is generally in its pristine condition.

The reefs at million Dollar Point supports a diversity of Marine Fish and Invertebrates as seen during the cleaning up. Though there was no fish survey conducted, the fish populations in the area are still healthy as compare

Chart x: 2003 trochus stock assessment for Sanma Province



to commercial important Invertebrates such as Trochus niloticus whom the survey team only found 2 and some Bech Der Mer Species. Giant Clams were also present but in low numbers with only

Maxima and *Terasa* species recorded.

In 2003 the trochus catch per unit effort (CPUE) was 4 trochus/diver/hour as shown in chart x.

Million Dollar Point is known for its tourist's attraction PSS President Coolidge dive site. However the living marine environment including corals, fish and other living organisms complements the beauty of this site. Allan power has recorded an increase in the number of visitors mainly tourists who spend a lot of money just to get to dive and enjoy the beauty of the site.

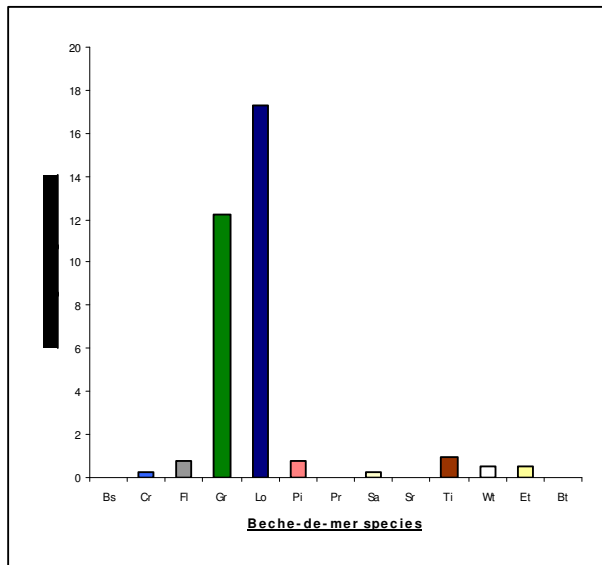
Apart from being the most famous dive site in Sanma Province, the reef around the dive site provides an important fishing ground for indigenous people living around the site. At low tide women and old men clean the reef for shellfish and other invertebrates such as octopus species for their family consumption as protein supplement in their diet. Similarly men use nets, underwater spear guns and hand held lines to catch fish for consumption and sometimes part of the catch is sold for much needed cash. Commercialized shellfish especially trochus niloticus has been harvested in this site in the past years and shell sold to buyers for export. Export figures from 2000-2002 revealed that 1.5 tones (Vanuatu Fisheries data for 2004) of raw shells were sold from Million Dollar Point area.

Status of Million Dollar Point Marine Protected Area.

This area has been declared a marine protected area in 19... and until today there has not been any management plan in place to manage the site. This has resulted in some activities that threaten the nature of this MPA for instance people have free access into the site and do anything they want. As a result, poaching is a major problem threatening the marine biodiversity in the area. This was revealed by the dive operators in Luganville, Santo.

Aore Island site has a poorly developed fringing reef system that has a gradual slope and stretches to about 400 meters. Since the fringing reef system was poorly developed, patched reef form the base for both hard and soft coral in the area. Unlike Million Dollar Point, the site on Aore Island as shown in picture x, the dead component was more than 60 % of total percentage substrate cover. This comprises of Recently Killed Corals (RCK) with the highest value of 28.1 %, Dead Rock (DC), Sand (SN) 10.6 % and Dead Coral (DC) 3.75%. On the other hand the living component of the reef was classified as coral that are alive and maintain the development of the reef. This consist mainly of Rock bolder (RB) 20.6%, Hard Corals (RC) 16.25 % and soft coral (SC) 1.25 %.

Aore island is a potential site for tourism development in the future because of its beauty nature and that the coastal waters support a vast diversity of



living marine organisms including coral. Already there are some tourism development taking place but at a very small scale. Despite that the site is frequently visited by Luganville Residents either for recreational purposes or doing some fishing activities. Therefore like Million Dollar Point, it is a fishing ground for subsistence fishers living on mainland area in Luganville Town and surrounding areas.

Stock Assessment Results in 2003 shows that, there were no Trochus (*Trochus niloticus*) found but a good diversity of Bech De Mer as shown chart x. The two-dominating species were Green Fish, Gr (*Stochopus chloronotus*) and Lolly Fish, Lo (*Holothuria atra*). The survey was conducted on the same site as shown in picture x. It was during this survey that the Crown of Thorn outbreak was first discovered.

Selecting an Indicator Species for COT Damage Reefs.

Indicator Species

This is to define specific marine organism species that have a more closer association with Coral reef and their survival is threaten should the coral reef be destroy by Marine Organisms, Natural disasters and Human induce damage.

It is difficult at this stage to define specific indicator species for both Million dollar Point and Aore Island sites because this will require more in-depth survey of both sites. For Example at this early stage of COT removal there is no information on the type of fishing activities being conduced and the species being target on both sites. Therefore more surveys should be conducted to really come up with such concrete information.

However Corals are always there, and they can always act as indicators for COT because they prefer some coral species only and not all. With that the Coral Reef Check method that is used in checking both sites will be useful in this early stage of COT clean up to monitor the level of damage.

Discussions

Vanuatu has a total reef area of 406 km² (Bell & Amos 1993) consisting of narrow fringing reef and a few lagoons and barrier reefs. Coral reefs in Vanuatu has a critical function in terms of Coastal habitat protection and provide protein supplement for locals or coastal people. Additionally coral reefs form the basis for economic activities in the rural areas thus contribute to the overall economy of this country. However, these coral reefs were continuously under threat of man induce and natural threats.

Man induce threats include live stock farming, soil erosion, effluent discharge from septic tanks, Eutrophication caused by domestic sewage discharged into our reef areas and coastal constructions. Past researchers have indicated that the most common form of natural damage to coral reefs in Vanuatu is caused by Cyclones because Vanuatu has a cyclone frequency ranging from 1cyclone/3 years to 3-cyclones/1 year. Since men do not control cyclones there is no way this can be prevented. But Crown of Thorns (COT) starfish *Acanthaster planci* which is also a form a natural threat is coming out very strongly in some areas severely damaging coral reef. Past researchers have reported seeing COT's in several sites including Port Vila, Aneityum, Epi and Malekula but deduce that coral regeneration was quite good in all sites. Recent outbreaks sites as reported by the Fisheries Department Research Team include Million Dollar Point and Banban area, Aore Island in Sanma Province and Epi. Since COT's can be control by manually collecting them and dispose them away from the reef area the Department of Fisheries, Environment Unit, Santo Dive operators and Banban Youths initiated some trial cleaning up of the two sites in Santo.

COT collected at Million Dollar Point (MDP) and Aore Island

A total of 102 COT were collected at MDP during the first while 97 were collected in the second cleanup, similarly 187 were collected at Aore Island during the first cleanup and 160 were collected during the second clean up. These numbers were collected during daytime though the numbers could have been higher if night dives were carried out. However considering the risks of night diving the day dives was recommended.

Crown-of-Thorns has been sighted in these two reefs for the past decades but locals did not have any knowledge on its predation threats to live corals. Until the beginning of this year they were aware of the potential threats and are very keen to organize their own clean up work. Locals have also reported that they have sighted large populations in the past and having no knowledge on the animal's biology, sometimes people cut the COT's into pieces and dump them back into the sea. Since COT's can regenerate the pieces that are able to grow back produce more COT's. This has contributed to the current outbreak of COT in the two areas.

Reef check results (Fig: x and Y) from the two sites clearly show that hard coral species have been damaged. For example the percentage of hard coral cover at Aore is 16% and 59% at Million Dollar Point of the total 100% substrate cover for each site. Additionally Aore has approximately 23% of Recently Killed Corals (RKC) while million-dollar point has 3.5 %. Further more Aore has approximately 4% Dead Coral (DC) and approximately 5% at Million Dollar Point. From these results it is clear that MDP has better coral reef development compare to Aore, however reefs at Aore are facing a greater threat from COT than Million Dollar Point and are prone to overexploit. Since Crown of Thorn starfish is a potential coral reef predator

*How do Crown of Thorns *Acanthaster planci* Feed?*



“Crown of Thorns feed by bushing its stomach out through the mouth and all or part of the coral colony with the stomach consuming and digesting away all the live coral tissue”. *The above picture shows a disturbed-feeding COT with its stomach still outside its body.*

and considering the high numbers in the area we assume that they contributed to some of the damage.

Calculating the basal length of COT may sound very inappropriate at this early stage because the size of the stomach does not cover the whole length of the animal while feeding at a particular time. However while feeding the whole body of the animal maybe causing some stress in the coral itself thus contributing to coral mortality. For example a

From the 2003 stock assessment survey observations shows that 90% of hard corals were dead starting from point **A** to midway from point **B** at Aore Island (see, photo x page x).

Apart from that, wild corals (*Millepora species*) were harvest from this site and were export to overseas markets. This operation, own by a local Ni-Vanuatu has already being ban to operate and two years ago the company discussed with the fisheries department for coral farming possibilities.

The report should cover: the following

1. The coral reef assessment done by the Department of Fisheries in 2003.
2. Proposal to the Environment Unit NBSAP Add-on project to fund the clean up.
3. Consultation with the Fisheries Extension Office in Luganville regarding the COT clean up and their involvement in the awareness component. Also to include involvement of Dive operators.
4. Methods use to assess the coral reef cover and COT clean up.
5. Analyzing and discussion of results
6. Discuss the capacity building needs to carry out coral reef (including fishes and other associated invertebrates) monitoring. (See the attached definition of capacity building needs). This should also include a discussion of possible or appropriate biological indicator species that are use or can be used to monitor state of coral reefs. A list should be annex.
7. Recommendations following the clean up and establishment of monitoring sites.

OUTPUTS

The outputs of the clean up would be a written report no more than 20 pages to the Environment Unit NBSAP Project in paper and computer disk formats. The report format will include:

- A cover page that clearly displays the title of the report, the authors, their affiliations and date of completion.
- A table of contents, including appendices
- Acknowledgements
- An executive summary
- A reference list
- As an appendix to the report, a list of people and organizations contacted in conducting the clean up campaign and date of contact.

A draft report should be submitted to us for review prior finalization.