

COMPONENT 2A - Project 2A2
Knowledge, monitoring, management and
beneficial use of coral reef ecosystems

January 2007

CRISP



Coral Reef InitiativeS for the Pacific
Initiatives Corail pour le Pacifique

REEF MONITORING

ROTUMA ISLAND (FIJI) CORAL REEF SURVEY REPORT 2006

November, 8 - December, 7

ROTUMA CORAL REEF CONSERVATION PROJECT III



CRISP



Coral Reef InitiativeS for the Pacific
Initiatives Corail pour le Pacifique



The CRISP programme is implemented as part of the policy developed by the Secretariat of the Pacific Regional Environment Programme for a contribution to conservation and sustainable development of coral reefs in the Pacific

The Initiative for the Protection and Management of Coral Reefs in the Pacific (CRISP), sponsored by France and prepared by the French Development Agency (AFD) as part of an inter-ministerial project from 2002 onwards, aims to develop a vision for the future of these unique eco-systems and the communities that depend on them and to introduce strategies and projects to conserve their biodiversity, while developing the economic and environmental services that they provide both locally and globally. Also, it is designed as a factor for integration between developed countries (Australia, New Zealand, Japan, USA), French overseas territories and Pacific Island developing countries.

The CRISP Programme comprises three major components, which are:

Component 1A: Integrated Coastal Management and watershed management

- 1A1: Marine biodiversity conservation planning
- 1A2: Marine Protected Areas
- 1A3: Institutional strengthening and networking
- 1A4: Integrated coastal reef zone and watershed management

Component 2: Development of Coral Ecosystems

- 2A: Knowledge, monitoring and management of coral reef ecosystems
- 2B: Reef rehabilitation
- 2C: Development of active marine substances
- 2D: Development of regional data base (ReefBase Pacific)

Component 3: Programme Coordination and Development

- 3A: Capitalisation, value-adding and extension of CRISP Programme activities
- 3B: Coordination, promotion and development of CRISP Programme

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COMPONENT 2A

Knowledge, monitoring and management of coral reef ecosystems

■ **PROJECT 2A-1 :**

Postlarvae (fish and crustacean) capture and culture for aquarium trade and restocking

■ **PROJECT 2A-2:**

Improvement of knowledge and capacity for a better management of reef ecosystems

■ **PROJECT 2A-3 :**

Synopsis and extension work on indicators for monitoring the health of coral ecosystems and developing a remote sensing tool

■ **PROJECT 2A-4 :**

Testing of novel information feedback methods for local communities and users of reef and lagoon resources

■ **PROJECT 2A-5 :**

Specific studies on i) the effects on the increase in atmospheric CO₂ on the health of coral formation and ii) the development of eco-tourism

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Cover picture - *Povona* growing amongst *Acropora* branching coral.



1. INTRODUCTION

The Rotuma Coral Reef Conservation Project (RCRCP) trip III to carry out the annual survey of Rotuma's coral reef was during from the month of November from the 14th to 22nd in 2006. The diving survey group consisted of four volunteer divers from mainland Fiji and one volunteer diver who lives on the island. All five divers volunteered their time to assist LājeRotuma Initiative (LRI) in its RCRCP activity. Three of the Suva-based divers are employees of the Wildlife Conservation Society (WCS) and the fourth, a graduate student under the Coral Reef Initiative for the South Pacific (CRISP) programme, from the School of Marine Studies (SMS) at the University of the South Pacific (USP).

Two of the WCS volunteers are certified SCUBA (Self-Contained Underwater Breathing Apparatus) instructors with PADI (Professional Association of Dive Instructors), and the graduate student a certified PADI Rescue Diver. The final two members of the dive team are both PADI certified Advanced Open Water divers.

The first RCRCP survey in 2003 focused on providing a biological baseline survey of Rotuma's coral reefs using Reef Check surveys to assess reef health. This expedition was conducted in October of 2003 with 11 sites of reef areas around Rotuma surveyed.

The RCRCP II was conducted in May-June 2004. The objective of the RCRCP II was to re-survey the permanent sites from the previous year and to survey six new sites that were not surveyed on the first expedition. This was to ensure that surveyed sites covered the entire island, and produce a non-biased assessment of Rotuma's reefs.

For this report RCRCP III main objective was to re-survey those permanent sites from the previous two expeditions. A comparison of the three sets of data was made to assess the benthic cover trends possibly related to human and natural influences onto Rotuma's reef ecosystem. An awareness campaign for turtle conservation was also initiated in preparation for the next turtle survey work in 2007.

Community sessions were conducted with various communities around the island to carry out follow up environmental awareness and inform about the current coral reef work done by the divers. Meetings were held at Ut'utu village, Noa'tau Catholic Youth Group, Hapmak village, Toa'koi village, and the Motusa Seventh-Day Adventist Youth Group.

Science training was also conducted at Ut'utu Village and the training included basic coral reef ecology, the common organisms found on Rotuma reefs as well as good practice principles for fishermen whether they be out fishing or out on the reef. There was high attendance for the community sessions.

2.BACKGROUND

2.1 LājeRotuma Initiative

LājeRotuma Initiative (LRI) is a community-based environmental education and awareness development programme in Rotuma initiated in February, 2002. For over the past five years the Initiative has expanded greatly from primarily environmental education and awareness programs to conducting surveys and scientific research in an effort to enhance understanding of Rotuma's social and economic circumstance in effect to the people's management of the island's natural resources. LRI has a network of youth volunteers that both live on the island and in mainland Fiji, whom are sourced for field visits. LRI encourages youth participation in its activities in an effort to to strengthen the capacity of youth as well as assist in the mobilization of community to manage well their natural resources. LRI is also part of a diverse network of the island communities, Rotuma Council, government departments and line ministries, donor agencies, institutions, conservation non-governmental organizations, professionals of varied backgrounds in energy, agriculture, business, conservation, environment, fisheries, diving and sustainable development.

LRI is an environmental adviser to the Council of Rotuma and in its goal to enhance understanding of islanders about its island ecosystem and effort to manage well its natural resources, the Initiative carry out its plan of action under the listed programmatic themes. 1) Community outreach 2) Building community resilience to climate change, 3) Integrated fisheries management 4) Sustainable livelihood options and 5) Research and capacity building for indigenous young people in their pursuit for further education as well as training opportunities for island youth in non-formal/ vocational education. The RCRCP is listed under the Research and capacity building Programme which has been an ongoing annual activity since 2003 with availability of funds. Funding assistance from the Global Coral Reef Monitoring Network (GCRMN) and Vodafone Fiji Foundation enabled the planning and successful implementation of the annual activity. Some of research work previously carried out by LRI and or facilitated by the Initiative includes the marine turtle conservation project supported by funds disbursed through the Institute of Marine Resources (IMR), The most recent post-graduate research is for a study of the subsistence fisheries in Rotuma Island sponsored under the Coral Reef Initiative of the South Pacific (CRISP), both of which are housed at the University of the South Pacific.

2.2 Geography and status of marine environment

The main island of Rotuma (location: 16°35' S, 177°00' E) with an approximate land area of 43 sq. km is located approximately 465 km North of the Fiji Islands. Rotuma has a central chain of forest clad peaks and undulating coastal flats of varying width. Its volcanic soil is very rich, supporting luxuriant growth of flora. A narrow sandy isthmus at Motusa connects the two essentially distinct parts of the island. Three small volcanic islets and five reef islets surround the main volcanic island of Rotuma. These islets are respectively, Hatana, Hafliua, and Uea, and Afgaha, Husia rua, Solkope, Solnahu, and Houa. The highest point in the Rotuma group is approximately 255m above sea level and is on the outer island of Uea.

Rotuma has no rivers or streams, that could input sediment to the onlying reef areas fringing the island. Therefore, there are no mangrove or estuarine habitats present except for a seagrass meadow located at the Maka Bay. Well-developed fringing reefs surround the island and the reef flat is narrow in all but a few places, notably the southeast corner of Noa'tau district. The Oinafa coastline provides enough shelter where the jetty and causeway is located and which last repair work was carried out in December 2001.

The location of coral reefs, with respect to extreme weather patterns, affects coral health in Rotuma. For eight months of the year, southeast trade winds prevail on Rotuma after which it turns to the northeast. The southern reefs are exposed for two-thirds of the year compared to only four months for the northern reefs. Conditions for optimal coral growth favor reefs from Itu'muta to Ut'utu along the northern coast.

Ocean water temperatures recorded on dive computers on the 2006 expedition ranged from 29-31°C. During the 2004 May expedition, ocean water temperatures were 28-29°C. Water visibility in the 2006 expedition was as much as 25m and as low as 15m at Itu'muta, compared to the 2004 expedition where visibility was on average 15-20m on most days. There were also minimal cloud cover was recorded with 10-15 knot winds from the southeast.

2.3 Population

There are seven districts on the island, Itu'muta, Itu'ti'u, Malhah'a, Oinafa, Noa'tau, Pepjei and Juju. Itu'ti'u is the largest district made up of six villages and has the highest population of all districts with 456 individuals.

The surveyed total population in 2003 was 1,358 people according to a socio-economic survey conducted by LRI in 2003. The population is made up mostly of young people of whom when they come of age, leave the island for mainland Fiji supporting figures which indicate a steady decline in population for over the last fifty years. Most migration out of Rotuma Island is due to opportunity to find employment and further education in mainland Fiji. Expectantly there is high remittances to the island playing a vital role in the economic returns to Rotuma., and an increasing dependence on processed packaged food items from the stores. An environmental concern is the resulting increase in number of household discarded/ rubbish items such as plastic packaging and empty cans, bottles as well as the shift of resource use from being heavily dependent on land and sea for food to moving away to buying in shops. There is a decline in fishing trends based on evidence on the low number of canoes owned per village as well the increased use of improved fishing gear and effort . This could mean that the connection and islanders' dependence on the reef resources have shifted from what the status was say some 20-50 years ago.

Known marine environmental concerns from previous consultation included community observations of smaller sized and reduced catch to date, the prolific growth of a hard coral species *Pavona* which has overgrown all other coral life and clogged the many fishing holes nearshore, turning much of the lagoonal area to raised cement-like platform. This local phenomena is referred to as Kama. Due to village setting near the coastline located at most areas some fifty meters away from the high tide mark, there is a high tendency by communities to dump household rubbish to the beach area. Irresponsible dumping coupled with coastal erosion creates a risk to flooding, human health and food security of the village due to the need to venture further away and out of the inshore shallow reef areas to fish.

Overall anthropogenic impacts are considered low to medium. There is no commercial harvesting of live rocks, live fish trade, invertebrates for curio sales, aquarium fishing, sewerage or industrial pollution, tourism (tourist snorkeling or dive operations).



3. METHODOLOGY

The RCRCP III employed Reef Check/Global Coral Reef Monitoring Network (GCRMN) methodology as used in the pilot study to determine substrate cover, fish and invertebrate counts to reflect reef health and promote conservation and environmental awareness, especially for the people of Rotuma.

This method involves the use of a 100m transect line at a shallow depth (3-6m) and a deeper one (8-12m). Both stations are collectively known as one site. During RCRCP I, a steel peg was used to mark the beginning and end of a transect line. Each transect is divided into four segments of 20m, each separated by 5m intervals. Within these segments, four sets of data were gathered: 1) site description, 2) substrate or benthos data, 3) fish counts, and 4) invertebrate counts.

A GPS (Global Positioning System) handheld unit was used to relocate the permanent monitoring sites.

Dive Plan

The dive plan was conducted as follows:

Site Name	Date of dives
Fapufa	November 14, 2006
Hapmafau	November 14, 2006
Itumuta (Maftoa)	November 15, 2006
Itumuta (Ahau)	November 15, 2006
Malhaha	November 16, 2006
Hapmak	November 16, 2006
Lulu	November 20, 2006
Lopta	November 21, 2006
Oinafa	November 21, 2006
Paptea	November 21, 2006
Juju	November 22, 2006
Haga	November 22, 2006
Kalvaka	November 22, 2006
Ut'utu	November 24, 2006

Table 1. Dive plan for Rotuma Coral Reef Conservation Project III



4. RESULTS

Based on the previous two expeditions, there was a series of seventeen sites to re-survey for the Rotuma Coral Reef Conservation Project (RCRCP) III. Fifteen of the seventeen total sites were able to be re-surveyed. Due to rough weather conditions, two sites were not re-surveyed located at Ko'ta and Losa both on the exposed side of Rotuma Island that frequently experiences heavy swell and 15-20 knot easterly winds.

Map of Rotuma Island

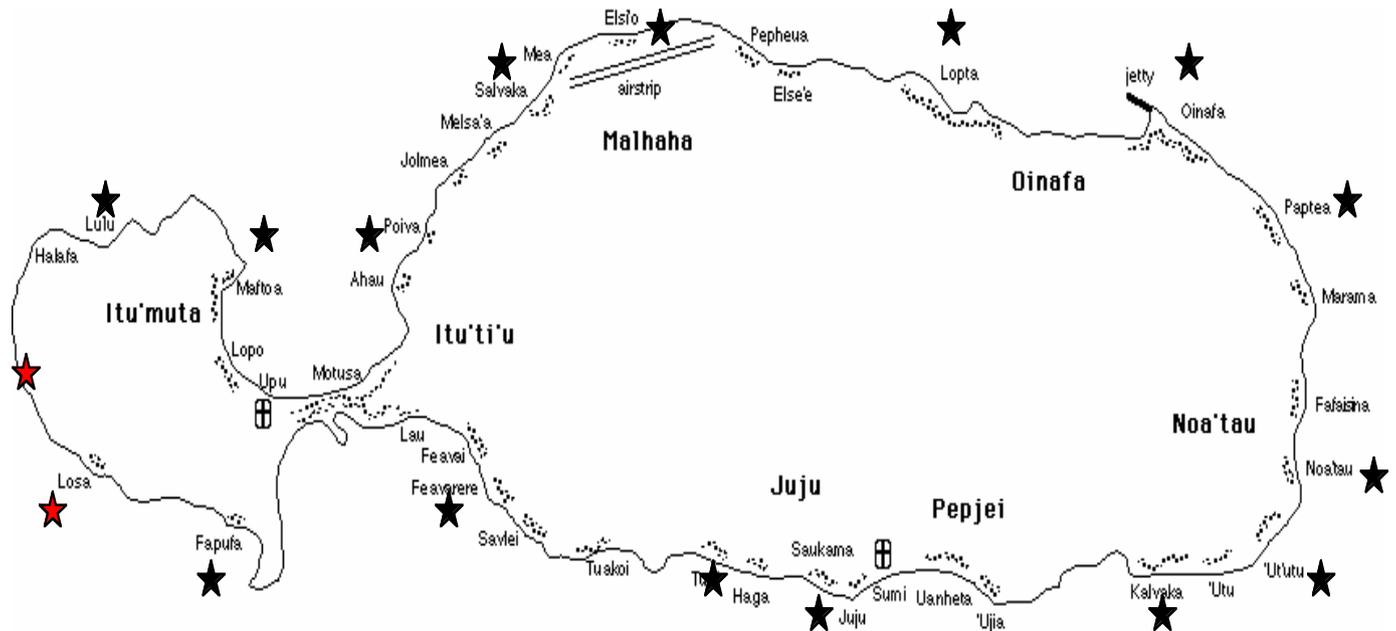


Figure 1. Location of surveyed sites around Rotuma Island. Losa and Ko'ta are indicated in red.

4.1 Benthic Cover

Substrate Type	Deep			Shallow		
	2003	2004	2006	2003	2004	2006
Live Coral (LC)	32.63	26.38	53.32	30.00	30.21	62.09
Soft Coral (SC)	0.00	0.75	0.60	0.00	0.42	0.30
Sponges (SP)	0.25	1.38	0.00	0.63	0.21	0.15
Zoanthids (ZO)	1.25	1.50	1.38	0.00	1.04	0.00
Algae	42.75	46.50	28.94	34.38	38.33	23.96
Dead Coral w/ Algae (DCA)	13.13	10.25	2.33	21.67	11.67	2.99
Abiotic	7.63	11.76	16.37	11.25	17.08	13.51

Table 2. Mean substrate cover for all re-surveyed sites for the years 2003, 2004, and 2006.

There was more live coral cover recorded in the shallow sites than the deep ones.

A comparison was made between the data collected in the previous expeditions with the expedition of 2006. Separate comparisons were also made between the deep sites and the shallow sites for the categories of live coral and their life forms, and algae. Live coral cover at both transects for deep and shallow have increased since the previous survey in 2004.

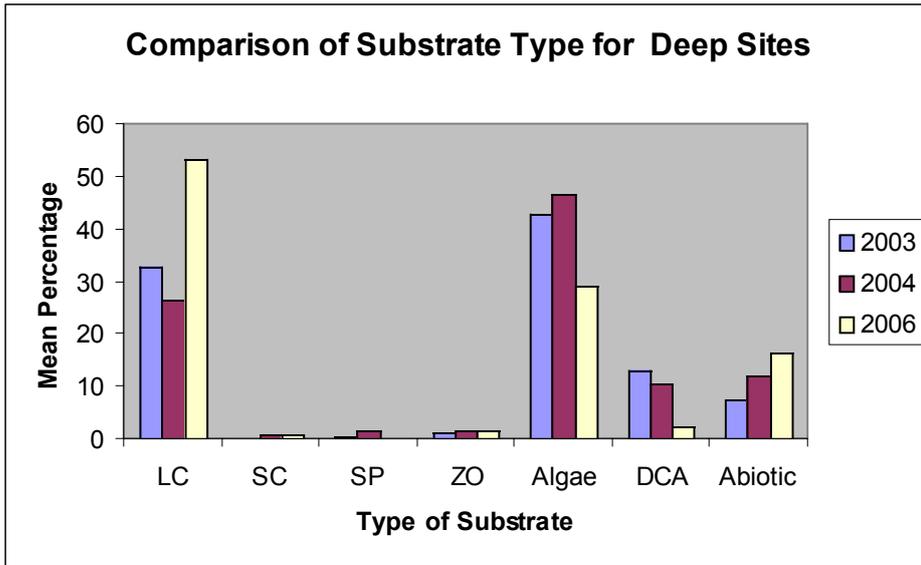


Figure 2. Comparison between the years of 2003, 2004, and 2006 of substrate types for all deep sites surveyed.

For the deep transects at the Rotuma sites, it is demonstrated above that live coral (LC) and Algae had the highest percent cover with surveys during 2003, 2004 and 2006. Considering the overall percent cover, there is a moderate representation of the different substrate types (each below 50% coverage) except for live coral coverage in 2006 survey. The substrate data presented an impression of a reef covered with more live than dead substrate matter when a comparison of Abiotic substrate cover is made against the sum of all live type substrates- LC, SC, SP, ZO, Algae and DCA.

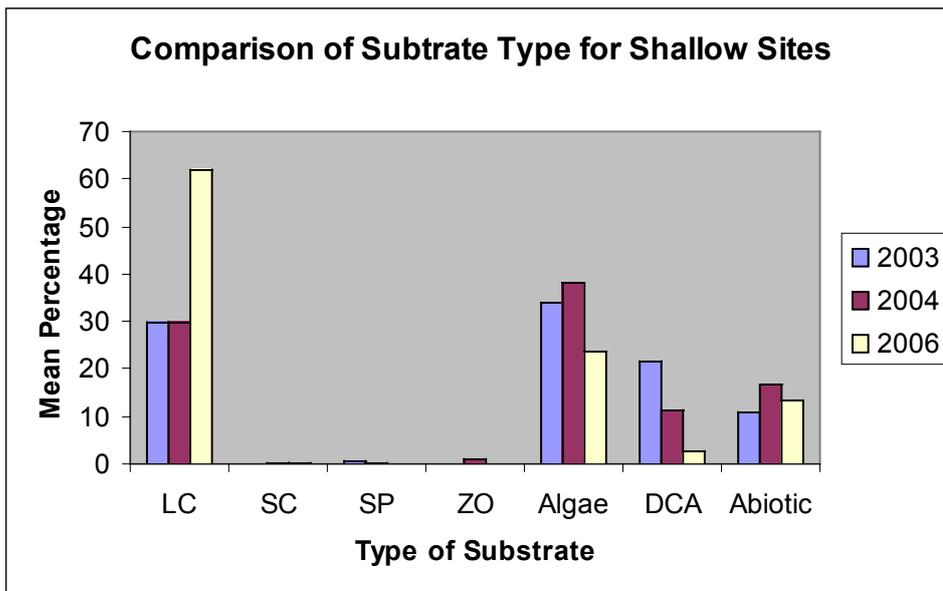


Figure 3. Comparison between the years of 2003, 2004, and 2006 of substrate types for all shallow sites surveyed.

For substrate cover at shallow reef areas surveyed, Figure 3 suggests a higher live coral coverage (above 50% cover). Compared to the previous two years' survey, there is no significant change in the ratio of coverage for each benthic/substrate type.

Algae Type	Deep			Shallow		
	2003	2004	2006	2003	2004	2006
Algal Assemblage (AA)	2.61	6.50	3.88	0.75	2.57	4.03
Coralline Algae (CA)	25.68	21.75	12.32	37.06	14.06	12.69
Halimeda sp. (CA)	16.53	15.50	8.70	4.56	5.25	3.28
Macro-Algae (MA)	0.28	1.38	1.72	0.38	1.56	0.90
Turf Algae (TA)	2.50	1.38	0.00	3.94	7.88	0.07

Table 3. Mean percentage of algal cover for the years 2003, 2004, and 2006 for re-surveyed sites.

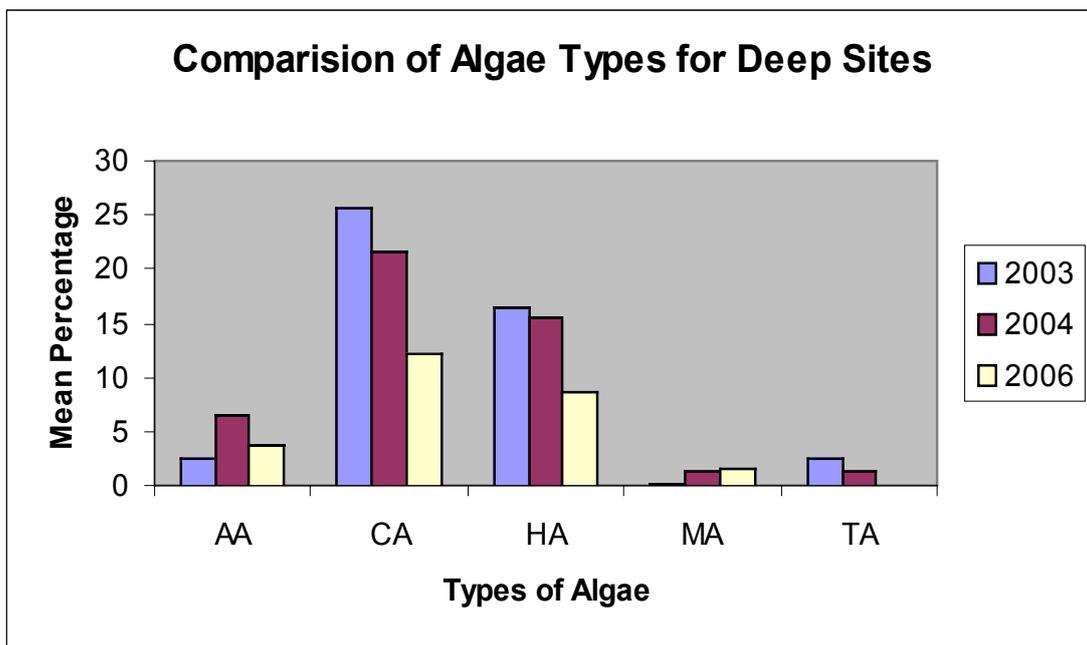


Figure 4. Comparison of algal types between the years 2003, 2004, and 2006 for all deep sites re-surveyed.

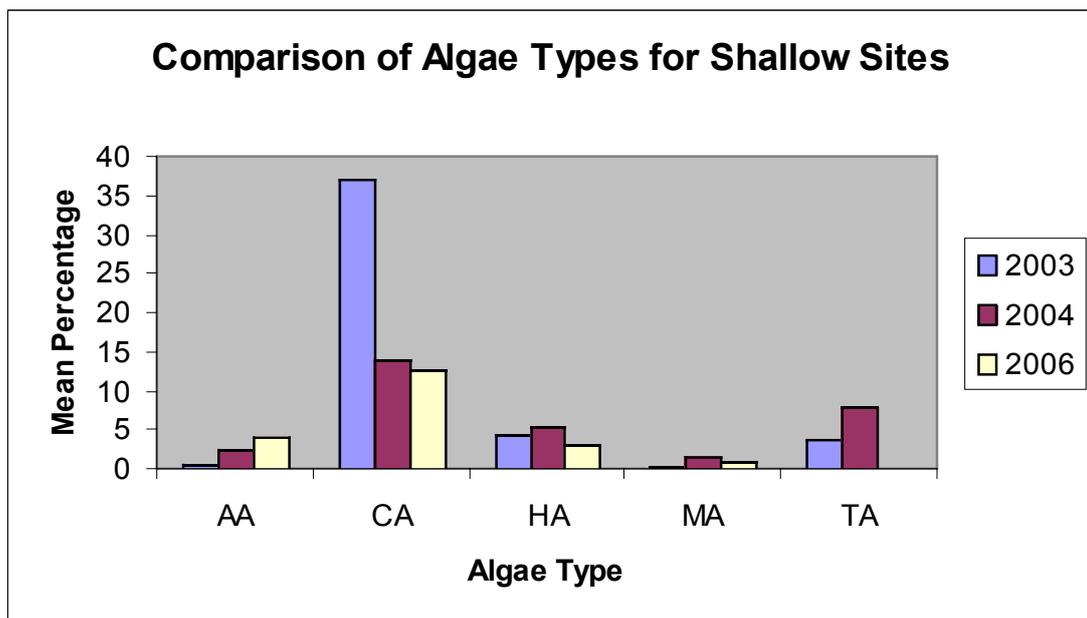


Figure 5. Comparison of algal types for the years 2003, 2004, and 2006 for all shallow sites re-surveyed.

Algal coverage at both the shallow and deep transects (sites) do not exhibit significant change in the algal composition of surveyed reef areas.

The lifeform of all hard corals was also recorded a comparison between the three years survey data was made.

Live Coral	Deep			Shallow		
	2003	2004	2006	2003	2004	2006
Coral Growth Type						
Acropora Branching (ACB)	4.15	2.63	4.57	5.50	9.24	11.27
Acropora Encrusting (ACE)	0.34	0.25	0.00	0.19	0.07	0.00
Acropora Submassive (ACS)	0.34	0.25	0.00	1.19	1.25	0.00
Acropora Digitate (ACD)	0.23	0.75	1.03	1.50	1.88	2.61
Acropora Tabulate (ACT)	1.88	1.75	11.37	1.00	0.28	15.00
Coral Branching (CB)	1.93	1.00	1.46	2.06	1.32	1.12
Coral Encrusting (CE)	12.10	10.57	15.85	7.05	3.06	7.61
Coral Foliose (CF)	0.68	2.42	1.38	0.19	0.63	0.37
Coral Massive (CM)	4.09	2.38	14.90	2.13	1.25	6.79
Coral Submassive (CS)	1.88	3.25	2.15	2.69	12.15	17.01
Mushroom Coral (MC)	0.00	0.00	0.00	0.00	0.00	0.00
Blue Coral (CHL)	0.17	0.00	0.00	0.06	0.49	0.30
Fire Coral (CME)	0.34	0.00	0.00	0.63	1.46	0.00

Table 4. Mean percentage of all coral lifeforms for the coral reef survey years 2003, 2004, and 2006.

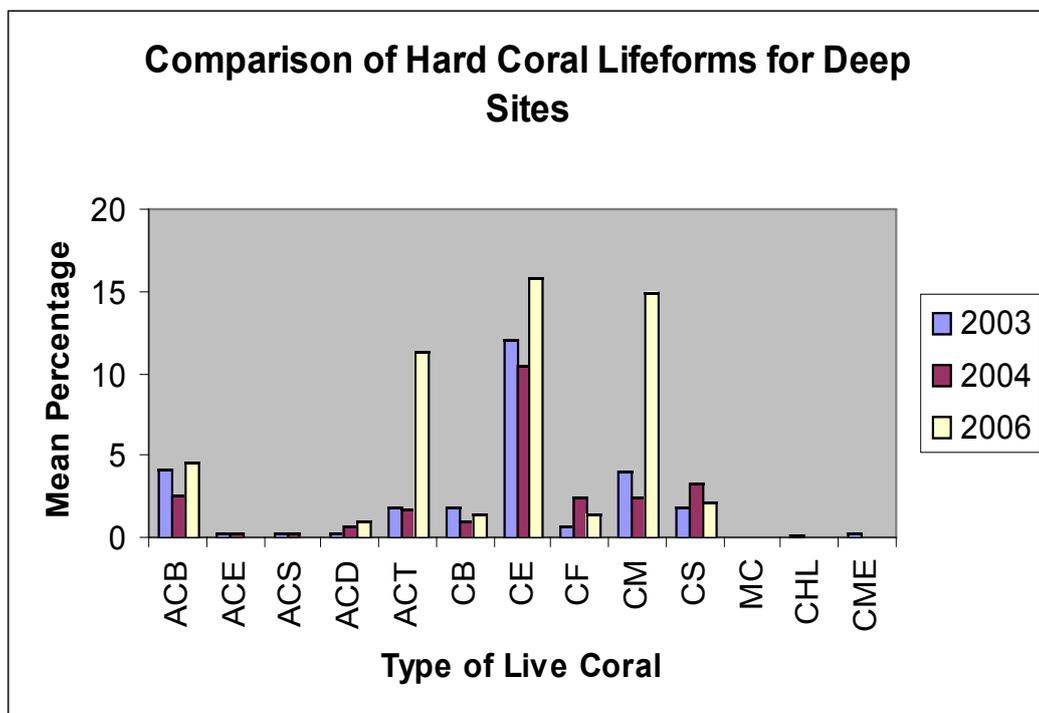


Figure 6. Comparison of hard coral lifeforms between the years 2003, 2004, and 2006 for all deep sites re-surveyed.

The most common coral lifeforms observed in the deep sites/ transects were *Acropora* tabular, Coral Encrusting and Coral Massive.

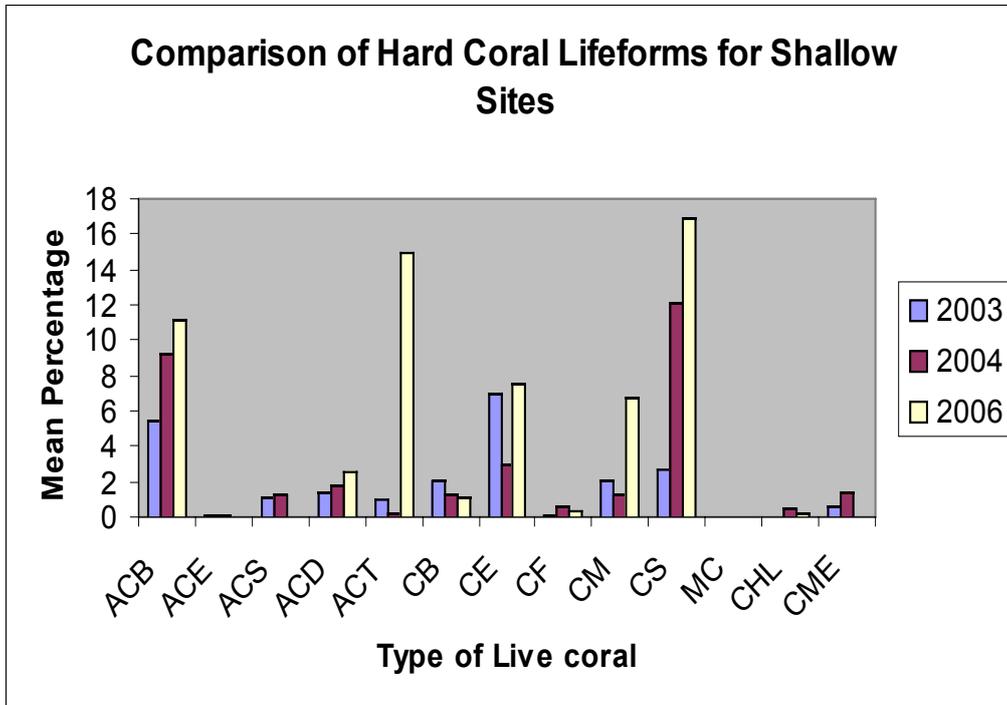


Figure 7. Comparison of hard coral lifeforms between the years 2003, 2004, and 2006 for all shallow sites re-surveyed.

Common coral lifeforms observed in the shallow transects/sites were solitary colonies such Mushroom corals, *Acropora* tabular and branching types.

4.2 Fish

Fish counts were conducted at all sites. The fish list was expanded to include Sweetlips, Emperors, Humphead Wrasse, Bumphead Parrotfish, Moray Eels, Unicornfish, Jacks and Trevally, and also Goatfish. These fish groups were not recorded on previous expeditions. Damselfish and Angelfish were recorded in the previous two expeditions, but were not included in the RCRCP III.

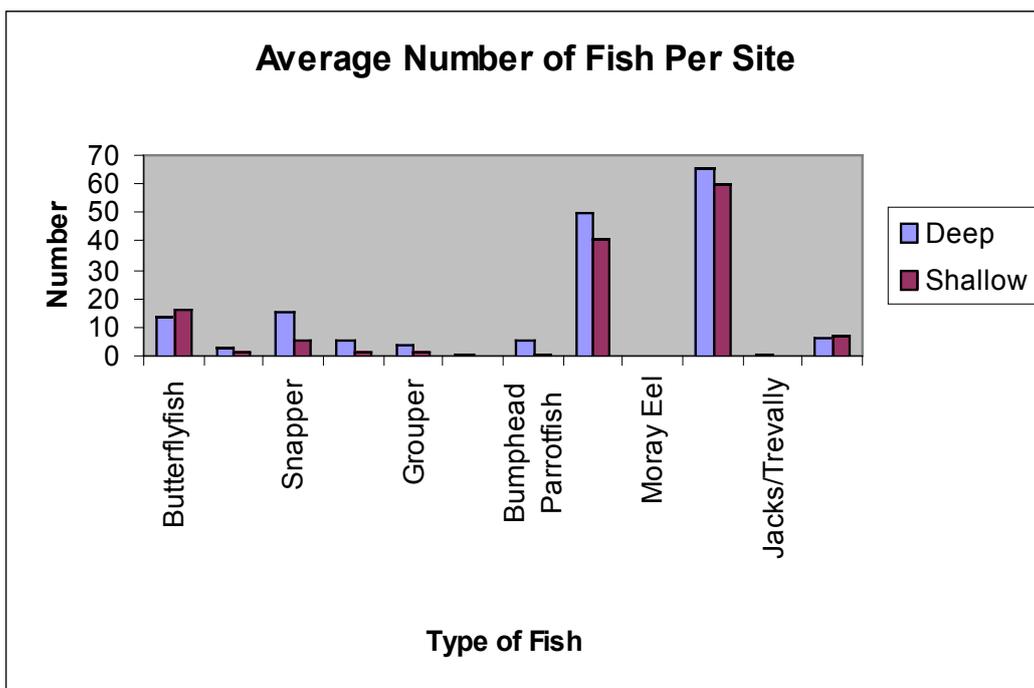


Figure 8. Average number of fish recorded at all re-surveyed sites for the year 2006

There was more fish observed along the deeper transects.

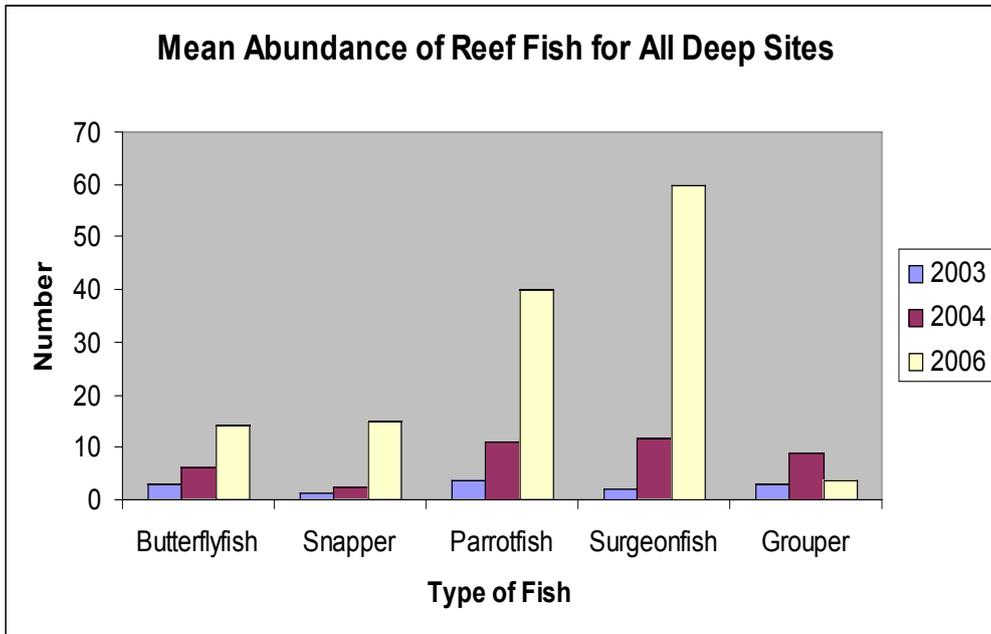


Figure 9. Mean abundance of reef fish recorded at all re-surveyed deep sites for the years 2003, 2004, and 2006

Fish abundance was significantly higher for the 2006 survey, this could be due to the varied observation skills of different surveyors as not all divers engaged in the earlier surveys participated in the 2006 survey.

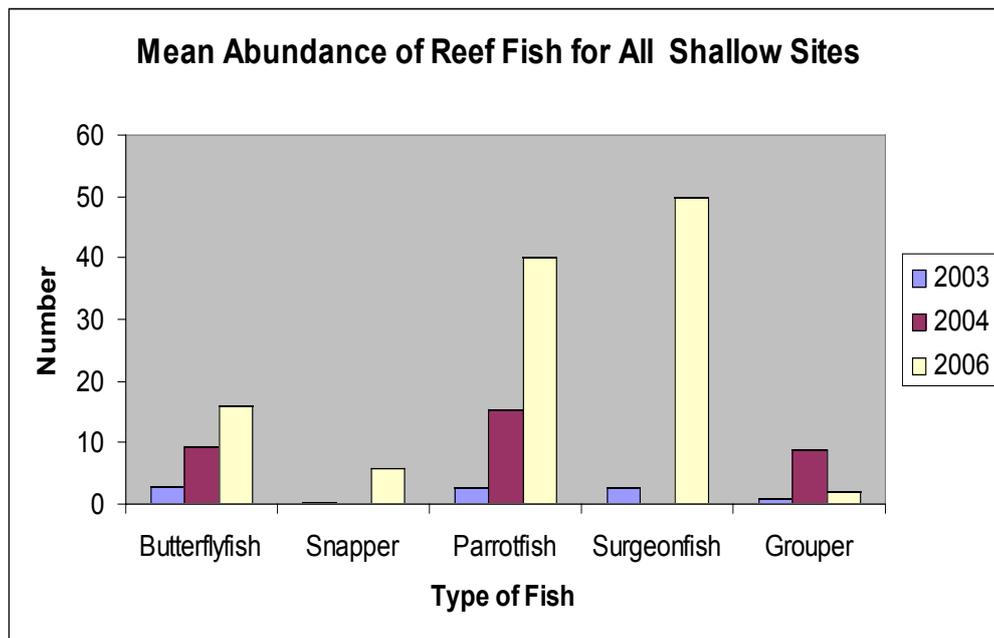


Figure 10. Mean abundance of reef fish recorded at all re-surveyed shallow sites for the years 2003, 2004, and 2006.

Megafauna that were sighted were also recorded. For the deep sites, two turtles and two reef sharks were recorded. For the shallow sites, two turtles, three reef sharks, and one blue-spotted eagle ray were recorded. Off transect, schools of dolphins were sighted everyday the dive team was out in the boat.

4.3 Invertebrates

The invertebrate list for the RCRCP III was expanded to include *Trochus sp.* snail, Crown of Thorns starfish, *Drupella sp.* snail, Spider conch. All sea cucumbers were grouped into one category, whereas in the RCRCP I and II, they were identified down to their common names of brown sandfish and green teatfish.

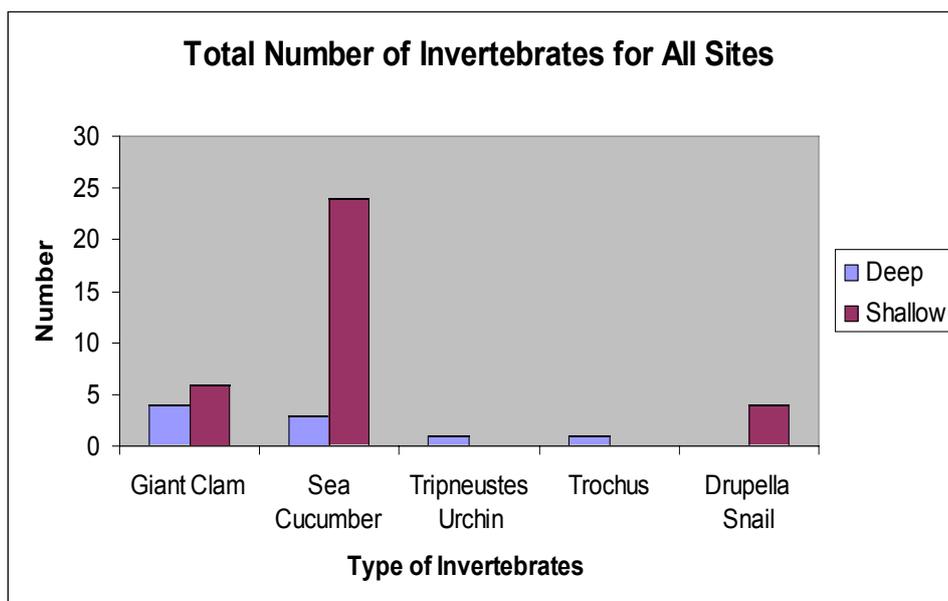


Figure 11. Total number of invertebrates recorded at all re-surveyed sites.

The average size of the recorded invertebrates was also noted. More invertebrates were counted in the shallow transects compared to the deeper transects, with sea cucumbers most commonly found.

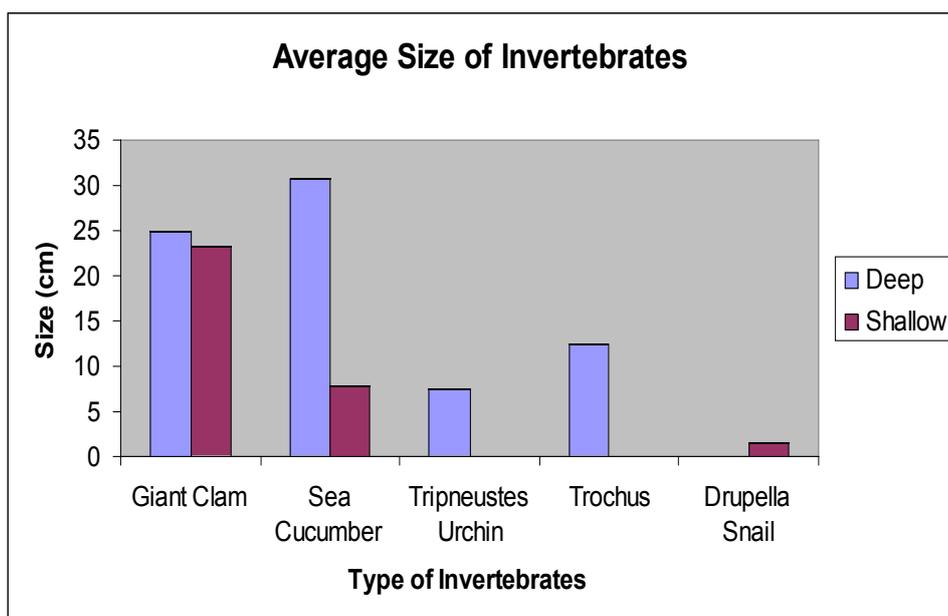


Figure 12. Average size of invertebrates recorded at all re-surveyed sites.

Size range for the common invertebrates found were 25-30cm particularly at the deep transects.

5. DISCUSSION

The mean percentage of live coral cover increased from 27% to 50% in all deep sites resurveyed, and from 30% to 60% in all shallow sites re-surveyed. Algae decreased in mean percent coverage from 47% to 30% in all deep sites, and from 39% to 24% in all shallow sites.

The live coral growth type with the highest mean percent coverage was the same for 2004 and 2006 in both deep and shallow sites. This was encrusting coral. For the deep sites, this was 16%, an increase from 11% in 2004. For the shallow sites, this was 17%, an increase from 12% in 2004.

Coralline algae with the highest mean percent coverage was the same for both deep and shallow sites, as it was for 2004 and 2006. For the deep sites, this was 12% and the shallow sites, with a 13% cover.

Rotuma's reef system supports an abundance of coral species, fish and invertebrates, even though it is exposed to natural elements year round. Commercial harvesting of fish and invertebrates is non-existent, however, there is increasing pressure on the island community to move from subsistence fishing to artisanal and possibly, even commercial fishing.

6. RECOMMENDATIONS

Community awareness on the importance of the marine environment needs to be conducted on a regular basis. LRI currently conducts awareness raising programs through hosting community meetings and other projects like the RCRCP, the school's program, and the waste management initiative.

Community issues raised by members of the island community include the increased use of herbicides and pesticides on plantations. The Agricultural Department encourages plantation owners to use these products, and so there is a conflict between advice provided by the department and that given by LRI facilitators. Concern has been raised over the contamination of the water supply system and because many plantations are located above the water supply area, including the water tables, and chemical run-off in to the supply system is possible.

Continued annual monitoring of the Rotuma Coral Reef Conservation Project's permanent sites is also imperative to keep a consistent track record of the health of Rotuma's reef systems.

There is no management form or form of protection. However, it is obvious that inshore fisheries, for the moment, are sustainable. This is dependent on banning all forms of commercial fishing and harvesting within the inshore areas, and to keep the inshore fisheries resources at a community-use level.

There is an urgent need to remove the grounded vessel M.V. Bulou Ni Ceva from the wharf area as villagers have noticed slick of oil around the partially submerged vessel at high tide particularly considering its close proximity to reef areas important for village fishing, the potential risk contamination by oil leakage from the grounded vessel can impact the ecology of the local reef area.

LRI is currently monitoring reef areas in the vicinity to determine the impact of the grounded vessel for over the next year in terms of immediate ecological disaster. A lobbying strategy was prepared and an online petition development by LRI on behalf of the island community. Rotuma still awaits the decision on the fate of the vessel M.V. Bulou Ni Ceva.

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Reef Check website. www.reefcheck.org

Rotuma website. www.rotuma.net