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ON CORAL REEFS, FISHERIES AND FOOD SECURITY

PAPUA NEW GUINEA

NUAKATA COMMUNITY BASED RESOURCE MONITORING PROGRAM SURVEY REPORT #: 5

MONITORING PERIOD: DECEMBER 2011

June 2013

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Nuakata Community Based Resource Monitoring Program Survey Report #: 5 Monitoring Period: December 2011

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5

NUAKATA COMMUNITY BASED RESOURCE MONITORING PROGRAM

SURVEY REPORT #: 5
MONITORING PERIOD: DECEMBER 2011

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PREFACE

I warmly welcome you to this 5th monitoring report for Nuakata Island Community Marine Managed Area (NICMMA). Firstly, I would sincerely like to thank the Nuakata management committees and the marine monitoring team for a wonderful effort in completing this December monitoring.

I also would like to extend my sincere thanks to the many members of the monitoring team who have displayed a courageous effort in getting the December monitoring competed and sincerely commend Mr. Joel Araea and Mr. Simeon Isaac for their tireless effort in organizing and analyzing all monitoring data and getting this report together.

I also thank the local boat operators for your commitment in ensuring all boats were in order for us during the monitoring period and your time with us out in the sea.

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 knowledge to manage our resources for today's use and for our future generation's benefit.

Mr. Anania Mesegai
Chairman
(Nuakata Island Community Managed Marine Area)

About this report

This report has two sections to it. The first section entails results from December 2011. The second section looks at population trend for monitoring indicators for the period of 12 months (December – 2010 to December 2011).

Simple analyses have been done to observe any improvement, decline and/or fluctuations in population numbers for each indicator species or indicator groups.

This report is divided as;

Part A - December 2011 monitoring results
Part B – Population trend for key indicator species.

1. INTRODUCTION

Members of Nuakata CMMA have successfully completed their December 2011 monitoring program and the results from their surveys have been analyzed and are summarized in respective sections. This report also provides population trend for data gathered between December 2010 and December 2011 to observe any change in population numbers for the different monitoring indicators inside and outside no-take areas of Nuakata Island.

2. METHODS

2.1. Field Data Collection

All field sampling methods and equipments used in this survey are similar to those used in past surveys. Addition of new monitoring members to the team was a positive indication of high enthusiasm derived by youths in supporting old personnel who has been involved in the last 4 monitoring programs.

2.2. Data analysis

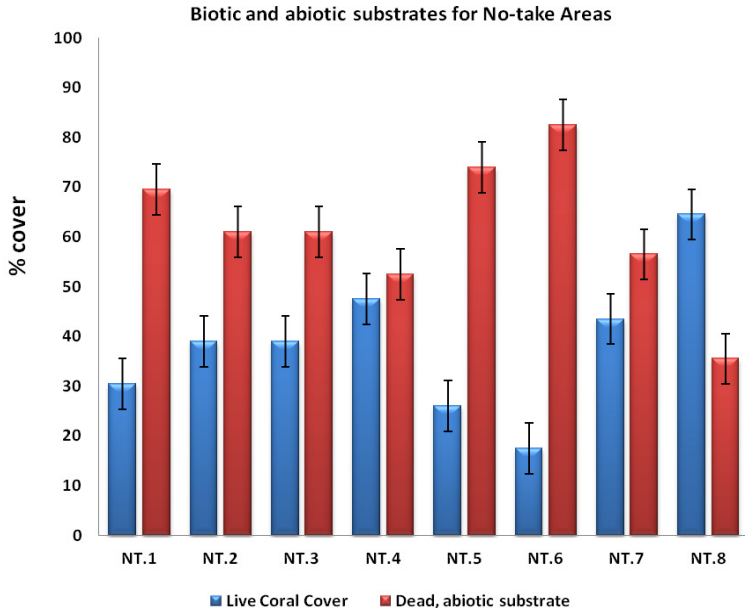
Analysis of all data in this monitoring is the same as those done in March and June. Same methods and procedures were again followed here to provide the results displayed in this report.

3. RESULTS

PART A. MONITORING RESULTS FOR DECEMBER 2011, RESULTS FOR LIVE CORAL COVER/BENTHIC SUBSTRATE; FISH AND INVERTEBRATES

I. SITES INSIDE NO-TAKE

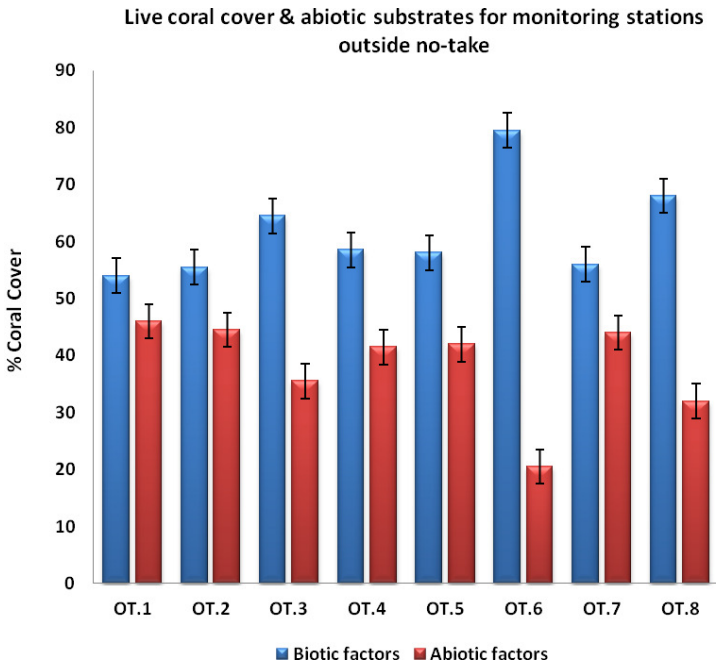
3.1. Benthic substrate for reefs inside no-take or conservation areas



Results from this monitoring period showed that there was an average live coral cover of 38.4% and 61.6% of dead, abiotic substrate representing the benthic substrates found inside no-take areas. The northwestern transact at Grace Island (NT.8) was the only site to show over 60% live coral cover while Badila Dabobona (NT.4) and Grace Island SE (NT.7) each recorded 47.5% and 43.5% respectively. All

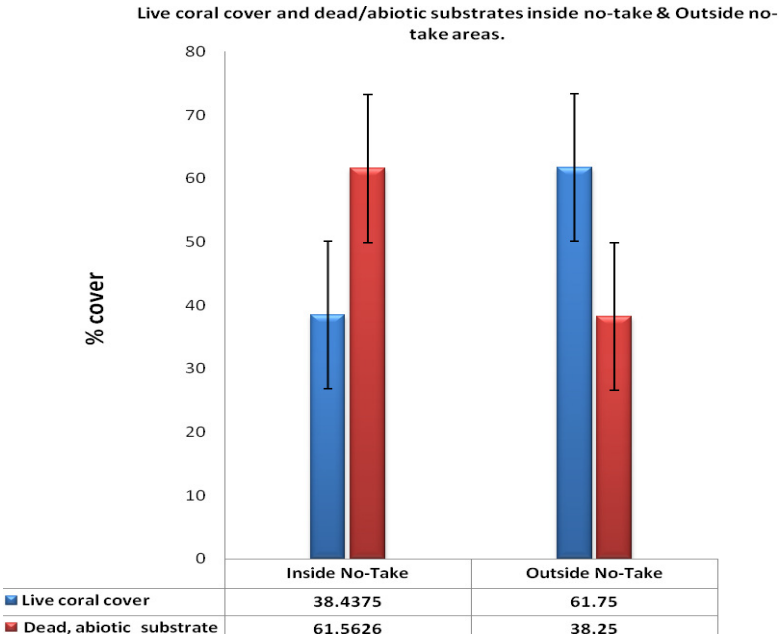
other monitoring sites had lower than 40% live coral cover. Abiotic substrate was recorded the highest at (Gallows) NT.6 with 82.5%. This percentage constitutes extensive bedrock with occasional patches of dead coral rubble which did not provide adequate substrate for coral settlement and growth. Other sites with similar values of high abiotic substrate include NT.5; Hibwa (NT.1), Batutuli (NT.2) and Tawali Iks (NT.3).

II. SITES OUTSIDE NO-TAKE



Coral cover was high for many reefs outside no-take zone. Those recording high values include Boirama (79.5%), Tupahilihili (68%), Gaima Niugini (64.5%), Illabo (58.5%), Gadohoa (58%), Tawali Daiwari (56%) and Sobasoba (55.5%). In general, live coral cover for OT areas constitute 61.6% while dead and abiotic substrates were 38.3%.

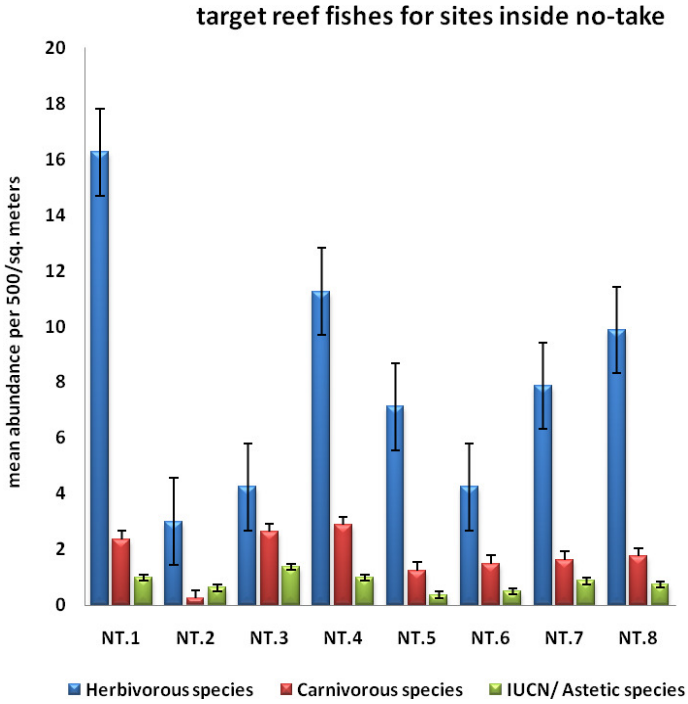
III. LIVE CORAL COVER (%) FOR SITES INSIDE & OUTSIDE NO-TAKE



General comparisons made for live coral cover inside no-take and outside no-take clearly illustrate that there were more live coral cover on reefs outside no-take (61.6%). Dead and abiotic substrates including hard calcareous bedrock, dead coral rubble and dead coral were more abundant inside no-take areas.

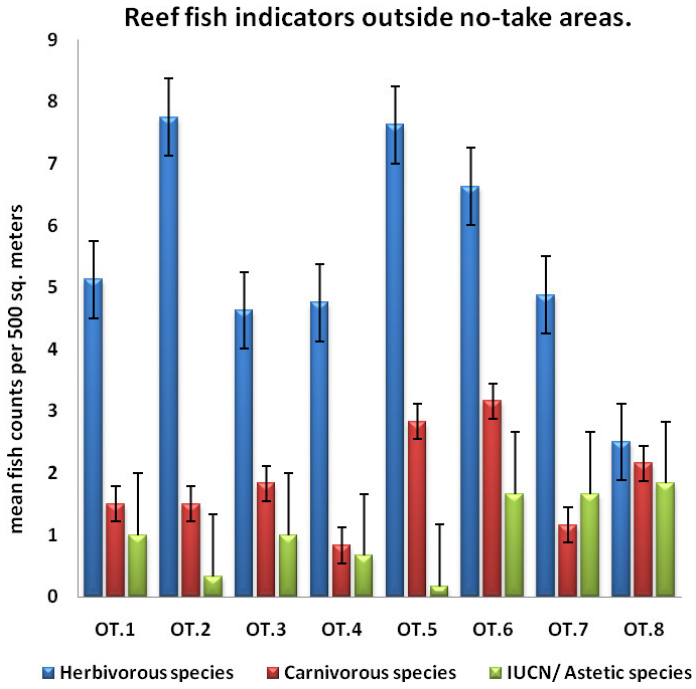
3.2. TARGET REEF FISH INDICATORS

3.2.1. Target reef fish indicators inside no-take



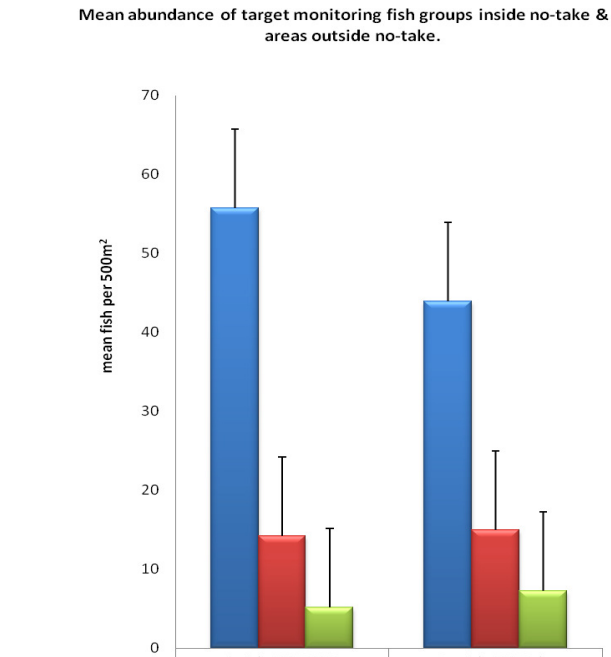
Data gathered for December monitoring clearly show high abundance of herbivore fishes in many sites inside no-take. On average NT sites recorded 7.98 herbivore per 500m^2 where the highest individual average was at Hibwa (16.3 species/500m^2). Other sites with high averages include Badila Dabobona (11.25 herbivore/500m^2) and NW Grace Island (1.75 herbivore/500m^2). Averages for carnivore fishes showed an overall average of 1.78 carnivores per 500m^2. This average is much lower than averages from previous monitoring. Badila Dabobona (NT.4) was the only site to record an average count of 2.87 carnivore/500m^2 followed by Tawali Iks (NT.3) recording an average of 2.63 carnivore/500m^2. Records for IUCN Red List species continue to be low with overall average of 0.81 carnivore/500m^2.

3.2.2. Target reef fish indicators in reefs outside no-take



Population for herbivore fishes continues to dominate all monitoring stations outside no-take. An overall average of 5.48 species per 500m^2 was observed for all 8 monitoring stations. Sites Sobasosba (OT.2) and Tawali Gadohoa (OT.5) had high records with respective averages of 7.75 herbivore /500m^2 and 7.63 herbivore/500m^2. Other sites with moderate averages were Boirama (6.63 herbivore/500m^2), Sioayoaoyoa (5.13 herbivore/500m^2), Illabo (4.75 herbivore/500m^2) and Gaima Niugini (4.63 herbivore/500m^2). Averages for carnivorous fishes was 1.87 species/500m^2 which indicated low abundance counts in many sampled sites. Hence, the highest average for this fish group was at Boirama (OT.6) with average of 3.16 carnivore/500m^2. Tawali Gadohoa (OT.5) was the other site with second high average of 2.83 carnivore/500m^2. Population numbers for IUCN Red List Maori Wrasse recorded high counts for Tupahilihili (1.83 species/500m^2), Boirama and Daiwari both having 1.66 species/500m^2.

3.2.3. Mean abundance for target monitoring fishes inside and outside no-take areas.

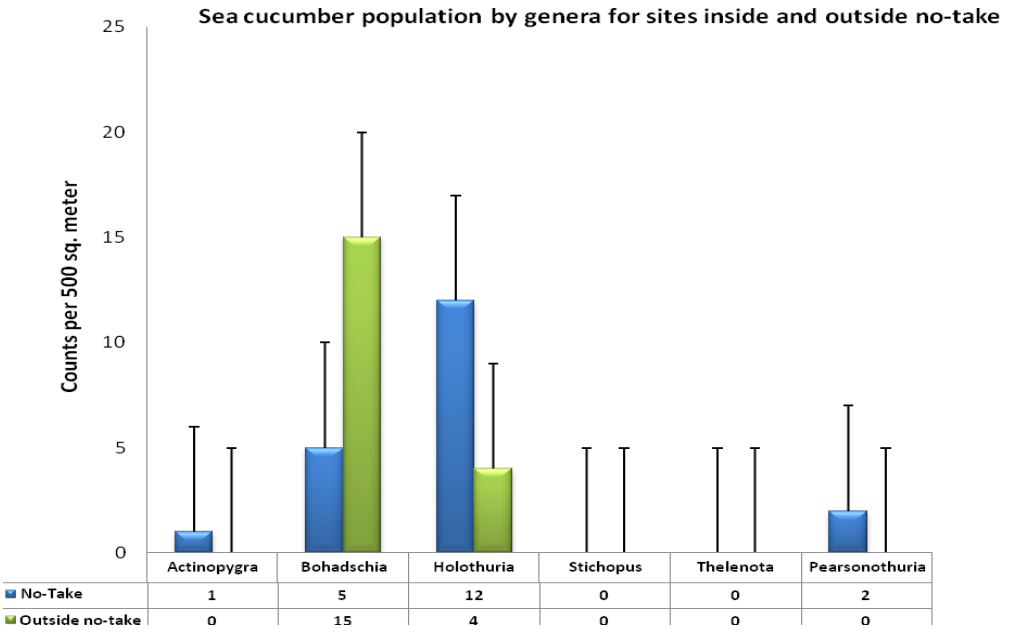


	Inside NO-TAKE	Outside NO-Take
Herbivorous spices	55.76	43.895
Carnivorous species	14.26	14.97
IUCN/ Astetic species	5.135	7.31

As previously shown in each individual graphs for sites inside and outside no-take, this graph presents a combination of what has been previously shown in graphs for monitoring fish species inside and outside no-take. What this graph tries to show is that in general, average number of herbivore fishes inside no-take areas was higher than those recorded for sites outside no-take. Thus, no-take areas had 55.76 herbivore fishes per 500m^2 while outside no-take had 43.90 herbivore fishes per 500m^2. Values for carnivore fishes for both no-take and outside no-take were the same and sites outside no-take had a little more IUCN species than no-take sites.

3.3. MARINE INVERTEBRATES

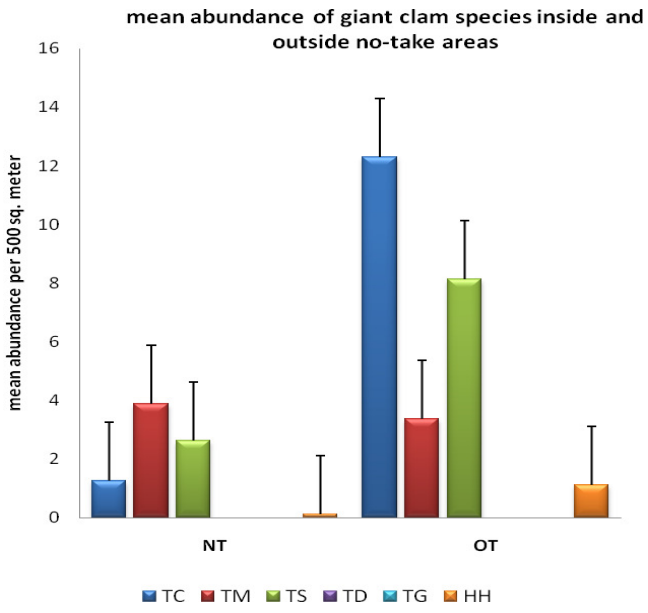
3.3.1. Sea cucumber population in no-take sites and outside no-take areas.



Records for sea cucumber for this survey showed high counts for Holothuria inside no-take areas and high counts for Bohadschia for sites outside no-take. The high counts for holothuria inside no-take were from Badila Dabobona (NT.4) and Gallows (NT.5) where all species recorded there were lolllyfish (*Holothuria atra*). The high records for Bohadschia were obtained from Illabo (OT.4) and Daiwari (OT.5), where Tigerfish (*Bohadschia argus*) was the only species with this high record.

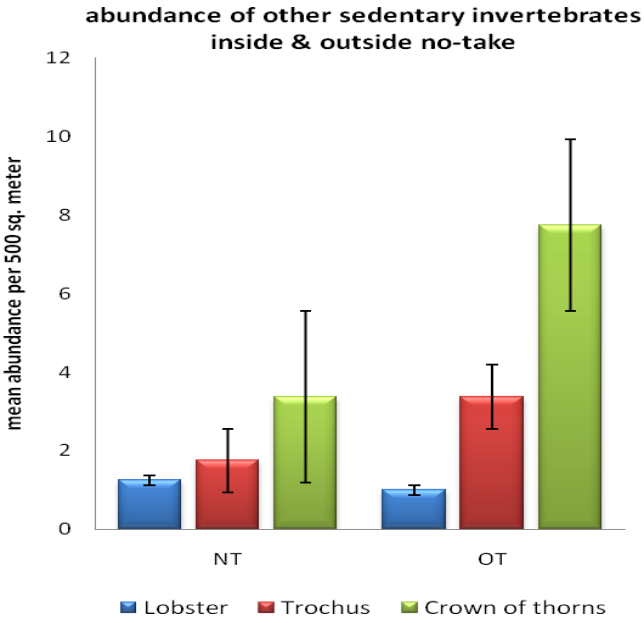
GIANT CLAM DISTRIBUTION/ABUNDANCE INSIDE & OUTSIDE NO-TAKE

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



Boring clam (TC) showed high abundance in sites outside no-take (12.23 clam per 500m^2) while Maxima clam (TM) had high mean occurrence for sites inside no-take. The scaly clam (TS) also recorded second highest abundance for the sites outside no-take with average of 8.13 clams per 500m^2. Other clam species such as bear paw clam (HH) had very little presence in OT areas while no records were observed for NT areas. The two largest species giant clam (TG) and southern giant clam (TD) had no record for all monitoring areas.

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



Lobster, trochus and crown of thorn starfish

Lobster

Average for rock lobster for no-take areas was 1.25 lobsters per 500m^2 while sites outside no-take were 1 lobster per 500m^2. Good number of lobster population was recorded in this monitoring period compared to previous monitoring as 4 lobsters were recorded at Hibwa (NT.1) and Tawali Iks (NT.3) while 2 lobsters were recorded at Sioayoaoyoa (OT.1) and Tawali Gadohoa (OT.5) respectively. Badila Dabobona (NT.4) also had 2 records of lobster within its 500m^2 sampling area.

Trochus

Average record for trochus inside no-take was 1.75 trochus per 500m^2 while sites outside no-take had high average of 3.38 trochus per 500m^2. 6 trochus shells were recorded in OT.4 and OT.8; 5 at OT.5 and 3 at OT. 1, OT. 3 and OT. 6. No-take areas had 7 records at NT. 1; 3 records at NT.4 and 2 records at NT.7. General observation from this abundance indicates a healthy return of trochus shells for sites inside and outside no-take.

Crown-of-thorn starfish (CoT)

Observations and records for crown of thorn starfish (CoT) is said to be on increase when compared to population numbers recorded during the September monitoring. There appeared to be more crown of thorns on reefs outside no-take areas. Thus, on average, there was 7.75 crown-of-thorn found for every 500m^2 studied for reefs outside no-take and 3.38 crown-of-thorn recorded for every 500m^2 for reefs inside no-take. Individual site record for crown-of-thorn showed that OT.5 recorded 12 CoT per 500m^2; OT.8 had 11 CoT per 500m^2; OT.6 with 10 CoT per 500m^2 and OT.7 with 7 CoT per 500m^2.

Records for stations inside no-take illustrated 5 individual record of CoT per 500m^2 at NT.1 and NT.7; 4 CoT per 500m^2 at NT.4 and NT.8 and 3 CoT per 500m^2 for the remaining 3 monitoring transacts (NT.2, NT.3 and NT.6).

4. DISCUSSION

4.1. Benthic substrate

All biophysical conditions for marine ecosystems inside and outside no-take areas for Nuakata area are the same here. The weather during which this monitoring was conducted was calm with no strong winds and/or no bad weather hence, this monitoring was conducted in the early part of NW Monsoon Winds.

All benthic substrates especially live coral cover observed during this study yield similar results as those for the last two monitoring period. Live coral cover was highest for reefs outside no-take than for many reefs inside no-take. Live coral cover for upper reef flat areas for many offshore reefs would normally have reduced coral cover as a result of the reefs exposure to strong waves and tidal currents. Thus, the lower parts of these reefs would have good coral cover. Since our monitoring transacts for many outer no-take reefs are on the shallow reef flat areas, records for live coral cover was significantly low. Coral morphologies such as branching corals (BC) and table corals (TC) will be much lower in these areas compared to the reef areas located on mainland fringing reefs and back reefs. A good way of determining whether the exposed reefs are suffering from severe coral damages would be to focus our attention on the amount of dead coral rubble (DCR) measured each time. If the percentage contribution of DCR is increasing every time a monitoring is done than it reflects the level of impacts on live coral cover for these areas. Data from this monitoring on DCR when compared to data gathered in September and June 2011 clearly shows that average DCR percentage for 8 monitoring stations in June yield (28.63%), while September was (24.81%) and for this monitoring, DCR percentage was 20.94%. This clearly showed that there has not been any extensive damage over the last 3 months, after the September monitoring. Many assessment studies have documented the mainland fringing reefs to have high live coral cover than any offshore reef flat and reef flat areas of submerged reefs.

It is therefore evident to conclude that there has not been any significant damage or impact in many reefs in both the no-take and areas outside no-take over the last 3 months.

4.2. Reef Fish

The fish records for December monitoring period showed an opposite result to those from September. The September monitoring data revealed high carnivore population with average of 23.38 carnivore/500m^2 inside no-take and 14.75 carnivore/500m^2 for sites outside no-take. The averages for this monitoring indicate 1.78 carnivore/500m^2 inside no-take and 1.87 carnivore/500m^2 for sites outside no-take. There has been a 12% reduction in the number of carnivore fishes inside no-take and an 8% reduction in the population for those recorded outside of no-take.

Values for herbivore fishes in this monitoring period showed an average of 7.98 herbivore/500m^2 inside no-take and 5.48 herbivore/500m2 outside no-take. Values for September monitoring showed an average of 37 herbivore/500m^2 for no-take and 62.13 herbivore/500m^2 for stations outside no-take. When comparing these two results we can see a difference of 21.6% reduction for herbivore fishes inside no-take and 8.8% reduction for sites outside no-take. Records for IUCN/aesthetic species continued to be low for many sites inside and outside conservation areas.

Proper scientific explanation to these population fluctuations cannot be provided at this stage as it will require specific studies to establish that information. For now we can only speculate a number of

factors that we think are the causes for the population fluctuations. Some of these factors could include;

- Seasonal variations in tides and currents influencing food source & supply for many species
- Error in different timing of monitoring. Times by which data are gathered for fish in different monitoring stations are not standard. Some monitoring could have been done in the morning hours of the day while other monitoring periods could have been done in the afternoon hours therefore different recording time was not standardized.

4.3. Sea Cucumber

Population of sea cucumber recorded within each monitoring transacts for sites inside and outside no-take continue to show gradual increase for some species while many others have yet to be identified and documented. Many monitoring stations inside and outside no-take recorded increase in the number of Lollyfish (Holothuria atra) and Tigerfish (Bohadschia argus) while other species such as stonefish (*Actinopygra lecanora*), prickly redfish (*T. ananas*) and white teatfish (*H. fuscogilva*) were observed in areas outside monitoring transacts and have showed signs of slow recovery.

4.4. Clam Shell

Numbers of clam shells counted within each monitoring transacts indicate that population of larger species of clams have been overharvested over the years. Supported by evidences of shell or remains in many areas further indicate that harvesting has been targeted at the larger giant clam (TG), XX shell (TD), scaly clam (TS) and bear paw clam (HH). Those that are found in relative abundance are those small sized species. Maxima clam (TM) and burrowing clam (TC).

Local initiatives of rearing clam have been undertaken by a number of individuals from Nuakata however; this attitude is only by certain individuals and should be promoted to all members of Nuakata to do the same in order for a quick species restoration around Nuakata's mainland fringing reefs. Provided in the picture below is an example of a clam restoration project undertaken by a member of the NIPCMMA management committee.

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

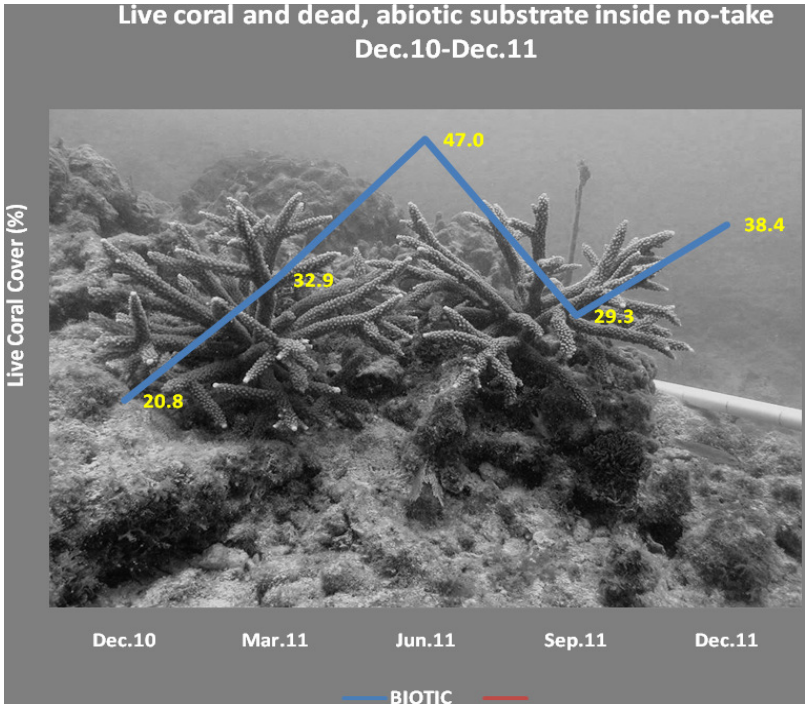
Population numbers for lobster found inside and outside no-take monitoring stations appeared to be the same as those from previous assessments. The only remarkable record is the increase in population numbers for crown of thorn starfish. There appeared to be more crown of thorn recorded per transacts where an average of (7.75 CoT per 500m^2) was recorded for sites inside no-take and (3.38 CoT per 500m^2) for sites outside no-take. Individual reef areas with high records per 500m^2 were Hibwa (NT.1) with 5 counts; SE Grace Island (NT.7) with 5, Badila Dabobona (NT.4) and NW Grace Island (NT.8) with 4 counts respectively. Other areas outside no-take include Tawali Gadohoa (OT.5) with 12 counts; Tupahilihili (OT.8) with 11; Boirama (OT.6) with 10 and Daiwari (OT.7) with 9 counts.

Furthermore, Sioayoaoyoa (OT.1) and Gaima Niugini (OT.3) both have 6 counts and Illabo (OT.4) with 5 counts. This high record is unusual when we compare this monitoring data with previous monitoring results.

PART B. POPULATION TREND FOR TARGET MONITORING PARAMETERS OVER 1 YEAR (December 2010 – December 2011)

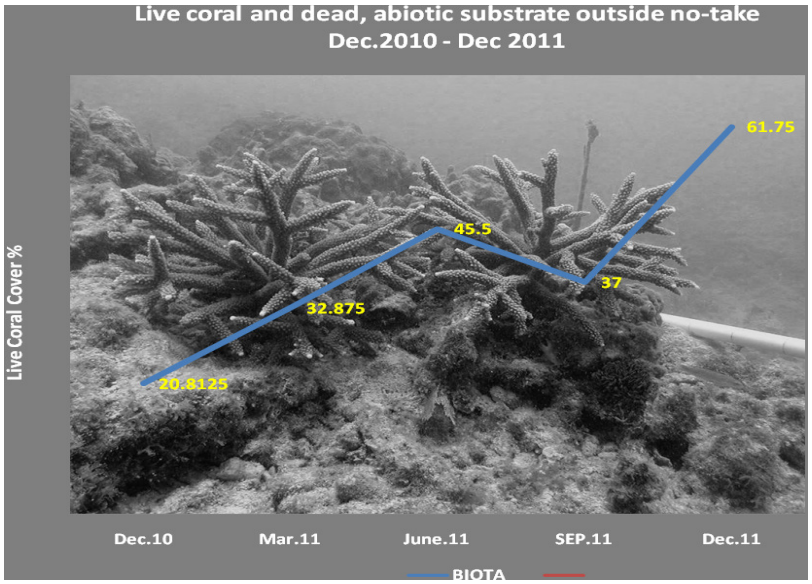
LIVE CORAL COVER & BENTHIC SUBSTRATE

Live coral cover for monitoring stations inside no-take



The trend displayed for live coral cover for monitoring stations inside no-take showed that in December 2010, all monitoring stations sampled had 20.8% live coral corals within a 100m stretched transact line. In March 2011, the monitoring team observed and recorded 32.9% live coral cover and again 47% live coral cover in June 2011. In the September 2011, there was a significant decline in live coral cover which recorded 29.3% cover and finally 38.4% cover in December 2011. The period by which data showed decline is relates to inconsistency and inaccuracy in data recording by local monitors as during that time a lot of new youths were given training by the old monitoring team members where these new monitors were not competent and accurate in their data collection. There was no significant storm, cyclone and/or disaster which could have contributed to this. Therefore, we can conclusively say that live coral cover for 8 monitoring stations inside no-take is on average lower than 50% where much of the benthic substrate comprises abiotic materials that comprised hard bedrock and sand in many exposed, outer, offshore reefs.

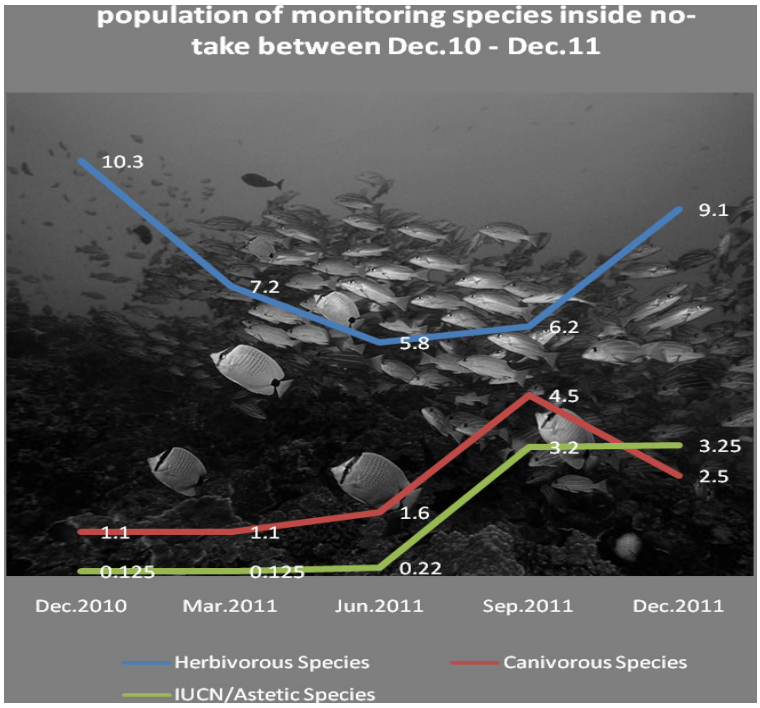
Live coral cover for monitoring stations outside no-take



The trend displayed over the 12 months for live coral cover for sites outside no-take was similar to that shown for sites inside no-take. There was steady increase in the percentage of live coral cover from monitoring periods Dec.10 – Jun. 11 then, there was significant reduction in the value of live corals recorded. Thus, from 45.5% to 37% recorded showed a reduction of 18.7% in the amount of coral cover for that period. The December monitoring displayed significant live coral cover with 61.75%. The decline in coral cover recorded in September is directly attributed to incorrect data recording by newly trained members of the NIPCMMA monitoring team. As described for data inside no-take, the same error is repeated for sites outside no-take.

TARGET FISH MONITORING INDICATORS

Population trend for monitoring species inside no-take for monitoring period Dec.10-Dec.11

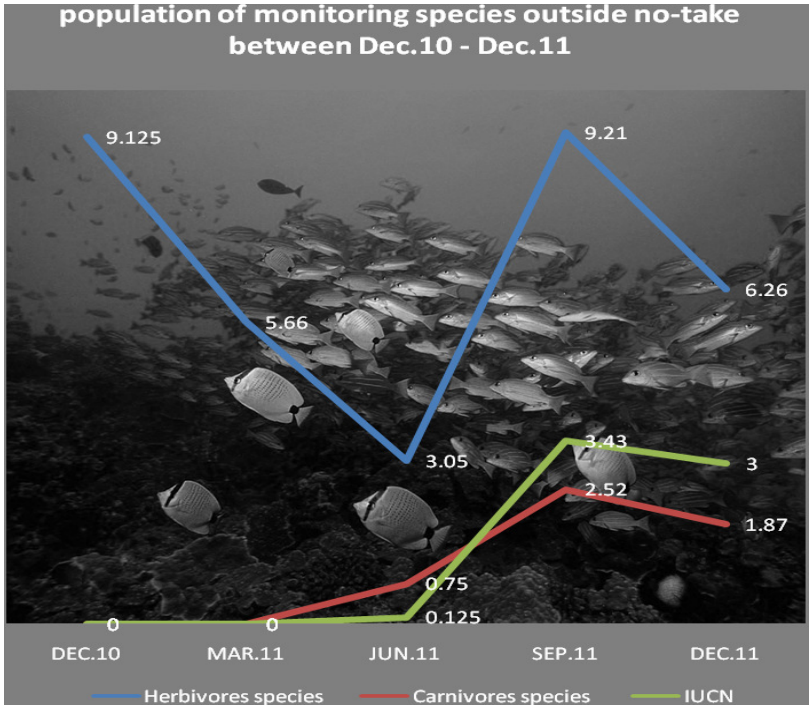


A. Herbivore fishes – The population trend for herbivore fishes over 12 months was not consistant. In December the monitoring team recorded an average of 10.3 herbivore fishes per 500m^2. Then in March 2011, a record of 7.2 herbivore per 500m^2 was observed. The June 2011 recorded the lowest average of 5.8 herbivore per 500m^2 for the last 12 months. This low average for this fish group picked up in September and finally in December 2011, an average of 9.1 herbivore was recorded per 500m^2 transact area.

B. Carnivore fishes – Population trend for carnivore fishes showed low average at the beginning of the monitoring program with 1.1 carnivore fish per 500m^2 and continued to stay that way in March 2011 before increasing to 1.6 fish per 500m^2. The highest average recorded was in September 2011 where an average of 4.5 carnivore fish was recorded per 500m^2. This value further reduced to an average record of 2.5 carnivore fish per 500m^2 in December 2011.

C. IUCN Red List Species – This fish group continue to have low mean abundance in three monitoring periods (Dec.10, Mar.11 and Jun.11) before recording its highest for the 12 month period with average of 3.2 fish per 500m^2 in September and 3.25 fish per 500m^2 in December 2011.

Population trend for monitoring species outside no-take for monitoring period Dec.10 – Dec.11.



A. Herbivore fishes – There was significant fluctuations observed for this fish group over the last 12 months. At the beginning of the monitoring program, herbivore fish recorded high averages of 9.13 fishes per 500m^2 transact and steadily declined to a lowest average of 3.05 fishes per 500m^2 in June 2011 then increased to 9.21 fishes per 500m^2 before decreasing to 6.26 fishes per 500m^2 in December 2011.

B. Carnivore fishes – Records for carnivore fishes only began in June 11 where an average of 0.75 fishes were recorded per 500m^2 for 8 monitoring stations outside no-take. This average value increased to 3.43 fishes per 500m^2 in September then declined to 1.87 fishes per 500/m^2 for December data.

C. IUCN Redlist Species – Records for IUCN Red List species observed a similar manner as Carnivore fishes where it was first recorded in June 11 with an average of 0.125 fishes per 500m^2 for 8 monitoring stations outside no-take. The highest average recorded was in September where 3.43 fishes were recorded per 500m^2 for all 8 monitoring stations outside no-take. This value was the same for December 2011 monitoring period where an average of 3 fishes per 500m^2 was observed.

EVALUATION OF POPULATION TREND FOR DECEMBER 2010 – DECEMBER 2011

1. LIVE CORAL COVER INSIDE/OUTSIDE NO-TAKE

There was not much difference and or effect on coral reefs over the last 12 months. It was apparent that live coral cover was higher for many reefs outside no-take than no-take itself. Many reefs marked as no-take were furthest from land and most have been either offshore, barrier of offshore barrier reefs which have often been subject to harsh weather conditions like storm surge and swells than those located close to mainland Nuakata itself. As such many live coral cover would normally be found on the lower slopes of these reefs than on shallow reef flat areas as any colonies of branching or table corals distributed in these areas would always be damaged by swells and strong currents. This could be the key reason for a low live coral cover record for many reefs inside no-take or community protected areas. Monitoring sites outside no-take comprised many immediate mainland fringing reefs and nearby patch reefs which are not fully exposed to any harsh weather conditions therefore selection of coral growth in these areas are in many growth forms. In particular, the most susceptible branching and table or plate corals are abundant in these areas. These two coral morphologies often provide a large cover area and, have been recorded in numerous colonies in many monitoring areas outside no-take. Other corals like brain corals, encrusting and those with massive and sub-massive structures further contributes to the high cover percentage witnessed in many OT monitoring stations.

Evidence of dead coral rubble and other broken coral fragments were low for many sites in both no-take and outside no-take. Key benthic substrate that made up large portion of abiotic substrate for any offshore reefs in the no-take was hard bedrock and calcareous bedrock which does not mean that the reef system has degraded nevertheless; these only reflects the kind of condition which these reefs are exposed to. The conditions as those described earlier prevent any settlement and growth of corals which do not have survival capabilities to thrive under harsh environment conditions.

It is therefore correct to say that many reefs inside and outside no-take areas around Nuakata are healthy and in their near pristine condition as the level of anthropogenic impacts by both human and nature are very low. Should no major catastrophic event and/or natural perturbation occur in the next 10 years, our monitoring would definitely pick up new information on more coral larvae settlement and growth for many branched and plated coral in many monitoring stations on the offshore reefs (i.e. mostly no-take areas).

2. TARGET REEF FISH MONITORING SPECIES

An accurate statement on the fluctuating fish populations for herbivore and carnivore fishes cannot be provided at this stage as it will require more specific and detailed study to establish that information. Besides that, the trend provided in 1 year could mean anything and will require a continuous time frame to observe if the trends are associated with seasons, food supply or other ecological parameters. Continuous human error by different local monitoring team continue to be a part of this and will require a lot more time before local participants can record data accurately.

Many observations displayed in each monitoring reports present only those that have been record within a defined area of 500m^2 transact which is often monitored. The results from these monitoring stations in both the no-take and outside no-take areas is used to reflect what is found in each areas. It

would be impossible to conduct surveys in all the reefs inside and outside no-take as it will be costly and time consuming therefore; selected monitoring stations have been selected for continuous monitoring to reflect what is expected in the many reef areas inside and outside no-take areas.

In this 1 year period of monitoring both community based monitoring program and deepwater monitoring program undertaken by SCUBA shows healthy populations for herbivore fishes and carnivore fishes in many areas. Data gathered from deepwater shows large sizes of coral trout, snappers, sweet lip, Humphead Maori Wrasse (those recorded as IUCN Red List species) in many areas inside and outside of the monitoring stations. The record for Humphead Maori Wrasse and Bumphead Parrot fishes have been good over the 12 month period which indicate low fishing pressure from the communities on Nuakata Island. Population for herbivore fishes on many reef areas appeared to be in a healthy state however; sizes for many species appeared to be of a concern. Many schools of herbivore fishes observed have been small where many species could have reached their large adult stage. This is a concern which shall be addressed further in awareness for local communities to take note of and observe.

3. SEA CUCUMBER POPULATION

Population of sea cucumber is slowly recovering in many areas we study. This is a good sign of stock recovery. There are other sea cucumber species which we have not recorded in our shallow and deepwater transacts however we anticipate that as we continue to manage our resources into the future we will be able to see these species returning. Sizes for many sea cucumbers are still small and should the closed fishery be opened by the National Fisheries Authority, the current recovering stock will be further decimated.

Data gathered from the monitoring and from general observations made on many reefs inside Nuakata recommends the current ban to further extend for another 3 years to allow for these recovering stock to be become fully mature and be the brood stock to supply more sea cucumber for a full recovery to be optimized. It would only be pre-mature to allow the fishery to commence at this stage as the current supply can only be wiped out in one season.

4. OTHER BENTHIC INVERTEBRATES (Giant clam, trochus, lobster & crown-of-thorn starfish)

There have always been new records for these invertebrates (especially trochus and lobster) in each monitoring period indicating a gradual increase in their population. Monitoring data on giant clam follow a similar trend however; there is still confusion in the distinction between maxima clam (TM) and scaled clam (TS). This confusion presents the need for more exercise and practice on clam identification for members of the monitoring team. There has also been significant rise in the number of crown-of-thorn starfish (CoT) over the last 12 months. This recent monitoring period (December, 2011) recorded the highest average per $500m^2$. As summarized in the result section, there was an average of (7.75 CoT per $500m^2$) where the highest individual site record was observed at Tawali Gadohoa (OT.5) with 12 CoT recorded inside its $500m^2$ areas.

SUMMARY & CONCLUSION

Population trend for those monitoring species over the last 12 months did show some increase in the number of individual target monitoring species. Conclusions on these increases cannot be provided at this stage as more sampling and a longer time period in monitoring is required to observe trend in species population. It is good to know that resources are recovering at this stage. More time is needed to see further changes happening in the population of fishes and other marine organisms around Nuakata and Iabam-Pahilele CMMA.

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