CORAL TRIANGLE INITIATIVE
ON CORAL REEFS, FISHERIES AND FOOD SECURITY

PAPUA NEW GUINEA

NUAKATA COMMUNITY BASED RESOURCE MONITORING PROGRAM SURVEY REPORT #: 3

MONITORING PERIOD: JUNE 2011

June 2013

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Nuakata Community Based Resource Monitoring Program Survey Report #: 3 Monitoring Period: June 2011

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3

NUAKATA COMMUNITY BASED RESOURCE MONITORING PROGRAM

SURVEY REPORT #: 3
MONITORING PERIOD: June 2011

Underwater world at Nuakata and the hardworking June monitoring team

MONITORING REPORT WRITTEN BY
JOEL ARAEA (*Nuakata CMMA Data Specialist*) and Edited by NOEL WANGUNU
(*Conservation International*)

PREFACE

I warmly welcome you to this 3rd monitoring report for Nuakata Island Community Marine Managed Area (NICMMA). I would sincerely like to thank the Nuakata management committees and the marine monitoring team for a wonderful effort displayed in this June monitoring. This monitoring was a lot tougher than the two previous monitoring programs. The tough conditions induced by strong south-east winds driving rough seas, swells and strong surface and underwater currents which you all felt during your assessment. I am pleased to say that despite these obstacles, the monitoring was pursued, further completing all 16 monitoring sites inside and outside no-take. With the perseverance and determination shown by each member of the monitoring team, I congratulate you all for your time and effort in this important community activity.

Secondly, I would like to extend my sincere world of thanks to Mr. Simeon Isaac and other members of the committee who took out their time in providing additional training to our new members. Your time and commitment has shown positive results in these newly training members now having skills and knowledge to assist the team in the coming monitoring programs.

I also will like to extend my word of thanks to the local boat operators and owners for leading your boats for use during this monitoring period. Lastly, a final word of appreciation is extended to Conservation International and to the Coral Triangle Support Partners (CTSP) for your commitment and funding in building up this level of skills in our community. We thank you for your commitment and look forward to continue our work with you as you continue to provide important management skills and tools to manage our resources for today's use and for our future generation's benefit.

Mr. Anania Mesegai
Chairman (NICMMA)

About this report

This report and the coming reports shall be provided using the format outlined below. This format will always be used so that readers shall become accustomed to what each sections area presenting in the report. It is also important to have a standardized format so that it is easier to describe and compare results between different monitoring programs.

1. Introduction
2. Methods
2.1. Field Data collection
2.2. Data analysis
3. Results
3.1. Benthic substrate (i.e. live coral cover and abiotic substrate found inside no-take and at sites outside no-take where monitoring is conducted inside the 500 square meter transact
3.2. Monitoring reef fish groups used as indicators for many other fishes that fall inside the broad categories of Herbivore fishes, carnivore fishes and fish species with global importance (eg. Humphead Maori Wrasse)
3.3. Marine invertebrates like
3.3.1. Sea cucumber
3.3.2. Giant clam
3.3.3. Other marine invertebrates like trochus shell, lobster and crown of thorn starfish
4. Discussion. This section will provide possible explanations of what the results are and further make comparison with previous reports (e.g. December 2010 monitoring report, March monitoring report etc.)
4.1. Benthic substrate
4.2. Reef fish indicators
4.3. Marine invertebrates
5. References used in writing up this report.

With that I hope you a pleasant reading and should you have any questions or queries regarding any findings in this report, please do not hesitate to talk to me (Joel Araea) or my supervising biologist (Noel Wangunu, CI-Alotau)

1. INTRODUCTION

The successful completion of June monitoring is another milestone for the local monitors for Nuakata CMMA. Faced with great challenges and tasks, the monitoring team has done it again through sheer determination and enthusiasm.

Monitoring results for this period is indicate some slight changes in numbers of monitoring species no different to those done in December and March 2011. Some results have shown some changes, while some showed no change at all. Of all these results from permanent monitoring stations, other general observations for many reefs showed significant coral recruitment with a lot of new settlements on areas with bare bedrock. This has been one positive result for many reefs. A major setback for the last two monitoring periods was the high density records for crown-of-thorn (COT) starfish which continue to show increase abundance in some monitoring transacts. In fact the average record for no-take was 1.5 COT per 500 m^2 per surveyed transact. Many interesting findings in the area include increase population of reef herbivore fishes which signifies a very healthy and pristine condition in many of the reefs; increase records for carnivore fishes inside many no-takes' sampling stations which are good indication of what CMMAs can provide as good seeding or supplier for many open fishing areas for the people of Nuakata Island.

There are other many interesting findings summarized in the report which we would like you to read and know about what is happening inside Nuakata Island CMMA. Should there be any questions or queries you face as you read through this report, please do not hesitate to contact me (Joel Araea) of my supervising biologist (Noel Wangunu, CI Alotau).

2. METHODS

2.1. Field Data Collection

The June monitoring program commenced on the 8th and concluded on the 13th of June 2011. In these 6 days, monitoring was done as one team and later divided into two teams as per directions from our CI program advisor. The division of two teams was to achieve results in the 6 days allocated for monitoring.

Bad weather and rough sea condition driven by strong south east winds in that period were our main obstacles. Despite these, perseverance and determination from individuals in the monitoring team made it possible for the completion of this monitoring program within the set timeframe.

The survey methods used in this June monitoring program are the same as those used in the December 2010 and March 2011. (*Please refer to these reports for the specifications*); and monitoring was conducted again at the same permanent monitoring stations (Table. 1).

Table 1. Monitoring stations inside and outside no-take for Nuakata CMMA

Reef Code	Reefs inside Conservation Area (No-Take Zone)	Reef Code	Reefs outside conservation (no-take areas)
NT.01	Hibwa	OT.01	Sioayoaoyoa
NT.02	Batutuli (Bagshaw)	OT.02	Soba soba
NT.03.	Tawali Iks	OT.03	Gaima Niugini
NT.04	Badila Dabobona	OT.04	Illabo (Asailo Bay)

NT.05	Gallows (NE)	OT.05	Tawali Gadohoa
NT.06	Gallows (S)	OT.06	Bwelama (Boirama)
NT.07	Panamoimoi (Grace Island) SE	OT.07	Daiwari
NT.08	Panamoimoi (Grace Island) NE	OT.08	Tuphahilihili

Equipments and logistics used during this survey include;

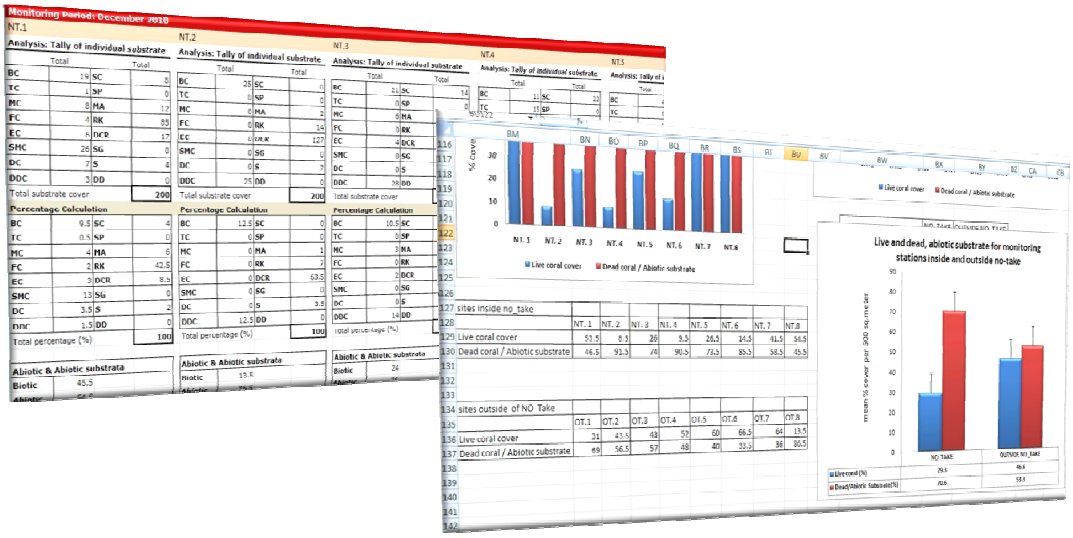
1. 2 x dinghy (40hsp)
2. 11 x set of snorkeling gears (kept by CI-Alotau Office)
3. 1 x GPS (recording coordinates for transacts)
4. 1 x 100 meter fiber glass tape measure
5. 1 x Underwater Digital Camera (kept by CI-Alotau Office)

2.2. Data analysis

Data gathered from each day's monitoring are organized, analyzed and entered into printed versions of database (Fig. 1). The data analyzed here comprised sum estimation for live coral cover, population of key fish groups (herbivores, carnivore and IUCN/Aesthetic) fishes. Other data recorded include sea cucumber, trochus, lobster and clam shells; all recorded as marine invertebrates. All data analyzed are stored and later transferred into an electronic database that is kept by Conservation International in Alotau. (Fig. 2.)

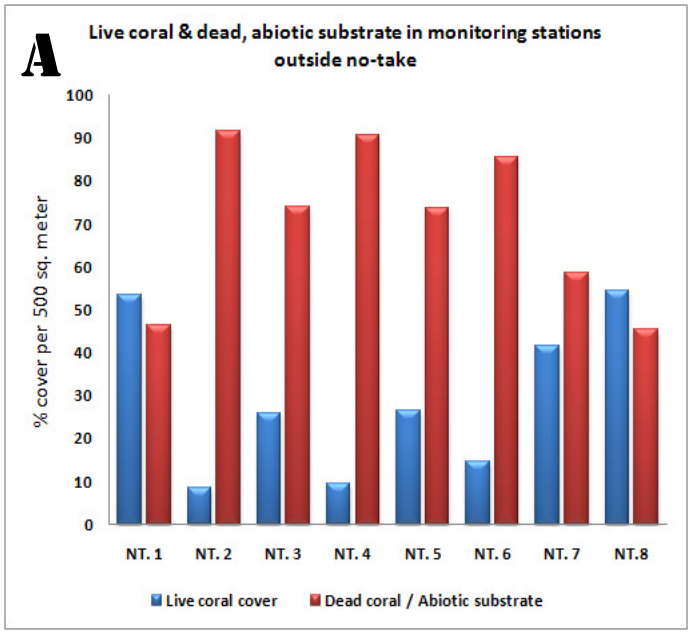
Fig.1. Nuakata monitoring team sorting and pre analyzing raw field data; Joel and Willington from IPCMMA in CI Alotau office analyzing and compiling June monitoring report for NICMMA and IPCMMA respectively.

Fig. 2. Sample of electronic database and analysis of data using Microsoft Excel Spreadsheet



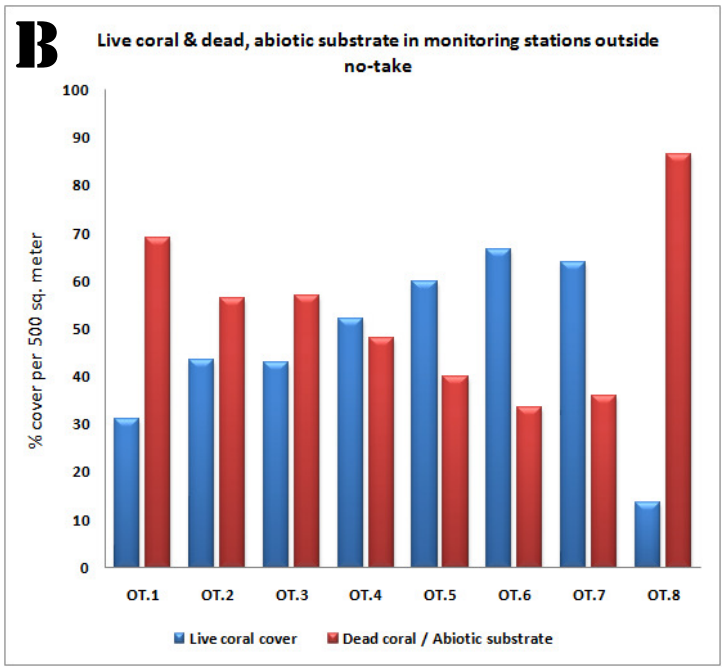
3. RESULTS

3.1. Benthic substrate for reefs inside no-take and reefs outside no-take areas.

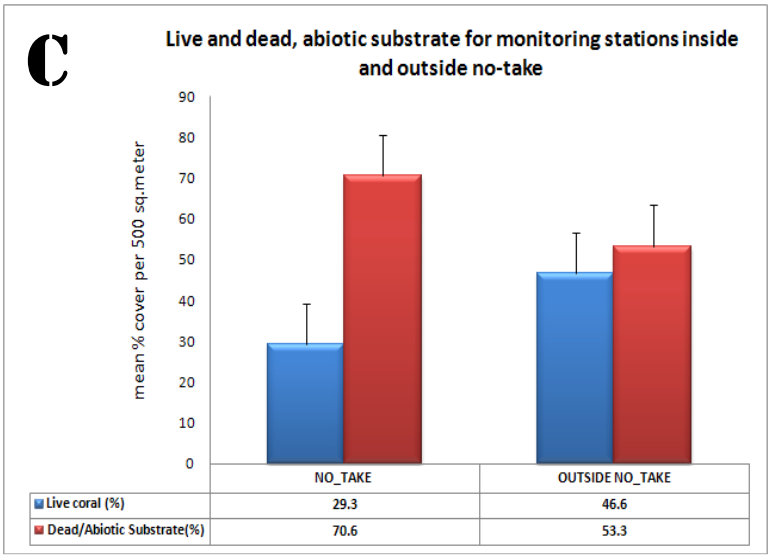


In graph A, live coral cover or biotic substrate for sites representing no-take illustrate that Hibwa (NT.1) and Grace Island's northwestern transact (NT.8) were the only sampling sites that had over 50% live coral cover within the sampling 500m^2 transact. All other sampling stations had coral cover lower than 30%. The monitoring site with least live coral cover was Batutuli (NT.2). Dead coral and abiotic substrate dominated (NT.2) with 91.5%; Badila Dabobona (NT.4) with 90.5%; southern monitoring station at Gallows (NT.6) had 85.5% while Tawali Iks with 74% and northwestern reef at Gallows with 73.5%. Considering percentage of dead and abiotic substrates, it was clear that Batutuli had 50% dead coral rubble and 26% dead corals. Badila Dabobona (NT.4) was dominated by hard bedrock substrate covering

71.5% of the transact line while at the southern Gallows (NT.6) comprised 68.5% dead coral rubble. Abiotic substrate for Tawali Iks (NT.3) comprised 28% dead coral rubble and 27.5% dead corals. The northwestern side of Gallows (NT.3) had over 50% hard bedrock substrate and 18.5% dead coral rubble.

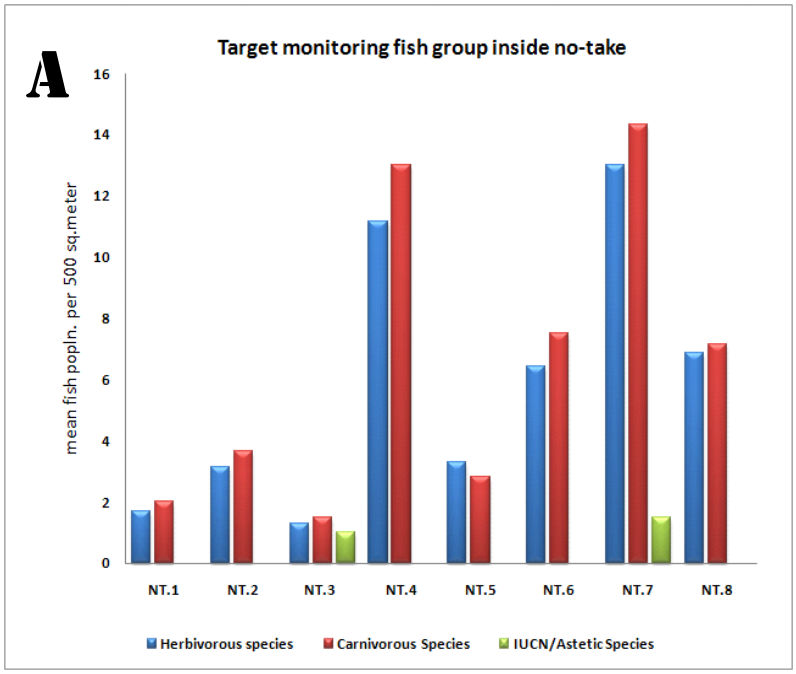


Graph B illustrates that the benthic substrate for sites outside no-take generally showed little variation between live corals and dead, abiotic substrate. In Boirama (OT.6), live coral cover was 66% while Daiwari (OT.7) live coral cover was 64%; Tawali Gadohoa (OT.5) had 69% and Illabo (OT.4) with 52% live coral cover per 100 meter transacts. Other sampling stations had live coral cover between 30-40% while Tupahilihili (OT.8) recorded the lowest live coral cover with 13.5% per 100 meter transact. The site recording highest abiotic substrate was Tupahilihili (OT.8) with 31.5% abiotic that was made up of hard bedrock substrate.

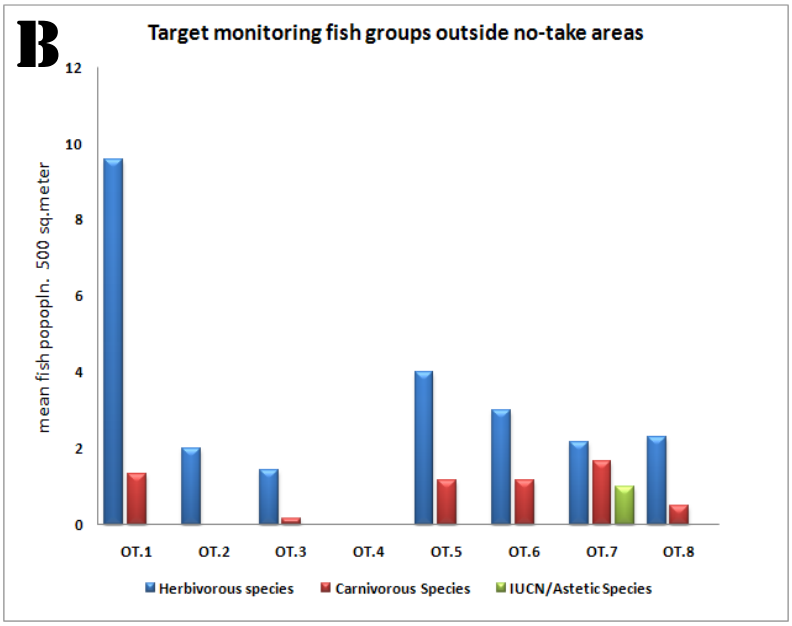


In graph C, data analysis for monitoring stations inside no-take and outside no-take showed that monitoring transacts inside no-take was dominated by dead coral and other abiotic substrate provided an average coral cover percentage of 29.3% (live corals) and 70.6% (dead/abiotic) substrate for all 8 monitoring transacts. The other 8 sites outside no-take showed fairly equal distribution of live coral cover with 46.6% and 53.3% of dead, abiotic substrate.

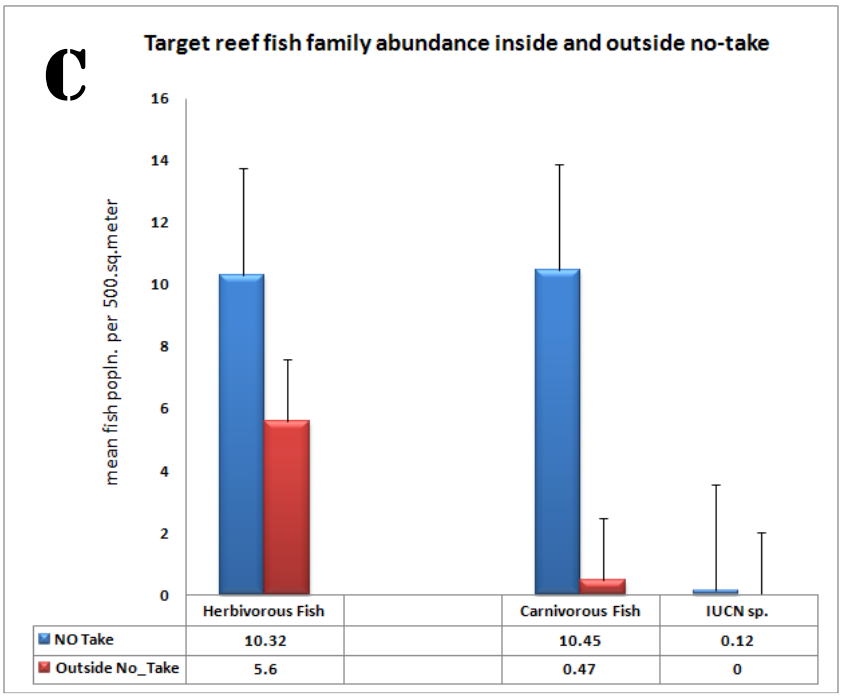
3.2. REEF FISH INDICATORS INSIDE & OUTSIDE NO-TAKE AREAS



Monitoring of target fish group indicators shows that the south-east transact at Grace Island (NT.7) recorded an average of 13 herbivore fishes followed by Badila Dabobona (NT.4) with 11 and NW monitoring station at Grace Island (NT.8) recording an average of 6 herbivore fishes. Average counts for carnivore fishes showed high distribution inside Grace SE (NT.7) with 14 individuals per 500 square meter; Badila Dabobona (NT.4) with 13 and south Gallows (NT.6) with 8 individuals per 500m^2. Presence of IUCN listed species (Maori Wrasse) was very low in all 8 sampling transacts. On average, only 2 records were obtained from SE Grace Island and 2 individuals at Tawali Iks (NT.3) providing averages of 1 and 1.5 for the two sites respectively.



In this second graph, monitoring stations outside no-take showed high abundance of herbivore fish group inside Sioyoaoyoa (OT.1) with an average count of 10 fishes per 500m^2 transact. Second to this was Tawali Gadohoa (OT.5) having an average of 4 counts, then Boirama (OT.6) with average of 3 fishes per 500m^2 monitoring transact respectively. Other monitoring stations recorded an average of 1-2 individuals per 500 square meter transact. Counts for carnivore fishes showed low average in many of the monitoring stations. The highest average recorded was at Daiwari Island (OT.7) 2 records per sampling area. Lastly, the abundance of IUCN Red Listed Maori Wrasse and species of aesthetic value were low with average of 1 individual per 500m^2 sampling transact for 8 studied sites outside no-take.

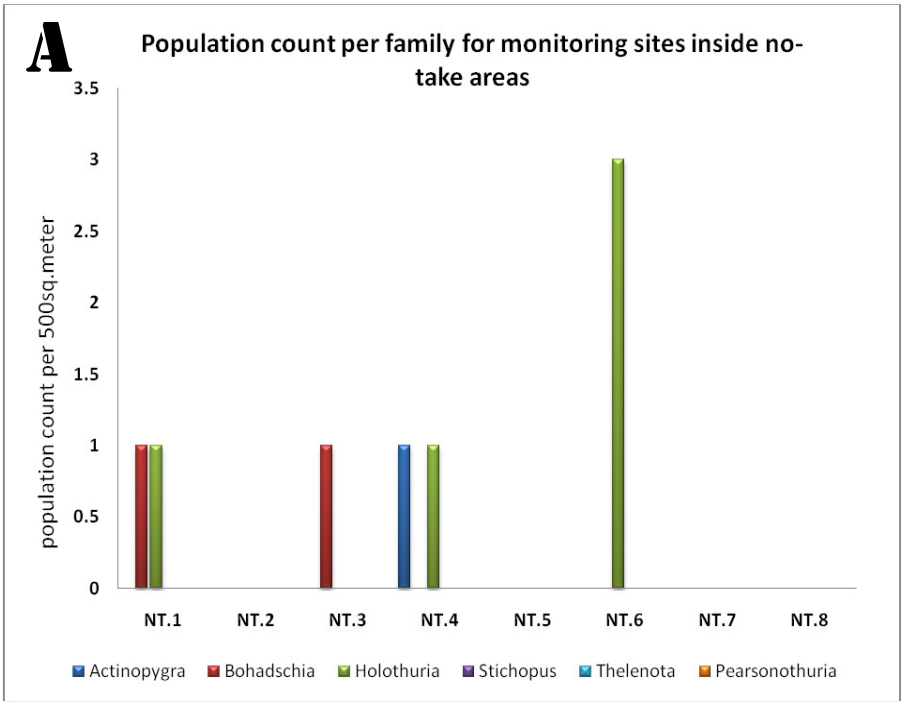


Looking at samples from inside and outside no-take areas it is clear that no-take areas had high average for herbivorous fishes (10.32 fishes per 500m^2 surveyed area); carnivore fishes

with (10.45 fishes per 500m^2 surveyed area) and IUCN/aesthetic species with (0.12 fishes per 500m^2 sampling transact).

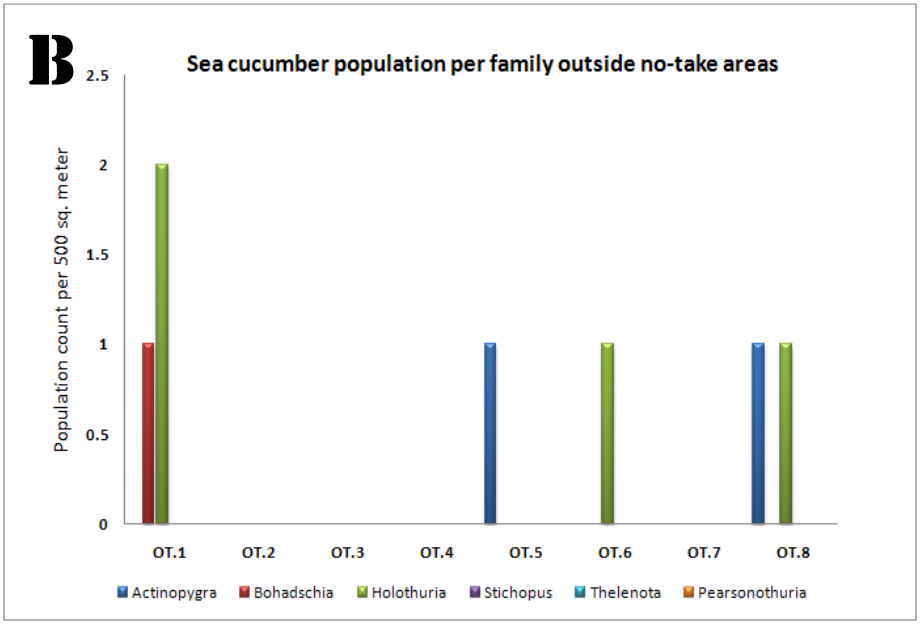
3.3. MARINE INVERTEBRATES

3.3.1. Sea cucumber population in no-take sites and in sites outside no-take

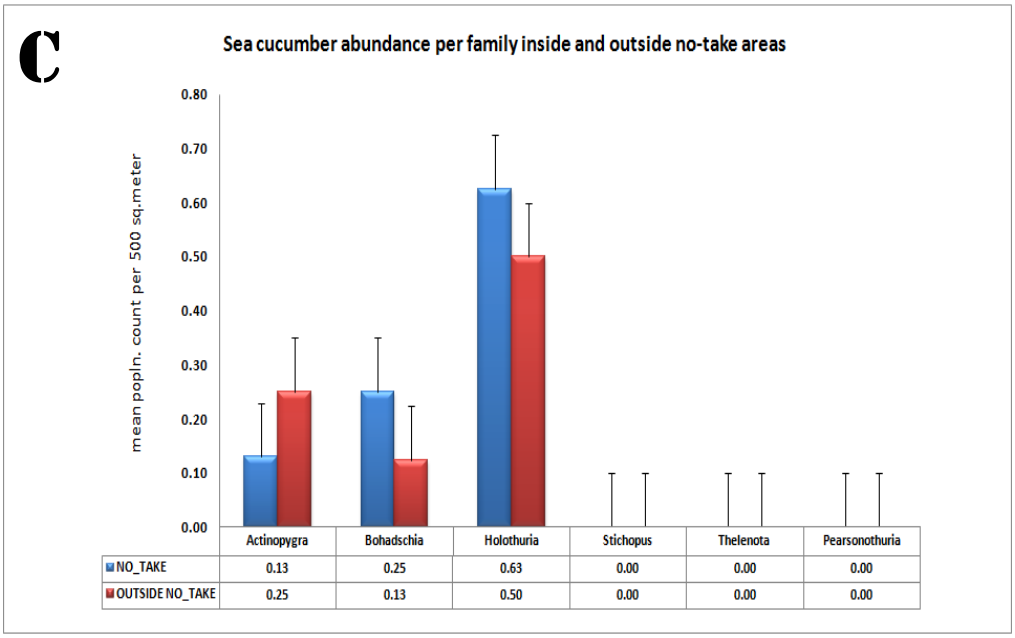


Assessments of sea cucumber population in no-take areas showed that the monitoring station at southern Gallows reef (NT.6) recorded 3 holothuria (all Lollyfish species) and 1 record for Hibwa (NT.1) and Badila Dabobona (NT.4). Other individuals recorded are summarized in the table below.

NT Sites	Actinopygra	Bohadschia	Holothuria	Stichopus
Hibwa (NT.1)	0	1	1	0
Tawali Iks (NT.3)	0	1	0	0
Badila Dabobona (NT.4)	1	0	1	0
South Gallows	0	0	3	0



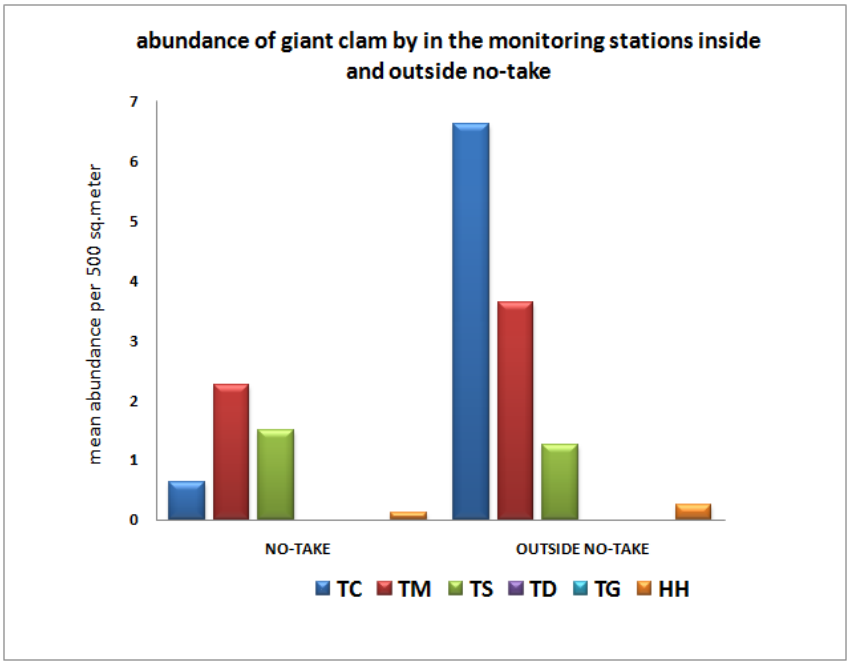
Monitoring stations outside no-take showed that Sioayoaoya (OT.1) had 2 holothuria and 1 bohadschia inside its monitoring transact. While OT.5 recorded 1 actinopygra and 1 holothuria at OT.6 Other monitoring stations with 1 record of sea cucumber family include Tawali Gadohoa (OT.5) with 1 Actinopygra and Boirama (OT.6) with 1 holothuria. Other sampling sites did not have any records for sea cucumber during this monitoring period.



	Actinopygra	Bohadschia	Holothuria	Stichopus	Thelenota	Pearsonothuria
NO_TAKE	0.13	0.25	0.63	0.00	0.00	0.00
OUTSIDE NO_TAKE	0.25	0.13	0.50	0.00	0.00	0.00

Graph C shows that family holothuria recorded high mean abundance in both no-take and outside no-take monitoring stations. The mean abundance for holothuria for the described sites ware (0.63 for no-take and outside no-take was 0.50 per 500m^2 survey area). Bohadschia and Actinopygra have similar mean where average for no-take was 0.25 and outside no-take was 0.50 per 500m^2. Actinopygra also had mean occurrence of 0.25 inside no-take and 0.13 outside no-take per 500m^2 studied transact.

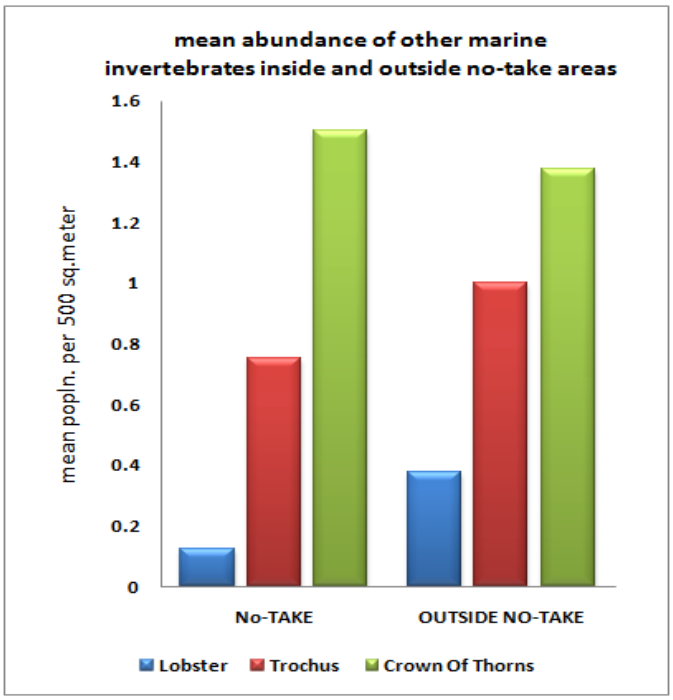
3.3.2. Distribution of giant clam inside no-take and in areas outside no-take



Monitoring stations inside no-take continue to record high abundance of Maxima clam (TM) followed by scaly clam (TS) and boring clam (TC). Highest record for TM was at Badila Dabobona (NT.4) and northwestern monitoring station at Grace Island (NT.8) both with averages of 4 clams per 500m^2 area. HH (bear paw) was only recorded at Badila Dabobona (NT.4) and southeastern station at Grace Island. TS recorded second highest clam numbers with 4 records for NT4 and 2 at NT. 6. Monitoring stations outside no-take was dominated by TC, followed by TM and TS. Illabo (OT.4) recorded the highest counts of 95 TC in its 500 m^2 study area while Daiwari (OT.7) recorded the second high count of 13 TC. On the other hand, TM recorded 10 individuals at OT.4 and 8 at OT.8. Other monitoring stations had between 1-3 individuals per 500m^2 transact.

On average, TM was the dominant species with (2.25 per 500m^2) inside no-take monitoring stations and TC was more common with an average of (6.63 per 500m^2) in stations outside no-take.

3.3.3. Other marine invertebrates (lobster, trochus and crown-of-thorns)



Lobster

Mean counts for lobster was low in transacts outside no-take. At Daiwari (OT.7) local monitors recorded 2 painted lobsters *(Palinurus versicolor)* and at Tupahilihili (OT.8), a similar species was also recorded. Inside no-take, 1 species was recorded at Hibwa (NT.1). Mean calculations as shown in the graph above illustrate that no-take area had a mean abundance of 0.13 and in sites outside no-take; a mean of 0.38 per 500m^2 were observed.

Trochus shell

A total of 3 individuals were recorded at the northwest end of Gallows (NT.6) while Hibwa (NT.1), Badila Dabobona (NT.2) and northwestern end of Grace Island (NT.8) all had 1 record each. Monitoring stations outside the conservation areas showed 4 individuals recorded in Daiwari (OT.7) and 1 record for Sioayoaoyoa (OT.1), Gaima Niugini (OT.3), Illabo (OT.4) and Tupahilihili (OT.8). Respective mean calculations from the graph indicate that no-take had a record of 0.75 and outside no-take having 1 trochus per 500m^2 area respectively. shown in the graph indicate that no-take had a record of 0.75 and outside no-take had 1 trochus shell per 500m^2 of surveyed areas respectively.

Crown-of-thorn starfish (CoT)

Counts for crown-of-thorn starfish (*Acanthester planci*) clearly showed very high abundance in this monitoring period. There were 11 records at SE Grace Island (NT.7) and 1 record at Batutuli (NT.2). The same was for sites outside no-take where 11 individuals were recorded at Gaima Niugini (OT.2). On average, no-take areas recorded 1.5 and outside no-take recorded 1.38 crown-of-thorn per 500m^2 for each 8 monitoring stations respectively.

4. DISCUSSION

4.1. Benthic substrate

Benthic substrate determined for all monitoring stations inside and outside no-take areas for Nuakata CMMA showed very little variation to that displayed and reported in the March monitoring report. No-take areas continued to have low live coral cover in many of its outer most barrier and fringing reefs while those inside sheltered areas continue to have moderate to high percentages. Sites outside no-take showed moderate to high live coral cover percentages as indicated by the monitoring data.

Many explanations to the distribution patterns have been provided in the December and March monitoring reports (*Please consult the discussion section, 4.1 for these two reports*). One determining factor that determines coral growth and distribution pattern nests with habitat and/or substrate condition. As coral growth is determined by the coral type and the habitat requirements. Example, boulder corals (CM) has high survival rates and high growth adaptabilities which enables them to grow in areas with high sediments as well as in areas with less sediment and high salinity areas whereas branching corals (CB) grows best in areas with less sediment and high water salinity therefore are found in areas such as patch reefs, shallow mid shelf sections of outer barrier reefs and also on parts of fringing reefs that often receive constant flow of currents.

Another important reef characteristic that has never been described and explained in previous reports is "reef complexity". Reef complexity basically describes how much habitat a reef can provide as a result of its geological formation and the amount of different coral morphologies *(type)* found on that reef. For instance, a reef with a lot of rock holes or crevices, large type branching corals and many types of corals provides diverse habitats for different kinds of reef fishes. In addition, a reef with rock crevices shall provide good habitat for large groupers; reef with a lot of branching corals will provide good habitat for coral trout and many reef fishes including Bailawa while reefs with flat rocky substrate, seagrass and macroalgae provides good habitat for herbivore fishes like surgeonfishes and rabbitfishes. A large area of sand patch could be described as low complex habitat which will not support any organisms.

Fig.3. Examples of 3 levels of reef complexities. First picture shows a very low complex type reef. Center is an intermediate reef with medium complexity and right shows a multi habitat high complex reef system.

4.2. Reef Fish

Highest record for herbivore fishes in this monitoring came from southeast Grace Island (NT.7) recording an average of 13 fishes per 500m^2 monitoring transacts. This high average comprised entirely of Osaos (Bullethead parrotfish), recording a total of 40 individual fishes. Badila Dabobona recorded the second in numbers of herbivore fishes with a mean total of 11 and the northwestern side of Grace Island (NT.8) recording 8 individuals of herbivores as the third highest. Other individual sites with single species abundance were NT.4 recording 49 species of Diyadiyayana (English Name); NT.6 recording 30 individuals of the same species and NT.4 further recorded a total of 21 Osaos (Bullethead parrotfish) inside its monitoring station.

Records for carnivorous species showed an average of 14 fishes per 500m^2 recorded for the southeast transact of Grace Island (NT.7) while Badila Dabobona (NT.4) recorded an average of 13 fishes in its 500m^2 monitoring transact. Other areas also recording good average of carnivore fishes include the southern reef of Gallows with 8 fishes. The most occurring species recorded for carnivorous fishes include Hibwa (NT.1) recording 22 counts of Bilawa (Sabre squirrelfish) followed by Tawali Iks (NT.3) with a record of 15 and south Gallows with 10 records of Bilawa each.

Presence of IUCN listed species (Maori Wrasse) was very low in all 8 sampling transacts. On average, 2 records were obtained from SE Grace Island and 2 from Tawali Iks (NT.3) which provides an average of 1 and 1.5 per 500 square meter transacts for respective sites.

The reef system surrounding Nuakata further supports diverse pelagic fish species. An opportunistic sampling conducted in 1 hour recorded a catch comprising 2 Rainbow runners (*Eligatis bipinulata*), 1 catch of bluefin travally (*Caranx melamnphygus*), 3 catches of Spanish mackerel (*Scomberiodes commerson*) which 2 individuals measured 153cm and 148cm (Fork length) while the third measured 79cm. (Fig. 4). This sampling information illustrates that Nuakata is an area of high productivity as a result of currents and food sources for all types of reef and pelagic fishes.

Base on our monitoring results alone, we conclude that there is a lot more herbivore and carnivore fishes inside no-take areas than at the areas that are open to fishing and other subsistence activities (basically the sites outside no-take).

Fig.4. Healthy aggregation of fusiliers (*Caesio terres*) and *Chlorurus bleekeri* and *Caranx melamphygus* in a site inside no-take monitoring station. Centre; Large school of individual large sized silvers pine foot (*Siganus argenteus*) and Right; A large sized Spanish mackerel (*Scomberomeros commerson*) caught while trolling outside no-take.

4.3. Sea Cucumber

Sea cucumber population inside the monitoring transacts for both no-take and outside no-take clearly indicates that large adult populations are significantly low. Many sea cucumber species expected to be recorded at their most favored reef habitats were not present. The data for the monitoring stations alone are a representative of what it would be like in a wider area and having low counts of individuals inside no-take may also indicate a sporadic distribution in many of the reefs inside Nuakata Island. Having mentioned that this monitoring have found interesting results on sea cucumber, there were a lot more juveniles on many of the area outsides the monitoring stations of both no-take and outside no-take. Figures from the 18 monitoring stations indicate that the family Holothuria remains dominant with high counts of Lollyfish (*Holothuria atra*), Bohadschia (*Bohadschia argus*) and Actinopygra (*Actinopygra lecanora*). Other species observed to have a lot of juveniles was greenfish (*Stichopus chloronotus*).

Data for sea cucumber indicate that some species are recovering quicker than others. General observations further conclude that species recovery is highly likely in the next 2-3 years. If the current recruitment continues at the current rate under no disturbance, the juveniles shall reach adult stage which provides good brood stock for further reseeding of reefs.

4.4. Clam Shell

Results from giant clams generated in this monitoring period are similar to those recorded in December 2010 and March 2011. Maxima clam (TM) continues to dominate the outer barrier and offshore reefs while Boring clam (TC) was again recorded the greatest on the mainland fringing reefs. The current highest record for TC was 95 per 500m^2 and was recorded in Ilabou (OT.4). There were also records for *Hippopus hippopus* or Bear paw clam (HH) inside the monitoring transacts as well as outside transact on same reefs.

Distribution of giant clams is determined by substrate type and environment conditions surrounding each reef systems. Thus, habitats such as those on mainland fringing reefs and bays with little influence of oceanic conditions and areas with high rocky substratum usually provide suitable habitats for TC and TM clam shells. TD, TS and TG grow best in habitats with less sediment and in areas with high saline conditions.

All clam species are expected to increase in their numbers in the coming years as their rate of harvest have minimized over the last few years as a result of no clam fishery in the province. Local harvest shall continue to occur but at a local scale where their use will be for subsistence purpose only. A lot of awareness and emphasis have been put into the community over the last 10 years regarding wise use of the resources and many people are now aware of the great need for better resource management and controlled resource use.

4.5. Other invertebrates *(Lobster, trochus, crown of thorn starfish & starfish)*

Results from this June monitoring shows that population of rock lobster and trochus are very low. Past overharvesting has caused depleted population in many outer reefs that we anticipate to record a lot of rock lobsters. Furthermore, many rock lobsters take up localized residency are always found to exhibit social habits by being together therefore; by locating 2 or 3 would mean many areas around within the vicinity. In our case that type of behavior was not present. It could also mean that a lot of our monitoring stations have been located on shallow reef flats where there is not much habitats like reef and rock crevices which are often

recorded alone reef wall. Moreover, lobsters have also been described to be nocturnal feeders (they feed at night and sleep during daylight hours). It is therefore anticipated that over the next few years the no-take areas are expected to record some or at least many lobsters in many of the sampling reefs

Records for trochus also indicate a similar pattern. An assessment of a wider area of reef which includes many areas outside the monitoring transacts further illustrate deficiency in numbers of large size stocks. Trochus are associated with habitats exposed to swells and surf which many areas with these conditions have been found to having very low numbers. The fishery for trochus in Milne Bay is still in operation however; there is no data and/or figures to establish the rate of harvest that might be happening in Nuakata region especially.

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