Project Title:

Strengthen the Management and Monitoring of Samoa's Community-Based Marine Management and MPAs Network

Grantee Name:

Government of Samoa

Ministry of Agriculture and Fisheries

Award Number: NA11NOS4820010

Award Period: 10/01/2011 - 06/30/2013

FINAL REPORT

Contents

A. Background

1. The project was identified as an important boost to the onward movement of the 2 Samoas Environmental Initiative. The Ministry of Agriculture and Fisheries (MAF) and the Ministry of Environment and Natural Resources (MNRE) who are the main counterparts in the Samoan Government developed this proposal as an initial implementation on some of the needed activities in which Samoa needs to be effective in the collaboration with American Samoa.

2. The project proposal targeted the NOAAs Coral Reef Conservation Grant Program Fiscal Year 2011 Federal Funding Opportunity–International Coral Reef Conservation Cooperative Agreements with relative Objective 2) Develop and Implement Comprehensive long-term capacity building programs for existing MPAs, based on capacity assessments to provide training, technical assistance, and follow-up support for a) management planning and effectiveness evaluation; b) community engagement program development and c) Integrated biophysical and socioeconomic monitoring linked to site management and objective 5: Use regionally appropriate biophysical and socioeconomic monitoring and evaluation protocol to: a) establish baselines and detect changes over time in an adaptive management framework; and b) Identify priority sites for conservation and assess community support for designation of new MPAs and MPA networks.

3. The main objectives of the project were:

   3.1. To establish a policy framework for effective collaboration for the 2 Samoas to address terrestrial and marine environmental issues affecting the Archipelago;
   3.2. Build capacity and awareness at community level through engagement and participation program through sharing experience and knowledge at local, national and regional level to provide insight examples for better and effective management measures;
   3.3. To provide latest information on the status of the resources and its users for effective management.

4. The project activities were divided into the three main objectives components in which its budget narrations and timelines were developed accordingly.

B. Project Strategies, Activities and Outputs

5. This report will now outline the main activities which were formulated to achieve the main three objectives and will highlight the implementation of each activity and the achieved outputs.

6. ***Strategy 1:*** To establish a policy framework for effective collaboration for the 2 Samoas to address terrestrial and marine environmental issues affecting the Archipelago;

   6.1. Activities:-
      6.1.1. Meeting of the 2 Samoa's to discuss issues and priorities to address in the strategic plan

6.1.2. Consultation in Samoa with stakeholders to raise communities priority areas and needs

6.1.3. Drafting of the Strategic plan (Samoa) and translation before forwarding to the team in American Samoa.

6.1.4. 2Samoa's Meeting in American Samoa to approve the Strategic Plan as well as discussing the ongoing project activities in both Samoas and the next step forward.

6.1.5. Promotion & launching of the Strategic Plan with stakeholders.

6.2. *<u>Achievements and Outputs:</u>*

6.2.1. 2 *Samoa's Environmental Initiative General Meeting:* The meeting took place on the 7th and 8th November 2011 mainly to discuss the main issues for the 2 Samoa's Strategic Plan, to come to consensus on pre-proposals for the FY12 NOAA International Cooperative Agreement, to ensure the successful implementation of established Two Samoas projects, to cultivate a collaborative ethos to archipelago-wide marine & terrestrial management and to agree on the next steps. The meeting agenda with approved minute in Appendix 1 highlights the discussion and agreements for the forward movement of the 2 Samoa's Environmental Initiative.

6.2.2. *National consultation:* This activity was schedule for the 26th of April 2012 but was postponed to the 13th and 15th of November 2012. The aim was to acknowledge the new initiative and its strategic plan to the village communities which are the main stakeholders and the collaborations with American Samoa on taking better management of the Samoa's one archipelago. This consultation was conducted in parallel with annual consultations with local communities within the community-based fisheries management program by the Fisheries Division.

6.2.3. *Samoa Drafting of Strategic Plan:* During the 2 Samoa's Meeting in November 2011, the Strategic Plan was approved in principle with the understanding that the Samoa's counterparts will have time to add on, modify and make changes to the plan to be in line with the 2 Samoa's long term goals. The drafting took place on the 21st – 23rd March 2012 and mainly to incorporate Samoa's national priorities which are in line with the 2 Samoa's long term goals for relevance and ease of implementation. Appendix 2 is the Strategic Plan Draft produced from this drafting which was later forwarded to the American Samoa side for their final comments. As of today, we are still trying to sort out a date for another 2Samoa's Environmental Meeting so the revised Strategic Plan is to be signed. However there is now an understanding there is a revised draft in existence and both parties are implementing this Strategic Plan draft.

6.2.4. *2 Samoa's Meeting in American Samoa to approve the Strategic Plan;* this meeting never took place as difficulties arises in trying to finalize a specific date for this meeting. Thus the money was not used.

6.2.5. *Promotion and Launching of the 2 Samoa's Plan:* This activity could not take place due to reasons explained in part 6.2.3, thus the money was not used.

7. **Objective 2: Building capacity of village leaders and community members to strengthen the management and monitoring of community-based fish reserves and MPAs.**

7.1. ***Activities:***

7.1.1. Community members exchange learning with communities in American Samoa.

7.1.2. Capacity Building Program (Workshops and Awareness Campaign.)

7.1.3. Marking and Demarcating of fish reserves and no take zones.

7.2. ***Outputs***

7.2.1. *Community Exchange of Village Representatives and Ministries from Samoa to American Samoa*: A total of 24 people travelled to American Samoa from the 10thto the 13th of September for this activity. Fifteen village high chiefs represented all the districts in Samoa were accompanied by Ministry staff members on this exchange. The Governor of American Samoa, Lolo Matalasi Moliga, welcomed the group on the first day with an traditional welcoming ceremony and wished them a successful visit. Throughout the week, the community members got to hear and visit four of the existing community-based fisheries management and the no-take marine protected area programs. Apart from learning about how American Samoa implements their programs, the members also shared their lessons - successes and challenges with their own programs with community members of American Samoa. Field trips to different Government departments include the American Samoan College, Department of Environment, Marine Sanctuary and the Forestry Department. The agenda of the visit and the Cabinet Report (Samoan) are in Appendix 3a and 3b.

7.2.2. *Village Consultations***:** Fisheries Division conducts regular consultations with villages within the Community-Base Fisheries Management Program and these consultations were used to promote the 2Samoa's Environmental Initiative. However two major consultations were conducted in Upolu on the 13th November 2012 and on the 15th November 2012 mainly to inform the village leaders within the Community-Base Fisheries Management Program on the update of the activities from the 2 Samoas Environmental Initiative. These consultations were conducted in Samoan.

7.2.3. *Awareness materials:* Productions of posters and pamphlets were carried out in May 2013, and October 2013 for the two main Agricultural and Fisheries Shows for the Ministry of Agriculture and Fisheries which farmers and fishers in Samoa compete for best produces, best farms, best fish catches, best tilapia farms and best fish reserves. Two of the posters are in Appendix 4 and the third one is in a separate document due to size.

7.2.4. *Marking and Demarcation of fish reserves:* Five (5) fish reserve were marked with buoys and signboards funded under this project. These new villages now can enforce their village by laws and management through the non access or no take zones as indicated by these marking within their marine areas. Appendix 5 show pictures of one of the fish reserves with typical markings and sign by buoys and signboards.

7.2.5. A total 9 newly established fish reserves within the project timeframe in which the project funds provided buoys and signboards for marking.

Table 1: List of newly approved 'village management plans' and newly established fish reserves

Villages	**Date of Management Plans Approval**
Satuimalufilufi	25 Jan 2012
Satapuala	3Feb 2012
Lano	21 Feb 2012
Salani	20 Mar 2012
Vaimaga	6 Nov 2012
Tafua	5 Dec 2012
Fasitoo-tai	23Jan 2013
Vaiusu	16 Mar 2013
Puapua	3 Apr 2013

8. *Objective 3: To conduct socio-economic training surveys in Samoa to provide information of marine resources status and changes as well as the effectiveness of our MPAs as management tools*

8.1. *Activities*

8.1.1. Conduct training for the local staff on socio-economic surveys and ecological assessments and pre-test

8.1.2. Conduct the socio-economic survey in Samoa and Upolu. There will be 2 weeks for this national wide survey covering 20% of the total number of villages in Samoa.

8.1.3. Develop database for data entry, analysis, and produce reports on the effectiveness of the management approaches in place.

8.1.4. Conduct ecological assessments at data less areas selected. There are villages that are not in either programs and thus are data less ecologically. The assessments will cover these areas in which there are about 5 sites.

8.1.5. Develop database for data analysis and storage and produce reports on the effectiveness of the management approaches in place, the level of participation of the local communities on the management approaches in place and the confirmations of areas with biological significance.

8.2. ***Outputs:***

8.2.1. *Training for the local staff on socio-economic surveys and ecological assessments.* This training was conducted for a week on the 11th – 15th of June. The training consists of 24 staffs who all were narrators for the socio-economic survey. The narrators were trained on the questionnaire and a trial run on the survey was conducted on the last day. The questionnaire is shown in a separate document titled "Socio-economic Fisheries Surveys in Pacific Islands: A Manual for the Collection of Minimum Database."

8.2.2. *Conduct the socio-economic survey:* The survey was conducted for the Upolu and Manono Island on the 25th – 29th of June and then Savaii on the 2nd – 6th of July. The survey was to provide the socio economic impacts of fisheries in Samoa and as a mean to update the status of local fisheries and marine conservation management programs existing in Samoa. A total of 100 villages were sampled out of the 330 sub villages and villages of Samoa. For each village 30% of its total household was sampled for questioning.

8.2.3. The Samoa Fisheries Socio-economic Survey Report 2012 was published and now available for the public. But more importantly provide an update of the status of community fisheries for us local fisheries managers to improve management. The report is included in a separate document due to the size.

8.2.4. *Develop database for data entry analysis and reporting:* The database specialist was sought from the Secretary of the Pacific Community (SPC) which is a regional fisheries management organization for our Pacific Region. He spent a week with us, in training our local staff on the features and operations of the database. Furthermore, our two senior staffs travelled to the SPC in New Caledonia, for a two week attachment for data analysis and the report writing. The database is now housed within the Fisheries Division accessible by Fisheries staff.

8.2.5. The purchasing of monitoring equipments has been done and assessment of one district has been completed. The assessments started off with the island of Manono and later on to selected represented sites for Samoa as a whole. This assessment was to assess the habitats and stock abundance of the sea cucumber species in Samoa. This work has now produced a report

which is fundamental in the preparation of the Sea cucumber fisheries management plan for Samoa. The report is included in a separate document because of the file size.

8.2.6. With the arrival of these monitoring equipments it replaces worn out and damaged monitoring equipments within the Division and enabled continuous monitoring of fish reserves, which included assessments of new sites for fish reserves and the re-assessments of existing fish reserves to update the ecological information of these reserves for the advice to village councils. The project has ended however these equipments are being continuously used for our ecological assessments to this date. The assessment reports are in Appendix 9.

Table 2: List of new sites with ecological assessments conducted within the project timeframe

New and on-going sites	**Assessment Dates**
Salamumu	22nd March 2013
Apolimauta (re-assessment)	4th December 2012
Afega	20th Mar 2013
Vavau	14th Feb 2013
Samatau	28th Nov 2012

C. Un-Achieved Activities

- *2 Samoa's Meeting in American Samoa to approve the Strategic Plan;* this meeting never took place as difficulties arises in trying to finalize a specific date for this meeting. Thus the money was not used.

- *Promotion and Launching of the 2 Samoa's Plan:* This activity could not take place due to reasons explained in part 6.2.3, thus the money was not used.

- *Capacity Building Program* – 2 National Workshops with 2 MPAs of Aleipata and Safata – the reason being all activities targeting these two districts were on hold during the project timeframe, due to an investigation by both the Government on the usage of trust funds for the two districts.

- *Monitoring of 2 sites under the MPAs of Aleipata and Safata* – The MPA program at the time was on hold due to an internal Government investigation on the usage of trust funds of the two MPAs.

D. Challenges

1. The timing to take advantage of this funding by the NOAA Coral Reef Conservation Grant Program was indeed very timely for the official initiation of the 2 Samoa's Environmental Initiative. The project was a good step for the promotion of 2 Samoa's to our local communities in terms of collaborations on environmental management. Note that the cultural and social ties between the two countries are interlinked and very close and thus the collaboration on social and cultural issues is not new. In fact it isknown that the 'Samoa Community Base Fisheries Management Program was first introduced to American Samoa Government back in 2002 in which Samoa Fisheries staff travelled over to American Samoa to introduce the program and train the American Samoa staffs.

2. The major challenge faced by the project was our project management team turn over, in early 2012, we lost Ms Olofa Tuaopepe who passed away and since then Ms Joyce Samuelu Ah Leong took over the management of the implementation of activities. In June 2012 our ACEO then Mr Mulipola Atonio Mulipola was suspended and later on had his contract terminated in November the same year. We also lost a senior officer and an officer die to sudden deaths and the turnover in the year 2012 alone was 9 staff. Since Ms Samuelu Ah Leong took over the role of Acting ACEO on and off since June 2012 and since then tried to balance the coordinating of the project with her other responsibilities.

3. The other challenge was when trying to liaise with the American Samoa Government for implementation of certain activities as they also have other priorities and often these activities are postponed or cancelled.

4. The Fisheries Division believes this project contributed tremendously in promoting the 2 Samoa and the Fisheries Division is standing firm as a key stakeholder in the movement of the 2 Samoa's Collaboration.

Recommendation and Conclusion:

5. While there were failures due to incomplete of some of the activities of the project, most of the activities were completed and the outputs produced are now building blocks to improve marine conservation and fisheries management for Samoa. The project also provided the opportunity to strengthen the understanding and appreciation among the two countries at the village levels on the efforts carried out individually and the impacts it has on the whole Samoa's archipelago.
6. The funding opportunity was essential as it was the first time for Samoa to receive such funding and enabled the productions of some of the essential work in marine conservation and fisheries management and for that we acknowledge with appreciation the funding, patience and support of the NOAA team whom have continuous to push us into a successful completion of this project.

Appendices

Appendix 1: 2 Samoa's General Meeting Agenda and Minutes for Meeting on the 7th & 8th November 2011.

Meeting of the Two Samoas: Agenda

An Archipelago-wide Approach to Natural Resource Management and Conservation

November 7th-8th, 2011; Apia, Samoa

The purpose of this meeting is to adopt the Two Samoas Management Plan, come to consensus on pre-proposals for the FY12 NOAA International Cooperative Agreement, ensure the successful implementation of established Two Samoas projects, cultivate a collaborative ethos to archipelago-wide marine & terrestrial management, and agree on the next steps.

MEETING PROGRAM* (November 7th, 2011)

TIME	PRESENTATION	DISCUSSION	PRESENTER	OUTCOMES	MINUTES
1 pm	**Welcome**	Formalities	CEO/Director Fanuatele Dr. T. Vaiaga'e (AS-EPA)	*Official opening and participant introductions. Identify a record keeper from each jurisdiction.*	*CEO MNRE welcome the American Samoa delegation followed by the traditional welcoming ceremony 'ava'.*
1.15 pm	**Meeting Introduction**	Review meeting agenda and objectives	CEO (MNRE)	*Establish consensus on the purpose and agenda of meeting.*	*NO alterations were made to the Agenda and was pass and endorse for*
1.30 pm	**Review of current status**	Summary and outcomes of previous Two Samoas meeting (January/ February 2011, Utulei) Two Samoas Management Plan development process	Faleafaga Toni Tipama'a (Samoa) Lelei Peau (AS)	*Review agreements from previous meeting to set stage for current discussions. Review the process in which the current version of the Management Plan was drafted.*	Toni ACEO-MNRE highlighted on the work by the Samoa side for the 2 Samoas. The NOAA Grant initiation was noted. The 2 exchange visit by the villages from Am Samoa and hosted by MAF Samoa. Deputy Director DoC Lelei Peau presented on the update summary from Am Samoa. These include, the drafting of the management plans starting in January these include the consultations with Samoa in identifying the key threats affecting the Samoa archipelago, also identifying solutions to counter these threats. • Request by Am Samoa to standardize what term to use for the Strategic Plan whether to use Management or Strategy. This was further discuss and later agreed that

					'Strategic Plan' to use. • Director of the DMWR raised the members
2 pm	**Progress since previous meeting (con't)**	Status of funded/active Two Samoas Projects	Selaina Vaitautolu-Tuimavave (AS)	*A short presentation on the completed MPA Stewardship Exchange project.*	Selaina from Am Samoa presented on the updates highlighting the Exchange village to Samoa. Faleafaga highlighted Samoa ongoing projects mentioning MPA extension work here in Samoa, Turtle and Cetation survey, the 1 million tree replanting. Director DMWR acknowledges his appreciation of the assistance by MAF and MNRE on their visit. Joyce acknowledges the NOAA Grant approval and awaiting the availability of funds. Also highlighting the 'Biogeographical Assessment of the Samoa Archipelago'. Director EPA question clarifications on the perception of the villages on this community-base fisheries management program. CEO MNRE and ACEO Fisheries responded the views from the local communities.
2.30 pm	**Afternoon Tea Break**				
2.45 pm	**Two Samoas Management Plan**	Review and adoption of the draft Two Samoas Management Plan	Faleafaga Toni Tipama'a (Samoa) Hideyo Hattori (AS)	*The management plan must be adopted by the Two Samoas and submitted to NOAA CRCP to legitimize and formalize the body, and to leverage funding for the Coordinator/Secretariat position in the FY12 CRCP Int'l Cooperative Agreement*	*Hideyo presented the Plan page by page and comments were raised:* • *Goal 2 Objt2Action 2: Revise this to mitigate* *CEO MNRE again emphasize the importance of having the right TITLE for the Plan, something to encompass the whole Archipelago including terrestrial resources. Also emphasize the importance of having the plan drafted base on our current work. Some of the objectives and actions have been completed and thus needs to be revised.* *Lelei reemphasize this point however clarify the need to have reference to 'coral reefs' due to the available funding from NOAA which is base on 'coral reefs'.* *Call for the technical staff to work more on the 'actions' to reflect the current situations and be ready for the Nov 18th NOAA funds.* *There was consensus to leave the drafting and revision base on the comments put forward by the participants.* *The Goals and Objectives are ok and the technical team to work on the 'ACTIONS'* *Consensus on the name to be 'STRATEGIC PLAN FOR THE TWO*

					SAMOAS ENVIRONMENTAL COLLABORATION.
3.45 pm	**Closure**	Formalities	CEOs/Directors		Chair confirmed to resume the meeting at 0930 and have the technical team work on the draft earlier.
					DISCUSSIONS FROM THE TECHNICAL GROUP:
6 pm	**RECEPTION**				

**The agenda is subject to change*

MEETING PROGRAM* (November 8th, 2011)

TIME	PRESENTATION	DISCUSSION	PRESENTER		MINUTES
8.30 am	**Recap of previous day**	**Review of the outcomes from day 1**	CEO, MAF (Chair)	*Establish point of reference for day 2*	*CEO MNRE opens the meeting and pass to the technical group to comment on their drafting from yesterday.* *ACEO MNRE Faleafaga presented the changes made, such as the name of the Plan 'Strategic Plan for the 2 Samoa's Environmental Collaborations.'* *Goal 2: Objt 2: Include shark as a specific species* *G2, Ob2: include trevallies in the list of species* *G2 Ob3:* *Goal 3: Objt 3: Action2: needs revision and was changed.* *Goal 4: Objt 1: Acknowledge the term use to explain the types of land-base pollution 'point and non point pollution.* *Goal5:Action 2: Include 'colleges'* *Chair thank the technical team and pose the question on what is the next step for the plan such as the 'what is the costing to implement this plan'. Emphasizing Goal 1 Objective 1 on the 'operating the Secretariat'.* *Director of EPA raised his doubt on the word 'environment' as the right word to reflect the intention of the plan and*

					suggesting the word 'biodiversity' which can truly reflects the intention of the plan. *Chair suggested on the plan to have a life span with the annual review to suit the annual meetings by the two countries and was second by the Directors.* *Deputy Director (DD) Lelei raised the missing timeline that needs to be incorporated to implement this plan. The Chair raised the issue of having a provision within the plan to acknowledge that this plan should link to the existing strategic policies of the two national Governments. So that specific actions required of each Government will be uptake by the systems within each Government and thus avoid replications of activities.* *The two countries will endeavor to raise wide awareness and gage wider support to_____* *DD making a request that the TORs for the Secretariat should include a provision whereby the guidelines will be provided by this body during their general meetings.* *American Samoa delegation provided a document, which puts in paper the establishing of a steering committee to guide the work of the secretariat. Mr Chair appreciates the documents and sees this as a progress from the last meeting.*
8.45 am	**NOAA CRCP Int'l Program**	Presentation by NOAA CRCP representative regarding the	NOAA Representative	*Review of NOAA CRCP's International Program and*	*Joyce presented on the approved activities and timelines for the current NOAA Grant FY11. The*

		NOAA CRCP International Program		*the FY12 Cooperative Agreement*	*meeting were also notified that even though the Grant officially started in Oct 31st as indicated by NOAA, the Samoa Government is yet to receive the funds that has been delayed.*
9.30 am	**FY12 NOAA CRCP Int'l Grant**	Review and prioritization of pre-proposals	CEOs/Directors	*Pre-proposals will be presented in a short 'wish list'. The Two Samoas will prioritize this list into projects of up to $150,000 for the first 12 months of a 24-month cooperative agreement. The pre-proposals are due to NOAA CRCP on November 18th.*	
10.30 am	**MORNING TEA**				
10.30 am	**Next Steps**	• Any pending items yet uncovered • NOAA Grant Application tasks, leads, and timeline • Implementation plan of pending projects • Signing of official meeting records • Next meeting	All	*Identification of next steps, timeline, and next meeting. Other general 'housekeeping' needs.*	*Mr Chair suggested that the Strategic Plan be adopted in principle. But need to incorporate the other matters, such as the budget, and other implementation plan.* *Lelei suggested that Am Samoa is hosting the US CORAL REEF TASKFORCE meeting on the 2nd wk of August for this meeting and inviting 2 participants from Samoa.* *Lelei raised the fact that the NOAA research ship to visit the American Samoa in February. Am Samoa has secured a 1wk for Samoa and has made communications to CI and SPREP.*

12 pm	**Closure**	Formalities	CEOs/Directors	*Conclusion of the Two Samoas Environmental Collaboration Meeting*	*Chair closes the meeting with word of thanks.*
12.30 pm	**LUNCH**				

**The agenda is subject to change*

Appendix 2: ***Two Samoa's Strategic Plan*** – unsigned

Development Process of the Strategic Plan for the Two Samoas Environmental Collaboration

This document captures the final set of priorities agreed upon by the technical staff from Samoa and American Samoa. From a list of over 50 issues covering eight broader categories, 11 were prioritized with the highest possible rating. All 11 of these items fall into the following categories:

Threats:

- Minimize *land-based pollution* and marine debris to improve water quality and ecosystem health.
- Build community and ecosystem *resiliency to climate change*.
- Protecting and maintaining the rich and natural heritage of the Samoan islands from the impacts of *invasive species*.
- Manage *fisheries* to ensure sustainable harvest and use of marine resources.

Solutions:

- *Increase scientific understanding* of natural resources for evidence based policy/planning/decisions support.
- Ensure *effective management* of shared natural resources.
- *Communication, education/outreach, and partnership building*.

The four threats identified were developed into four of the Goals listed in this Strategic Plan through consultations with technical staff. The first Goal, "Building a Regional Partnership between the Two Samoas for improved archipelago-wide environmental management" reflects the overall purpose of the Two Samoas Environmental Collaboration, and aims to ensure a collaborative approach to the remaining four goals. The solutions identified were integrated into the Objectives that support each Goal.

For the purpose of this Strategic Plan, the following definitions were used:

> Goals are defined as the highest-level result the Two Samoas seeks to achieve.
>
> Objectives are defined as the environmental, social, and institutional outcomes that the Two Samoas must achieve to reach its Goals.
>
> Action/Strategy are specific projects that were identified as necessary to achieving the objectives.

This Strategic Plan serves as a living document and Action/Strategy can be modified throughout continued consultations. Any new additions or modifications must be developed in a transparent consultation process consistent with the collaboration that led to the development of this Strategic Plan. This Strategic Plan will be reviewed and evaluated on an annual basis.

These Priority Goals and Objectives will help guide Samoan and American Samoan practitioners develop funding opportunities for projects that fall under this Strategic Plan. Samoa and American Samoa have already developed their own management plans; it is imperative that any action under this Strategic Plan be connected to existing programs to prevent a duplication of work already being undertaken.

Two Samoas Management Priorities

In order to comprehensively and effectively address shared environmental threats to the Samoan archipelago and carry out priority management goals, management agencies and organizations must approach their work collaboratively with a shared set of guiding principles. This document aims to foster coordination, information sharing, and resources-sharing between the environmental management agencies of Samoa and American Samoa.

Goal/outcome 1 –a STRONG regional partnership between the Two Samoas for improved archipelago-wide environmental management

Objective/ Outputs1: <u>Strengthen collaborative relationships</u> between the Two Samoas' government, industries, private sector, villages, individuals, as well as regional and international organizations.

Activity 1: Develop a Two Samoas Strategic Plan, which will guide all Action/Strategys that occur under the Two Samoas process. (Approve and formalize by June 2012)

Action/Strategy 2: Hire a Two Samoas Environmental Collaboration Coordinator, based in Apia, to coordinate and oversee the implementation of projects that fall under the Two Samoas Environmental Collaboration. (Address under the NOAA Grant Proposal 2012/13).

Action/Strategy 3: Develop the operational structure of the Two Samoas Environmental Collaboration by establishing the Steering Committee members, Points of Contact, and stakeholder membership.

Action/Strategy 4: Review of Strategic Plan on a triennial basis.

Objective 2: Improve <u>transparency and communication</u> of Two Samoas actions with outside stakeholders and environmental managers.

Action/Strategy 1: Build and maintain regular communication between American Samoa's Coral Reef Advisory Group agencies and Samoa's Ministry of Agriculture and Fisheries and Ministry of Natural Resources and Environment through annual meetings.

Activity: Conduct annual meeting around June/July – (to go in line with our fiscal year planning, this is the time with reporting of last fiscal year achievements and propose plans for the upcoming FY.)

Action/Strategy 2: Build and maintain a website to serve as a portal into the Two Samoas Environmental Collaboration, including an online archive of all related documents and materials.

Activity: 1) Coordinator to facilitate the development and designing of the website. 2) Launch the website by the end of June 2012

Action/Strategy 3: Develop a schedule of quarterly status updates (Monitoring and Evaluation M&E system) and calls that allow each of the agencies that collaborate on programs and projects to dialog, exchange ideas and revise activities.

Activity: 1) Develop the M&E two months after recruiting of 2 Samoas Coordinator

Objective 3: Increase an archipelago-wide <u>scientific understanding and transfer of knowledge</u>.

Action/Strategy 1: Build and maintain an archipelagic-focused marine-science center. Activity: Establish marine science center at both Samoa's by mid 2013.

Action/Strategy 2: Exchange scientific and traditional ecological knowledge between Samoa, American Samoa, and other Pacific Island Nations.

Activity: 1) Coordinate and organize an annual seminar/conference to exchange this information e.g Climate Change Conference by American Samoa.

Action/Strategy 3: Assess and strive to maintain/sustain the nature of biodiversity of the terrestrial and marine life in the Samoa archipelago.

Activity: 1) Propose to share and compare available and relevant information and know how on biodiversity and identify gaps)

Goal 2 LONG TERM SUSTAINABILITY OF FISH STOCKS AND ECOSYSTEMS TO SUPPORT FUTURE GENERATIONS OF SAMOANS.

Objective 1: Increase the scientific understanding of key marine species and biological areas, in order to improve science-based planning, decision making, and adaptive management.

Action/Strategy 1: Conduct an archipelago-wide study to determine the population and genetic structures of key reef species, including but not limited to surgeon fish, parrot fish, jacks, and grouper to infer the dispersal patterns of these critical fish species.

Activities: 1)Source funds and technical expertise for a archipelagic study. 2) Identify key species and study sites. 3)Develop stock assessment model. 4) Create an MoU to implement the set undertakings.

Action/Strategy 2: Conduct an archipelago-wide study to determine the spatial and temporal distribution of various life history stages of key reef species and their related habitat requirements.

Activity: Improve model for the larval dispersal. 2) Develop a resource profile for the archipelago. 3) Create an MoU on study of larval dispersal and temporal distribution.

Objective 2: Ensure the protection of critical coral reef habitat – including spawning and aggregation areas – through the development of Marine Protected Areas (MPAs).

Action/Strategy 1: Develop and strengthen of culturally appropriate education and outreach activities to improve the awareness and participation of the communities. Activities: Produce brochures, information sheets, posters, audio visuals on MPAs/fish reserves and coral reef management.

Action/Strategy 2: Develop an archipelago-wide network of no-take MPAs.

Activity: Create an MoU to facilitate the establishment of an archipelago wide MPA network

Action/Strategy 3: Expand upon existing village/community-based MPAs, marine reserves, sanctuaries, and special management areas.

Activities: 1) Establish new local and regional management areas. 2) Create an MoU to facilitate regional MPAs.

Action/Strategy 4: Investigate the possibility of species specific protected areas that incorporate the biological needs of shark and marine mammal populations in the Samoan archipelago.

Activity: Conduct investigations and establish protected areas for sharks and marine mammals within the archipelago.

Objective 3: Reduce fishing pressure on coral reef fish by <u>introducing alternative sources of marine-based protein and economic livelihoods</u>.

Action/Strategy 1: Assess the social, economic, and cultural drivers of fishing activity throughout the Samoan archipelago via socioeconomic studies.

Activity: Conduct socio-economic and fisher creel surveys

Action/Strategy 2: Based upon socioeconomic studies, formulate appropriate strategies to encourage a shift from fishing to alternative and sustainable livelihoods, such as aquaculture.

Activity: Develop and implement aquaculture development plan and projects. Develop alternative fisheries e.g ornamental, sea cucumber farming, sea grape fishery and trochus fishery. Develop alternative systems such as FADs and offshore fishery

Action/Strategy 3: Conduct a species assessment of underutilized marine and freshwater species, including prawns, offshore mariculture, etc.

Activity: Conduct feasibility studies for underutilize species such as prawns, mud crabs, coconut crab and other potential species.

Objective 4: <u>Improve and strengthen enforcement of fishing regulations</u> to ensure the exploitation of fish resources is sustainable.

Action/Strategy 1: Maintain a detailed record of reef fish catch data, including species of concern, to be used to better inform fishing regulations.

Activity: maintain and improve data collection protocols and systems,

Action/Strategy 2: Update/strengthen fishing regulations to include seasonal takes, size limits, and catch limits of key species, especially low abundance large species such as humphead wrasse, bump head parrotfish, and all sharks.

Activity: Review existing regulations and incorporate recent scientific assessment outcomes on target/concern species.

Action/Strategy 3: Maintain a regular review of fishing regulations to update regulations based on new, relevant biological and socio-economic factors. DELETE as covered by Action/Strategy 2

Action/Strategy 4: Establish mitigation measures for shark, turtle, and marine mammal takes in long-line fisheries.

Activity: Develop and implement management plans for shark, turtle and marine mammals which outline mitigation measures

Action/Strategy 5: Develop an enforcement learning exchange to share existing fisheries regulations, capabilities and identify mutual areas that can be addressed in a regional effort.

Activities: 1) Use SPREP and SPC as a regional office to assist in the building of our local enforcement teams in capacity of enforcement. 2) Involve the communities in enforcing village level regulations and build their capacity in enforcement. 3) Community exchange of experience and lesson learnt in by-laws formulation and enforcement.

1. Strengthen local and regional enforcement teams
2. Build capacity through the entire law enforcement chain, including the prosecution service.
3.

Action/Strategy 6: Develop and facilitate culturally appropriate education and outreach activities to increase and improve community awareness of, participation in, and support for fisheries management and regulations.

Goal 3 – Strong resilient ecological and community to the effects of climate change

Objective 1: Continue to support transboundary research, analysis, and evaluation of climate change and its evolving implications for the Samoan archipelago.

Action/Strategy 1: Conduct and build upon climate change vulnerability assessments for all ecological and community sectors within the Samoan archipelago, including modeling for potential climate change scenarios.

Activities: Collect/collate and use available data from existing climate change vulnerability assessments and related researches 2) establish relevant models for adaptations and mitigation measures.

Objective 2: Establish adaptive management strategies to maximize resilience of coral reef and mangrove ecosystems across the Samoan archipelago.

Action/Strategy 1: Incorporate current climate change scenarios into policy development and management decisions.

Activity: Identify and establish climate change coral reef & mangrove ecosystem issues into the national and village level management decisions/policies

Action/Strategy 3: Encourage continued exchange of climate change-focused ideas, experiences, and best management practices between the two Samoas.

Activities: 1) Exchange visits for village communities on climate change specific issues. 2) Carry out an annual seminar/conference on climate change specific issues.

Objective 3: Enhance the ability of the public and communities to prepare for, adapt to the environmental changes due to the effects of climate change..

Action/Strategy 1: Build an informed public through climate change-focused outreach and education activities that highlight (a) factors that contribute to global climate change; (b) climate change impacts relevant to the Samoan archipelago; and (c) knowledge of applicable mitigation and adaptation options.

1. Assess the social, economic, and cultural issues that may hinder progress toward a climate-resilient archipelago.
2. Develop and facilitate education and outreach activities for a range of audiences to increase community awareness, preparedness, and buy-in.
3. Ensure community buy-in and ownership of projects that focus upon community resilience.

Action/Strategy 2: Provide communities with feasible options for improving resilience to climate change

Activities: 1) Determine feasible options for community resilience to climate change. 2) Improve on existing resilient options.

Objective 4: Ensure the sustainability of potable freshwater resources.

Action/Strategy 1: Work within existing frameworks to ensure that existing water resources are protected and conserved with the ultimate goal of sustainable use.

Activity: Implement activities identified for the protection and conservation of water be in line with existing framework.

Action/Strategy 2: Improve water infrastructure to ensure that all communities have access to potable drinking water.

1. Build an informed public that is aware of the impending climate-change related impacts to island water supplies. – Get the activities from the Water Sector Plan, and insert into plan.
2. Improve sustainable wastewater management throughout the Samoan archipelago. (Get activities from Marine Pollution Act, Waste management Act)

Goal 4 – ImproveD water quality and MARINE ecosystem health through the reduction of land-based pollution and marine debris.

Objective 1: Improve our understanding of links between land-based pollution (both point and non-point sources) and coral reef health through scientific research and monitoring in order to create a standard archipelago-wide assessment of the impact of pollution on the archipelago's coral reefs.

Action/Strategy 1: Assemble existing water quality data and establish a long-term status and trends water quality monitoring program for the coastal and offshore waters. Compile this information in a biannual Samoan archipelago water quality status report.

Activities: 1) Collect and collate existing data on water quality and identify gaps for data collection. 2) Harmonize assessment methods and reporting on reef health assessments. 3) Conduct research on gaps identified such as water quality testing, sedimentation testing. 4) Create an MoU to collaborate on data collection of offshore water pollution.

Action/Strategy 2: Based on the archipelago-wide water quality status report, target management activities to address the most vulnerable reef ecosystems as well as sources of pollution requiring urgent attention.

Activities: 1) Set national standards/reference points on seawater quality. 2) Create management policies in protection and rehabilitation of affected areas from pollution, man made and natural disasters.

Objective 2: Reduce solid waste, runoff and resulting sedimentation loads to surface water and reef systems by developing and implementing best management practices.

Action/Strategy 1: Reduce solid waste by establishing and implementing an effective 3R (Reduce, Reuse, Recycle) program throughout the Samoan archipelago.

Activities: 1) Effectively implement activities within the Waste Management Act and the Marine Pollution Act. 2) Set up local processor for the implementation of 3Rs.

Action/Strategy 2: Strengthen and build upon existing legal frameworks and regulations emphasizing archipelago-wide cooperation.

Activity: Develop and incorporate community-waste management options into existing management policies.

Action/Strategy 3: Effectively enforce existing land use regulations to manage the impacts of land-based sources of pollution.

1. Improve existing enforcement activities through the use of new technologies such as GIS and satellite imaging.
2. Conduct capacity building to strengthen enforcement by relevant agencies.

Action/Strategy 4: Preserve, restore, and protect mangrove and wetland habitats.

Activity: Implement activities under the MESCAL project and Community-based mangrove restoration programs and UNDP climate change adaptations.

Objective 3: <u>Increase public understanding</u> of the impacts of land-based sources of pollution on the marine ecosystems, encouraging a "sense of guardianship" and improving public compliance with existing pollution and waste reduction measures.

Action/Strategy 1: Conduct Participatory Learning and Action and Conservation Action Plan workshops to increase public awareness and enhance support for, and participation in, existing management programs.

Activity: Strengthen existing awareness programs on impacts of land-based pollutions on the marine ecosystem.

Action/Strategy 2: Conduct outreach activities that focus on proper disposal of solid waste and recycling.

Activity: Conduct community consultations on solid waste and recycling

Action/Strategy 3: Organize community- and government agency-led clean-up programs that target youth groups, villages, and community groups to encourage local environmental stewardship.

Activities: 1) Organize national events for cleanups 2) Increase community participations on cleanup programs.

Goal 5 – Ensure continued protection of endemic AND THREATENED terrestrial and marine biodiversity of the Samoan archipelago from the threat of invasive species.

Objective 1: Develop and build upon programs and procedures to minimize the impacts of established invasive species by eradicating them where practical, otherwise managing them.

Action/Strategy 1: Identify the existing invasive species in the Samoan archipelago, their current and projected distribution, and their potential environmental, economic, and social impacts.

Activity: Assess the impacts of invasive species on environment and other species.

Action/Strategy 2: Develop and implement management programs to eliminate/minimize/cull the invasive species or minimize the impact of established infestations of invasive species, taking into account community attitudes, resource requirements, and potential risks and constraints.

Activity: Implement activities under the National Invasive Species Action/Strategy Plan

Action/Strategy 3: Identify training needs and develop and implement necessary training and capacity building programs to strengthen the capacity of Samoa and American Samoa to manage invasive species.

Activity: 1) Conduct trainings on eradication program such as 'yellow crazy ants eradication method'. 2) Seek assistance from the Pacific Invasive Learning Network for capacity training

Objective 2: Enhance public awareness and understanding of the sources and impacts of invasive species in order to increase levels of compliance and support for managing existing invasive species and preventing the introduction of new invasive species.

Action/Strategy 1: Create an archipelago-wide information portal on exotic and invasive marine and terrestrial species. Information should include general background on species, how invasive species are introduced, and ways to prevent future introduction.

Activity: 1) Create the information portal and ways to prevent introductions of invasive species.

Action/Strategy 2: Develop a comprehensive educational program that targets key stakeholders by:

1. Reviewing the curricula of education institutions and incorporate information about invasive species;
2. Reviewing existing government and community programs to identify opportunities to incorporate information about invasive species; and
3. Enhancing awareness of relevant legislation and enforcement.

Objective 3: Prevent the introduction of new invasive species by fostering regional and international cooperation.

Action/Strategy 1: Compile a comprehensive list of invasive species present amongst trading partners

Activities: 1) Ensure databases remain current and readily accessible to all relevant stakeholders Include essential information for an effective response. 2) Create an MoU on the response and preventative actions from invasive species.

Action/Strategy 2: Enhance current inspection and surveillance systems and procedures for potential invasive species.

Activity: Strengthen surveillance systems through inspections and enforcement.

Action/Strategy 3: Reinforce Samoa's and American Samoa's existing partnerships and participation in regional and international conventions and treaties, in order to:

1. Maximize the sharing and exchange of information;

Recommend further Action/Strategy in relation to binding and non-binding instruments to prevent the introduction of new invasive species

Appendix 3a: Communities Exchange Agenda

Two Samoas Exchange Visit

10th – 13th September, 2013

Date	Activities	Presenter
Monday **9th Sep 13**	Samoa Team arrive Am Samoa	
Tuesday **10th Sep 13**	9:00am – Ava Ceremony 10:00am – Welcoming Remarks 10:15am – Department of Marine & Wildlife Resources: Community-based Fisheries Management Program 11:00am – Department of Marine & Wildlife Resources: No-Take Program 12.15pm – LUNCH BREAK 1:00pm - National Marine Sanctuary of American Samoa 2:00pm – National Parks of American Samoa 3:00pm – Background of CBFMP in Samoa (process/status and initiatives) 3:30pm – MPA Program (background/status/lessons learned)	 DMWR Director, Dr. Ruth Matagi-Tofiga Saumaniafaese Uikirifi CFMP Tafito Aitaoto No-Take Program Representative of NMSAS Representative of NPS Samoa FD Samoa MNRE
Wednesday **11th Sep 13**	***Field Day 1: Department of Marine & Wildlife Resources*** 8:00 am - Field to trip Fagamalo and (CFMP/No-take MPA site)	 Faleniu Faletogo

	Progress of both programs in the village; importance of programs to community; challenges and strengths of programs 1:00 pm Field trip to Matu'u & Faganeanea (CFMP site) *Update of program status; changes since the implementation of program; importance of the program to community; challenges and strengths* 3.00pm – Visit to Alo (CBFMP) and snorkeling in the fish reserve	Tofiga Ale
Thursday **12th Sep 13**	***Field Day 2: Visits to:*** ***National Marine Sanctuary of American Samoa*** ***National Parks of American Samoa*** ***Department of Environment, Am Samoa.***	Representative of NMSAS
Friday **13th Sep 13**	***Leave for Upolu, Samoa***	Representative of NPS

Community Members share their experiences on marine resource protection and fisheries management in American Samoa

Figure 1: Samoa delegation during one of the visits to the village of Fagamalo in American Samoa

Fifteen members from selected Community-based Fisheries Management Program (CBFMP) and the Marine Protected Areas (MPAs) programs of the Fisheries Division and the Ministry of Natural Resources and Environment gathered together to attend a three day learning exchange visit in American Samoa. Funded by NOAA under the Two Samoa Environmental Collaboration Initiative, the delegates whom are made up of leaders of their respective marine reserves around Savaii, Manono and Upolu as well as staff of the two Ministries were provided an opportunity to learn about the operations of the different marine protected area programs in American Samoa.

The Governor of American Samoa, Lolo Matalasi Moliga, welcomed the group on the first day with an ava ceremony and wished them a successful visit. Throughout the week, the community members got to hear and visit some of the community-based fisheries management and the no-take marine protected area programs. Apart from learning about how American Samoa implements their programs, the members also shared their lessons - successes and challenges with their own programs with community members of American Samoa.

Malama Tiitii of Savaia fisheries reserve expressed his sincere appreciation and thanked the two Ministries for providing them the opportunity to visit American Samoa stating that "…*I've learnt so much from this learning exchange and am eager to return and continue to carry out this program*…"The Samoa delegation were headed by the two ACEOs of the relevant Ministries Mrs Joyce Samuelu Ah Leong and Mr Faleafaga Tipamaa. Mrs Samuelu- Ah Leong was quite pleased with this rare opportunity to have the community leaders of two countries meet and share their success stories and challenges on the management and protection of their marine environment. This has certainly promoted the awareness of the two Samoas on the issues that matter the most at the village level.

Field trips to the different Government departments, colleges such as the American Samoa Community College and the Ocean Center in American Samoa also re-emphasized the importance of working together to ensure that our marine resources are not lost and are there for our future generations to enjoy and continue to protect. The Ministries would like to thank the various departments of American Samoa especially to the Department of Marine and Wildlife Resources for hosting and organizing the visit. The learning exchange visit would also not have been possible without the support of the Government of Samoa.

Appendix 3b: Cabinet Report (Samoan)

PEPA I LE KAPENETA

LIPOTI O LE MALAGA A SUI O AFIOAGA MA MATAGALUEGA A LE MALO I TUTUILA MO LEA'OA'OGA MO SAMOA E LUA

[Saunia ele afioga i le Minisita o Faatoaga ma Faigafaiva]

1. MAFUA'AGA

1.1 E tusa ai ma le fa'atonuga a le Kapeneta [F.K.(13)32] mo se lipoti atu o le fa'aiuga o le a'oa'oga mo sui e 15 o afioaga (Vailoa Aleipata, Saleaumua, Aufaga, Tafatafa, Salesatele, Savaia, Sataoa, Tafitoala, Vaie'e, Siufaga i Falelatai, Salua tai, Malae i Faga, Papa i Palauli, Vaisala ma Salelologa) ma sui e 9 o le Matagaluega o Fa'atoaga ma Faigafaiva ma le Matagaluega o Punaoa Fa'alenatura ma le Siosiomaga lea na malaga i Amerika Samoa.

1.2 O sui o afioaga e aofia ai pulenuu, o isi o tuua lava o afioaga ma o afioaga uma o loo i lalo o le polokalame mo le puipuiga o le gataifale a Matagaluega na lua.

2. FA'AMATALAGA

2.1 O le malaga na fa'ataunu'uina i le aso 10 – 13 o Setema 2013 ma e 24 sui o le faigamalaga.

2.2 O le polokalame ma lona fa'atinoga ua otooto atu.

- Aso Lua 10, Setema
    - **Usu Fa'aaloalo a le Malo o Amerika Samoa** – Sa faia le ava usu e le Malo o Amerika Samoa, ma sa auai ai le kovana Sili o le malo o Amerika Samoa ia Lolo Matalasi ma Fa'atonu Sili o Ofisa eseese i Amerika Samoa. O galuega o le ava na saunia e le Ofisa o Alamanuia ma Faigafaiva o Amerika Samoa.

    - **Polokalame Eseese a le Malo o Amerika Samoa mo le puipuiga ma le faasaoina o gataifale -** O le polokalame lea o le aso Lua atoa o le mafutaga faasemina i le Ofisa o Alamanuia ma Faigafaiva na folasia ai e Ofisa eseese i Amerika Samoa polokalame tau faasao o le gataifale o loo faatinoina i Tutuila. E taua tele folasaga na folasia mai Ofisa eseese i totonu o Amerika Samoa na maua ai le malamalama i polokalame eseese o loo faatino tau le gataifale. Na fefa'asoaa'i i galuega o loo faatino iinei i Samoa ma talatalanoa i galuega foi e le o mafai ona faatinoina i Samoa ae o loo faatino i Tutuila ma lesona lelei o loo maua mai ai . O le tasi vaega taua, o le tele o le alamanuia tau seleni ma le poto faapitoa o loo maua e Tutuila e ala mai ile malo tele o Amerika, ma ua amanaia foi e le Malo o Amerika le taumafaiga o loo taumafai iai Samoa e lua. (Two Samoas Initiative) O nisi o galuega ua faasoa mai ai sui o Ofisa o le Malo o

Amerika (Federal office) o le faamalosia lea o tulafono a le Malo o Samoa i i'a ma figota laiti o loo ave atu i totonu o Tutuila.

- Aso Lulu 11 Setema
    - **Feiloaiga ma le afioaga o Fagamalo** - Sa asia e le faigamalaga le nuu o Fagamalo, ma maua le avanoa e feiloa'i ai ma le sui Pulenuu o Fagamalo ma maimoaina le gataifale fa'asao. Na faailoa mai ai e lua ituaiga faasao o gataifale o loo I Fagamalo. O le tasi e I lalo o le malo o Amerika Samoa e faasao ai le aloalo ma le aau. O le faasao lea e faa-vaitaimi ma e i le faitalia o le afioaga le taimi ma le aso e tatalaina ai mo fagotaga. O le isi faasao e i fafo atu o le aau e agai atu ile 3 maila le mamao i tai, e i lalo o le vaavaaiga o le Malo o Amerika (No Take Zone Marine Protected Area). O le faasao lea ua faamauina e oo ile faavavau le faasaina o soo se gaioiga e aofia ai ma le fagota se'i vagana le fagotaga o le afa afa loloa (bottom fishing). Sa tele ni fefaasoaiga i ituaiga o loo lelei ma le lelei ai nei ituaiga faasao, ma o le molimau a le pulenuu sa umi se taimi na faatalanoaina ai lenei polokalame (5 tausaga) ma ua na o Fagamalo ua faatino ai le ituaiga faasao lea.

    - **Asiasiga i le afioaga o Aoa –** O le afioaga o Aoa o loo faatino ai foi le faasao o le gataifale ma o le faatinoga a le afioaga e fai sone lona gataifale. O le molimau a le pulenuu ma lana komiti na feiloai ma le au malaga, o sone e eseese tulafono e faatino ai. O le sone i matu e faasaina ai le moulu poo le lama ona o le latou molimau o loo tele le amu e ono faaleagaina i taula o paopao aemaise le au tautai. O le sone i sasa'e e faatagaina ai na o le afa loloa ona e loloto.

- Aso Tofi 12 Setema
    - **Asiasiga i le Kolisi o Amerika Samoa (American Samoa Community College)** – Sa molimauina ai e sui o le malaga atina'e tau su'esu'ega eseese o loo faatinoina i totonu o le Kolisi. Sa molimauina le su'esu'ega o le laupele ua silia ma le 10 ituaiga pele ua faafofoaina i Tutuila. Molimauina le tolu (3) ituaiga faa-faatoagaina o meatuaolo. Molimauina le faa-faatoagaina o le tilapia faatasi ma fualaau aina (aquaponic). Molimauina suesuega mo le totoina o le talo, ma auaunaga lautele a le Kolisi mo Tutuila i le unaina lea o faatoaga manu, mea toto ma i'a ma figota.
    - **Asia le Ofisa o Paka i Amerika Samoa (National Parks in American Samoa)** – Sa asia ma molimauina galuega eseese o loo faatinoina e le Ofisa lenei mo le faasaoina o le vaomatua ma aafiaga o le gataifale ma lona puipuiga.

    - **Asia le Ofisa o Siosiomaga** – O le asiasiga mulimuli lea I lea aso o le asia lea o le Ofisa o Siosiomaga (Department of Environment) ma o le mataupu

autu o le faailoa mai lea o le tasi o matati'a ua faatuina e Tutuila. O le fausia lea o le fale muamua ile Pasefika ua ta'ua o le Green Building (fale meamata). O le igoa ona o le fale e le fa'aaogaina ai se eletise mai le suau'u ae ua fa'aaogaina ai le malosi o le la (solar system) ma o le fale atoa ua fauina mai oloa ua toe fa'aaogaina (recycle materials). Ma o lea na molimauina ai lenei taumafaiga taua aua le faasaoina o le siosiomaga mai kasa oona o le suauu, aemaise le tuuitiitia o le faalagolago i suauu ae fa'aaoga ave malolosi o le la o loo maua i aso uma i Samoa. O taavale foi e lua o loo fa'aaogaina e le Pule Sili ma le sui Pule Sili o taavale ua fa'aaogaina ai le eletise (electric powered by solar) ae le o le penisini poo le tiso (diesel). Sa maua le avanoa o le au malaga e maimoaina ai taavale nei.

3. **FA'AIUGA**

3.1 O lenei malaga o se avanoa taua lea ua molimauina ai e sui o afioaga mai Upolu, Manono ma Savaii galuega mo le puipuia, faasaoina ma vaaia lelei o le gataifale o loo faatinoina e Tutuila, amata mai i lana faiga Malo i vaega eseese, Ofisa Tumaoti, Aoga e oo lava i afioaga. O le taua o le galulue faatasi mo le puipuia o le gataifale.

3.2 Ua molimauina ai le moomia o le galulue faatasi o Samoa e lua, aua e tasi le sami. O aafiaga o le gataifale i Tutuila e iai alamea o loo tauivi ai nei, o le tasi foi lea o aafiaga o loo ua aafia ai o tatou gataifale i Samoa nei. Ua mautinoa ai, o le galuega o loo faatino e le Pulenuu ma lona nuu i Samoa nei o loo iai le aafiaga lelei poo le leaga ile gataifale o soo se itu i Tutuila.

3.3 Ua talitonu sui o Matagaluega o se faamalosi au taua lea mo sui o afioaga le taua o le sao o afioaga ile puipuia, faasaoina ma vaaia lelei o gataifale. O punaoa o loo fitoi tonu mo afioaga, ma a leai lo latou tu malosi e faatino, e le mamalu tulafono a latou afioaga, e le malu foi tulafono a le Malo o Samoa, ma e iai le aafiaga i le gataifale o Tutuila. E faapena foi i o tatou gataifale i Samoa nei pe afai e le o lelei puipuiga faatino i Tutuila.

3.4 E momoli tele atu le faafetai a sui o afioaga ma sui o Matagaluega ile paia o le Kapeneta mo le taliaina o le talosaga mo le faatinoina o le faigamalaga.

Appendix 4: Community-based Fisheries Management Program Poster

Live Coral Poster

Faisua Pull up poster-separate document due to size

POLOKALAME MO LE VAAIA MA LE PULEA TATAU O GATAIFALE O SAMO

Afioaga o Salesatele

1. FONO MUAMUA: ALII MA FAIPULE & VAEGA O FAIGAFAIVA

1. Faamalamalama ma Taliaina e le afioaga le Polokalame
2. Ia silafia ma siitia le malamalama o le afioaga i le aoga ole Faasao o le Gataifale mo le lumanai

2. FAATALATALANOAGA: VAEGA UMA O LE AFIOAGA

1. Sailia ni faafitauli o iai ile gataifale, ma se fofo o nei faafitauli
2. Faia ni Tulafono ma Faasalaga aua le puipuiga ole Gataifale

3. FONOTAGA KOMITI OLE GATAIFALE & VAEGA O FAIGAFAIVA

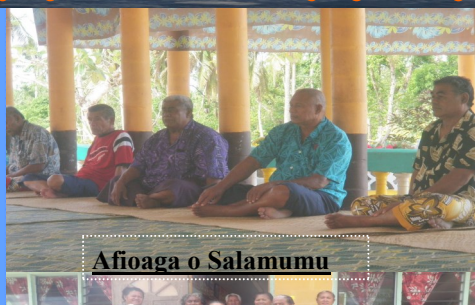
1. Soalaupule nisi o vaega mo le Tusi taiala ae lei Pasiaina ile Fonotaga Mulimuli

4. FONO MULIMULI MO LE PASIAINA OLE TUSI TAIALA, AFIOAGA& VAEGA O FAIGAFAIVA

1. Faamalamalama ma Pasiaina le Tusi Taiala a le Afioaga
2. Galueaina le Tusi Taiala e le Ko miti o le Gataifale

5. FAUSIA TULAFONO LAITI O LE GATAIFALE A LE AFIOAGA

1. Ia faaaoga ma malu puipuia ai Faasao o le Gataifale
2. Amanaia ma Faasalaina i Tulafono ale afioaga, olea amanaia foi I tulafono ale Malo lenei tulafono laititi e fai ma molimau I ana faamasinoga. Aua lava le puipuiga ole Gataifale o Samoa mo le Lumanai.



Afioaga o Salamumu

FAI SUESUEGA MOLE NOFOAGA

TOTONU OLE NOFOAGA FAASAO (FAISUA)

TOE TOTOINA OLE AMU AUA LE SIOSIOMAGA O I'A/FIGOTA

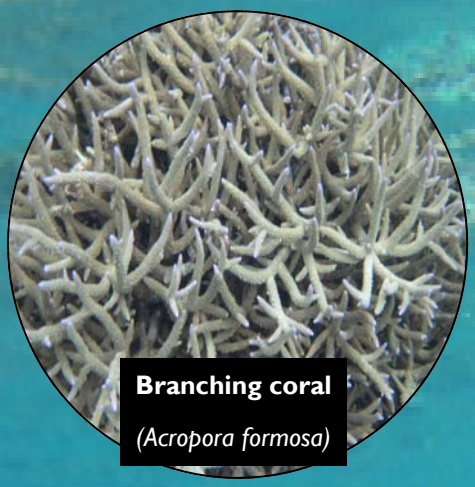
FAIA NI FAASILASILAGA MO LE FAASAO

FAATUINA LE NOFOAGA FAASAO, MA OLE TALI FO LEA OLE FAAFITAULI

Saunia: Vaega Faufautua, Vaega o Faigafaiva, Matagaluega o Faatoaga ma Faigafaiva, SAMOA.

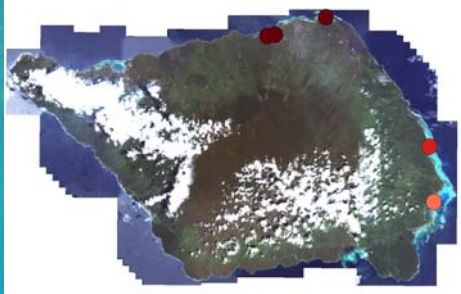
Ph: +68520369, Fax: +6824292, Email: www.fisheries.@maf.gov.ws, Website: www.maf.gov.ws, Design & photo by Tuluiga Taito James

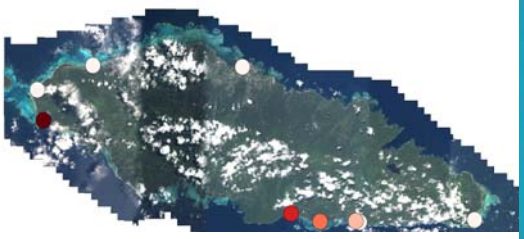
STATUS OF FISH RESERVE CORALS



Branching coral

(Acropora formosa)





Foliose coral

FACTS:

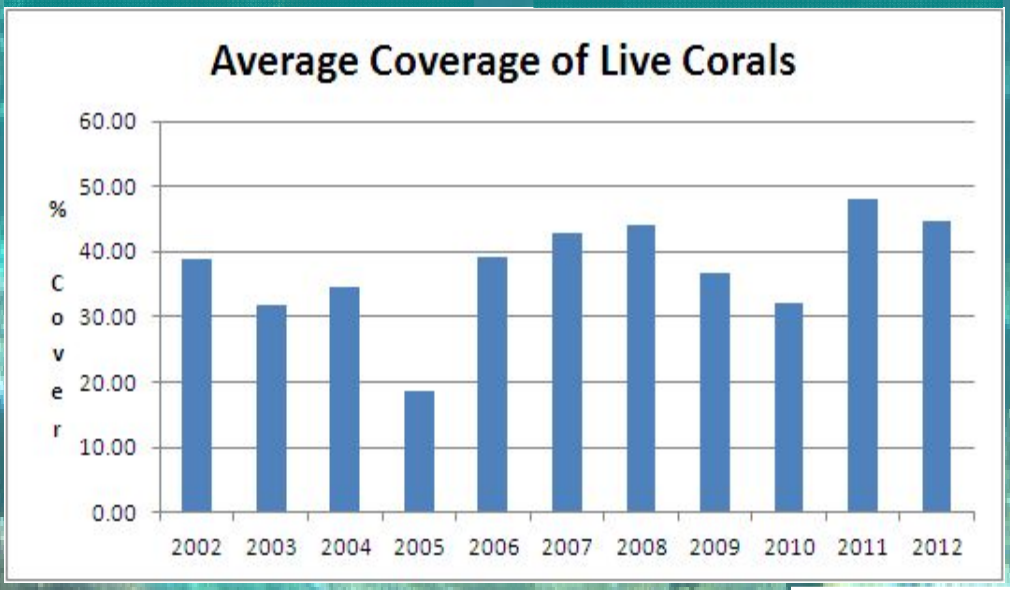
- Corals are unisex & hermaphroditic
- Reproduce asexually and sexually
- Various growth form variations
- Live symbiotic with other animals

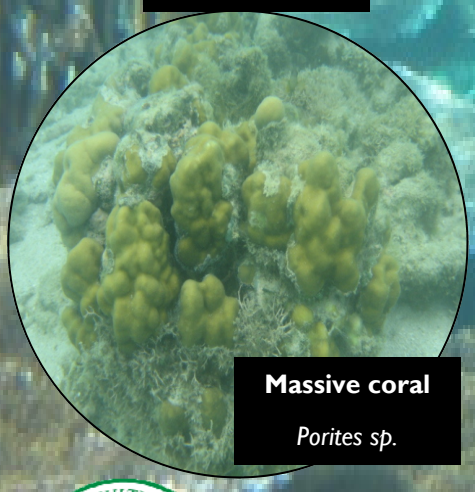
THREATS:

- Pollution
- Destructive fishing
- Sedimentations
- Crown of thorns
- Elevated sea surface temperature

Tabular coral

Acropora hyacinthus





Massive coral

Porites sp.

Prepared: M. Sapatu & J. Aiafi
Fisheries Division, Ph: 20368
Funded: NOAA

Appendix 5: Pictures of Floats and Signboards, funded by the NOAA Projects

Picutre 1: Signboard to acknowledge the fish reserve in the village of Gagaifoilevao

Picture 2: Signboard to acknowledge the fish reserve for Sale Saipipi village

Picture 3 and 4: Set of floats and ropes for fish reserve boundary marking

Picture 5, 6 ,7: Typical on field training villagers in rope splicing and connecting of floats for reserve markings

Picture 8 ,9: Fish reserve markings using buoys for the Gagaifoilevao village

Appendix 6: Ecological Assessments conducted at data less sites

Report for the Initial Assessment of Salamumu Fish Reserve

22th March 2013

Justin Aiafi (Fisheries Officer) and Maria F. Sapatu (Senior Fisheries Officer)

Inshore Section

Fisheries Division

Ministry of Agriculture and Fisheries

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1. Introduction

Fish reserve is the protection of marine ecosystems and its resources from anthropogenic and natural impacts. It also focuses on restoring damages made to resources and ecosystems as well as sustaining its status in order to continue its usual role to nearby communities which is to provide source of food, income and employment.

Establishment of such fish reserves within the coastal environment is one activity that the Samoa Fisheries Division is implementing under the Community Based Fisheries Management Program (CBFMP). This management tool is collaboration with local communities as they deal mainly with the

management and protection of these reserves while the Fisheries Division is that of a technical assistant.

Majority of coastal communities in Samoa have joined the program since its launching in 1995. Up until now, more than 80 communities have registered as members of the CBFMP. Salamumu of Gagaemauga 2 district is one community that has recently joined the program (Figure 1). This community is located on the southern part of Upolu with an estimate population of 359 (Statistics: 2006). Positive feedback on the program and intention to better manage and enhance coastal resources stock was the pushing factor that drove Salamumu to establish a fish reserve. Management plan for its coastal resources and ecosystems of the community was completed on the 4th of March 2013. This plan is a guideline for the community on ways or issues they need to address in order for their reserve to be successful as well as small regulations that needs to be enforced by the community such as banning of destructive fishing methods.

On the 22nd of March 2013, 18 days after the launching of its management plan, the fisheries monitoring team (Inshore Section) headed out to Salamumu to conduct an initial ecological resource assessment of its proposed fish reserve. This initial assessment is to unveil the current status and diversity of substrate coverage (e.g. live corals and algae) within the reserve. As well as document the diversity and abundance of fish and invertebrate present. This report will portray the data collected and findings from this initial assessment.

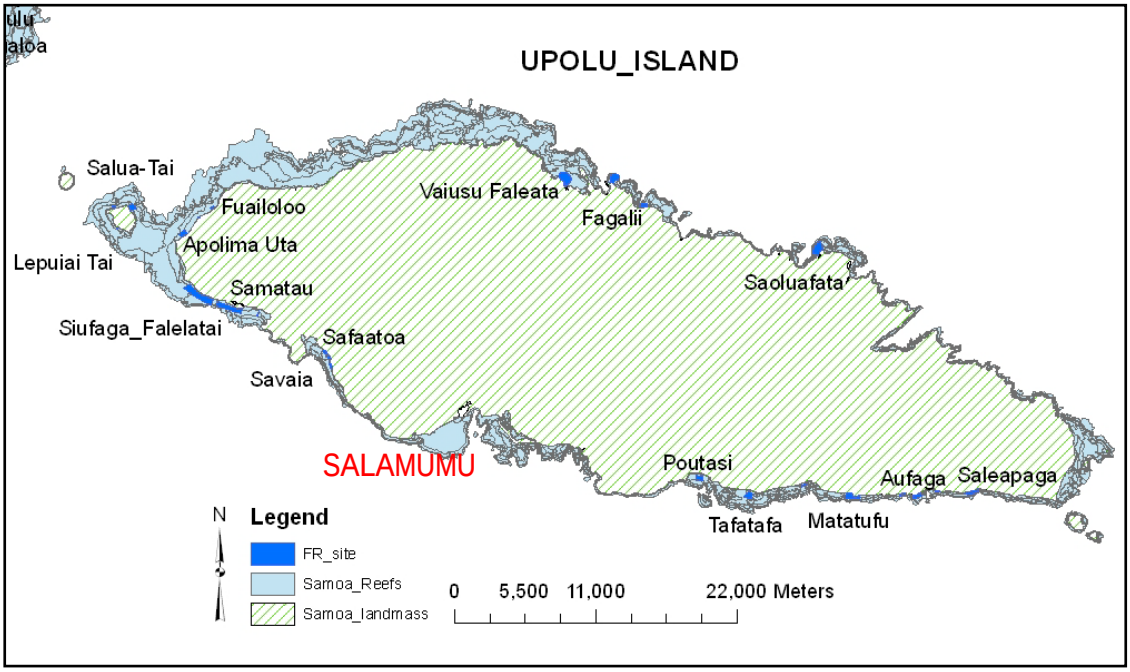

Figure 1: Map of Upolu, indicating the location of Salamumu coastal community

2. Methodology

Underwater visual census of the surveyors was used to carried out the 3 Point Intercept transect (3 PIT) and the Belt Line Transect (BLT) methods.

The BLT method was used for the invertebrate, fish species and their abundance. The fish assessment was conducted first due to the mobility of such organisms. Three surveyors are employed in this method; one swam and laid out the 50 meters tape in a straight line (transect) while the other two are about two meters left and right of the tape. These two recorded the abundance and estimated lengths (in centimeters) of the fish species observed (Figure 2). Afterwards, similar procedure was conducted for invertebrate abundance however the measurable invertebrate species are physically measured with a caliper.

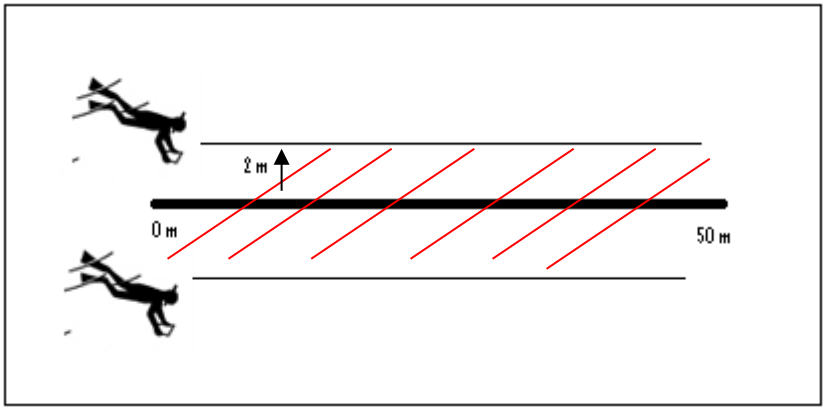

Figure 2: Diagram portraying the survey design of the Belt Line Transect

On the same transect (50 meters) the substrate coverage was then carried out using the 3 Point Intercept Transect method. Similar number of surveyors were used the only difference from the BLT method is that at every two meters all three were to record the type of substrate observed at that particular point (Figure 3). A three letter code for the substrate type observed was recorded (Australian Institute Manual Survey Substrate code).

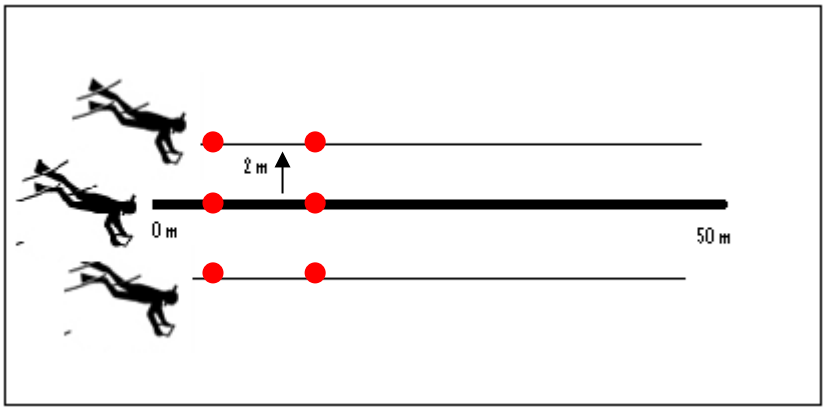

Figure 3: Diagram portraying the survey design of the 3 Point Intercept Transect

Five transects (Figure 4) were randomly laid out parallel to the coastline within the fish reserve in order to be of representative of the whole fish reserve. Each transects covers about 200m^2 therefore the total assessed area was 1000m^2. The estimated total area of the fish reserve was 60,000m^2.

Figure 4: Map of the coastal marine habitat of Salamumu indicating the locations of the assessment transects (5 transects were laid out but only 4 transects where the GPS locations was recorded)

3. Results

3.1 Substrate coverage

All the different substrate types observed were sorted into relevant substrate groups as tabulated in Figure 6. Live coral was the most abundant substrate group within Salamumu fish reserve with 62% in coverage. The most common live coral type was the Acropora branching that of the Acropora *nobilis* (Figure 5) followed by coral branching. Details of these coral types are portrayed in Figure 7. The second ranked common substrate group was abiotic or non living organisms of 20% which consisted mainly of sand and rubbles. This was followed by dead corals with algae 14%. A small percentage of dead and broken corals were also recorded.

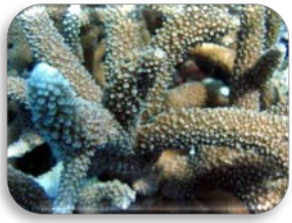

Figure 5: Acropora branching (*Acropora nobilis*)

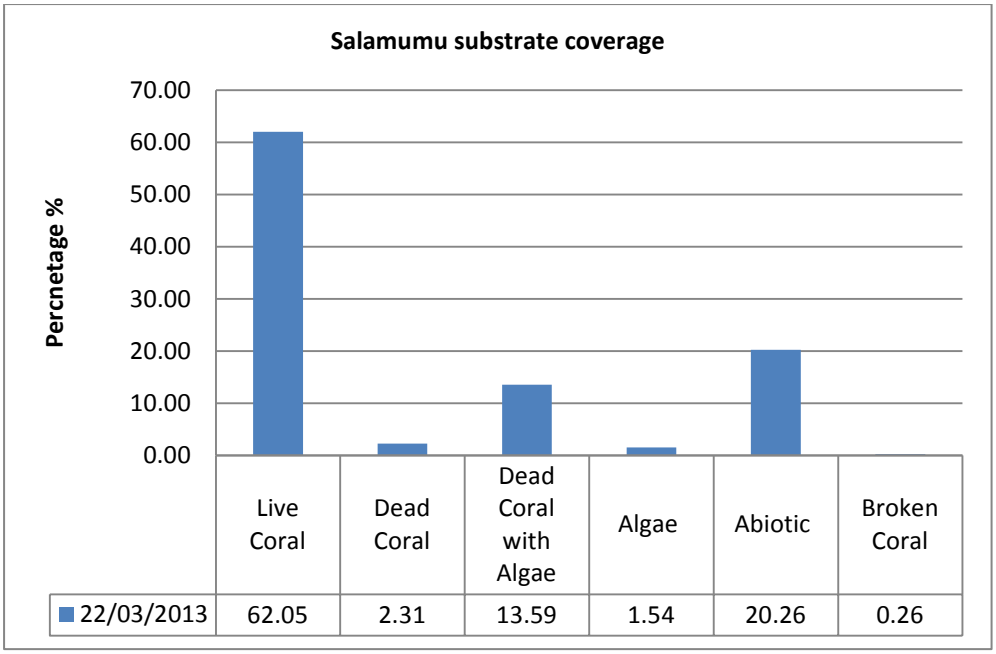

Figure 6: Substrate coverage of Salamumu Fish Reserve

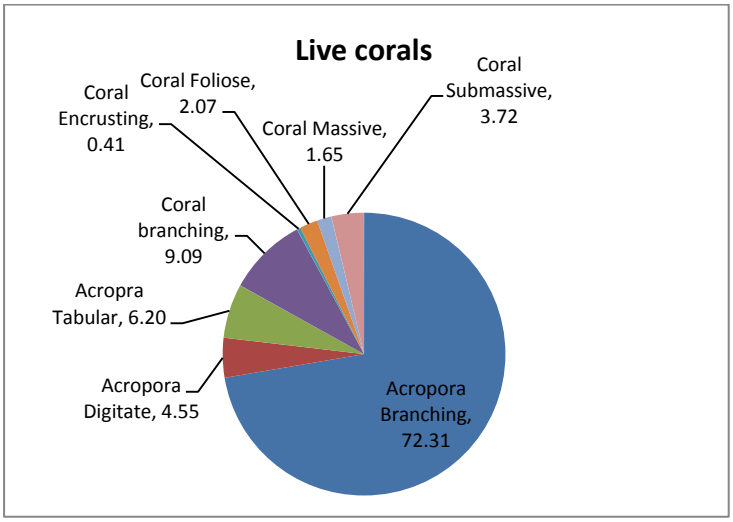

Figure 7: Live Corals at Salamumu

3.2 Fish Abundance

Twenty fish species was noted during the assessment to inhabit in Salamumu reserve with a total of 692 individuals. Total estimated biomass of these species within the whole fish reserve was 1849 kg.

The species with the highest quantity was the black damsel (*Neoglyphidodon sp*.) with a total amount of 249 equivalents to 36% total fish percentage. Parrotfish (*Scarus sp.)* had the highest estimated biomass of 375 kg but has only 2.3% contribution of the fish percentage abundance. Checkerboard wrasse (*Halichoeres hortulanus*) of 27 centimeter average length was the biggest fish observed. Other species recorded are listed in Table 1 with their average length; total count in numbers and percentage and estimated biomass within the total fish reserve area.

Table 1: Fish Abundance from Salamumu fish reserve

Fish Species	Scientific name	Avg Length (cm)	Total Count	Est. Biomass (kg)	Percentage (%)
Sixbar wrasse	*Thalassoma hardwicke*	7.3	66	33.8	9.5
Brown surgeon	*Ctenochaetus striatus*	11.7	68	361.0	9.8
Butterflyfish	*Chaetodon sp.*	12.7	38	127.2	5.5
Black damsel	*Neoglyphidodon mela*	6.6	249	171.0	36.0
Convict surgeon	*Acanthurus triostegus*	13.7	38	164.5	5.5
Two spot demoiselle	*Chrysiptera biocellata*	5.7	77	137.2	11.1
Dark capped parrotfish	*Scarus oviceps*	15.0	24	163.1	3.5
Parrotfish	*Scarus sp.*	22.7	16	375.1	2.3
Checkerboard wrasse	*Halichoeres hortulanus*	27.3	4	69.8	0.6
Lined surgeonfish	*Acanthurus lineatus*	18.0	11	95.8	1.6
Goldspotted spinefoot	*Siganus punctatus*	19.5	8	106.0	1.2
Little spine foot	*Siganus spinus*	24	1	16.7	0.1
Southseas devil	*Chrysiptera taupou*	6	3	0.9	0.4
Blue green chromis	*Chromis viridis*	5	7	1.6	1.0
Humbug damsel	*Dascyllus aruanus*	3.5	15	2.2	2.2
Threadfin butterflyfish	*Chaetodon auriga*	5.5	12	3.6	1.7
Surge wrasse	*Thalassoma purpureum*	5.5	2	0.3	0.3
Bird wrasse	*Gomphosus varius*	5.3	44	3.2	6.4
Threespot wrasse	*Halichoeres trimaculatus*	16.3	4	13.0	0.6
Speckled butterflyfish	*Chaetodon citrinellus*	6.7	5	2.5	0.7
Total		-	**692**	**1848.50**	**100**

3.3 Invertebrates

There were five species of invertebrates tallied and measured from the assessment. Majority of these invertebrates were that of sea cucumbers where lollyfish (*holothuria atra*) was the most abundant with 27 counts and had an average length of about 11 centimeters. This was followed by crown of thorn (*Acanthaster planci*) with only 3. Other species are listed below in table 2 with abundance and average lengths.

Table 2: Invertebrates from Salamumu initial assessment

Invertebrate species	Scientific Name	Avg Lengths (cm)	Count	Percentage %
Lollyfish	*Holothuria atra*	10.5	27	75.0
Crown of thorn	*Acanthaster planci*		3	8.3
Greenfish	*Stichopus chloronotus*	8.5	2	5.6
Tigerfish	*Bohadschia argus*	26	2	5.6
Blue Starfish	*Linckia laevigata*		2	5.6
Total		-	**36**	**100**

4. Discussion

Being a new comer to the program surprisingly, there was a good coverage and diversity of live corals recorded within the proposed fish reserve. However recorded low coverage of dead and broken corals may be considered to be due to fishing activities that was once conducted within the marine area but not of that of Cyclone Evan in 2012.

With such live coral characteristics the proposed fish reserve inhabits a diversity of species as noted in the 20 fish species recorded. This included a mixture of corallivore and herbivores species. The highest recorded species was the black damsel (*Neoglyphidodon sp*.) with more than 200 individuals. Often abundance of corallivore fish as such is an indication of healthy live corals within the habitat. Being a member of the Pomacentridae family, black damsels are small size fish are noted in its recorded size range from 4 to 10 centimeters. On the other hand, the herbivore parrotfish (*Scarus spp*.) can grow from 3 to 40 centimeters and more. This is why parrotfish has the highest biomass out of twenty species as shown in table 1 because it grows to huge sizes, and size is proportional to weight. Presence of herbivore fish species is important as they help stabilize the growth of algae within the habitat so that it does not become a threat to live corals.

Five invertebrate species were recorded where three belonged to the Holothuriidae family (sea cucumbers). These slow moving species are considered an advantage to the reserve as they are sea cleaners. They ingest dead organic materials through their tentacles leaving the sand clean and clearing water column of floating phytoplankton. However, a few crown of thorns (*Acanthaster planci*) the coral predator was noted which can lead to massive coral bleaching if there abundance is not managed and properly monitored.

5. Conclusion and Recommendations

To conclude, the substrate coverage of Salamumu is currently at a good status where live corals was the dominant substrate group. A good diversity of corals was also noted which can provide lots of shelter and niches to various marine organisms. This was shown in the abundance of fish and species recorded (20 species) with black damsel as the most abundant species. Abundance of a corallivore species as such is a good indication that the live corals within the proposed fish reserve are healthy. Herbivore species was also seen in

good abundance which are a advantage to have because they help stabilize the growth of algae. The invertebrate assessment on the other hand, was mostly that of sea cucumber species which helps maintain clean the water column and seafloor.

Therefore, this report recommends that with good management and enforcement of Salamumu's small regulations with regards to this reserve, the substrate coverage will improve and accommodate more and diverse fish and invertebrate species. As well as, efforts to remove crown of thorns (*Acanthaster planci*) from the proposed fish reserve in order to prioritize the healthy growth of live corals. Ignoring to do so will eventually lead to bleaching and of course with no doubt affect the status of the fish and invertebrate found within the reserve.

Government of Samoa

MINISTRY OF AGRICULTURE AND FISHERIES SAMOA

Initial Assessment Report of Samatau reserve Reassessment

MAF-Joyce

Inshore Section

Fisheries Division

Ministry of Agriculture and Fisheries

Staff involved with the initial assessment of Sapoe Fish Reserve

7th September 2012

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1. Introduction

Coastal fishery is one of the primary targets of the Fisheries Division in the past years through since majority of the coastal households in Samoa depends on it for livelihood. One of the ongoing programs through this fishery is the Community Based Fisheries Management Program (CBFMP). The objective of this program is to ensure national food security, sustainable usage and good management of coastal fisheries resources. One of the activities under this program is the establishment of fish reserves. Many communities settling on the coast of Savaii and Upolu have joined in such initiative.

The process of such establishment is conducting a first consultation between the Fisheries Division and the community requesting to join. The completion of this first consultation gives rise to a drafted Management Plan and proposed location of the fish reserve. Inshore Section of the Fisheries Division then heads out to assess this proposed area to document the initial status of the fish reserve.

Sapo'e is one of the newcomers in the CBFMP and their fish reserve was established on the 23rd of April 2012 after their final meeting on the 16th April 2012. Sapoe is located on the southeast coast of Upolu island and it is a member Falealili district (Figure 1). On September 7th 2012, the inshore section made their way to Sapo'e community to conduct its initial monitoring of the fish reserve. This report portrays the overall results of this monitoring which will be submitted to Sapo'e community in order for them to understand the present situation of their fish reserve.

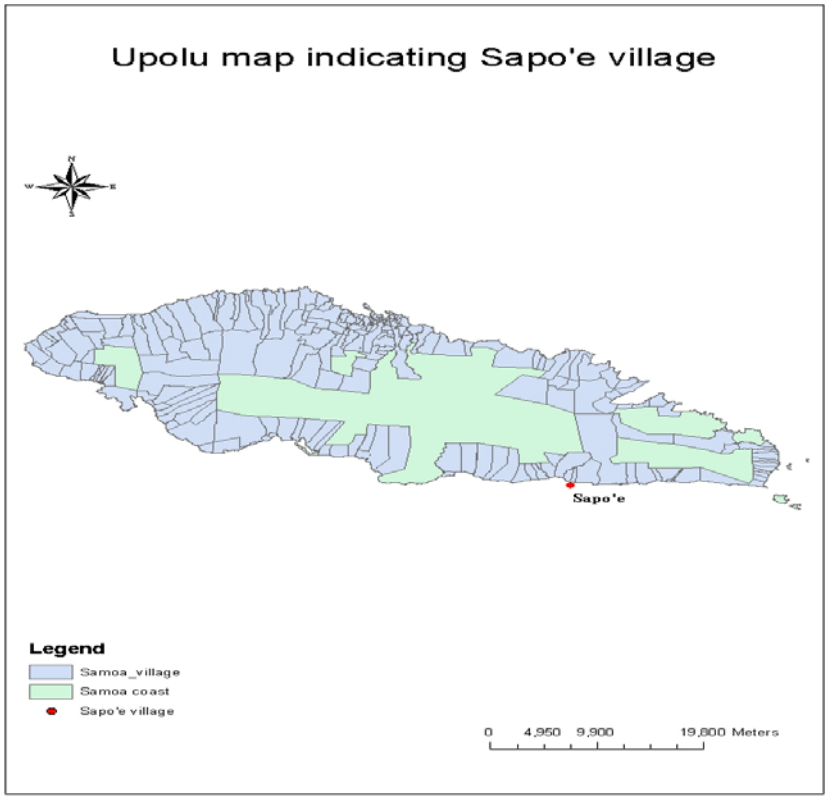

Figure 2: Map of Upolu indicating the location of Sapoe community

2. Methodology

Fish reserve assessment used two separate methods which also require skilled surveyors (divers). The first method deals with fish and invertebrate species identification, length and abundance. This method

is known as Belt Line Transects (BLT). Two surveyors are needed for this method and they should be familiar with different fish and invertebrates common names and their scientific names. Transects are laid randomly parallel to the coastline within the marked fish reserve and a tape measuring up to 50 meters is pulled along the selected site. The BELT surveyors swam two meters apart from the tape counting and recording the fish and invertebrate species up to the 50 meter mark (Figure 2).

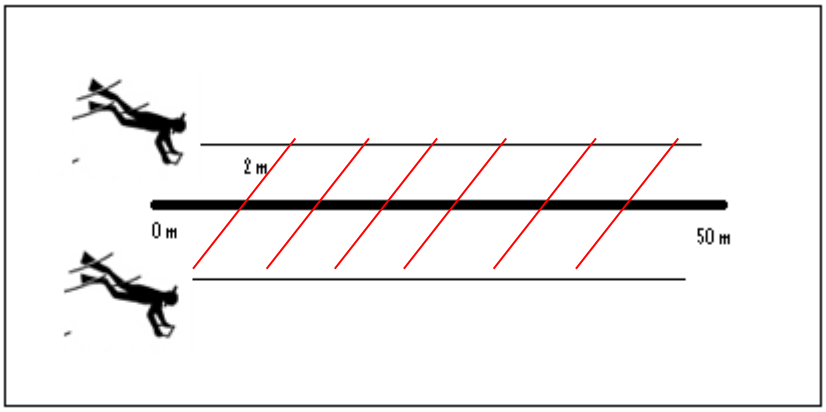

Figure 3: Diagram portraying the belt line transects (BLT) method

The second method is the Three Point Intersect Transect (3PIT). This method is done by three surveyors after the fish count. One person will swim above the tape, signalling every two meter mark to his/her right and left side surveyors and then record the substrate type. This continues until they reach the 50 meter mark (Figure 3). These two methods must be done for every five transects of each monitoring per site. GPS readings are also taken for mappings and to point exactly the area that was assess.

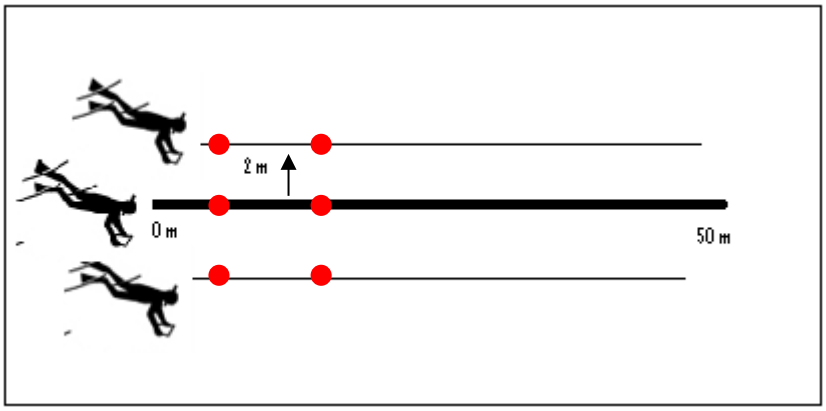

Figure 4: Diagram portraying the three point intercept transects (3PIT) method

Five transects were randomly laid out within the fish reserve with a total of sampling area of 1,000m^2 with the estimated total area of the fish reserve to be 55,000m^2 (Figure 4).

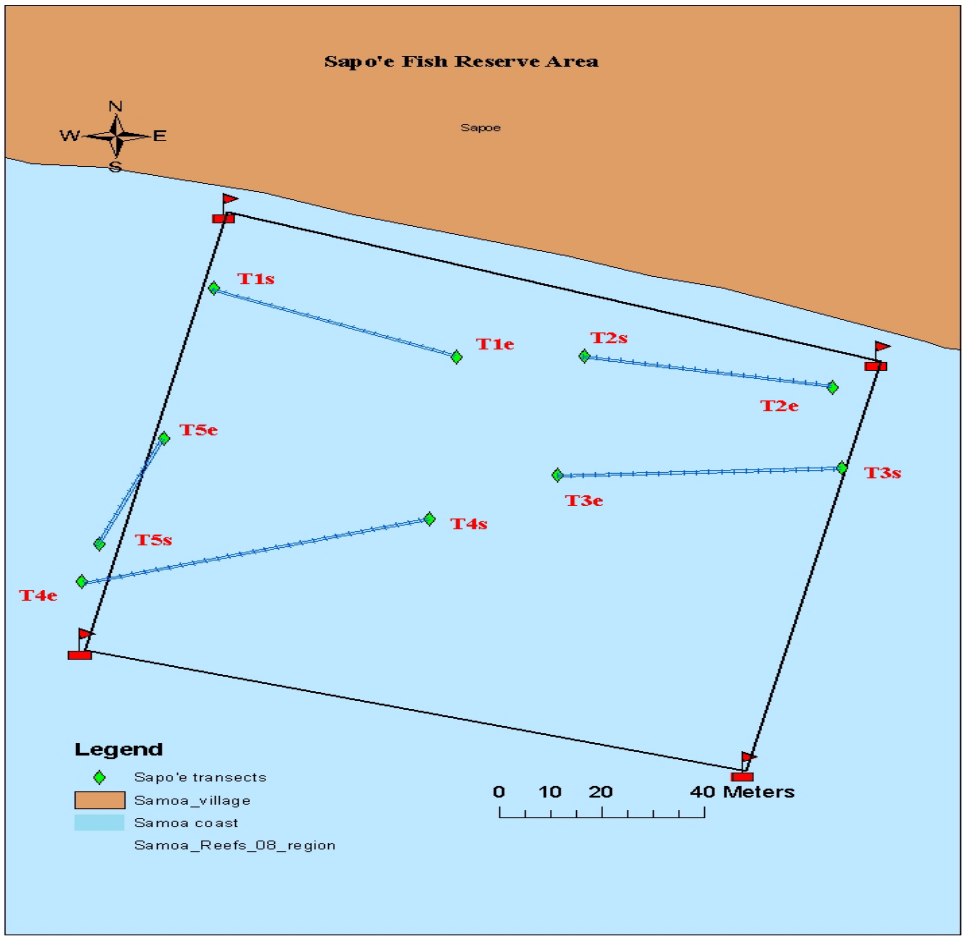

Figure 5: Closer view of Sapoe fish reserve with location of the laid out transects

3. Results

3.1 Substrate coverage

After analysis of the raw data from the Sapo'e initial monitoring, abiotic substrate group dominates the substrate coverage with 37.1% (Figure 5). Algae group was in second rank followed by dead corals and dead corals with algae. Live corals were recorded the lowest substrate cover with only 4.1%. Two types of live hard corals were identified from the assessment. Coral massive was the dominant coral type with 87% (Figure 6). The other coral type was massive with 87%.

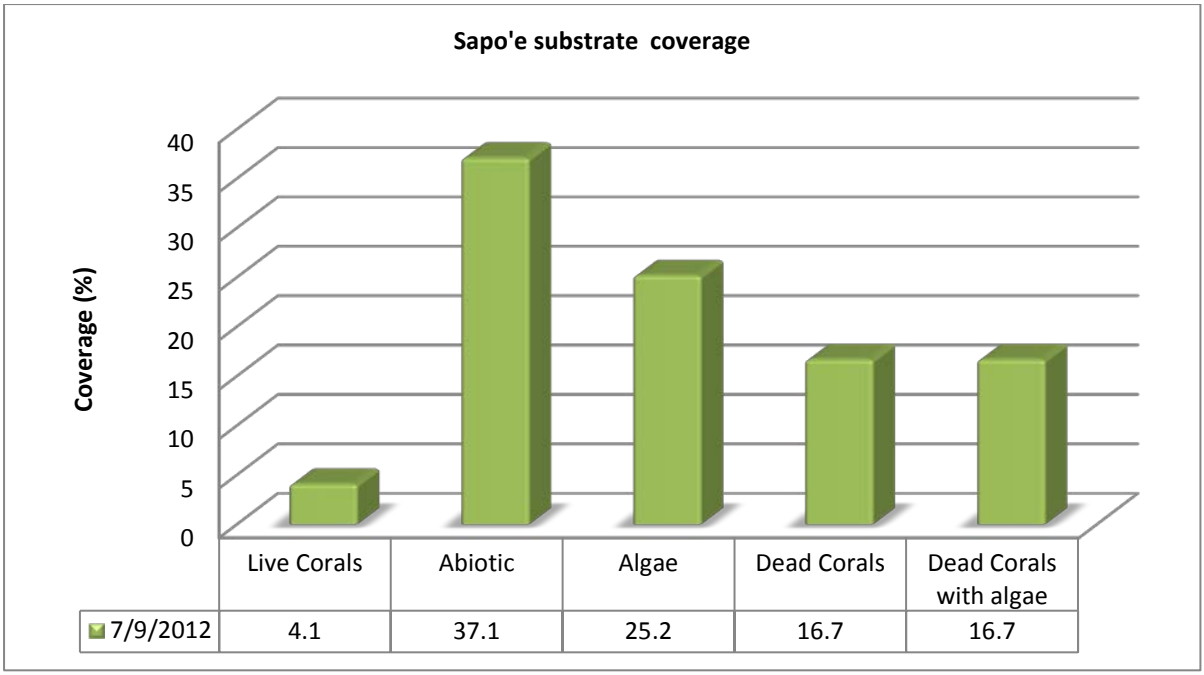

Figure 6: Summary of substrate groups with percentage coverage

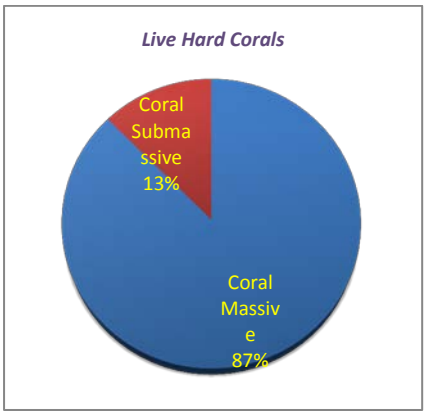

Figure 7: Types of hard live corals

Photo 1: An image of the coral types observes, coral massive (left side) and coral submassive (right side)

3.2 Fish Abundance

Ten fish species were identified where checkerboard wrasse (*Halichoeres hortulanus*) of the *Labridae* family was the most abundant species (Table 1). Second ranked was another member of the *Labridae* family which was the sixbar wrasse (*Thalassoma hardwicke*) with 6 individuals. Majority of the fish species recorded are juveniles as noted from their average lengths with majority less than 6cm. The white band triggerfish (*Rhinecanthus aculeatus*) had the highest estimated biomass within the fish reserve.

Table 3: Fish species recorded from survey with abudance, calculated weight and biomass

Fish species	Common Name	Av. Length (cm)	Count	Weight (kg)	Biomass (kg)	Percent (%)
Halichoeres hortulanus	Checkerboard wrasse	5	7	0.014	0.78	24.14
Thalassoma Hardwicke	Sixbar wrasse	5.5	6	0.015	0.83	20.69
Halichoeres Trimaculatus	Threespot wrasse	6	4	0.017	0.95	13.79
Acanthurus triostegus	Convict surgeon	3	4	0.006	0.31	13.79
Rhinecanthus aculeatus	White-band triggerfish	3.5	2	0.866	47.60	6.90
Lutjanus fulvus	Yellow-margined snapper	5	2	0.005	0.28	6.90
Chaetodon vagabundus	Vagabond butterflyfish	5	1	0.003	0.18	3.45
Lethrinus harak	Thumbprint emperor	10	1	0.019	1.03	3.45
Parupeneus multifasciatus	Manybar goatfish	3	1	0.000	0.02	3.45
Chaetodon rafflesi	Latticed butterflyfish	7	1	0.011	0.59	3.45
Total		-	**29**	**0.956**	**52.57**	**100**

3.3 Invertebrate abundance

Six invertebrate species was recorded from the assessment (Table 2). The most common invertebrate species recorded was the rock boring urchin (*Echinometra mathei*) followed by blue starfish (*Linckia Laevigata)*. Other invertebrates observed were holothurians such as lollyfish (*Holothuria atra*) and greenfish (*Stichopus chloronotus*) and least abundant species are listed below.

Table 4: Invertebrate species recorded from the survey with average length and abundance

Invertebrate species	Common Name	Avg Length (cm)	Count	Percentages (%)
Echinometra mathaei	Rock boring urchin	-	79	50.32
Linckia Laevigata	Blue starfish	-	37	23.57
Holothuria atra	Lollyfish	12.04	26	16.56
Stichopus chloronotus	Greenfish	16.38	12	7.64
Conus vexillum	Cone shell	-	2	1.27
Echinothrix diadema	Long spine urchin	-	1	0.64
Total			**157**	**100**

4. Discussion and Recommendations

The Sapo'e fish reserve shows low coverage of live hard corals. The dominant group was abiotic which includes sand, rubbles and rocks to name a few. This may be the result of both natural and human impacts on these coastal habitats, for instance the tsunami that struck the southern part of Upolu Island in 2009 where Sapo'e was one of the most affected communities. This is also an indication of the various fishing and other activities like swimming when this area was note reserves causing coral trampling which results to high coverage of rubbles.

The second rank, algae is most likely due to developments along the coastline such sea walls and resorts which causes disturbances to these habitats. Also run off of nutrients from inland that is eventually deposited into these coastal areas within the raining season. This coverage is considered an advantage for nursery for juvenile marine organisms and food source. However when such coverage is higher than live corals can be considered a nuisance.

Fish abundance recorded was of ten species which is a good indication that the reserve houses a diversity of species which is similar to invertebrate abundance. Most of these species were noted to be in their juvenile stage as noted by the average lengths may point out the heavy fishing on the area where is hardly any adult fish recorded. Whenever there is an abundance of urchins in an area it is an indication of high disturbance of habitat this was reflected on this fish reserve. However the abundance of holothurians would help a lot with the cleaning of the seafloor and water column.

The village council and community must put efforts in managing their fish reserve well as much as possible. This would allow this marine area to cover naturally from the various impacts it was subjected to before it entered the program. Such as enforcing their regulations like no destructive fishing to allow the live corals rehabilitate the fish reserve as well as fish and invertebrate to grow to adult stages in order to produce more juveniles.

5. Conclusion

Overall result of the monitoring reveals that abiotic dominates the substrate coverage of Sapo'e. Live hard corals had the lowest coverage and it could increase given the good management of the fish reserve for favourable conditions for their healthy growth. There is good diversity of fish and invertebrate species at present in the fish reserve however mostly are juveniles and in low abundance. With time given reserving the area from destructive fishing methods, coral trampling and so forth live corals would rehabilitate providing more shelter for the fish and invertebrates as well as for these species to reach adult hood to produce more juveniles within the area.

Samatau reserve Reassessment

Maria F. Sapatu
Senior Fisheries Officer

Inshore Section

Fisheries Division

Ministry of Agriculture and Fisheries

FISHERIES INSHORE STAFF WHO CONDUCTED THE INITIAL ASSESSMENT

1 November 2012

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1. Introduction

Establishment of fish reserve is a tool implemented by the Government through the Fisheries Division to protect and sustain marine resources and habitats that are of vital importance to the local community's livelihood. This tool is part of the Community Based Fisheries Management Program (CBFMP) where ownership and management of the reserves are solely that of the local communities while the Fisheries Division provides technical assistance and support.

The community of Utulaelae of Falealili district is one of the new members of this program (Figure 1). Initially the reserve was under the Ministry of Natural Resource and Environment (MNRE) conservation program in 2011 with funds from United Nations Development Program (UNDP). This year, the Fisheries Division was approached by the community requesting to be part of the CBFMP and to establish a management plan to safeguard their reserve. Utulaelae fisheries management plan was approved on the 23 April 2012.

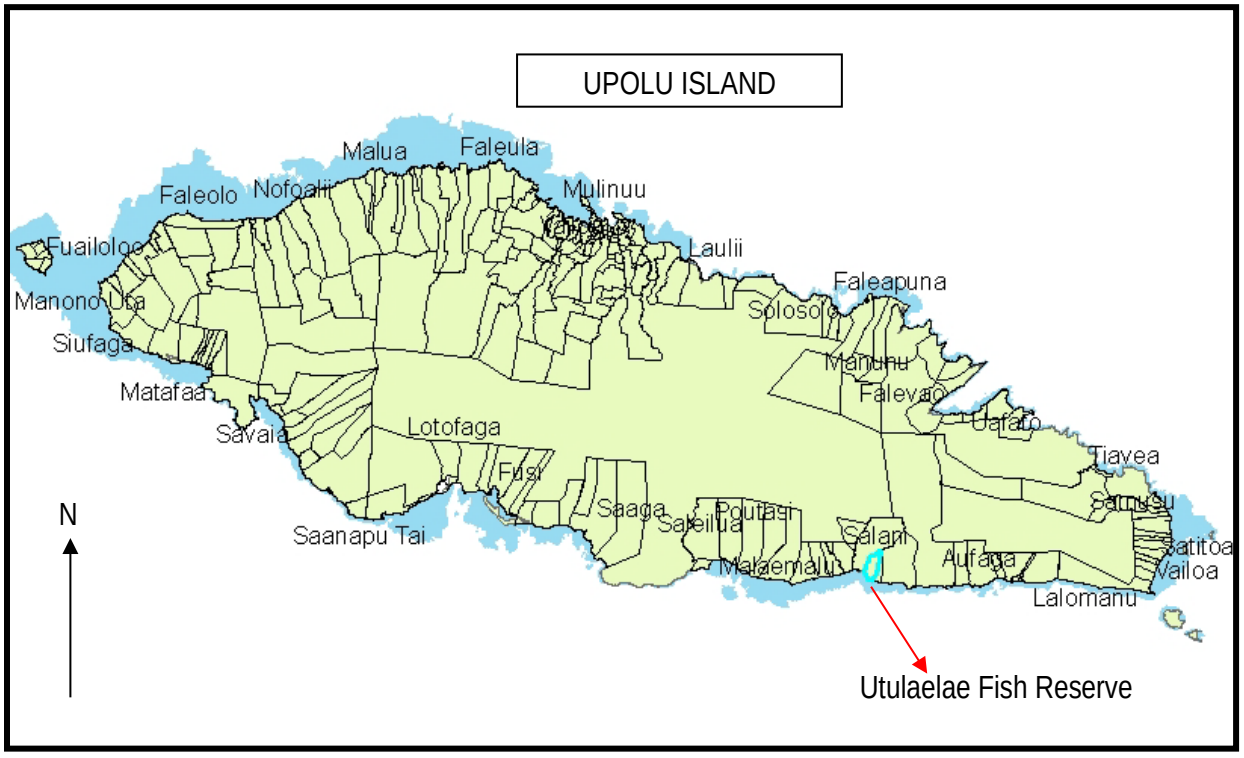

Figure 8: Map of Upolu indicating the location of the Utulaelae Fish Reserve

Assistance was also provided by the Fisheries Division through the Advisory Section is setting up a nursery for giant clams; such nursery was established with stocks from the wild mainly that of fluted giant clam (*Tridacna squamosa*). Recent monitoring of these clams on the 8th November 2012 reported 73 live giant clams with an average length of 10.82 cm. On the 1st March 2012, a workshop was conducted on construction of fish houses which later followed by practical and coral replanting within the reserve.

Conducting ecological resource assessments and providing a report to the communities on a feedback or status of the fish reserve in terms of substrate coverage, finfish and invertebrate abundance is another assistance provided by the Fisheries Division. On the 1st November 2012, the Inshore Fisheries Section headed out to coastal waters of Utulaelae to conduct an initial assessment of its fish reserve. The results and findings of this assessment is presented and described in this report.

2. Methodology

Underwater visual census of the surveyors was used to carried out the Three Point Intercept transect (3 PIT) and the Belt Line Transect (BLT) methods.

The BLT method is used for the invertebrate and fish count and was conducted first due to the mobility of such organisms. Three swimmers are employed in this method; one swimmer laid out the 50meters tape in a straight line (parallel to the coastline) while other two about two meters left and right of the tape recorded the abundance and estimated lengths of the fish species observed (Figure 2). Similar procedure was conducted for invertebrate abundance.

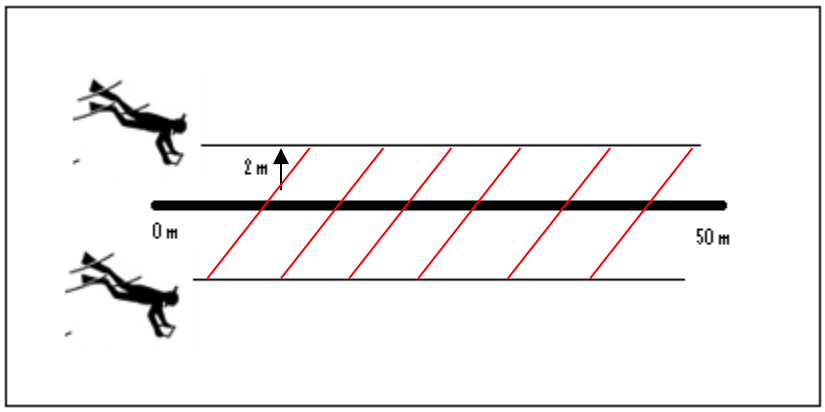

Figure 9: Diagram portraying the belt line transects (BLT) method

Afterwards, the substrate coverage was then carried out using the Three Point Intercept Transect method. Similar amount of swimmers are needed the only difference from the BLT method is that at every two meters all three were to record the type of substrate observed at that particular point (Figure 3). A three letter code for the substrate type observed was recorded (AIMS Substrate code).

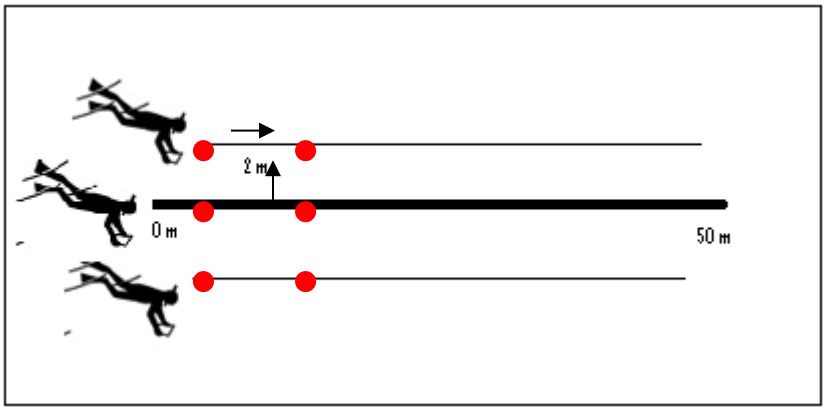

Figure 10: Diagram portraying the three point intercept transects (3PIT) method

Four transects were randomly laid out parallel to the coastline within the fish reserve where the assessed area was 800m^2 of the estimated total fish reserve area of 20,000m^2.

3. Results

3.1 Substrate Coverage

The various substrate types recorded were categorized in four groups (Figure 4). The abiotic group consisting of rubbles and sand was the dominate substrate cover with about 58%. While the other half of percentage cover mainly consisted of live corals and dead coral with algae growing on it. Three types of live corals were noted where *Acropora* submassive coral (ACS) was common of 70% followed by coral massive (CM) that of *Porite* species (Figure 5). The least common coral type was *Acropora* branching such as *Acropora formosa*.

Fish houses were also observed during the assessment with some sign of *Acropora formosa* coral recruits on some of them. This is a good indication that the coral replanting initiative is progressing well within the fish reserve.

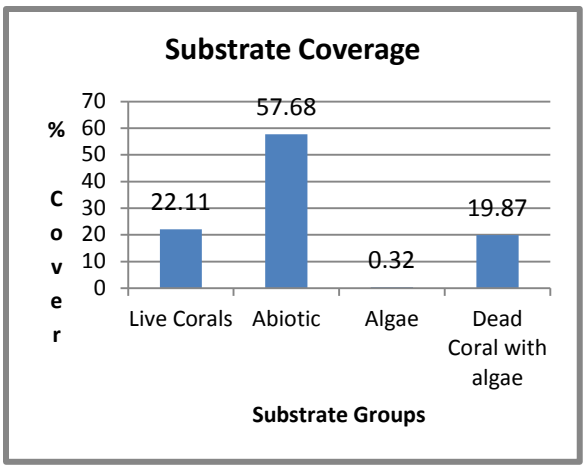

Figure 11: Summary of the substrate coverage

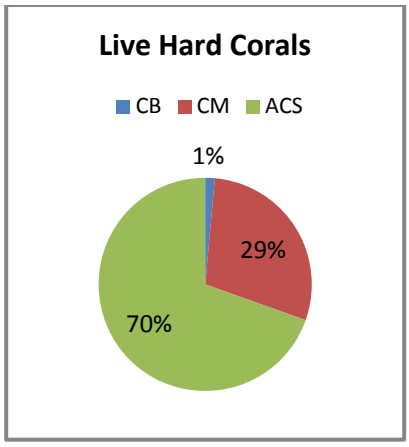

Figure 12: Different types of live hard corals recorded

3.2 Finfish diversity and abundance

A total of 284 finfish was recorded of 20 species belonging to seven fish families (Table 1). *Pomacentridae* family had the most species recorded and most abundant in numbers. *Acanthuridae* family had only two species recorded but had moderate abundance compared to *Labridae* of five species.

Table 5: List of fish families and species recorded

Fish Families	No. of Species	No. of individuals
Pomacentridae	6	161
Labridae	5	44
Chaetodonidae	3	6
Acanthuridae	2	54
Scaridae	2	7
Mullidae	1	2
Siganidae	1	10
TOTAL	20	284

Species wise, the most abundant observed was the blue damsel with a density of about 17 fish within one transect of 200m^2. However estimated biomass of blue damsel within the total fish reserve area is low (4kg) compared to that of bristletooth surgeon (93kg) with a density of 10 fish/transect. This is mainly due to the fact that the average length of bristletooth is double the average size of the blue damsel which was 5cm.

Moderate abundant species were that six bar wrasse, threespot wrasse and the little spine foot rabbit fish. The average length recorded for these three species indicate that they are mainly of juveniles with estimated biomasses of less than 15kg. The least common species were that of moorish idol and bird wrasse and others as tabulated below.

Table 6: Abundance of finfish species recorded with their average length, density and estimated biomass

Fish Species	Scientific Name	Count	Av. Length (cm)	Density (ind/transect)	Est. Biomass	Percentage (% Count)
Blue damsel	*Pomacentrus pavo*	64	5.00	16.50	4.49	22.54
White bar damsel	*Plectroglyphidodon leucozonus*	61	12.40	15.25	57.10	21.48
Bristletooth surgeon	*Ctenochaetus striatus*	46	11.70	10.00	92.55	16.20
Dusky gregory	*Stegastes nigricans*	20	5.50	5.00	2.51	7.04
Sixbar wrasse	*Thalassoma hardwicke*	17	10.60	4.25	12.71	5.99
Threespot wrasse	*Halichores trimaculatus*	15	15.30	3.75	15.36	5.28
Little spinefoot rabbitfish	*Siganus spinus*	10	3.00	2.50	0.11	3.52
Humbug damsel	*Dascyllus aruanas*	9	4.00	2.25	0.56	3.17
Checkerboard wrasse	*Halichores hortulans*	8	10.40	2.00	4.42	2.82
Convict surgeon	*Acanthurus triostegus*	8	10.60	1.50	6.91	2.82
Onespot demoiselle	*Chrysiptera unimaculata*	6	3.50	1.50	0.18	2.11
Dark capped parrotfish	*Scarus oviceps*	6	4.00	1.50	0.21	2.11
Surge wrasse	*Thalassoma purpureum*	3	11.00	0.75	1.93	1.06
Manybar goatfish	*Parupeneus multifasciatus*	2	15.00	0.50	3.47	0.70
Redfin butterflyfish	*Chaetodon lunulatus*	2	7.00	0.50	0.54	0.70
Dotted butterflyfish	*Chaetodon semeion*	2	11	0.50	1.92	0.70
Speckled butterflyfish	*Chaetodon citrillenus*	2	20	0.50	8.59	0.70
Moorish idol	*Zanclus cornutus*	1	15.00	0.25	3.38	0.35
Bird wrasse	*Gomphosus varius*	1	20.00	0.25	2.01	0.35
Parrotfish	*Scarus sp.*	1	10	0.25	0.53	0.35
Total		284	-			100

3.3 Invertebrate diversity and abundance

Nine invertebrate species were recorded that belonged to nine invertebrate families. However these nine families can be grouped into four in relevance to their nature and characteristics which are the sea cucumbers, sea urchins, star fish and gastropods. Among these four groups, the sea cucumbers was the most abundant consisting of green fish and lollyfish (Table 3). This was followed by sea urchins mainly that of rock boring urchin and longspine urchin. Overall abundant species was the green fish with 151 individuals and a density of about 38 individuals within one transect (200m^2). Other species abundance and density are tabulated below.

Table 7: Abundance of invertebrate species with their density

Invertebrate species	Scientific Name	Count	Percentage (% Count)	Density (ind/transect)
Green fish	*Stichopus chloronotus*	151	53.93	37.75
Rock boring urchin	*Echinometra mathei*	110	39.29	27.50
Lolly fish	*Holothuria atra*	8	2.86	2.00
Blue starfish	*Linkia laevigata*	4	1.43	1.00
Crown of thorns	*Acanthaster planci*	2	0.71	0.50
Tiger cowrie	*Cypraea tigris*	2	0.71	0.50
Goldmouth turbanshell	*Turbo chrysostomus*	1	0.36	0.25
Longspine urchin	*Echinothrix diadema*	1	0.36	0.25
Samoan trochus	*Tectus pyramis*	1	0.36	0.25
Total		**280**	**100**	-

4. Comparison with past existing data

As mentioned earlier Utulaelae was under the MNRE's conservation program and a similar assessment was conducted by their Division of Environment Conservation (DEC) in early December 2011. Survey methods used are similar to Fisheries Division methods therefore comparison of such collected data with recent results is compatible.

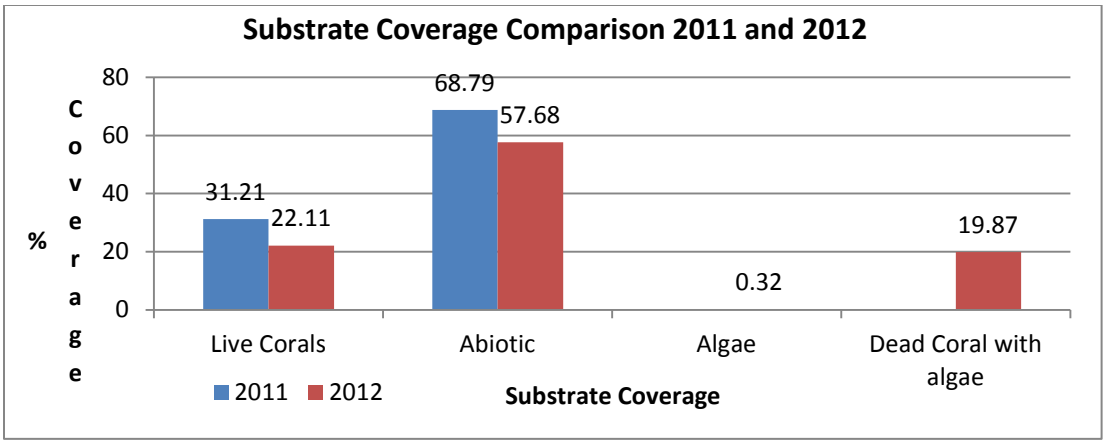

Figure 13: Comparison of substrate coverage data from 2011 MNRE assessment and Fisheries 2012 assessment (2011 data derived from MNRE report)

Substrate coverage in live corals and abiotic material have both declined in about 10%. This may due to to the number of dead coral with algae growing it recorded whose percentage of about 20% fairly substitute the declined percentage in live corals and abiotic. Algae coverage may have been triggered by excess nutrients from inland by the Fagatoloa River whose river mouth is located about half a kilometer west of Utulaelae moreover the neighboring community Salani. In particular, this year assessment was conducted beginning of November often the heavy raining season compared to the December the month when the 2011 assessment was done. In terms of finfish abundance comparison, recent assessment still show good diversity of species as noted in 2011. The 2011 survey mainly recorded herbivore (e.g. *Labridae*, *Acanthuridae*) and carnivore (e.g. *Letherinidae*) fish but recent survey mainly recorded herbivore and corallivore (*Pomacentridae*, *Chaetodonidae*) finfish. Overall finfish are mobile organisms and easily flee when disturbance in the water during assessments this may explain such difference however most of fish families recorded in 2011 were also recorded in 2012. On the other hand, invertebrate abundance has increased such as the sea cucumbers and sea urchins while starfish (crown of thorns) have declined. The decline in crown of thorns poses an advantage for live coral growth within the fish reserve.

Table 8: Finfish abundance comparison (2011/2012)

Finfish Families	2011 MNRE	2012 FD
Labridae	97	44
Acanthuridae	46	54
Chaetodonidae	31	6
Scaridae	12	7
Mullidae	9	2
Siganidae	2	10
Pomacentridae		161
Letherinidae	5	
Serranidae	1	
Haemulidae	1	
TOTAL	204	284

Table 9: Invertebrate abundance comparison (2011/2012)

Invertebrate Groups	2011 MNRE	2012 FD
Sea cucumbers	21	159
Sea urchins	27	111
Star fish	32	2
Gastropods	5	4
TOTAL	85	276

5. Conclusion and Recommendations

In summary of the data collected the Utulaelae fish reserve is housing a diversity of finfish and invertebrate species mainly that of juveniles as noted in the average length recorded. Similar status was noted in MNRE 2011 survey. The abundance of the *Pomacentridae* finfish family is a good indication that the live coral within reserve are in good health since species of such family mainly consume coral polyps, filamentous algae and small crustaceans.

Sea cucumber abundance (namely the greenfish) was noted to have increased and this is also a positive sign for low turbid waters that is good for live coral growth. However, the community needs to monitor the number of crown of thorns as they pose threat to diminishing the existing live corals even though data comparison to MNRE 2011 survey show decline.

Substrate coverage shows a low coverage of live coral with abundance of rubbles and sand (abiotic group). Comparison to MNRE 2011 survey also show decline in percentage cover of both substrate groups. Never the less, the abundance of finfish and invertebrate as mentioned earlier show a healthy substrate coverage that can further improved if the coverage of live corals were to increase. This can be assisted with reassessments of the coral recruits on the fish houses and its maintenance. As well as better management and protection of the fish reserve from coral trampling and illegal fishing activities.

In conclusion this report recommends

- The community actively promotes good management of their fish reserve with regards to their approved management plan and to work together with Fisheries Division in promoting replanting and sustaining the live coral growth.
- Continue reassessments of the fish reserve to put more emphasis on the crown of thorns abundance both by community and Fisheries
- Reassessment of replanted corals and fish houses and maintenance both by community and Fisheries

6. Acknowledgements

Fisheries Division would like to thank the Ministry of Natural Resource and Environment in particular the Division of Environment Conservation for sharing their assessment data on Utulaelae fish reserve. Appreciation further extends to Mr. Taua Latu Afioaga (Principal Marine Conservation Officer) and Ms. Juney Ward (Senior Marine Conservation Officer) for the collaborative spirit and effective assistance in such task.

Government of Samoa

SAMATAU RESERVE REASSESSMENT

MAF-Joyce

INSHORE SECTION

FISHERIES DIVISION

MINISTRY OF AGRICULTURE AND FISHERIES

Staff involved with the reassessment of Apolima Uta Fish Reserve

4th December 2012

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1. Introduction

Coastal communities depends very much on marine resources for subsistence living. Good management and development of these resources is vital for the continuing supply of livelihood for not only the coastal settlers but also those who enjoy sea food. With the increasing demand on seafood, the Fisheries Division (FD) developed a management tool that develops and manages the coastal resources in order to sustain its ecosystem from extinction and overexploitation. This tool is known as Community Based Fishery Management Program (CBFMP) and one of the activities under this program is the establishment of fish reserves also known as marine protected areas.

The conservation of such marine areas will not only increase marine species in terms of abundance and diversity but also rehabilitate damage corals that may shelter other marine animals. Many local communities have joined this program in partnership with the Fisheries Division with the intention of having a healthy marine environment.

Apolima community set up their fish reserve in 2003 and had their initial assessment on the 4th December 2003 (Figure 1). On the 29 March 2012, coral replanting was conducted within the fish reserve in order to assist in establishing more coral habitats for the marine organisms.

In the same year on the 4th of December, Apolima fish reserve gets the nod of reassessing their fish reserve by the Inshore section (FD) which deals with coastal research, monitoring and management. This assessment will bring forward the present condition of the reserve compared to its previous data whether it's decreasing, stable or increasing in terms of live corals, fish and invertebrate abundance. It will also identify any changes within the area and what may have caused these changes. The data collected was analyzed and is tabulated in this report.

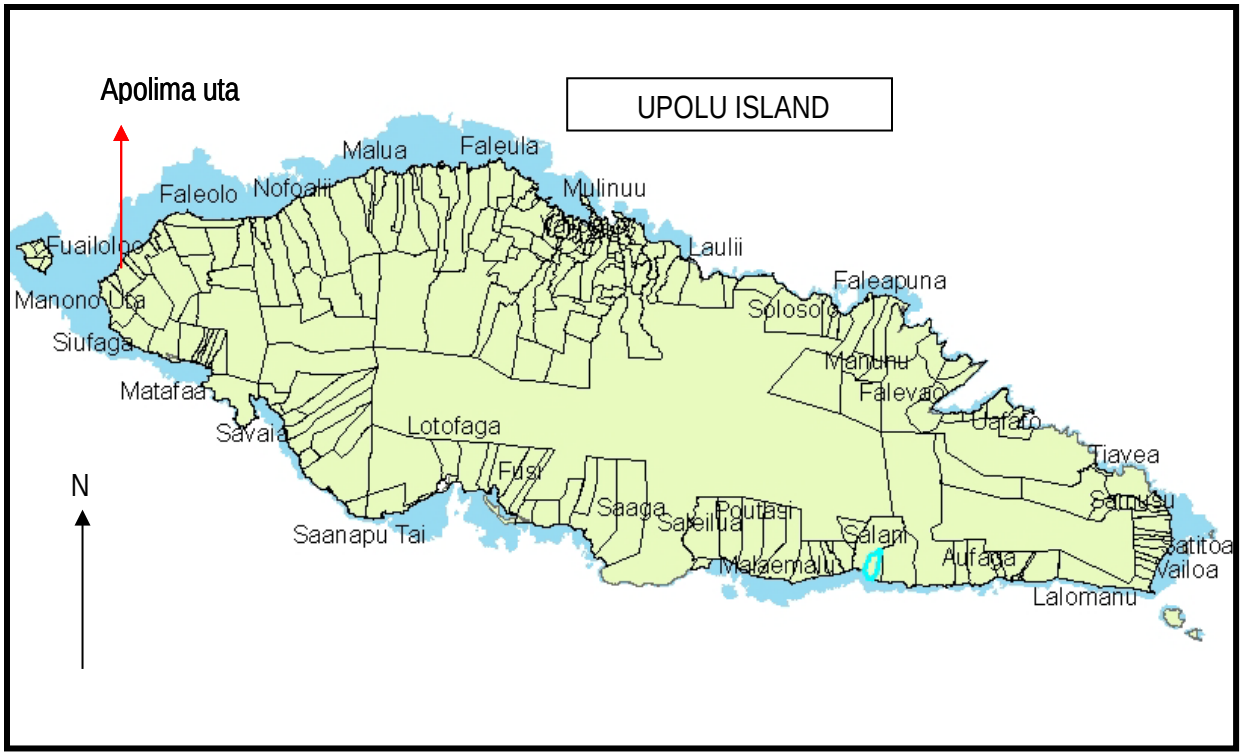


Figure 1: Map of Upolu indicating the location of Apolima uta fish reserve

2. Methodology

There are two different methods employ for this assessment. For the substrate coverage the 3 Point Intercept Transect method (3-PIT) was used. This requires three divers, where one diver swims along the 50 meter tape measure, while the other two divers swim about 2 meter from the tape on both the left and right sides (Figure 2). Then the substrate is recorded in accordance with every two meters on the tape from the 0 meter mark to the 50 meter mark.

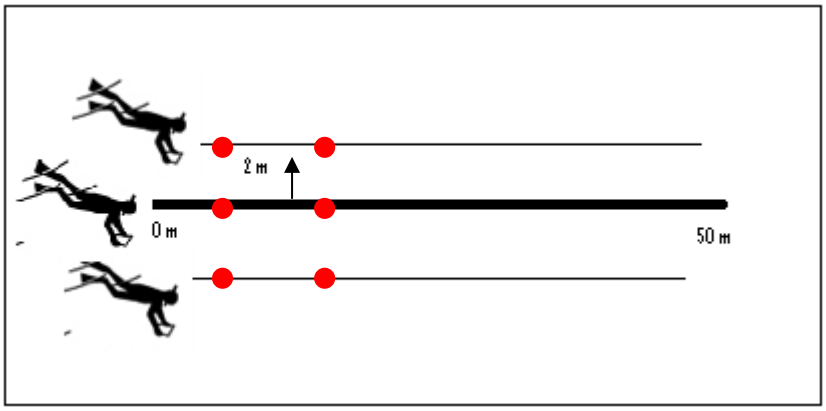


Figure 2: Diagram portraying the three point intercept transects (3PIT) method

For the fish and invertebrate count, the 50 meter tape was used but required only two divers instead. The two divers will swim at about 1.5 meters from the tape on both sides and will count the fish as they swim from the 0 meter mark to the 50 meter mark (Figure 3). They will record the number and estimate the lengths of these individual fish as well as invertebrates.

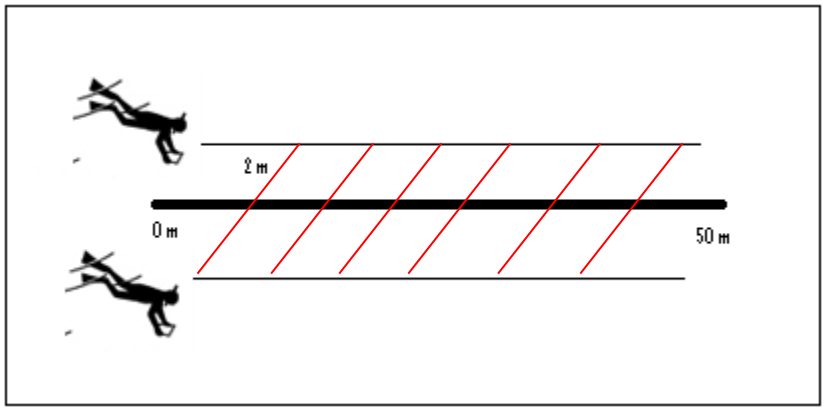


Figure 3: Diagram portraying the belt line transects (BLT) method

Three transect lines were laid out within the fish reserve in parallel to the coastline (Figure 4). This is a total sampled area of 600m^2 with an estimated total area of the fish reserve of 100,000 m^2.

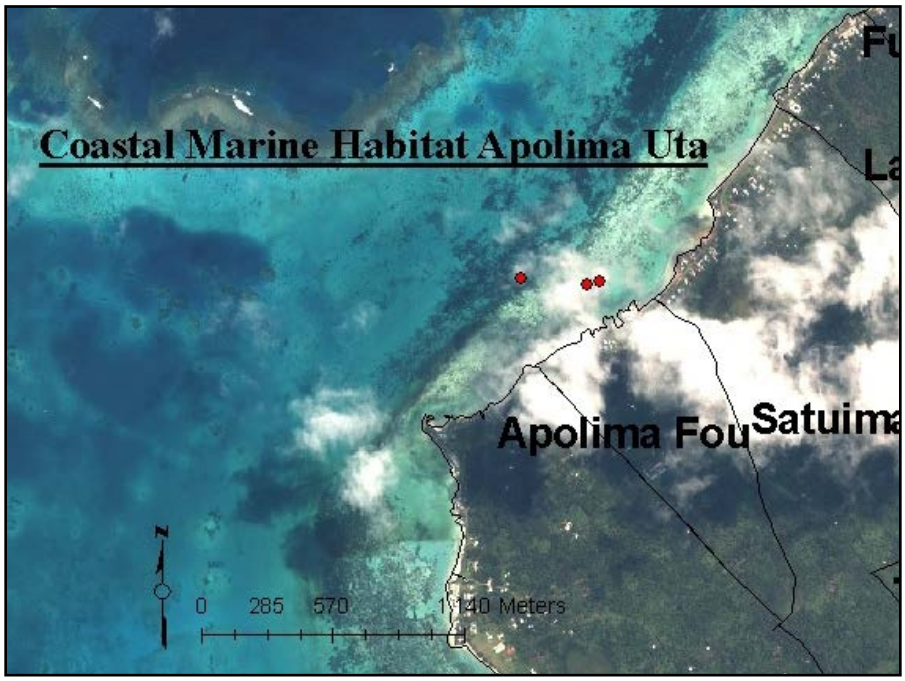


Figure 4: Close up view on coastal marine habitat of Apolima uta with location of the assessment transects

3. Results

3.1 Substrate

Collected substrate data from Apolima fish reserve presents high algae coverage. The total percent of algae sums up to 68.36% (Figure 5). Non living organisms known as abiotic have a total of 26.49% which include rocks, rubbles, sand to name a few. The least group consist of live corals which has an amount of only 5.11% which makes the 100% of total substrate. In comparison with the 2003 monitoring, abiotic was dominant (50.51%) as algae sits in second rank (43.33%). Figure 5 will elaborate more on these comparisons (Figure 6).

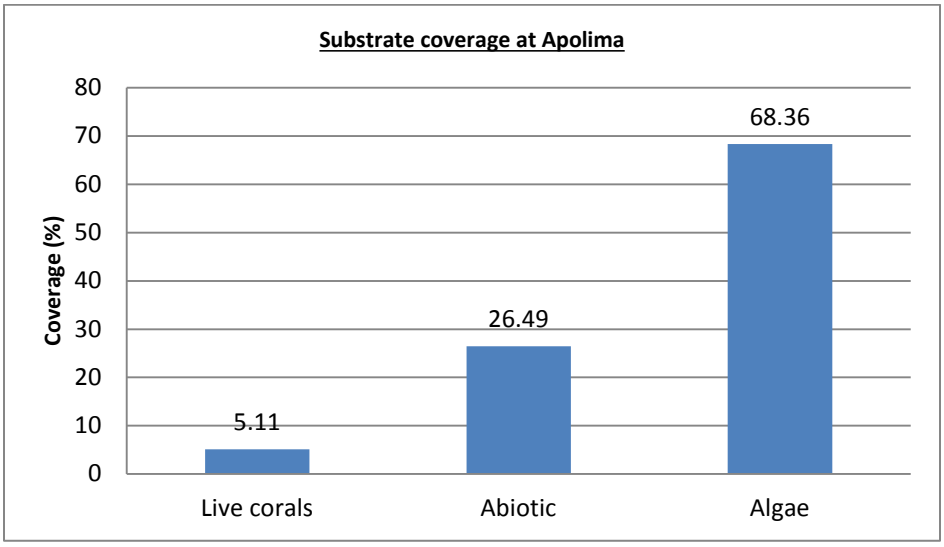
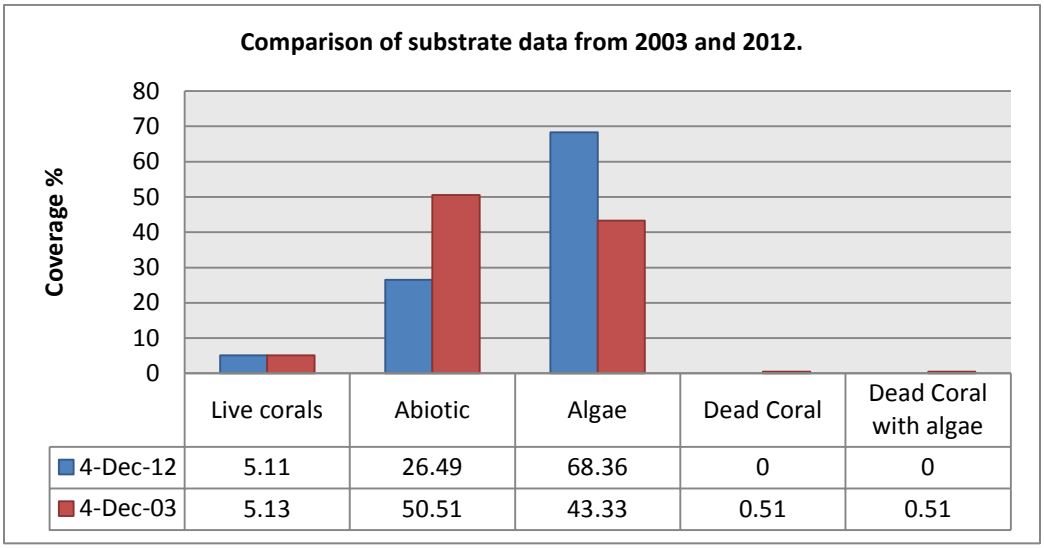


Figure 5: Substrate coverage at its major groups of Apolima Fish Reserve



	Live corals	Abiotic	Algae	Dead Coral	Dead Coral with algae
4-Dec-12	5.11	26.49	68.36	0	0
4-Dec-03	5.13	50.51	43.33	0.51	0.51

Figure 6: Substrate summary of major groups from 2003 compared to 2012.

3.2 Fish Count

Only six fish species indicators were recorded from the monitoring. These species are commonly found on the coastal waters and the most abundant species was the humbug damsel *(Dascyllus aruanus)* with 64 individual counts. Blue green chromis (*Chromis viridis*) was second with a total count of 30 while Whiteband damsel (*Plectroglyphidodon leucozonous*) was of 8 individuals. Other fish species recorded were only one from their type, for instance the Checker board wrasse *(Halichoeres hortulanus)*, Honeycomb grouper *(Epinephelus merra)* and Scissortail sergeant *(Abudefduf sexfasciatus).* Table 1 demonstrates each species with their total count, total weight in (kg), biomass as well as their percentage.

Table 1: Fish abundance and diversity in Apolima Fish Reserve

Fish species	Count	total weight (kg)	Biomass (kg)	Av. length (cm)	percentage
Humbug damsel (*Dascyllus aruanus*)	64	0.245	40.89	4.43	60.95
Bluegreen chromis (*Chromis viridis*)	30	0.073	12.19	4.20	28.57
Whiteband damsel (*Plectroglyphidodon leucozonous*)	8	0.037	6.16	5.10	7.62
Scissortail sergeant (*Abudefduf sexfasciatus*)	1	0.002	0.28	4	0.95
Checkerboard wrasse (*Halichoeres hortulanus*)	1	0.002	0.33	5	0.95
Honeycomb grouper (*Epinephelus merra*)	1	0.015	2.44	10	0.95
Total	**105**	**0.374**	**62.30**	**-**	**100**

Note: Total weight of Sampled Area, Biomass is the weight raised to the total fish reserve area
Sampled area: 600m^2, Estimated Total Area: 100,000m^2

3.3 Invertebrates

Only two species of invertebrates were recorded which belonged to the same family the sea cucumber. Lollyfish was the most abundant with a total of 3195 (69.14%) with an average length of 11cm. Greenfish had a total of 1426 equivalent to 30.86% abundance (Table 2).

Table 2: Invertebrate species recorded from Apolima Fish Reserve.

Invertebrate species	Count	Avg Length	Percentage (%)
Lollyfish (Holothuria atra)	3195	11.03	69.14
Greenfish (Stichopus chloronotus)	1426	17	30.86
Total	**4621**		**100**

4. Discussion

The increase dominance of algae coverage within Apolima's fish reserve is a sign of increase nutrients in the water column which is favorable for its growth. It is confirmed by Figure 4 where algae coverage accounted for 68% compared to the 43% in past assessment. This may be of anthropogenic impacts such as coastal developments and natural impacts such a heavy rainfall season which causes erosion, runoff nutrients to such marine environment. Considering the location of the fish reserve where it is mainly of silt sandy substrate which is favorable substrate for algae growth this may be work hand in hand to such

increased growth. This algae coverage have also coincide the decrease coverage of abiotic group since the algae have tend to grow on the rubbles and sand.

Live hard corals were noted as the lowest group with expectations that time will take for it to grow in order for more habitats and more species to inhabit. However, positive signs were noted on a past development project on coral replanting (fish houses) which may assist with the natural growth of these live corals recorded and as well as provide more shelter for other marine organisms such as fish and invertebrates.

Fish diversity was quite low due to limited habitation as it was more favorable for small fishes which tend to gather at patches of corals such as the humbug damsel and blue green damsel. Sea cucumbers were the only invertebrates recorded from the assessment namely lollyfish and greenfish. This is due to the fact that these species tend to favor sandy substrate and turbid waters for them to occupy as it suits their natural role of cleaning up the sea floor and water column.

5. Conclusion and Recommendations

To sum up the assessment has documented changes in the Apolima fish reserve in terms of substrate coverage from comparing 2003 assessment to recent one. This change is the increase of algae coverage and decline in abiotic group. The cause may due to anthropogenic and natural impacts as mentioned earlier as well as the suitability of the marine environment to prosper its growth. Live corals show low coverage but positives signs were noted from past developments projects such as coral replanting. This would in turn provide more housing for other marine organisms such as fish and invertebrates that were noted low in diversity.

Having a high coverage of algae rather than live corals is also an advantage. Since algae tend to provide nursery homes for juvenile fish and invertebrate species. Algae also provide a good source of food to mobile adult fish and invertebrates that comes and goes along these habitats as it's their natural life cycle. To record only sea cucumbers is not a disadvantage, because sea cucumbers play a vital role in cleaning the sand and water column to obtain conditions that are favorable for other marine organism to settle within such fish reserve.

In conclusion this report recommends that the community and group of Chiefs of Apolima continue the good management of their fish reserve. As well as to seek other developments or assistance from the Fisheries Division to maintain their good management of the fish reserve as such monitoring of the replanted live hard corals or seek other organizations in terms of coastal developments occurring within the area such as the Planning Urban Organization Agency (PUMA).

Government of Samoa

Samatau reserve Reassessment

MAF-Joyce

Maria F. Sapatu (Senior Fisheries Officer)

Inshore Section
Fisheries Division

Ministry of Agriculture and Fisheries

Fisheries staff that conducted the reassessment of Afega Fish Reserve

20 March 2013

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1. Introduction

Being a Pacific Island Nation, marine resources is one of the major components in Samoan people's diet. Many may have think that these resources are unlimited due to the vast ocean that surrounds Samoa's islands and the endless fish caught by a fisherman in a normal day to day activity. However with modern life style, technology and increase in populations some factors have impacted these resources such as pollution, well equipped gears as well as the move from subsistence fishing to artisanal and semi commercial that lead to overfishing and destructive fishing methods.

Fisheries Division of the Ministry of Agriculture and Fisheries (MAF) answered these impacts with implementing the Community Based Fisheries Management Program (CBFMP) which is about 9 years now. The main objective is for better management practices in order for the sustainable utilization of these marine resources. This is with the establishment of fish reserves where it is solely managed by local communities with assistance of a management plan that is recognized under law (By-Law). Other developments were also conducted by the Fisheries Division within these fish reserves such as introduction of species for restocking purposes. As well as farming certain species that may be of alternative fishery for local communities. Overall, Fisheries Division (FD) works in collaboration with these local communities with its role as the technical assistant.

One of the technical assistance provided is carried out by the Inshore Fisheries Section (FD) which is an ecological resource assessment. Such assessment is initially conducted before the fish reserve is established as the results recommend to the community the location and area to set up the reserve. With approval from the community the fish reserve is then set up and taboo from fishing and it is continuously monitored by the Inshore Fisheries Section annually. The assessment is based on two categories the substrate coverage (habitat) assessment and the fish and invertebrate assessment. These assessments are reported back to communities for awareness on the current status of the fish reserves whether they are improving and may have some negative impact that they community needs to address.

One of the communities under this program is Afega. Afega is located north of the main island Upolu and about 2,021 people settle within this community (Figure 1). On the 7th December 2009 Fisheries Management Plan for Afega's inshore waters was completed and approved. In the same year on the 18th December an initial assessment was conducted in the proposed marine area by the community to set up the fish reserve. Results obtained showed that the proposed area was not relevant where it's heavily impacted by the nearby Aleisa stream through sedimentation as well as the rubbish from nearby homes. Recommendations were given to move the fish reserve seaward away from the Aleisa stream and coastline.

On the 20 February 2013, a reassessment was conducted for Afega fish reserve of the area recommended by the Fisheries Division and approved and shifted by the community. Results obtained from this reassessment are tabulated and explained in this report. As well as recommendations on issues that the monitoring noted in order to improve such establishment.

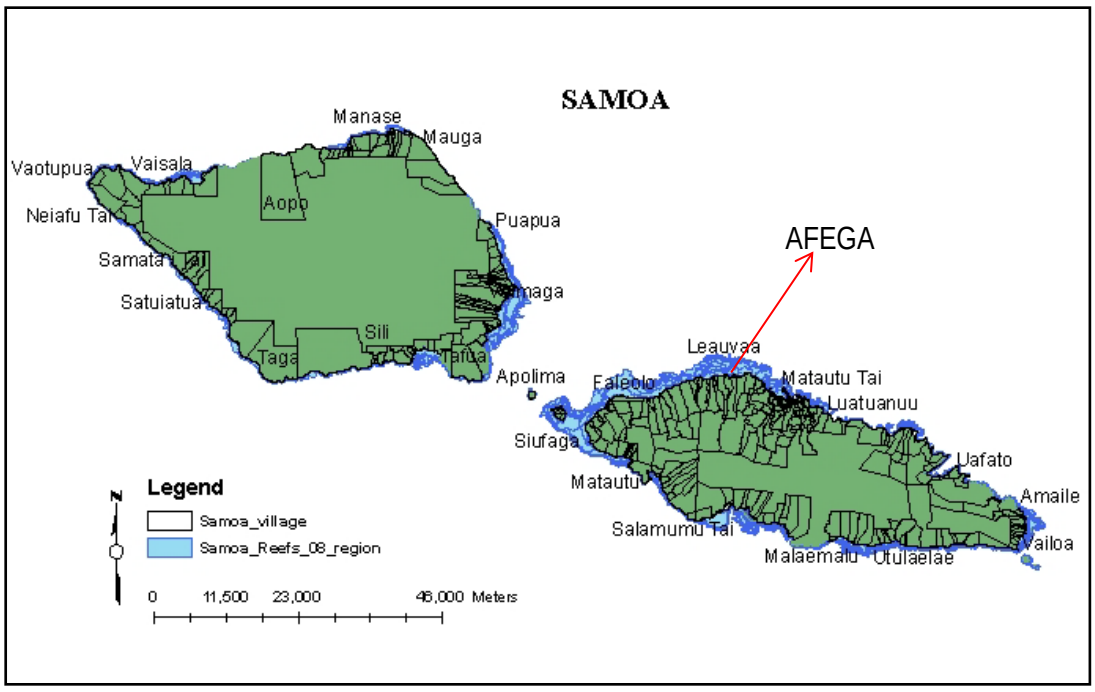

Figure 1: Map of Samoa portraying the location of Afega community

2. Methodology

Underwater visual census of the surveyors was used to carried out the 3 Point Intercept transect (3 PIT) and the Belt Line Transect (BLT) methods.

The BLT method was used for the invertebrate, fish species and their abundance. The fish assessment was conducted first due to the mobility of such organisms. Three surveyors are employed in this method; one swam and laid out the 50 meters tape in a straight line (transect) while the other two are about two meters left and right of the tape. These two recorded the abundance and estimated lengths (in centimeters) of the fish species observed (Figure 2). Afterwards, similar procedure was conducted for invertebrate abundance however the measurable invertebrate species are physically measured with a caliper.

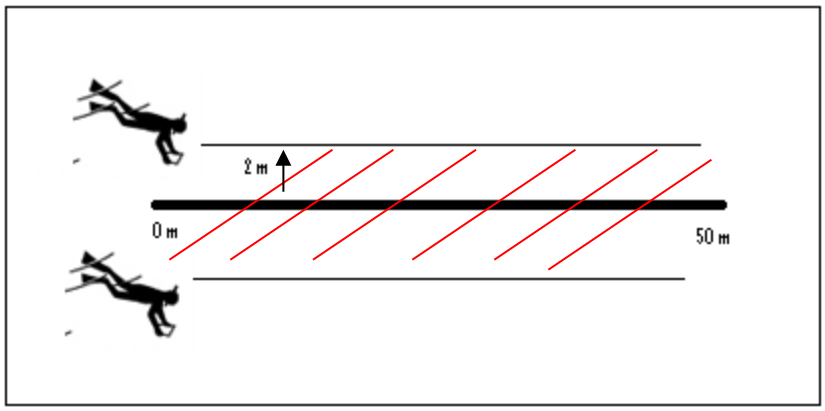

Figure 2: Diagram portraying the survey design of the Belt Line Transect

On the same transect (50 meters) the substrate coverage was then carried out using the 3 Point Intercept Transect method. Similar number of surveyors were used the only difference from the BLT method is that at every two meters all three were to record the type of substrate observed at that particular point (Figure 3). A three letter code for the substrate type observed was recorded (Australian Institute Manual Survey Substrate code).

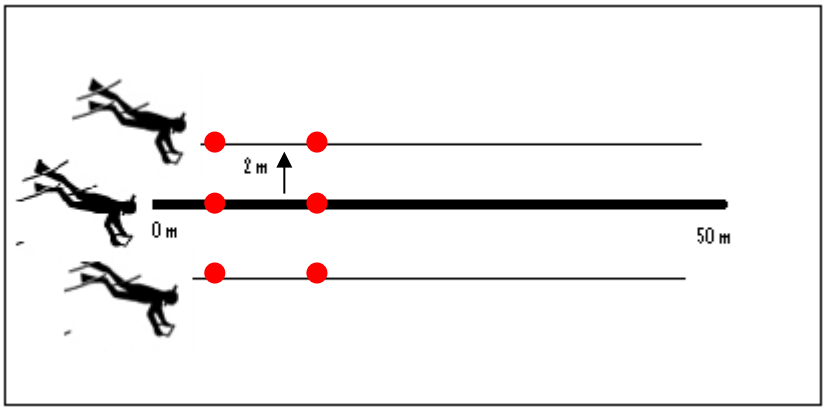

Figure 3: Diagram portraying the survey design of the 3 Point Intercept Transect

Three transects (Figure 4) were randomly laid out parallel to the coastline within the fish reserve in order to be of representative of the whole fish reserve. Each transect covers about 200m^2 therefore the total assessed area was 600m^2. The estimated total area of the fish reserve was 26,820 m^2.

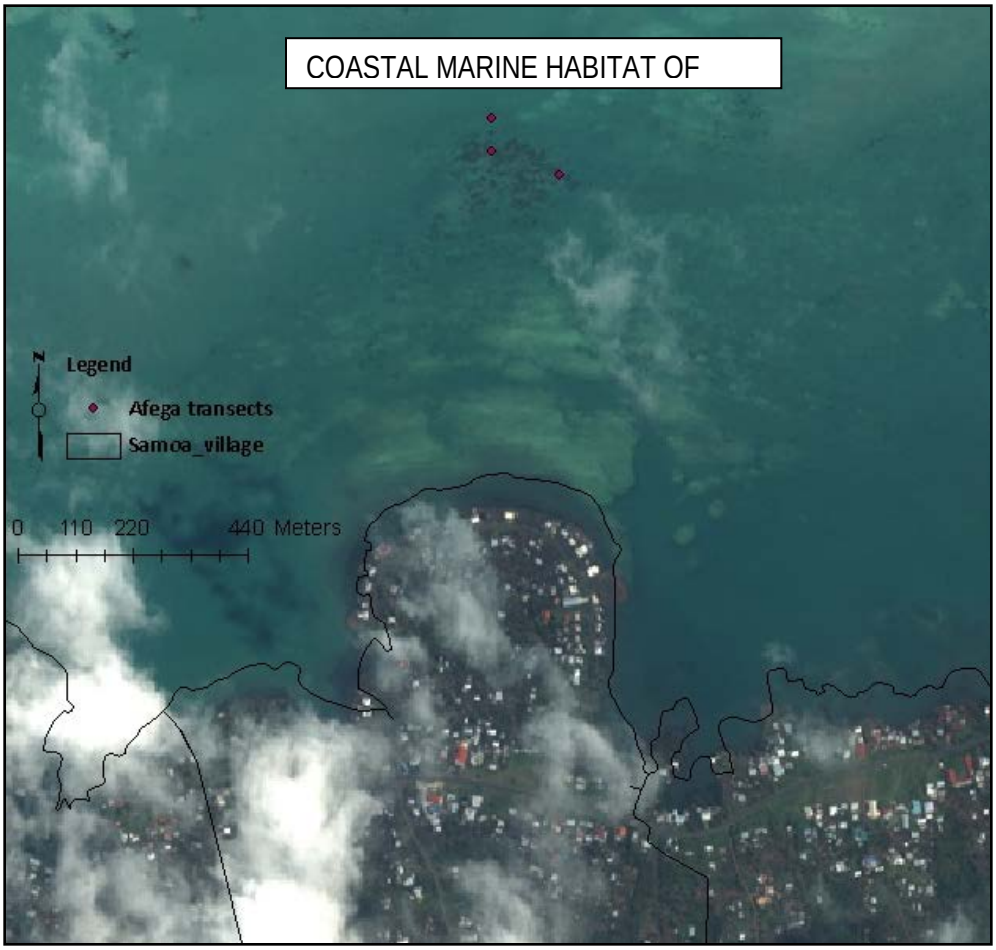

Figure 4: Map of the coastal marine habitat of Afega showing the location of the assessment transects

3. Results

3.1 Substrate coverage

The different types of substrate recorded were summarized into six substrate groups (Table 1). The dominant substrate cover was that of live corals with 54%. Within this group five types of live hard corals were recorded the most common was the coral submassive (*Porites antennuata*) followed by coral branching (Figure 5). The least common was coral massive and Acropora submassive (Figure 6).

Figure 5: The common submassive live coral (forefront-school of golden sweeper, back-lollyfish)

The second common substrate group was abiotic which includes sand, rubbles and rocks. Dead corals with algae growing on it were also noted to be at a moderate coverage. The algae group mainly consisted of coralline algae (*Halimeda micronesica*) and macroalgae. Other substrate types were that of sponges and sea grass (*Halophila ovalis*).

Table 1: Substrate covers in groups with their percentage cover

Substrate Group	Percentage Cover (%)
Live corals	54.25
Abiotic	25.20
Algae	0.84
Dead coral with algae	14.95
Dead coral	1.70
Others	2.98
TOTAL	100

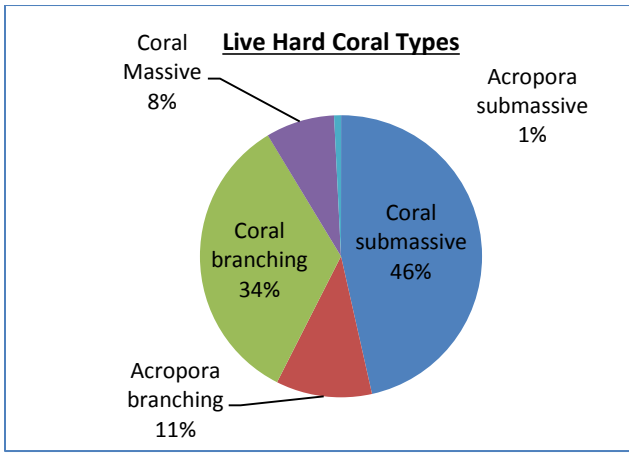

Figure 6: Different types of hard live corals and percentage cover

Comparison of recent substrate coverage to past assessment in 2009, showed that this new habitat that the reserve have moved has a higher live coral coverage and less algae beds only that of algae growing on dead corals (Figure 7). Moreover this recent assessment would be considered as the baseline information of Afega fish reserve.

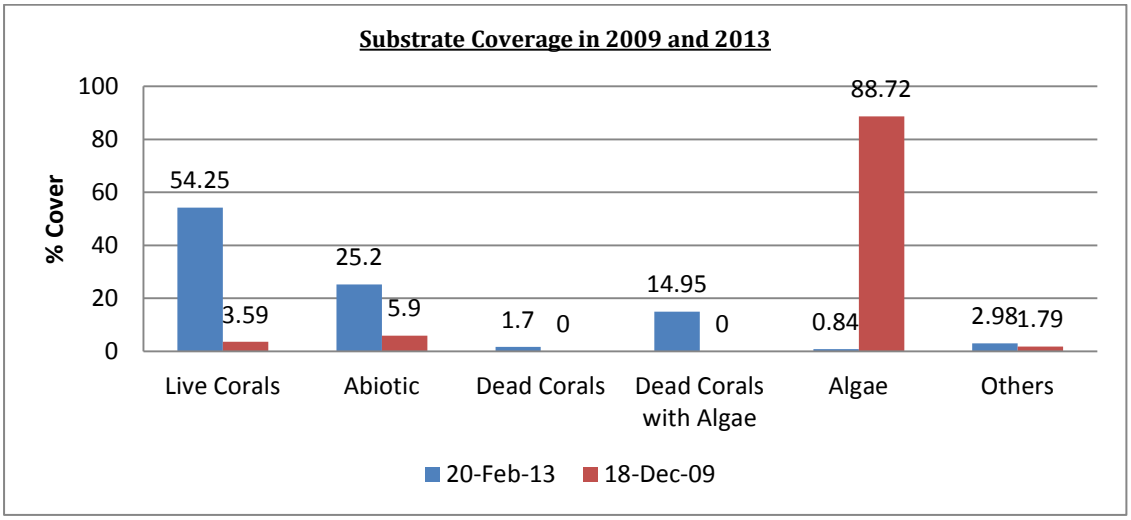

Figure 7: Substrate coverage recorded in comparison to coverage in 2009

3.2 Fish species and abundance

Figure 8: The dominant fish species within the reserve humbug damsel (black/white) and dusky gregory (black) damsel

A total of 328 finfish was recorded of 14 species (Table 2). Five of these species belong to the *Pomacentridae* fish family and was noted to be abundant within the fish reserve. The dominant fish species was that of humbug damsel (*Dasyllus aruanas*) with about 166 individuals recorded. It also had the highest estimated biomass of 40kg. Other species are tabulated below with their abundance and average length.

Majority of the fish observed were juveniles as noted by the average length ranging from 4-14 cm. In terms of biomass some less abundant species have a higher biomass than the abundant ones such as the dusky gregory compared to the blue green chromis. This is mainly due to the fact that blue green chromis are small size fished compared to the dusky gregory. Estimated total biomass of all fish species recorded within the fish reserve was 143kg.

Table 2: Fish species recorded from the assessment with their average length, abundance and estimated biomass

Fish species	Scientific Name	Avg length (cm)	Count	Biomass	Percentage (%)
Humbug damsel	*Dascyllus aruanus*	5	166	40.52	50.61
Blue green chromis	*Chromis viridis*	4	62	7.87	18.90
Blue Devil	*Chrysiptera cyanea*	6.75	28	4.30	8.54

Dusky gregory	*Stegaste nigricans*	10	25	37.45	7.62
Whiteband damsel	*Plectroglyphidodon leucozonous*	9.1	15	22.37	4.57
Bullethead parrotfish	*Chlororus sordidus*	8	12	9.59	3.66
Blacktail snapper	*Lutjanus fulvus*	9.5	6	7.94	1.83
Saddle Butterfly	*Chaetodon Ephipium*	9	5	4.41	1.52
Dusky parrotfish	*Scarus nigricans*	9	3	3.45	0.91
Vagabond butterfly	*Chaetodon vagabondus*	6.5	2	0.75	0.61
Threespot wrasse	*Halichoeres trimaculatus*	7	1	0.25	0.30
Forktail rabbitfish	*Siganus argentus*	14	1	2.01	0.30
Scissortail sergeant	*Abudefduf sexfasciatus*	10	1	1.35	0.30
Dot-dash goatfish	*Parupeneus barberinus*	7	1	0.25	0.30
TOTAL		**-**	**328**	**142.52**	**100**

3.3 Invertebrate species and abundance

Seven invertebrate species was observed during the assessment with an overall total counted of 237. Four of the above species belonged to one family the *Holothuriidae* (sea cucumber). The dominant species was that of lollyfish followed by greenfish and operculate worm snail which were nestled within the coral massive (Table 3). The least common species was that of the cushion star and tigertail sea cucumber.

Figure 9: Least common invertebrate, the cushion starfish

Table 3: Invertebrate species recorded with their average length and abundance

Invertebrate species	Scientific names	Avg Length (cm)	Count	Percentage %
Lollyfish	*Holothuria atra*	13.97	191	80.59
Greenfish	*Stichopus chloronotus*	15.67	20	8.44
Operculate worm snail	*Dendropoma maxima*		20	8.44
Curry fish	*Stichopus horrens*	6	2	0.84
Blue starfish	*Linckia laevigata*		2	0.84
Cushion star	*Culcita sp*		1	0.42
Tigertail	*Holothuria hilla*	8	1	0.42
Total		-	237	100

4. Discussion

Results show good substrate coverage of Afega fish reserve where there is a dominance and diverse of live corals with common species *P. antennuata*. In comparison to the old site that was reserved, this new fish reserve area had higher coral coverage and less algae coverage considering that it was now

of a good distance away from the Aleipata stream and poor waste management along the coastline. As well as towards the reef where there is good circulation of lagoon water and open sea. However with moderate water turbidity there is still a moderate growth of algae on dead corals as nutrients from inland are favorable conditions for algae growth.

In terms of the finfish assessment a good diversity and abundance of species were recorded. The abundance of corallivore species which is mainly that of the *Pomacentridae* family reflects the good status of the live corals. Moderate abundance was noted in herbivore species such as dusky parrotfish, bullethead parrotfish and forktail rabbitfish who are responsible for keeping coral free of suffocating algae growth. The average length recorded from most of the species show that the reserve is catering for many juvenile species which is important to protect. As for invertebrate assessment, the abundance of sea cucumbers is to an advantage for they help clean the turbid water column by turning over the sand on the sea floor. Furthermore the dominance of the lollyfish species will help secure its stocks within these coastal waters as it is one targeted invertebrate for consumption.

5. Conclusion

In summary, Afega fish reserve has moved to a much better habitat where there is a good coverage of live corals and a diversity and abundance of fish and invertebrate. In addition, it has moved away from direct impact of the Aleipata stream and the rubbish along the coastline but close to the reef where there is good water circulation with the open sea.

The abundance of certain species was also towards an advantage to the fish reserve. This was shown in the abundance of corallivore species mainly that of the *Pomacentridae* fish family indicating good healthy live corals. The moderate numbers of herbivore species which help stabilize the growth of algae so that do not suffocate the live corals. The average length recorded also show that the reserve is catering for many juvenile species which is important to protect. The abundance of sea cucumbers which help cleans the turbid water column through turning of sand of the sea.

With good management, awareness and strong enforcement of the village regulations such documented results would improve in the future. Hence, this report recommends that the community continues its good management of the reserve and to address the poor waste management noted along the coastline. As well as better demarcation of the fish reserve in order for the public to be aware of the boundaries and area that is taboo from fishing.

Samatau reserve Reassessment

MAF-Joyce

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Inshore Section
Fisheries Division
Ministry of Agriculture and Fisheries

Fisheries staff that conducted the reassessment of Vavau Fish Reserve

14th February 2013

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1. Introduction

With various negative impacts on coastal fisheries such as overfishing one approach to resolve such situation is to set up a fish reserve where fishing is banned. The idea is to provide relief to stressed fish stocks by providing safe habitat where fish can reproduce, and then spread out. This is one activity under the Community Based Fisheries Management Programme (CBFMP) which is a collaborative work implemented by the Fisheries Division and local communities.

Before setting up a fish reserve, the community council must first carry out the preliminary stage with the Fisheries Division Advisory section to draft and approve a management plan bylaw. This plan consists of guidelines that assist the community to managing well their fish reserve as well as small regulations to help them in protecting the reserve from illegal activities. In addition services or developments that Fisheries Division can provide for the community with such establishment.

When the management plan is finally in place, the research team which is the Inshore section of the Fisheries Division heads to the proposed area for the fish reserve to conduct an ecological resource assessment. The sole purpose is to document the current status of the proposed fish reserve and whether the area proposed is suitable to be reserved. The results obtain from the assessment will be reported back to the community. In that way, the community is aware of the status of the proposed marine reserve and what needs to be improved for the fish reserve to prosper.

Vavau is one of the communities under this program which is located on the south east of Upolu Island (Figure 1). Its Fisheries Management Plan was completed and approved on the 30th April 2003. The last assessment of the fish reserve was conducted on the 3rd December 2009. Results obtained showed that the reserve substrate coverage is still dominated by live corals but have declined due to the broken corals observed. This was mainly due to the tsunami that struck Samoa in September 2009.

On the 14 February 2013, this above fish reserve was visited again by the Fisheries Division for its reassessment. It was to document its current status and report back to the community. This report will portray the results obtained from the reassessment as well as findings and recommendations to Vavau community.

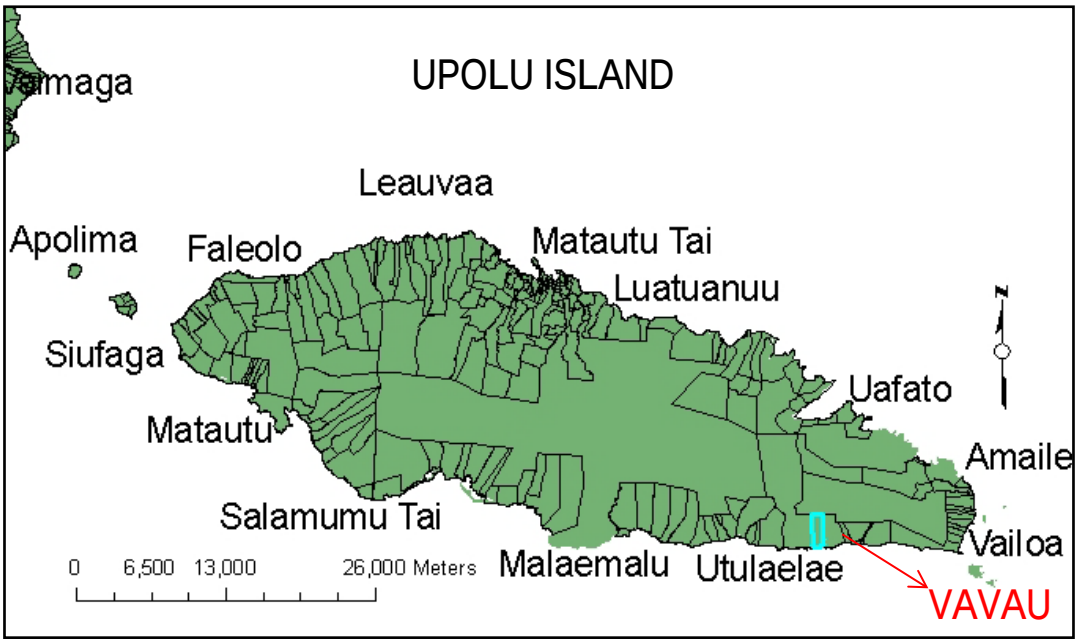

Figure 1: Map of Upolu Island, indicating the location of the Vavau community

2. Methodology

Underwater visual census of the surveyors was used to carried out the 3 Point Intercept transect (3 PIT) and the Belt Line Transect (BLT) methods.

The BLT method was used for the invertebrate, fish species and their abundance. The fish assessment was conducted first due to the mobility of such organisms. Three surveyors are employed in this method; one swam and laid out the 50 meters tape in a straight line (transect) while the other two are about two meters left and right of the tape. These two recorded the abundance and estimated lengths (in centimeters) of the fish species observed (Figure 2). Afterwards, similar procedure was conducted for invertebrate abundance however the measurable invertebrate species are physically measured with a caliper.

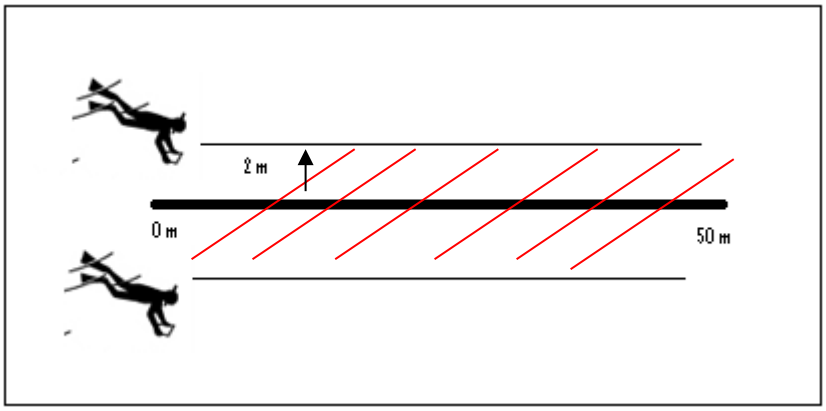

Figure 2: Diagram portraying the survey design of the Belt Line Transect

On the same transect (50 meters) the substrate coverage was then carried out using the 3 Point Intercept Transect method. Similar number of surveyors were used the only difference from the BLT method is that at every two meters all three were to record the type of substrate observed at that particular point (Figure 3). A three letter code for the substrate type observed was recorded (Australian Institute Manual Survey Substrate code).

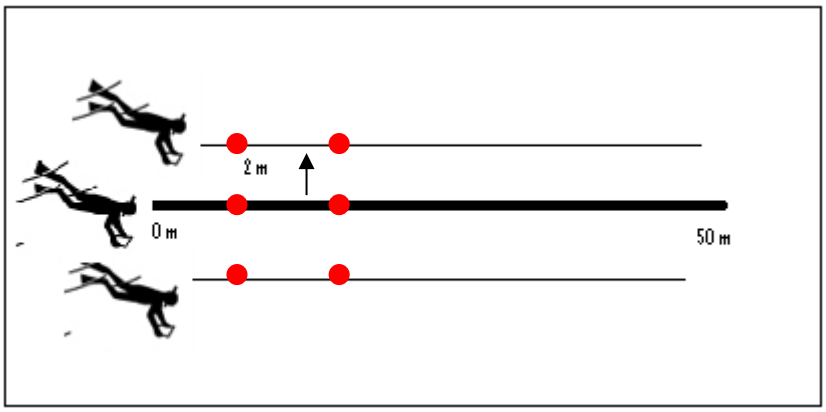

Figure 3: Diagram portraying the survey design of the 3 Point Intercept Transect

Five transects (Figure 4) were randomly laid out parallel to the coastline within the fish reserve in order to be of representative of the whole fish reserve. Each transect covers about 200m^2 therefore the total assessed area was 1000m^2. The estimated total area of the fish reserve was 80,000 m^2.

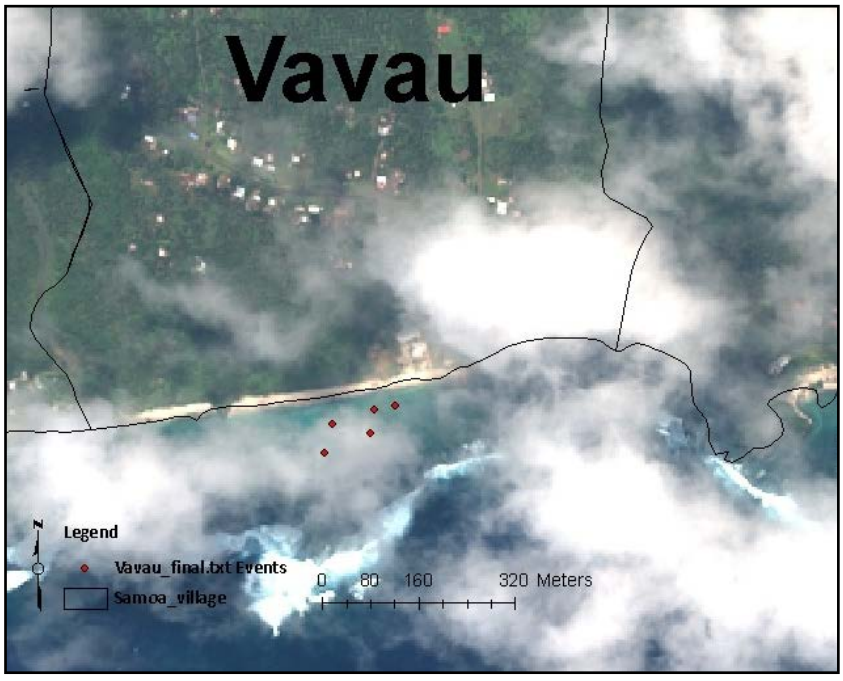

Figure 4: Coastal marine habitat of Vavau with locations of assessment transects

3. Results

3.1 Substrate coverage

Various types of substrate was recorded and grouped accordingly to five groups (Table 1). The most common substrate group recorded was that of the dead corals with algae growing on it (Figure 5). It was followed by live corals which mainly consisted of coral massive (*Porites sp.*) and Acropora tabular (*Acropora hyacinthus*). Other types of live corals observed are tabulated in Figure 6. The moderate substrate group in coverage was abiotic which that of rubbles and sand.

Figure 5: dead coral with algae

Table 1: Substrate coverage in groups with percentage cover

Substrate Group	Percentage Cover (%)
Live corals	30.25
Abiotic	11.28
Algae	1.79
Dead corals with algae	48.30
Dead corals	8.46
TOTAL	100

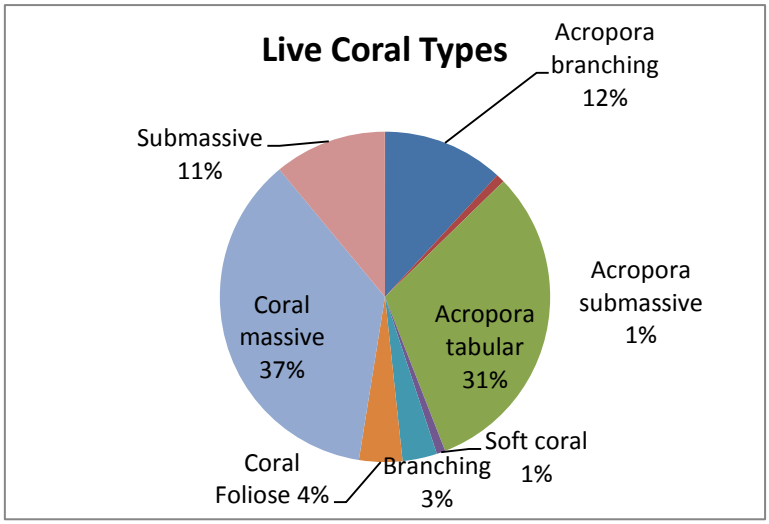

Figure 6: Different types of live corals recorded and percentage cover

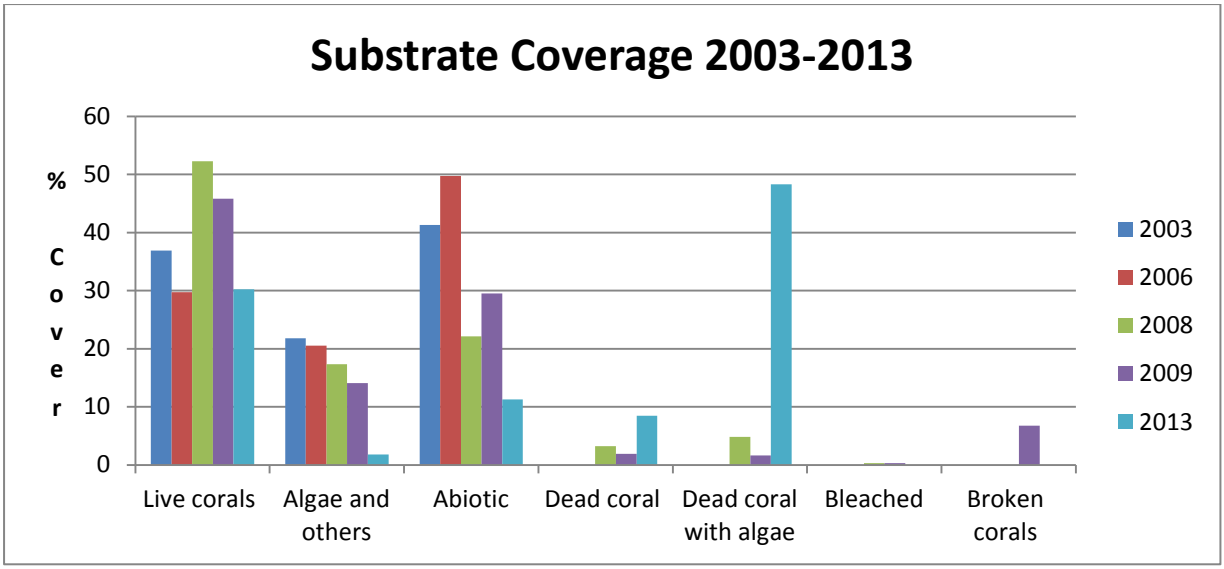

Figure 7: Substrate coverage from assessments in 2003 till now

In comparison with substrate coverage data from past assessments, live coral have declined about 15% since 2009 (Figure 7). This recent coverage was similar to its status in 2006 but it recovered later in the years. The algae and abiotic group have also declined. Substrate cover that has increased in coverage was that of dead corals and dead corals with algae. This coverage may be considered to be contributed by the broken corals documented in 2009 due to the Tsunami.

3.2 Fish species and abundance

Figure 8: Ctenochaetus striatus

The total number of all the fish recorded was 973 with 24 species (Table 2). The dominant fish species was that of the bristle tooth surgeon fish (***Ctenochaetus striatus)*** **with an average length of 12cm (Figure 8).**

The next common fish recorded was the south seas devil damsel a corallivore species. Moderate abundant species were the wrasses and goatfish. The least common species are detailed in table 2.

In terms of biomass, bicolor goatfish had the highest estimated biomass within the total fish reserve area which was 25,161kg. Even though the bristle tooth surgeon was of high abundance but had a lower biomass due to its smaller average length compared to the bicolour goatfish. Majority of the species recorded were of juvenile stage as noted in their average lengths. The estimated biomass of all the fish species recorded within the fish reserve was about 29,971kg.

Table 2: Fish species recorded with their abundance, average length and estimated biomass

Fish species	Scientific name	Length (cm)	Count	Biomass	Percentage
Brown surgeon	*Ctenochaetus striatus*	11.88	214	1,901.99	21.99
South seas devil	*Chrysiptera taupou*	4.50	201	35.41	20.66

Bullethead parrotfish	*Chlororus sordidus*	15.78	188	1,901.74	19.32
Whiteband damsel	*Plectroglyphidodon leucozonus*	11.00	107	313.87	11.00
Sixbar wrasse	*Thalassoma hardwicke*	10.17	51	93.70	5.24
Blue damsel	*Pomacentrus sp*	5.00	49	16.69	5.04
Convict surgeon	*Acanthurus triostegus*	6.00	40	18.07	4.11
Surge wrasse	*Thalassoma purpureum*	12.67	31	59.63	3.19
Checkerboard wrasse	*Halichoeres hortulanus*	16.45	23	197.85	2.36
Bicolor goatfish	*Parupeneus barberinoides*	37.43	12	25,161.85	1.23
Threespot wrasse	*Halichoeres trimaculatus*	15.00	11	29.78	1.13
Wrasse	*Labridae*	9.00	5	4.94	0.51
Picasso triggerfish	*Rhinecanthus aculeatus*	14.50	5	24.01	0.51
Wedgetail triggerfish	*Rhinecanthus rectangulus*	16.33	5	31.50	0.51
Speckled butterflyfish	*Chaetodon citrinellus*	10.75	5	12.66	0.51
Goldspotted spinefoot	*Siganus punctatus*	15.67	5	32.69	0.51
Gobies	*Istigobius sp.)*	8.00	5	2.27	0.51
Longnose butterflyfish	*Forcipiger flavissimus*	14.50	4	27.36	0.41
Chevroned butterflyfish	*Chaetodon trifascialis*	21.00	4	65.07	0.41
Spotfin squirrelfish	*Neoniphon sammara*	13.67	3	13.40	0.31
Epaulette surgeonfish	*Acanthurus nigricauda*	4.00	2	0.22	0.21
Redfin butterflyfish	*Chaetodon lunulatus*	22.00	1	21.59	0.10
Blackeye thicklip	*Hemigymnus melapterus*	13.00	1	3.49	0.10
Orange-lined triggerfish	*Balistapus undulatus*	11.00	1	1.56	0.10
TOTAL		-	973	29,971.34	100.00

3.3 Invertebrate species and abundance

A total of 11 invertebrate species was recorded from the assessment with a total count of 456 individuals (Table 3). The most common invertebrates were the sea urchin with the most abundant species was the rock boring sea urchin followed by the long spine urchin. Moderately abundant were the sea cucumbers namely that of lollyfish and greenfish. Measureable species like sea cucumbers showed average lengths ranging from 17-20cm. The least abundant species are tabulated below with their abundance recorded.

Table 3: Invertebrate species recorded from the assessment with their abundance and average length

Invertebrate Species	Scientific Name	Count	Average length (cm)	Percentage %
Rock boring urchin	*Echinometra mathaei*	378	-	83
Long spine urchin	*Echinothrix diadema*	52	-	11.4
Lollyfish	*Holothuria atra*	14	17.75	3.1
Spider shell	*Lambis lambis*	2	22.5	0.4
Blue starfish	*Linkia laevigata*	2	-	0.4
Giant clam	*Tridacna sp.*	2	9	0.4
Pyramid top shell	*Tectus pyramis*	2	3.5	0.4

Cushion starfish	*Culcita sp.*	1	-	0.2
Turban shell	*Turbo argyrostomus*	1	-	0.2
Greenfish	*Stichopus chloronotus*	1	20	0.2
Spindle shell	*Fusinus colus*	1		0.2
TOTAL		456	-	100

4. Discussion

Results obtained from this assessment showed that the substrate cover of Vavau fish reserve is dominated by dead corals with algae growing on it. This is an indication that the dead corals are not recent (minimal impact by Cyclone Evan, December 2012) and that there is high nutrients within the habitat to have triggered the growth of algae. Second common substrate group was live corals with signs that is slowly recovering from the 2009 Tsunami impact. In comparison with past assessments live corals have declined at about 15% while the level of algae on dead corals has increased dramatically. This is to a disadvantage as algae growth poses a competition towards live corals in terms of space to grow.

On the other hand, the numerous number of herbivore fish species recorded will be responsible in stabilizing the algae growth by feeding on it. These are mainly the surgeon fish (e.g. *Ctenochaetus straits*) and parrotfish (e.g. *Chlorurus sordidus*). High biomass fish species such as bicolor goatfish, brown surgeon fish and bullethead parrotfish is good news to the community as these are main targeted species for local consumption. With their abundance in the reserve they would spur over to nearby fishing areas.

In terms of invertebrate abundance, the reserve was noted to cater for various species (11 species). Record of giant clams and pyramid top shells in the reserve was a positive sign as these species nowadays are seldom found in coastal waters due to its heavy exploitation, in particular giant clams as it's a delicacy. Several numbers of sea cucumber (greenfish and lollyfish) observed is another aid to the high nutrient of the area for they turn the sand and clean the nutrients on the sea floor that are often suspended in the water column. Abundance of sea urchins (long spine urchin and rock boring urchin) is often found in barren habitats with a good supply of algae as it mainly feeds on algae. Therefore, considering the characteristics of the substrate coverage where there is high coverage of dead corals with algae growing this have triggered favorable conditions for such species.

With continuation of good management of the fish reserve, live corals will have time to rejuvenate and restore its status before the 2009 Tsunami. As well as chance for the algae, sea cucumbers to use up the nutrients moreover clean up of the area naturally. At the same time have the fish and invertebrate species grow out to adult stage and increase in abundance and diversity.

5. Conclusion

Vavau fish reserve has changed in substrate cover since the 2009 Tsunami but not so much of the recent cyclone Evan in December 2012. This was noted by the decline in live coral coverage and increase in dead corals with algae growing on it. Recovery of live corals was noted by small live coral recruits and the fact that it is the second common substrate group.

The above status did not pose a negative impact on fish and invertebrate abundance since there was a good diversity and abundance species recorded. Key species were also recorded that help stabilize the current situation of high algae cover on dead corals which were the herbivore fish species and sea cucumbers. Not to mention records of main targeted fished species which is good news to the fishers as abundance of such species would spur over to nearby fishing waters. This includes the giant clams, pyramid top shell, brown surgeon fish, Bullethead parrotfish and bicolor goatfish.

This report recommends that the community of Vavau continues its good management of the fish reserve. As well as strong enforcement of its small regulations to assist the reserve in recovering from Tsunami impact and chance for the live corals to rejuvenate, fish and invertebrate to grow out into adult stage.

SAMATAU RESERVE REASSESSMENT

28th November 2012

Justin Aiafi (Fisheries Officer) and Maria F. Sapatu (Senior Fisheries Officer)

Inshore Section
Fisheries Division
Ministry of Agriculture and Fisheries

Staff involved with the reassessment of Samatau Fish Reserve

28th November 2012

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Justin Aiafi *(Fisheries Officer)*

Fatutolo Iene *(Fisheries Assistant Officer)*

Rilloy Tautalagia *(Fisheries Assistant Officer)*

3. Introduction

Marine resources are facing issues of overexploitation, depletion, extinction to name a few. Less effort has been develop to replenish the vanishing ocean beauty. It has been considered that the demand of people from the sea is more than the sea can replace its resources. This is why the Fisheries Division has developed one of its tools to implement the enhancement and augmentation of natural marine resources for its ecosystem to function and create a healthy and wealthy marine biological diversity. This tool is known as the Community Based Fisheries Management Program (CBFMP) to assist communities with resource management and development.

Many rural communities joined this program as some of its members have been long gone while others reactivate their registration under the CBFMP with more newcomers on the way. Samatau is one of the longest serving communities under the CBFMP (Figure 1). Its management plan was established on 18th August 1998 and its fish reserve was set up afterwards. From there onwards, fish reserve assessment was continuous for Samatau. A task that is responsible by the inshore section in which they collect the data from the reserve, analyze and writing reports according to the monitored data. This report reveal the current status of the reserve in terms of substrate coverage (live corals, algae, abiotic, dead corals, dead corals with algae and others), fish abundance (different species, size, lengths and count) and invertebrates.

On the 28th of November 2012, the inshore section heads to Samatau for their usual monitoring. Usually there are five transects to be laid randomly within the reserve area but Samatau reserve is far too big for only five transects. Hence six transects were laid due to its vast area being marked for protection, approximately 200000 m^2 total area. The results of the monitoring are detailed below together with graphs and tables that disseminate the present condition and the differentiation of each substrate type, fish type and invertebrate type. It also includes comparison of previous monitoring with the most recent one.

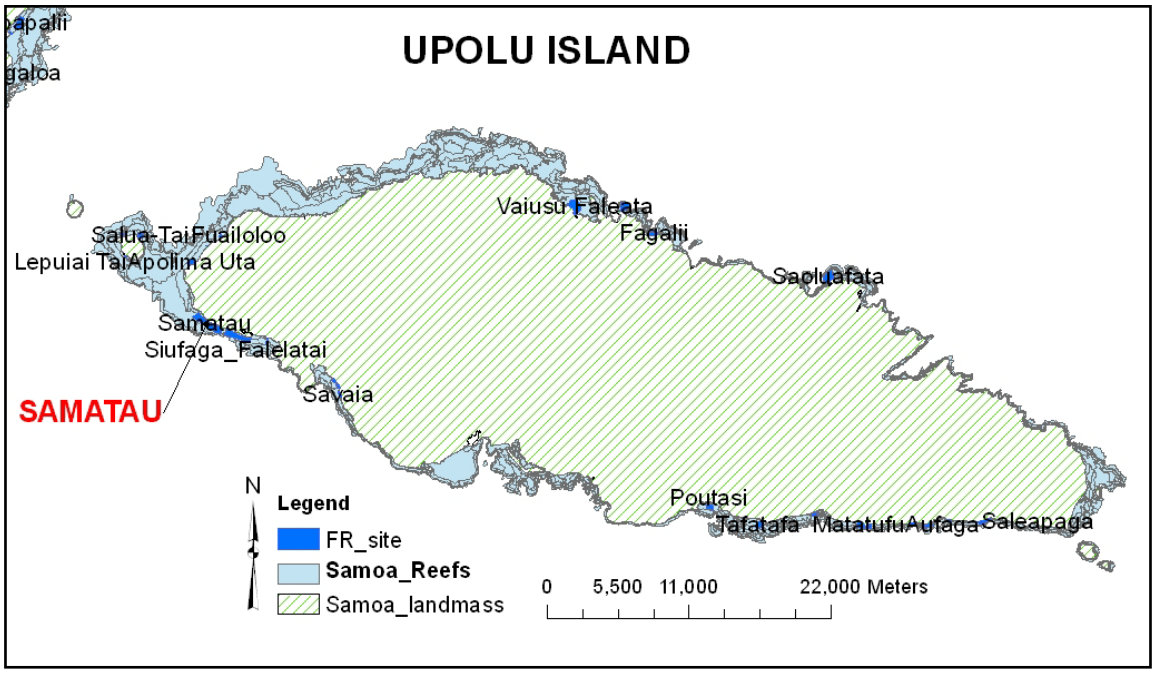


Figure 1: Map of Upolu Island, indicating the location of Samatau community

4. Methodology

There are two different methods employ for this assessment. For the substrate coverage the 3 Point Intercept Transect method (3-PIT) was used. This requires three divers, where one diver swims along the 50 meter tape measure, while the other two divers swim about 2 meter from the tape on both the left and right sides (Figure 2). Then the substrate is recorded in accordance with every two meters on the tape from the 0 meter mark to the 50 meter mark.

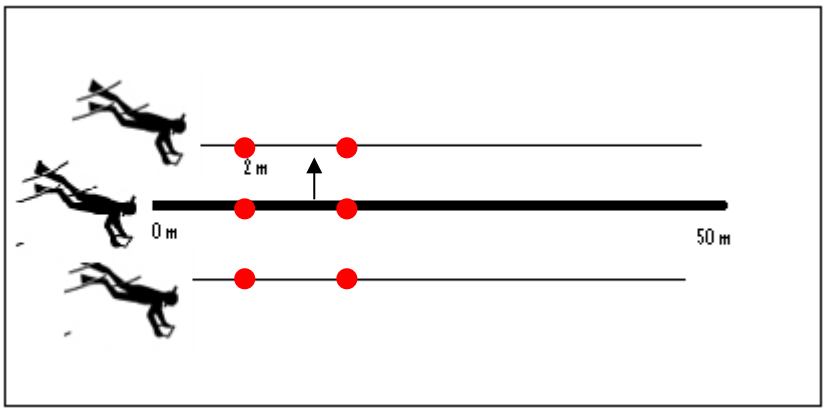


Figure 2: Diagram portraying the three point intercept transects (3PIT) method

For the fish and invertebrate count, the 50 meter tape was used but required only two divers instead. The two divers will swim at about 1.5 meters from the tape on both sides and will count the fish as they swim from the 0 meter mark to the 50 meter mark (Figure 3). They will record the number and estimate the lengths of these individual fish as well as invertebrates.

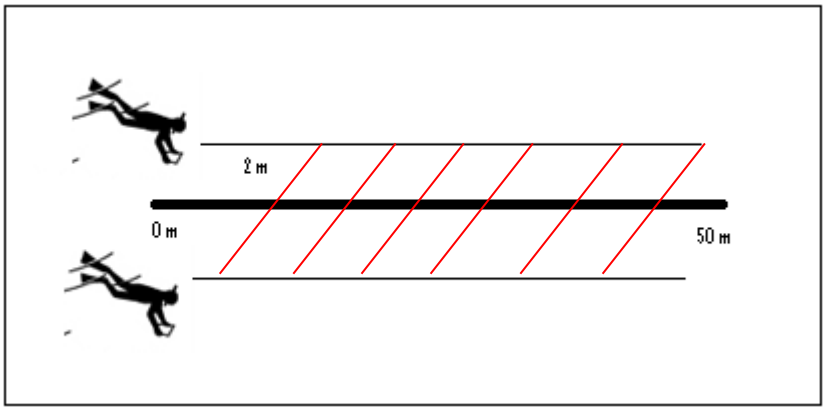


Figure 3: Diagram portraying the belt line transects (BLT) method

Six transect lines were laid out within the fish reserve in parallel to the coastline (Figure 4). This is a total sampled area of 1200m^2 with an estimated total area of the fish reserve of 200,000 m^2.

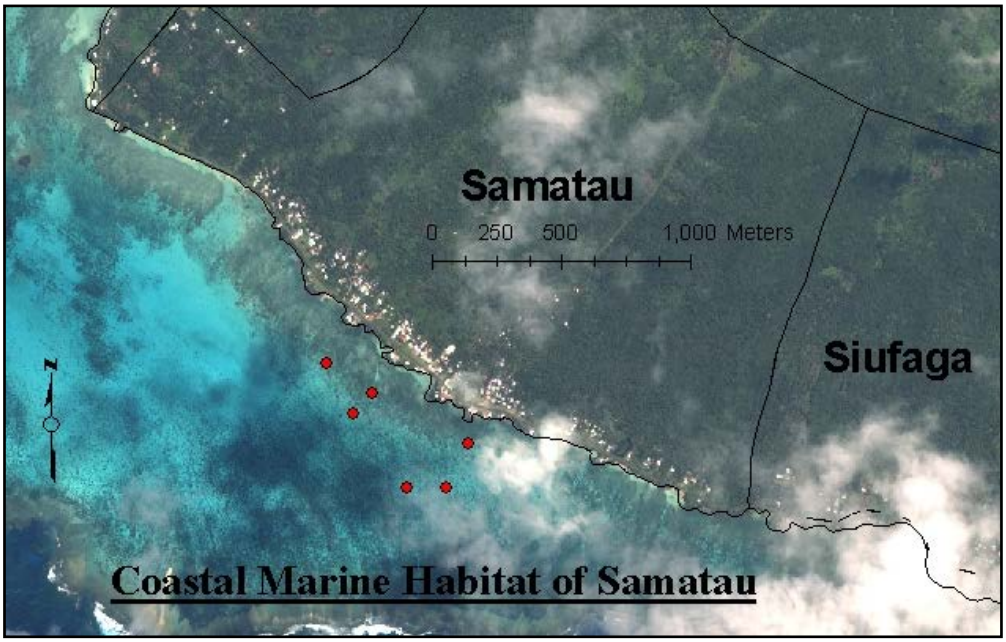


Figure 4: Closer look at the coastal marine habitat of Samatau, with location of the assessment transects within the fish reserve

5. Results

3.1 Substrate coverage.

The recent monitoring of Samatau fish reserves reveal that hard live corals still dominate the area with 74.5%. Abiotic has 10.9% whereas algae, dead corals and dead coral with algae have less than 10% total substrate. The graph (Figure 5) below demonstrates more on the results of the monitoring from Samatau fish reserve.

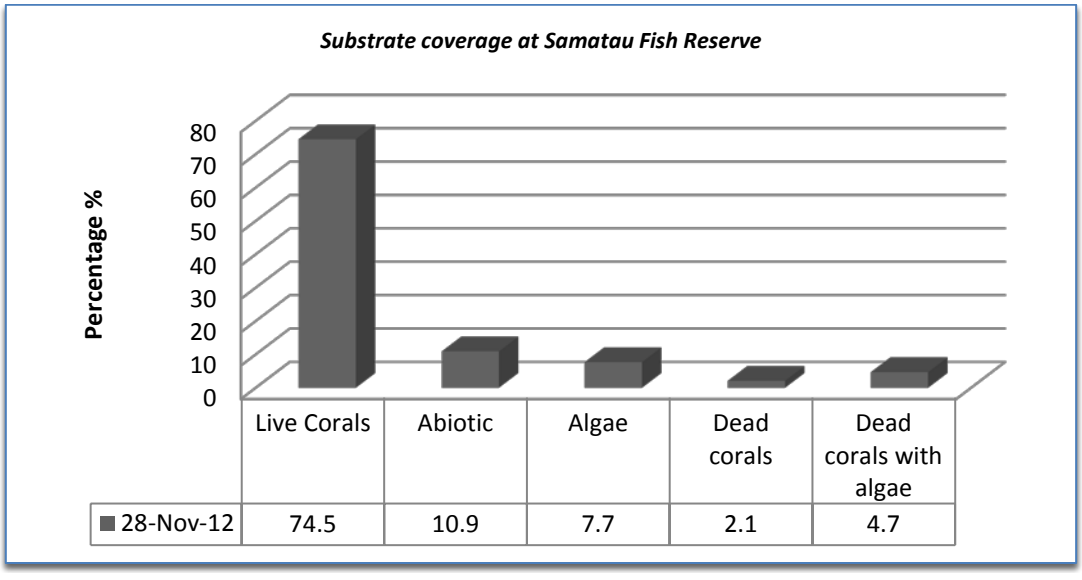


Figure 5: Substrate coverage at Samatau fish reserve

Figure 6 explains the diverse live corals and their quantity recorded during the assessment which includes Acropora coral branching (ACB), coral submassive (CS), coral massive (CM), Acropora coral digitate (ACD), Coral foliose (CF), Coral encrusting (CE), *Acropora* tabular (ACT).

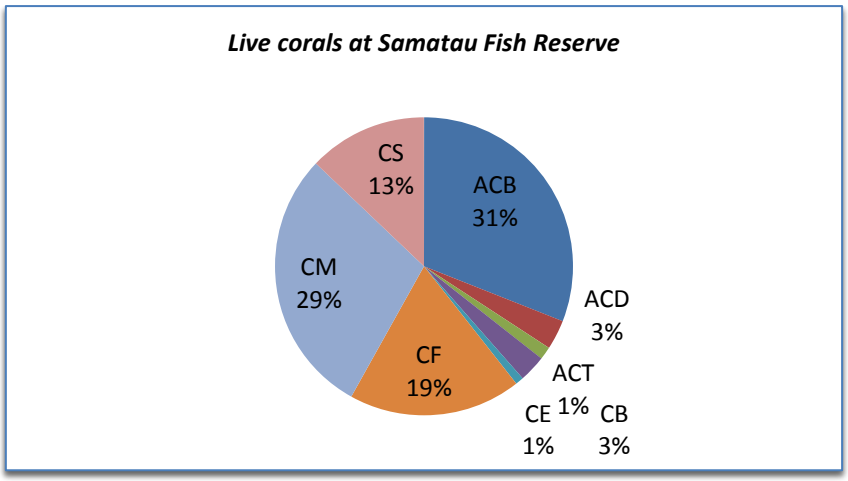
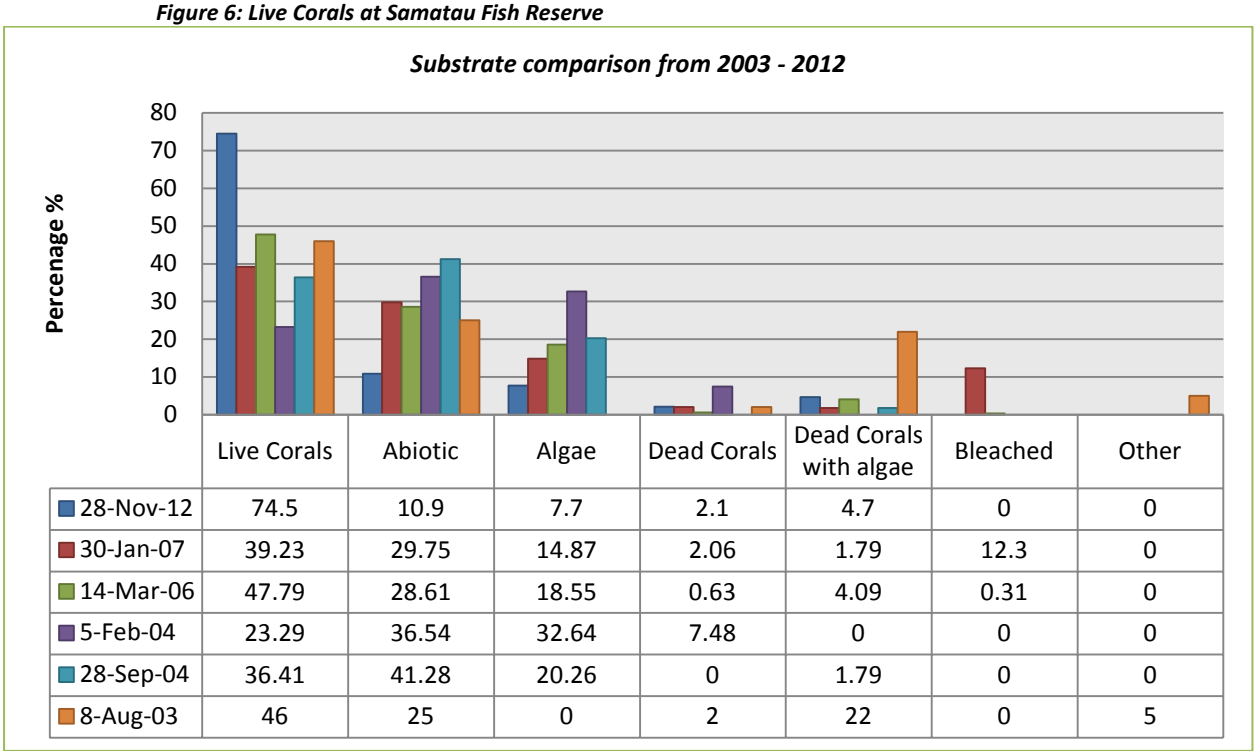


Figure 6: Live Corals at Samatau Fish Reserve



	Live Corals	Abiotic	Algae	Dead Corals	Dead Corals with algae	Bleached	Other
28-Nov-12	74.5	10.9	7.7	2.1	4.7	0	0
30-Jan-07	39.23	29.75	14.87	2.06	1.79	12.3	0
14-Mar-06	47.79	28.61	18.55	0.63	4.09	0.31	0
5-Feb-04	23.29	36.54	32.64	7.48	0	0	0
28-Sep-04	36.41	41.28	20.26	0	1.79	0	0
8-Aug-03	46	25	0	2	22	0	5

Figure 7: Substrate comparison from 2003 – 2012

Figure 7 shows the trend between each monitoring and will also demonstrate the causes of ascending and descending groups. So far, the fish reserve has increased in live coral substrate. It had declined in abiotic algae coverage.

3.2 Fish Abundance

Twenty five (25) fish species indicators were identified during the monitoring. Out of this huge number, humbug dascyllus *(dascyllus aruanus)* was the most abundant species from

the Pomacentridae family with 275 individual counts. Whiteboard damsel *(Plectroglyphidodon leucozonous)* is less than 6 from the humbug and has a total of 269, and it is also from the same family but has contrasting genus and species. The least species count was the South Seas devil *(chrysiptera taupou)* and has a total percent of 0.0726216. Table 1 lists all the species indicators observed from the monitoring.

Table 1: Fish species abundance, total w (kg), biomass and percentage

Fish species (Scientific name)	Count	Total Weight (kg)	Biomass (kg)	Count Percentage (%)
Whiteboard damsel (*Plectroglyphidodon leucozonus*)	269	9.619	1923.89	19.54
Blue devil (*Chrysiptera cyanea*)	58	1.698	339.54	4.21
Blackbar damsel (*Plectroglyphidodon dickii*)	9	0.324	64.86	0.65
Dusky gregory (*Stegastes nigricans*)	106	3.135	627.00	7.70
Sixbar wrasse (*Thalassoma hardwicke*)	3	0.034	6.87	0.22
Scissortail sergeant (*Abudefduf sexfasciatus*)	14	0.020	4.08	1.02
Threespot wrasse (*Halichoeres trimaculatus*)	39	1.193	238.59	2.83
Red fin butterflyfish (*Chaetodon lunulatus*)	5	0.411	82.11	0.36
Bullet head parrotfish (*Chlororus sordidus*)	178	6.141	1228.26	12.93
Humbug damsel (*Dascyllus aruanus*)	275	1.810	362.10	19.97
Dark-capped parrotfish (*Scarus ovicep*)	21	1.307	261.33	1.53
Brown surgeonfish (*Ctenochaetus striatus*)	20	0.497	99.32	1.45
Blue green chromis (*Chromis viridis*)	86	0.354	70.85	6.25
Threespot damsel (*Pomacentrus tripunctatus*)	179	5.936	1187.18	13.00
Little spine foot (*Siganus spinus*)	3	0.084	16.75	0.22
Yellow stripe goatfish (*Mulloidichthys flavolineatus*)	3	0.159	31.88	0.22
Brushtail tang (*Zebrasoma scopas*)	5	0.086	17.26	0.36
Manybar goatfish (*Parupeneus multifasciatus*)	6	0.250	50.09	0.44
Vagabond butterflyfish (*Chaetodon vagabundus*)	7	0.313	62.69	0.51
Streamline spinefoot (*Siganus argentus*)	30	0.283	56.58	2.18
Yellow-barred parrotfish (*Scarus dimidiatus*)	42	1.833	366.58	3.05
Princess damsel (*Pomacentrus vaiuli*)	5	0.018	3.64	0.36
South seas devil (*Chrysiptera taupou*)	1	0.011	2.28	0.07
Checkerboard wrasse (*Halichoeres hortulanus*)	10	0.124	24.74	0.73
Goldspotted spinefoot (*Siganus punctatus*)	3	0.006	1.11	0.22
Total	**1377**	**35.648**	**7129.58**	**100**

3.3 Invertebrates

About thirteen (13) different invertebrate species recorded during the monitoring. Majority of these invertebrates are from the sea cucumber family including curryfish *(stichopus hermani)* 0.86%, king sea cucumber *(synapta maculata)*, black teatfish *(holothuria nobilis)* to name a few but the most abundant species was lollyfish *(holothuria atra)* which has a total of 267 equivalents to 46% of all invertebrates. Other high quantity species was operculate worm snail (dendropoma maxima) with a total of 90 = 15.5%. Table 2 lists all the

invertebrates recorded from the monitoring as well as their average lengths, total count and their percentages.

Table 2: Invertebrate species from Samatau FR monitoring

Invertebrate species	**Count**	**Avg length (cm)**	**Percentage (%)**
Curryfish (*Stichopus hermani*)	5	12.70	0.86
Lollyfish (*Holothuria atra*)	267	13.48	46.03
King seacucumber (*Synapta maculata*)	29		5.00
Tiger fish (*Bohandschia argus*)	7	23	1.21
Greenfish (*Stichopus chloronotus*)	5	15.40	0.86
Operculate worm snail (*Dendropoma maxima*)	90		15.52
Longspine urchin (*Echinothrix diadema*)	3		0.52
Blue starfish (*Linckia laevigata*)	8		1.38
Cone shell (*Conus vexillum*)	4		0.69
Pin cushion star (*Culcita sp*.)	2		0.34
Sea urchin (*Echinometra mathei*)	74		12.76
Black teatfish (*Holothuria nobilis*)	1	17	0.17
Ring cowrie (*Cypraea annulus*)	85		14.66
Total	**580**		**100**

6. Discussion

True marine reserves that offer a high level of protection are effective in achieving conservation objectives. Samatau community has been outstanding with the management of their fish reserve and shows consistency. This is based according to previous data (figure 3) that hard live corals dominate since the 2003 monitoring. In 2004 there has been a drop with corals due to cyclone Heta that struck Samoa on January. Hence abiotic escalate and dominates from that period. The following assessment in 2006 shows a huge bounce back from live corals and still continues on today (figure 3). Abiotic only dominates for one term and from there it starts to decrease, so as algae, while other groups like dead corals, dead coral with algae, bleached and others remain low. There is growing evidence that they would remain constant if live corals continue to proliferate.

With the high percentage of live corals within the Samatau reserve, this is a symbol of healthier habitats for most reef fish species. The healthier the environment, the more species will live and inhabit the area. Twenty five different species were identified from Samatau reserve and it adds up to a total of 1377. Majority of these species are corallivore which they depend mostly on corals not only for shelter but food. It is also noted that humbug dascyllus *(dascyllus aruanus)* is the most abundant species but has a low biomass of 362 kg due to its minimal size. Compared to the second most abundant whiteboard damsel *(Plectroglyphidodon leucozonus)* which has the highest biomass of 1923.8 kg out of the 25

species recorded. Eight of the twenty five species comes from the *Pomacentridae* family and it is a symbol of species diversity.

With the diverse invertebrates occupying the Samatau reserve, sea cucumbers were abundant and outnumber other species. For instance, lollyfish *(holothuria atra)* were densely scattered all over the place. These sea cucumber species are considered as sand cleaners ingesting dead organic matters depositing on sea floor. Sea urchins were also abundant and they burrow under corals and they are categorized as nocturnal species which only comes out at night time.

7. Conclusion and Recommendation

To conclude, Samatau retain their consistency of good and proper management of their fish reserve. It is a representation of achieving future objectives. It has been considered that Samatau is one of the best reserves ever present since its establishment in the late 90's. Hard live corals have been the dominant group since 2003 and only the following year (2004) saw a shift from corals to abiotic as aftermath of cyclone Heta which struck Samoa. It didn't last too long before live corals hits back and take over from abiotic until today.

With the ascending quantity of live corals, it supports a diverse number of reef fish species wandering this particular reserve. It has provided shelter and habitats to many marine organisms but also fish enjoy the comfortable of this area as it protects them from predators and competition with other species. Invertebrates are also playing a vital role in the reserve with sea cucumbers cleaning and clearing sand for sand dwelling species.

Samatau community must continue the good work by sustaining their marine resources. Somehow coastal expansion such as road developments, tourism activities cannot be stopped; hence Samatau should ban these developments as it will produce great impacts on marine ecosystem, for instance soil erosion, land reclamation and so forth. They must also continue working jointly with the fisheries division for assistance in order to prolong the healthy and wealthy of their coastal waters.