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COMMUNITY-BASED REFUGIA MANAGEMENT IN FIJI

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Alifereti Tawake
Bill Aalbersberg

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Alifereti Tawake* and Dr Bill Aalbersberg.

Institute of Applied Science, The University of the South Pacific, Suva, Fiji.

* *Email:* Tawake_a@usp.ac.fj

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Abstract

Many coastal communities in Fiji depend on the sea particularly on mangrove, seagrass and reef ecosystems, for their livelihood and the use of "tabu" or refuge areas are increasingly being revitalized by resource owners as a tool to sustain local fisheries. One of the main challenges is the limitation in the scientific or appropriate skills to judge their effectiveness, which is traditionally based upon beliefs and casual observations. Through a Biodiversity Conservation Network (BCN) project, people in the Verata district in Fiji have developed skills to help address marine issues. Using participatory techniques, communities determined threats to marine resources and developed a marine resource management plan.

Community members were also trained to perform simple biological monitoring techniques to assess the effectiveness of the use of refuge areas. Two target species; mud lobsters (Thallasina anomala) and clams (Anadara sp.) have been monitored. Since the baseline surveys in 1997, there has been a 13-fold increase in clam abundance in the refuge area and a 5-fold increase in the harvest area indicating the success of these interventions. Mud lobster numbers have also increased. Consequently, new refuge areas involving five target species have been set up and monitored by the communities. In collaboration with the government and other NGOs, efforts are also underway to replicate this 'Veratavou model' in other parts of Fiji and to create a learning network of community-managed refuge areas. This will help determine conditions under which the declaration and monitoring of community-managed fishery refugia can be an effective tool in sustaining local fisheries in Fiji.

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1.0 Introduction.

The intention of this paper is to share the lessons learned from the application of small-scale refugia areas, locally known as *tabu* areas, using a case example from Verata district, Fiji. In order to discuss lessons learned, this paper will focus on both the process and the tangible results achieved from the monitoring of the approach and the management actions taken. It will highlight:

- Project setting, the initial condition of the site and the approach taken for the proposed interventions including the hypothesis and the assumptions for the locally-manage marine area (LMMA) tool used in this case study,
- Monitoring methods and results relating to the community actions and the use of refuge area at this site and,
- Lessons learned that have been the basis of the replication work outside Verata community.

This case study provides a model for the replication of the locally managed marine area (LMMA) tool currently underway in Fiji.

Project Sites Setting: Verata District and the replication sites.

Verata district or county consists of eight villages with close to 2500 residents and spreads over an area of 140km^2 stretching (see Figure 1) across 10 km of coastline. This is adjacent to their fishing ground of about 95km^2. Within their fishing ground, the ecosystems are tropical in origin. Mangroves line much of the rocky coastlines and sandflats and seagrass beds extend up to 200m from the shoreline. Enclosing these primary ecosystems are fringing and submerged coral reefs. These ecosystems offer not only subsistence seafood products for the Verata people but also a vital economic base. More than 90% of the Verata people are either subsistence farmers or fishermen or both and the village fishery is a combination of intensive subsistence and commercial fishing, involving both men and women.

'*Bula na Luveni Yali*' translated as 'even the orphan will survive' is the Fijian phrase commonly used to refer to the richness of the Verata fishing ground in the past. This simply means that a child without a parent can survive on his or her own in this area. In the mid 1980s, Verata elders realized that this was no longer the case. Local fishermen had noticed that they had to go further away from the villages to catch enough fish to eat and sell and that they were catching smaller fish and fewer types. *Kaikoso* (*Anadara sp.*), their food totem[1], and beche-de-mer were getting smaller in size and their populations were fast declining. Shrimps, crabs and mudlobsters were also becoming difficult to find where the mangroves had been cut down mainly for firewood and construction materials. The women were spending longer hours fishing and at times had to travel further away to fish, harvest shellfish and seaweed to eat and to sell. They also noticed that residents from neighboring districts and commercial fishing boats were frequently coming into their fishing grounds. Realizing these threats posed to their depleting marine resources, the chief and the residents of Verata sought help from the University of the South Pacific (USP) and the Biodiversity Conservation Network (BCN) to try and solve these problems. The primary goal of this collaboration effort was to help the communities sustainably manage their marine resources upon which their livelihood depends, both socially and economically.

[1] Totem : food restrictions

One of the three-replication sites in which the project is active is Votua in the Ba Province. It is on the western side of Viti Levu and owns fishing grounds close to 750 km^2, one of the biggest fishing grounds in Fiji. They have a very extensive mangrove forest that extends along the mouth of the third biggest river in Fiji, Ba River, and along the coastline and more than 40 submerged reefs. Concerns have been raised by the communities about the overfishing problem in the area, particularly due to the increasing number of commercial (licensed) fishermen and the extensive use of destructive fishing practices such as dynamite and undersized gillnets. Another primary issue raised has been the river pollution from industrial and sewerage wastes. Like Verata, the project's primary goal in Votua is to reverse these trends of declining fishery productivity and to assess the effectiveness of the community's actions.

Project Approach:

The approach used, community-based coastal management, is holistic and depends heavily on community's decisions and participation. It involves *ex situ* initial site assessment of marine resources by the participatory aquatic resource transect (PART) method (Parks, 1997) that includes issue identification, assessment of management options and opportunities, action planning and training of communities to monitor and evaluate management actions taken. Part of the project was to enable the community know how to make decisions on solving their marine resource management problems. The intention was to revive and strengthen traditional management practices such as refuge areas and to help the community quantify changes that they would have only perceived.

The communities identified critical resource issues which were ranked in order of their perceived importance (*Table 1*). These issues were then thoroughly discussed and management actions developed as part of their resource management plan (Aalberberg *et al*, 1997).

Table 1: Critical resource issues and management actions taken by community of Verata.

Issues	Management actions
Overharvesting or overfishing of resources	• Stop the issue of commercial fishing license and the use of gillnets. • Alternative income source arranged by USP through bioprospecting enterprise to offset short-term losses in income from actions taken. • Delineate species-specific reserves via refuge areas or *tabu*.
Mangrove and coral extraction	• Banned
Siltation	• Mangrove replantation
Trash and human waste	• Set up of village health committee to periodically organize beach and water cleanups and oversee that each household has proper toilets and rubbish dump.
Poison Fishing	• Ban the use of *Derris sp* plant and other killing agents.

Refuge areas were established as replenishment zones and specifically to rehabilitate depleted economically important marine resources and degraded habitats. The assumption is that when the resource population in the refuge area has recovered and increased, there can be a 'spillover and reseeding effect' to harvest areas provided there is enough broodstock.

2.0 Methods:

Monitoring and Evaluation

A local village team was trained to conduct monitoring and evaluation to assess the effectiveness of the management actions taken. The biological surveys were designed for the team to systematically collect information and use it for further informed management decisions. Specifically, it provided information on whether refuge areas would reverse the declining trend of food resources and replenish harvest areas. The author also conducted a parallel study and collected data to corroborate the community's results. Catch effort and household surveys were also conducted to see if management actions taken such as refuge areas would increase food resources and eventually increase their income. Hence, also improving their living standard.

Biological survey:

The possible biological indicator species to be monitored were those most sought after by the communities for both subsistence and commercial purposes. These included blood cockle (*Anadara sp.*) on seagrass and mudflats, mudlobster (*Thallasina anomala*) in mangroves, prawns in streams and rivers and beche-de-mer, grouper fish, parrotfish, giant clam and coneshell on fringing and submerged reefs. Initially, the community identified mudflats and seagrass beds, and clams as the most vulnerable yet important ecosystem and resource respectively in Ucunivanua village, the site of the first demarcated *tabu* area. Seagrass beds provide a sink for silt to minimize impacts on the reef, nutrients to living resources on the reefs and are also part of the coral reef ecosystem. In addition to the economic value of the *tabu* target species (*Anadara sp.*), it is also their food totem and a biological indicator of pollutants. Historically, clans in Fiji are closely associated to resources in their surrounding environments and also have a moral obligation to protect and conserve their totem.

For kaikoso survey, paired samplings were conducted in order to compare conditions at the refuge area and adjacent harvest area. Fifty $1m^2$ permanent quadrats were sampled on 5 x 100m line transect at each site. Each transect involved selecting a random compass bearing, laying out a 100m tape measure, and then sampling the number of clams within each quadrat at 10m intervals along the transect line. Sizes of each clam were also measured using a template that had different sized holes. The local monitoring team then recorded the numbers of clams they found in each size class in a logbook and analyzed their data using simple descriptive statistics on dry land.

In implementing designated refuge areas, the biological survey and data collection method was initially conducted every 6 months for the first year and then annually thereafter both at refuge and harvest sites. Analyzed results, particularly pictorial comparisons of abundance and size class changes since the baseline survey in 1997, were prepared by the trained local monitoring team and discussed with community members.

Socio-economic survey:

Catch rates were also collected by the community and researchers on two occasions over a 3 month period in 1998 and 1999. The harvesters recorded the total number of *kaikoso* caught and the number of hours spent collecting. The results were collated, analyzed, discussed with the local monitoring team and displayed on blackboards in the community hall for all the community to see.

The trained local monitoring team also conducted household surveys to collect household

information and income derived from the sale of *kaikoso* and other marketed marine products in 1998 and 1999. Forty out of the fifty-six households were randomly selected for this survey.

3.0 Results.

Impact of Refuge Areas:

The community monitoring data indicated that both the number and sizes of clams increased in both the *tabu* area (Figure 2) and the adjacent down current harvest areas (Figure 3). A comparison of baseline data (April, 1997) showed that there was not much difference between abundance and sizes classes at the *tabu* and the harvest area. Annual replicate surveys conducted in August 2000 revealed a cumulative 1353% increase in abundance at *tabu* site and a 523% increase in adjacent harvest areas. The results, therefore, indicate a significant repopulation process in the *tabu* area and a potential 'spillover effect' to the adjacent harvest area. Also at the start of the project, it was extremely rare to find a clam bigger than 5 cm in diameter. Today, the community routinely finds clams that are over 8 cm. In fact, the largest clam *(Anadara antiquata)* (9 cm) ever recorded in the South Pacific region (Tebano, 2000: *in process*) was found in the *tabu* area in August 2000. The author also conducted a parallel study to corroborate the community data and found that there is no significant difference between the two sets of results (Figure 4) (Tawake, 2001*: in process).* Hence, the community monitoring results are just as good as any scientific research. As an additional measure of ecosystem health, the community is finding that other animals are returning to the system for example, it has become more hazardous to conduct the surveys in the past year because of the large numbers of stingrays (a major predator on the clams) that now frequent the mudflats.

Overall Marine Biodiversity and Socio-economic Impact:

Setting up a small *tabu* area targeting one species of clam on a mudflat, while good for resource management, does not necessarily have much of an overall biodiversity conservation impact. Once the Ucunivanua community saw the effectiveness of the *tabu* area in increasing clam stocks on the mudflats, they decided they would also set up other *tabu* areas in their mangroves and coral reefs. The community in collaboration with university researchers are currently working on developing monitoring systems for these areas. The expansion to these other ecosystems, however, ensures conservation impact on the overall biodiversity of their fishing

The five sites within the Verata district that now have monitoring data (Table 2) of at least one year indicate that at least two organisms are being effectively sustained at a local level through the use of this locally managed marine area tool. The continuing increase in clams and mudlobster indicated clearly in the data below is also showing that the 'reseeding and spillover effect' of these species is appreciable.

Table 2: Biological survey results on sites within Verata district that have data for more than 1-year of monitoring.

Site/village	Status	Species	Years	% Increase
Ucunivanua	tabu	clams	4	1353
	harvest		4	523
Kumi	tabu	clams	2	643
	harvest		2	347
Sawa	tabu	Mudlobster	2	500
	harvest		2	200
Naivuruvuru	tabu	clams	2	463
	harvest		1	156
Naloto	tabu	clams	1	456
	harvest	Mudlobster	2	250

These efforts were not only replicated in other villages within the district but also in other parts of Fiji. Refuge areas have increased from 2 sites (0.63km^2) for 2 villages in 1997 to 9 sites (> 7km^2) for 7 villages within the Verata district in 2000 involving 5 target species (Table 3). Furthermore, Votua, one of the replication sites has also demarcated about 15 km^2 of their inshore area as totally protected temporary refuge areas. This consists of 7 km^2 of submerged reef, 3 km^2 of mangrove forests and 5 km^2 mudflats and lagoon area and includes all the species therein. The increase in scale within and outside Verata district reflects the communities' awareness of the benefits of the refuge area tool.

Table 3: Replication of tabu areas within Verata district from 1997 to 2000.

Year	Total number of *tabu* sites	Estimated Total area	Number of target species	Number of communities
1997	2	0.63 km^2	2	2
1998	3	0.75 km^2	2	3
1999	4	3.75 km^2	3	4
2000	9	>7.01 km^2	5	7

In addition, there is also anecdotal evidence by communities that overall biodiversity within each refuge site has also improved since the imposition of the refuge areas. Mudflat areas that used to be bare are now covered with seagrass and algae and endangered species such as the seahare that have not been seen for generations are now being seen again. Socio-economic surveys have also indicated that the *kaikoso* and other marine products caught from the Verata fishing ground have also increased during the last 3 years and that fishers need only spend 50% of their usual time for the same output or catch. Household surveys have also indicated that the resultant increase in abundance of these economically important resources has raised their income level from $F85.00 per fortnight in 1998 to $F135.00 by 2001. This increase in income is also attributed to the fact that part of the $F45, 000 revenue from bioprospecting license fees is directed towards the necessary schools and village developments within the district that would have otherwise been met by the communities extracting marine resources from their fishing ground.

communities trust local trainers more than others and are also capable of sharing results at international conferences. While carrying out the monitoring, the project faced numerous challenges that required:

- *Intensive Training* – Setting up the monitoring protocols and getting the community members familiar with them required a substantial investment of time and effort.
- *Frequent Follow-Up* – If trainers and researchers had just done the initial training and not come back, it is likely that the project would have fallen apart. Instead, the researchers had to frequently come to the village and work with the project team.
- *Assistance with Analysis* – Although the community became quite proficient at collecting data, analysis proved to be more difficult. The community members certainly understood the results of the analyses, but needed help to do the analysis better.

6. *Community Excitement and Empowerment.*

Because the monitoring work was fun, people became very interested in it. And because they were doing the monitoring themselves, the community members became very invested in the *tabu* area. Each monitoring session was greatly anticipated and people were very curious to obtain the latest results.

7. *Strong Leadership and Community Involvement.*

Strong leadership is a major contributing factor to the success of the project. The late paramount chief of Verata was full of wisdom, highly respected and cared for his people and the environment thus the community members valued and respected his decisions. Other actions taken to strengthen community involvement in the project include:

- *Participatory techniques*---One of the project's priorities is to encourage all community members to actively participate in all stages of the project from awareness raising and planning to monitoring and evaluation. Involving them in the biological monitoring has certainly created a lot of community interest and involvement in the project.
- *Regular reporting* --- The local monitoring team and researchers reports the monitoring results regularly at village and district meetings for discussion on further resource management decisions.
- *Project name*---- Initially, community members referred to the project as BCN and felt that they had very little ownership of the project and their effort/work. The new project name *'Veratavou'* meaning 'new Verata' was then decided in one of the district wide local monitoring team meetings. New Verata was translated as the revival of the phrase *'Bula na luveni yali'*, which refers to the richness of their fishing ground in the past and to make it true for their future generations. It reflects and consolidates the eight villages renewed effort to protect and conserve their fishing ground. The name gives the communities ownership of the project and a willingness to take more responsible actions as it relates to something that they hold so dearly, their future generations.

[2] SPACHEE - South Pacific Action Committee on Human Ecology and Environment

4.0 Lessons Learned.

Developing a successful refuge or *tabu* area and increasing clam populations are major accomplishments. But the real results of this project extend far beyond and provide learning opportunities for the sustenance of refuge area management in Verata and the replication effort in other parts of Fiji.

1. *Resource Sustainability.*

Refuge areas not only increase abundances and sizes of target species, but also can eventually improve overall resource biodiversity, reef ecosystems health and communities' standard of living.

2. *Degree of Protection.*

Species-specific reserves were not fully respected by the community even though there was reduced fishing intensity and increasing clam populations. Fishers in the area are called 'generalists and gatherers' (Vunisea, 1996) as they gather any harvestable species of any sizes they come across while on their usual fishing trip. Within the early stages of the local monitoring team's monitoring and policing of the refuge area, they found out that fishers found it hard to resist gathering the *tabu* target species. The community, after discussions on this issue, decided to impose total protection (no form of fishing allowed) in demarcated refuge areas and target species continue to be monitored as harvest level and ecosystem health indicator.

3. *Resource Management Options.*

Decisions on how to protect fishing grounds should be made by the resource owners and community if they are going to manage and monitor fishing grounds taking into consideration:

- *Sizes of refuge areas* should be big enough for biological processes to take place, even though these are small-scale marine reserves.
- *Area open to fishing* should be able to support the communities' day- to- day living.
- *Target ecosystems and indicator species* must have biological, economic and cultural value.

4. *Holistic and Enterprise Approach.*

Locally managed marine area (LMMA) tools such as refuge areas will only be successful if the approach is holistic and they are part of a broader resource management plan, and must include monitoring and evaluation. Unless the community totally understands the benefits and there is supplementary income, they will not fully respect refuge areas. In this era of modernization where resources are getting scarce and cash needs are increasing, fishers and community members are capable of doing anything to make ends meet even if it means breaking the *tabu.* Hence, a sustainable enterprise to generate income and continuous community awareness programs should be part of the approach if the LMMA tool used is expected to work.

5. *Community Monitoring.*

Communities can do the monitoring and use collected data for informed decision making of marine resources. Too often, monitoring duties seem to be relegated to outside scientists who collect only the data that interests them and/or collect only complex data that cannot be used by the resource managers. There is a need to train local community members as trainers since

8. Start Small and Then Scale-up.

Communities are more interested in tangible results before taking further committed actions and other conservation initiatives. Once the community saw the effectiveness of the *tabu* area in increasing clam stocks on the mudflats, they decided they would also set up other *tabu* areas in their mangroves and their coral reefs. Consequently, residents of the other seven villages in the district began implementing *tabu* areas within their fishing grounds. Today, there are similar projects being undertaken in collaboration with the Fisheries Department in four other districts in Fiji, and the trained Verata residents are in high demand to serve as trainers for these projects.

Currently, there is an evolving network between organizations, communities and the Fisheries Department in Fiji and across the Indo-Pacific region through the LMMA learning portfolio (Parks & Salafsky, 2001). This learning initiative, which is organized by the Foundation of Success, is to collectively share lessons learned about marine resource management interventions in order to avoid painful mistakes. The goal is to set up a network of locally managed marine areas in Fiji. This will help determine conditions under which the usage of the community-based fishery refugia can be an effective tool in sustaining local fisheries in Fiji and elsewhere.

If we have learned one thing from our experiences in Fiji that it is that refuge areas are a very useful tool in sustaining inshore fisheries at the village level and monitoring and evaluation of their effectiveness is essential. Not only can community members carry out good monitoring, but ultimately, involving community members in monitoring leads to conservation success in all sorts of unanticipated ways. The Ucunivanua project has been successful because instead of doing the monitoring and then reporting it to the community members, the researchers helped train the community members to harvest their own data alongside their clams.

Acknowledgements

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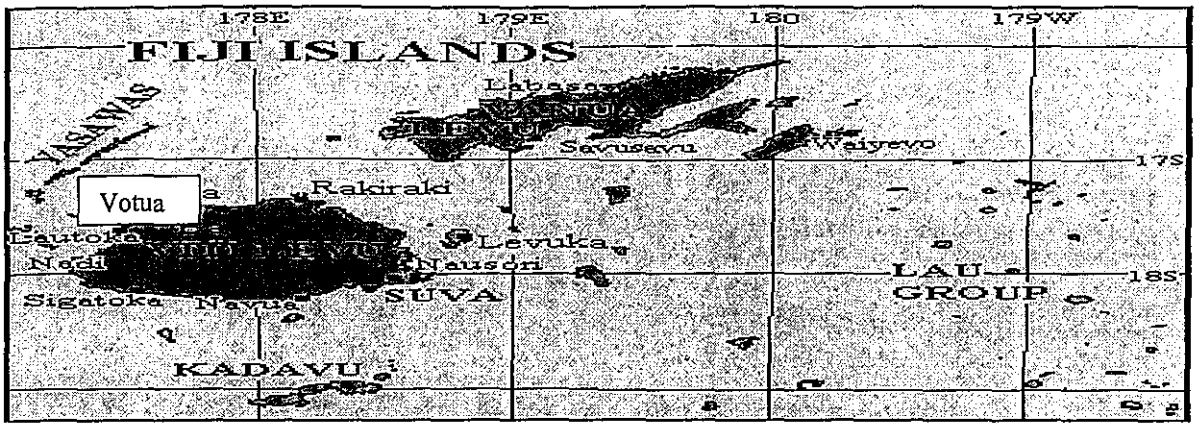
Figures

***Figure 1**. Map of Fiji (insert) and Viti Levu showing the location of Verata District (solid line), the project site and other replication sites (broken lines), Votua, Muaivuso, Navutulevu, Naboutini.*



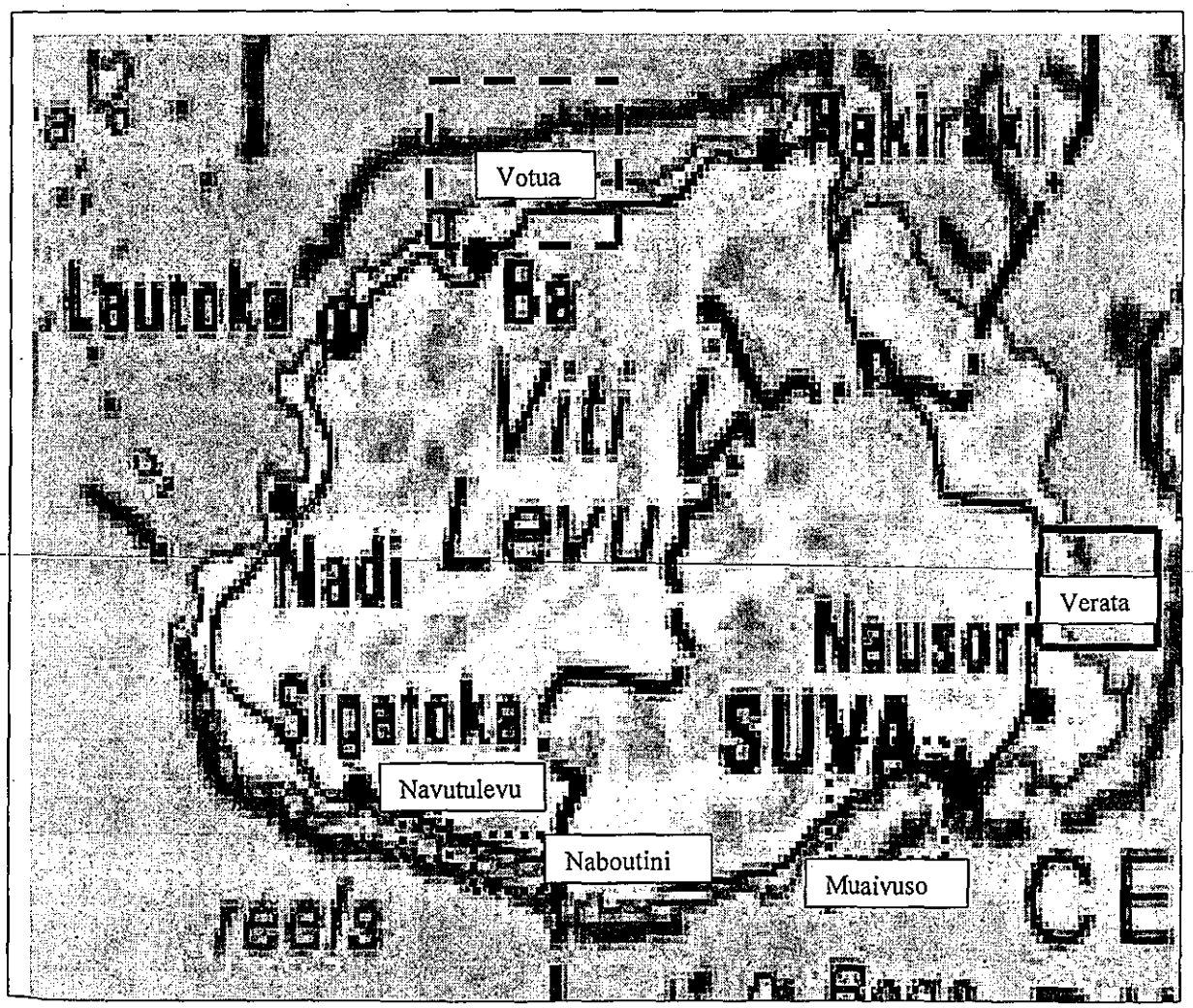


Figure 2. Number of clams measured in 50 1x1 meter quadrats in the tabu area at the start of the project and three years after protection was initiated.

Figure 3. Number of clams measured in 50 1x1 meter quadrats in the down current harvest area at start and three years after protection was initiated in the adjacent tabu area.

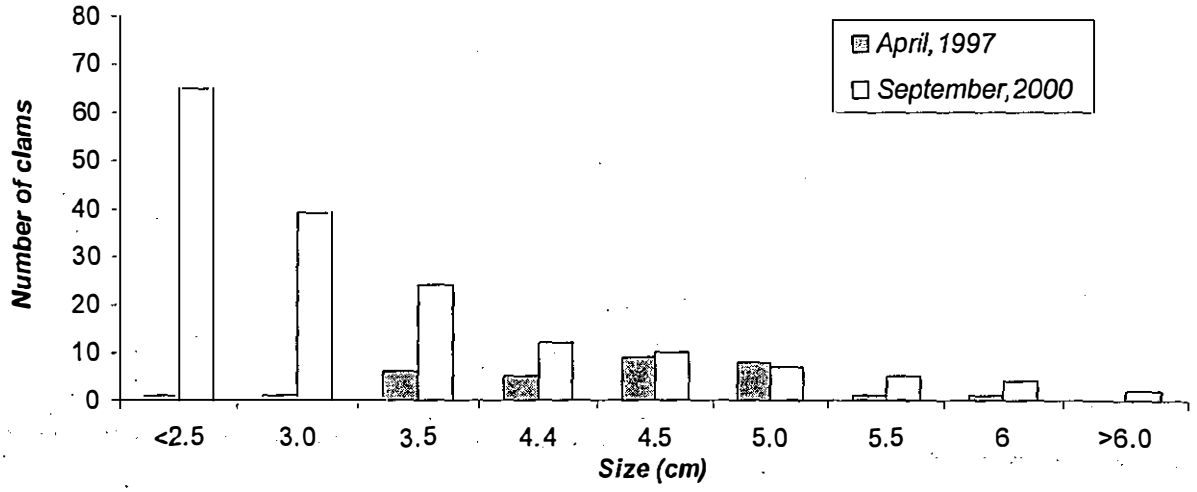
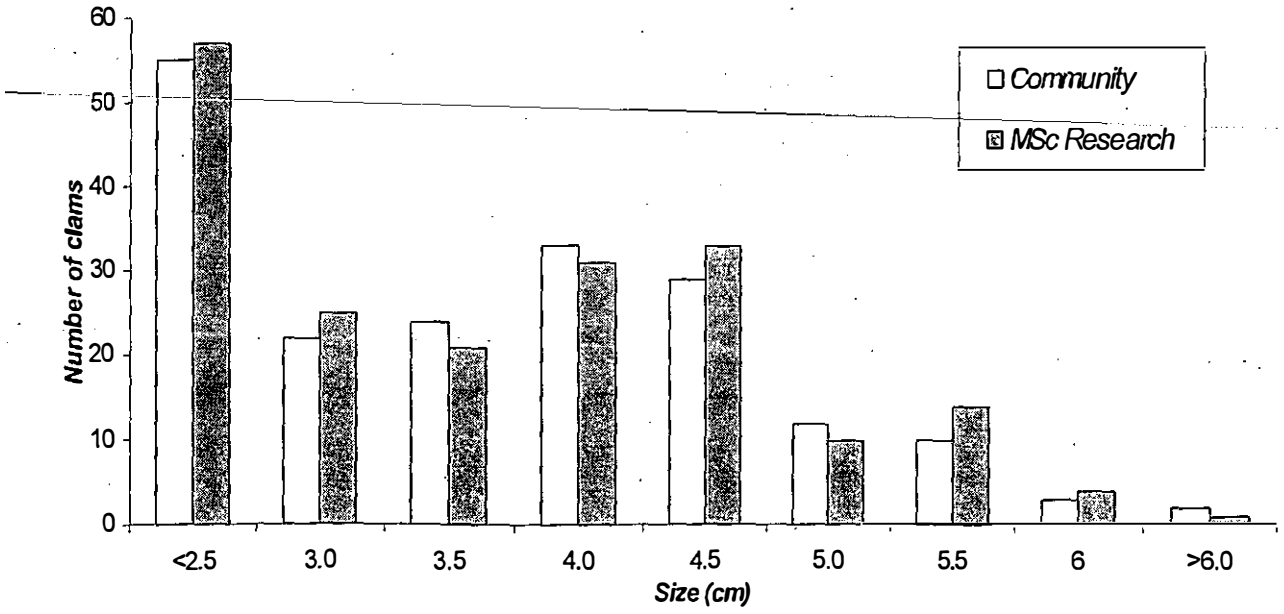


Figure 4. *A comparison of the numbers of clams in the tabu area measured by the community monitoring team and validated by the university researcher. A t-test reveals no significant difference (t-value = -0.827, df =16, p = 0.9375).*



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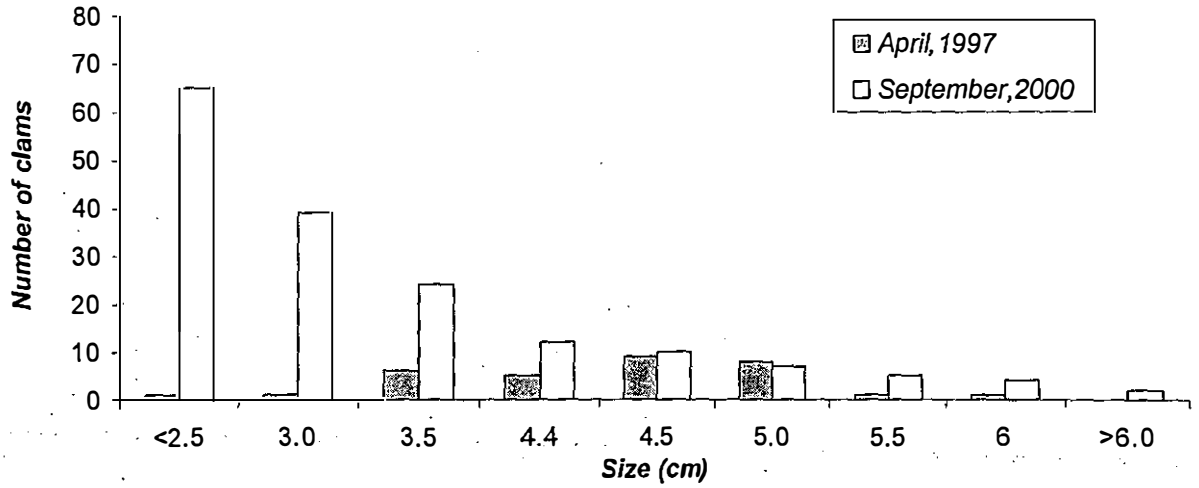

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