Project Report

Fish and Benthic Monitoring At Danjugan Island Marine Reserve and Sanctuaries, Negros Occidental, Philippines: Training Local Fisherfolk To Monitor Their Reefs Using SCUBA.

By Maria Beger

November 2002

Abstract

The Danjugan Island Marine Reserve and Sanctuaries (DIMRS) Reef Monitoring Programme (RMP) is an annual monitoring and community training programme and aimed to:

- Collect data on reef fish and benthic organisms to monitor efficacy of DIMRS management,
- Provide training and skill validation to local research assistants, encompassing revision of ID skills, fish size estimation, methods, project leadership and safety,
- Collect data by an accomplished scientist and a local trained research assistant, using SCUBA, aiming to compare results and scientifically validate the data of local researchers (who are former village fishermen),
- Hand over scientific leadership to local scientist counterparts.

This report details one year of monitoring where funding through a Rufford Small Grant was received to organise a major training and participatory survey workshop for local people.

Introduction

Marine Protected Areas (MPA's) encompassing are a well established tool to conserve biodiversity and manage fisheries and coastal resources (Allison et al. 1998, Bohnsack 1998, Dayton et al. 2000, Hastings and Botsford 2003). In the Philippines, MPA's are often established as part of community based coastal resource management (CB-CRM) initiatives, which the Philippines are in a leading position in South East Asia (Gomez et al. 1994, Uychiaoco et al. 2000).

Danjugan Island was identified as a coastal resource management site in 1994, when members of the local community approached a local non-government organisation, the Philippine Reef and Rainforest Conservation Foundation Inc. (PRRCFI), to request assistance with coastal management. Subsequently, the island was bought by the foundation and developed into a conservation site. Conservation education, a marine resource assessment programme, and community work at the adjacent villages and other activities built a foundation for the establishment of the Danjugan Island Marine Reserve and Sanctuaries (DIMRS), protecting the reefs surrounding Danjugan by municipal ordinance in 2000 (Beger et al. in review).

The DIMRS was established as part of PRRCFI's Poverty Alleviation and Conservation Education (PACE) project, a CB-CRM initiative facilitated in three Barangay's (villages) in the south of the Municipality of Cauayan, under the auspices of the provincial Southern Negros Coastal Development Programme. The project aimed to empower the communities to manage their coastal resources. Conservation education facilitated an awareness and stewardship towards the resources, capacity building provided communities with necessary skills and alternatively livelihood schemes aimed to both remove fishing pressure and to create economical incentives for resource conservation (e.g. nature tourism) (Rivera and Newkirk 1997, Alcala 1998).

The DIMRS RMP was started prior to the formal establishment of the reserve. In 2000 a monitoring team consisting of marine scientists collected a set of baseline data to describe the status of resources at this time. These monitoring surveys were repeated during the 2002 survey, focusing on the training and practise of a large group of local surveyors, supported by the Rufford Foundation. This report describes the results of the training and research during this field season, and compares data with the baseline dataset.

Background

The DIMRS RMP aimed provide information on the development of fish stocks and benthic life in the area, while also training the local fisherfolk to conduct surveys themselves, without or minimal external input. Such data provide a base for adaptive management (Murray et al. 1999, Agardy et al. 2003) and allow a continuation of community support by providing information on the efficacy of management.

DIMRS is located on Danjugan Island which is approximately 2 km long and 500 m wide. Fishing and collecting is regulated by permits inside the reserve area and prohibited in the Special Management Areas (SMA's); anchoring, destructive activities and extraction of minerals is prohibited throughout the reserve. For the MRP, there were three monitoring sites in three zones: the SMAs, inside the reserve and control sites outside the reserve at Agutayan Island (Fig. 1).

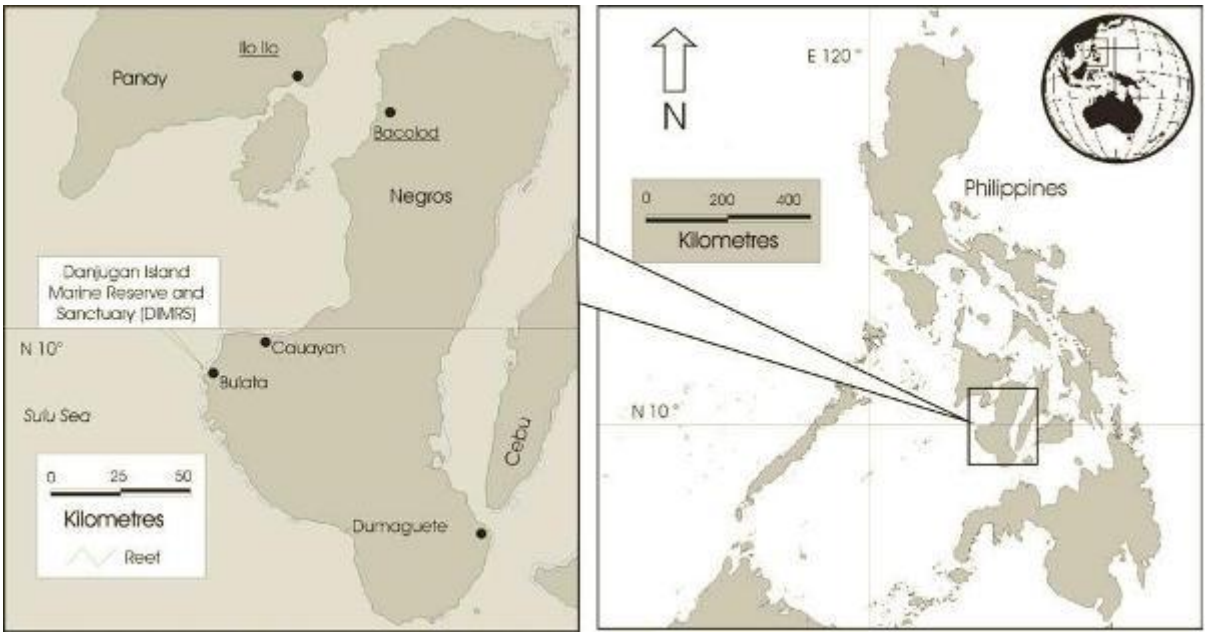


Figure 1. Danjugan Island in Negros Occidental.

The monitoring programme aimed to achieve the following goals:

- Baseline for adaptive management: reserve management can be regulated and changed according to outputs of efficacy data,
- Empowerment of local villagers: the ability of surveying their own resources will make them self-sufficient and promote coastal conservation to the community,
- Establishment of a local "action team", able to apply their skills to similar projects in the adjacent communities,
- Develop skills amongst local villagers which can be applied in the local conservation education centre developed by PRRCFI in Bulata, validation of skills of local research assistants with a scientist, will provide a basis for replicating the training – and survey programme elsewhere.

The core start up period was originally planned to be four years. I expected that the detailed scientist's data would show trends in fish and benthic community development after 3 - 4 years, based on experience from the close-by reserve on Apo Island (Russ and Alcala, 1999). The intention was to validate of the abilities of the local researchers, and to assess sufficiency of the training provided. Thereafter, the need to include an expatriate scientist would be re-assessed. The overall aim was to eventually leave the project entirely in local hands.

I became involved with this project in my previous position as Indo-Pacific Marine Scientist with Coral Cay Conservation Ltd. (CCC), a company specialising on coral reef surveys in developing countries by expatriate volunteers. PRRCFI and CCC are closely collaborating on other projects around the Philippines. I was asked by PRRCFI to develop and initiate the DIMRS MRP. Our team conducted the first baseline survey in March 2000, just one month before the buoys delineating the reserve were deployed, marking the full establishment of DIMRS.

The DIMRS MRP programme was building on existing expertise amongst the villagers that was developed during the CCC volunteer programme (Ledesma *et al.*, 1999). Several villagers were trained in SCUBA diving and identification of marine organisms. As the volunteer programme has now moved on after completing the baseline habitat assessment, facilities providing the villagers with easy access to equipment, practise and expertise are limited. To address this problem, a basic collection of equipment was included in the grant application budget. This equipment remained with PRRCFI to form a hardware base several years of monitoring and surveys.

Methods

Summary

The Danjugan Island Marine Reserve and Sanctuaries Reef Monitoring Programme (DIMRS MRP) is carried out annually in March. The two main survey components of the programme were the monitoring of commercial fish species and benthic life forms. The study aimed to compare the results of a scientist and local research assistants and hoped to achieve independent continuation of the study by the locals at a later stage. The training given to local monitors over the course of several years of monitoring would aid this process.

Five replicate transects were chosen at random within each site. This levels of replication was required to provide sufficient statistical power to detect an effect of the magnitude typical of reef fish community response to protection from fishing. The central concept was that by sampling randomly within a habitat-depth strata, an independent estimate of the community that applies to the entire area of that habitat-depth was derived.

There were the following components to the methodology:

1) Detailed fish counts recording size ranges (± 5cm) carried out by an experienced scientist along a 50 m transect, targeting all commercially important and 'indicator' fish at species level (Serranidae, Lutjanidae, Lethrinidae, Haemulidae, Carangidae, Acanthuridae, Mullidae, Siganidae, selected Labridae, Scombridae, Chaetodontidae);
2) Fish surveys carried out by local trained monitors under the supervision of a scientist, recording fish size ranges (± 5cm) and numbers of individuals of target families only. The species list was cut down to about 10 of the most important families/ genera for fisheries in the area;
3) Benthic cover was determined using the point intercept methodology (every 50 cm along a 50 transect).

There were nine sites, three each in SMAs, reserve but outside SMA and a control area. Five replicate 50 m transects along the15 m contour were chosen at random within each site.

Training

All participants underwent a training and validation programme prior to surveying. The initial training for the locals comprised of a revision of their existing knowledge. Familiarisation with the methods used and specific training in species identification, diving safety and logistics were given. Additionally, paired calibrations were run among all observers regularly until their census results were within about 10% similarity.

Benthic surveyors swam the transects side-by-side and both recorded life forms (using AIMSASEAN standards). During the training process, discussion about each point between experienced and inexperienced surveyor took place and aided the learning process.

Fish surveyors underwent a more detailed programme, starting with snorkels along a line of artificial fish and estimating their sizes. Styrofoam floating fish were suspended about 30cm off the bottom from lead weights in a manner that simulated the survey method, i.e. in a half circle of 5 m diameter and 2.5 m to either side. Fish were positioned inside and outside this target area (Figure 2). The following exercises were run:

a) Surveyors remained stationary while recording numbers of fish inside and outside the target area;
b) Surveyors remained stationary while recording fish sizes inside and outside the target area;
c) Surveyors swam into the target area and recorded sizes of all fish.

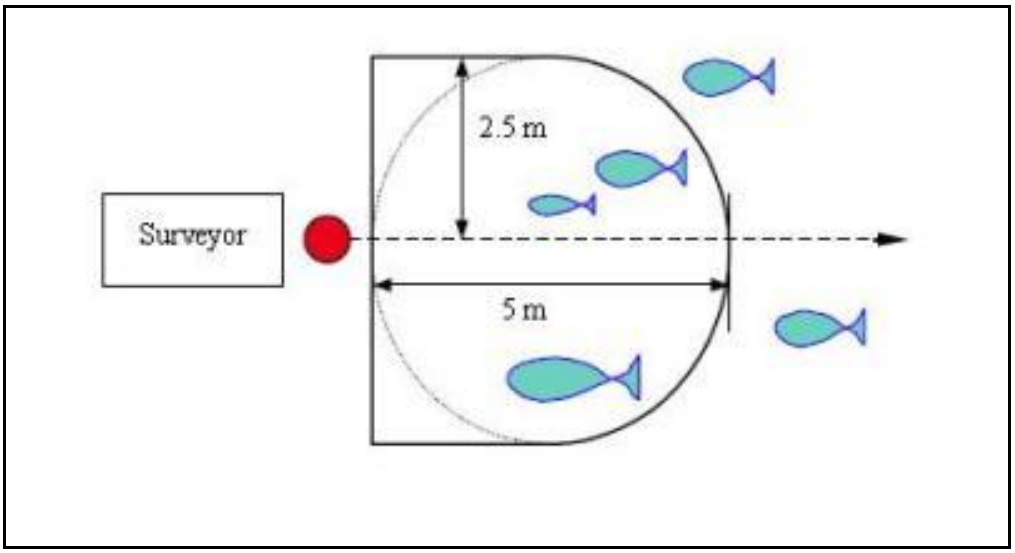


Figure 2. Set up of fish monitoring training for fish size estimation and counts.

Sites

Figure 3 provides the location of survey sites around DIMRS. Five transects in nine sites result in 45 transects for each annual sampling cycle.

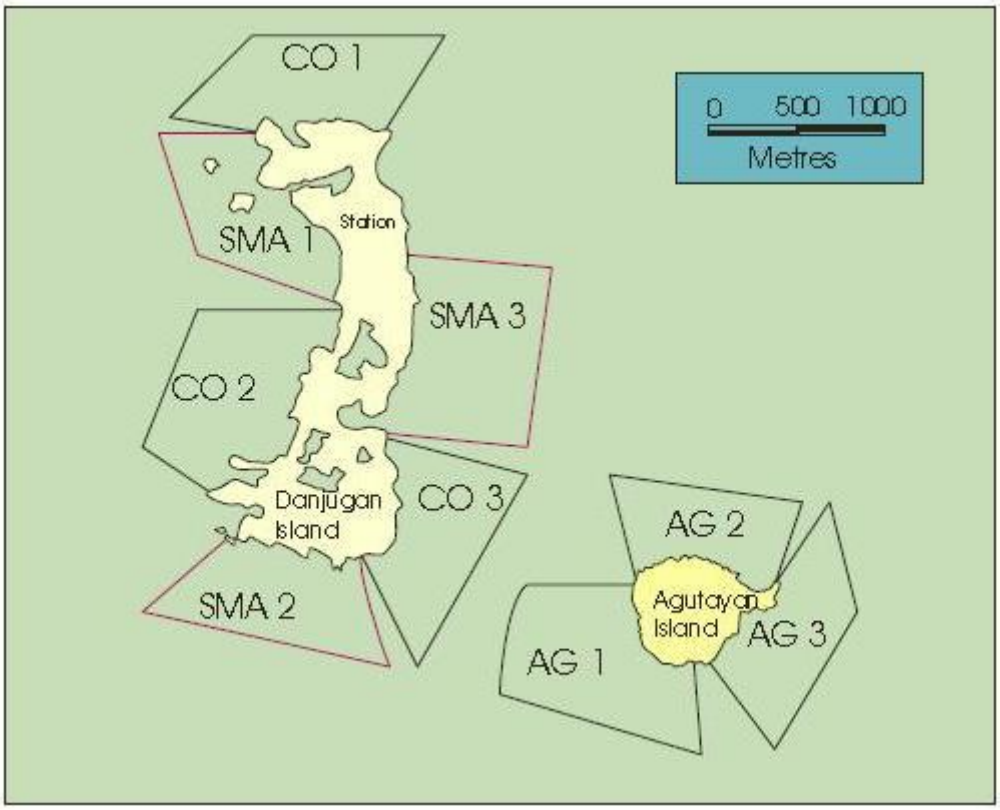


Figure 3. Sites in sanctuaries, reserve and control. SMA – special management area, CO – control inside the reserve, AG – control outside the reserve, Agutayan Island. Fishing and collecting is regulated by permits inside the reserve area and prohibited in the SMAs; anchoring, destructive activities and extraction of minerals is prohibited throughout the reserve.

Surveys

The sampling was carried out along a 50m transect. This was laid out by one of the two fish recorders (normally the trained scientist) as they swam along the depth contour. Fish recorders recorded all target fish looking forward, 2.5 m to either side, 5 m above and 5 m to the front (compare Figure 2). The observer estimated these distances as they swam along the reef. The transect laying and recording happened simultaneously. This minimised the disturbance to the fishes prior to their being counted. Benthic recorders followed the fish team, conducting the benthic point intercept survey. They also counted the number of lobster, conch and clams from any species. No attempt was made to size these invertebrates.

The size of each fish was estimated and assigned to the following size categories (<5 cm, 5-10, 10-20, 20-30, 30-40, >40cm), aided by a ruler with 5 cm increments marked on the recording slate to assist in estimating scale. Large groups of individuals of a species were classified by attempting to put them into one or more size categories as necessary. By remembering to keep effort equivalent on all segments of the transect, the tendency to count all members of a school crossing the transect, instead of just those members which happen to be within the transect could be limited. Individuals which were 'observed twice' (i.e. which cross in front of the divers once and shortly afterwards a similar fish (or the exactly same fish) is encountered again) were counted as separate individuals unless the observer saw them turning around and hence could be sure it was the same fish.

When surveying the transect it was important to give uniform attention to each part. This required swimming at a more or less constant rate, and looking consistently about 5 m ahead, except when

actually recording data. It was permissible to pause while recording data, and then to start swimming again. It was important to swim in a consistent manner while actually sampling the fish. A speed that counts each 50 m transect in 25 minutes was attempted. We had the form with the target species and size classes listed on the underwater slate to help logging the numbers efficiently and accurately. At the end of the 50 m transect, the tape/ line was rewound after the benthic team had completed their survey.

All data were recorded underwater on slates in pencil, following a set format which is printed on forms in Appendix 1. The data were then transferred to the survey forms immediately after the dive. The leading scientist gave support and guidance for the local research assistance during this time.

Results

General

The project achieved a great deal in training local people, collecting data towards the ongoing monitoring of the reserve efficacy, and in providing much needed infrastructure (equipment) to the local counterparts. The equipment provided to PRCCFI was listed in Appendix 2. Nine local people took part in the training and survey practise workshop at Danjugan Island between earlier for training 3 April and 23 April 2003 (for full details of participants, see Appendix 3).

Table 1. Summary time frame for this project

Item	Dates
Small Rufford Grant granted	22 June 2001
Project preparation	August 2001 to March 2002
Shopping for equipment	December 2001
Training of locals	21st March to 2nd April 2002
Data collection	3rd to 24th April 2002
Data encoding in country	Ongoing during surveys, 25th to 28th April 2002
Data encoding ex country	May/ June 2002
Data analysis	August – December 2003
Report writing	End of 2002, Jan & Feb 2003

Training

The training started with a revision day, since all trainees already had a basic knowledge in identification of marine organisms from previous workshops. The trainees had to identify the corals and benthic life forms marked by permanent buoyant floats along a snorkelling trail, and assign the life form that had been introduced in the morning lecture. In the afternoon, fish families and species were revised. After a lecture and slide show, the trainees conducted a dive where myself and local experienced surveyors pointed out fish. Most of the trainees were fishermen or came from a fishing family, so this exercise did not pose a problem to them. As some trainees had not been diving for a while, this dive also doubled as a check out dive, and basic diving skills were refreshed. We also refreshed the use of the Marinox unit. This is a safety device delivering 100% Oxygen to a casualty of a dive accident. Dive planning and safety considerations were discussed in the light of each trainee's function in the survey team (Figure 4).

Figure 4. Dive planning and logistics.

Further training days included lectures and practical's in dive planning, introduction to the survey methodology, and the validation of identification skills. For example, fish size estimation training was conducted on snorkel with wooden fish suspended under water and connected by a line. Each team member snorkelled along this line, noting the estimated size class of the wooden fish. After the snorkel, all results were written on a blackboard and checked for correct results, size over and underestimation. All trainees were briefed according to their requirements. For instance, one trainee only underestimated fish, so he needed to adjust his estimates upwards. Other trainees overestimated fish size, which is easy, as all objects appear larger under water. These trainees had to adjust their estimates accordingly. The procedure was repeated so that each trainee had three size estimation attempts on snorkel (Figure 6). Then the same procedure was carried out on SCUBA on STYROFOAM fish suspended off the seabed. In this exercise, trainees initially made more mistakes as they were challenged to concentrate on both SCUBA skills, writing under water and remembering estimation techniques at the same time. All trainees improved significantly as they repeated the exercise.

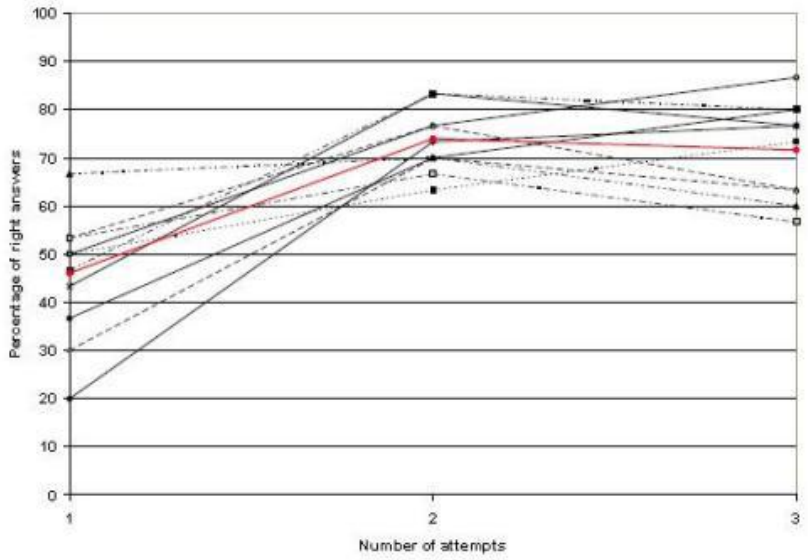


Figure 5. Improvement of ability to estimate fish length.

Surveys

Our team carried out 45 transect surveys at 15m according to the monitoring methodology. All observers recorded their data onto a slate under water, transferred the information to a data sheet and then it was entered in the evenings (Figure 5). Because of the large size of the team we were able to add transects at 9m. Data from this depth will not be compared with the baseline data set which only contained 15m transects. However, it allows a record of the depth stratification of the reefs and documents the health of shallower portions of the reef.

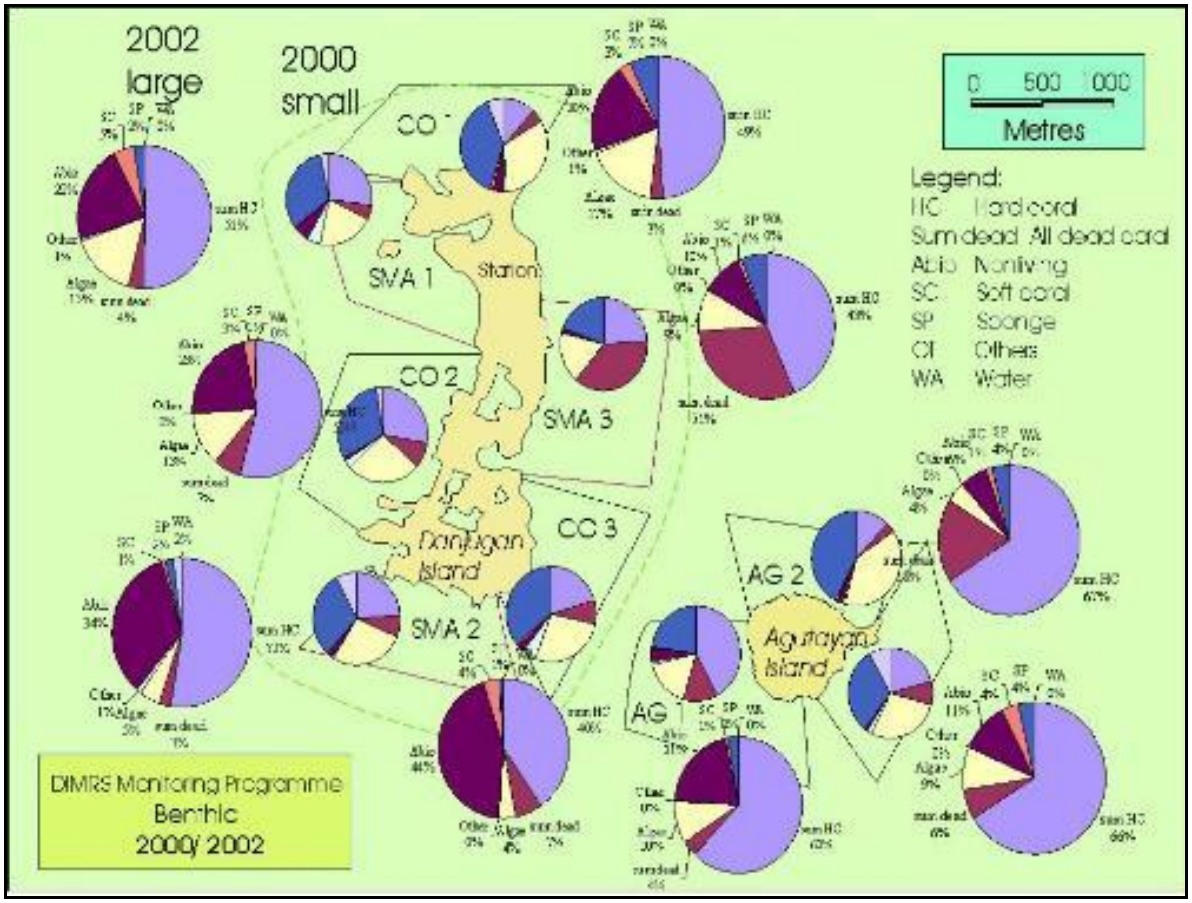
Figure 6. Two team members encoding data.

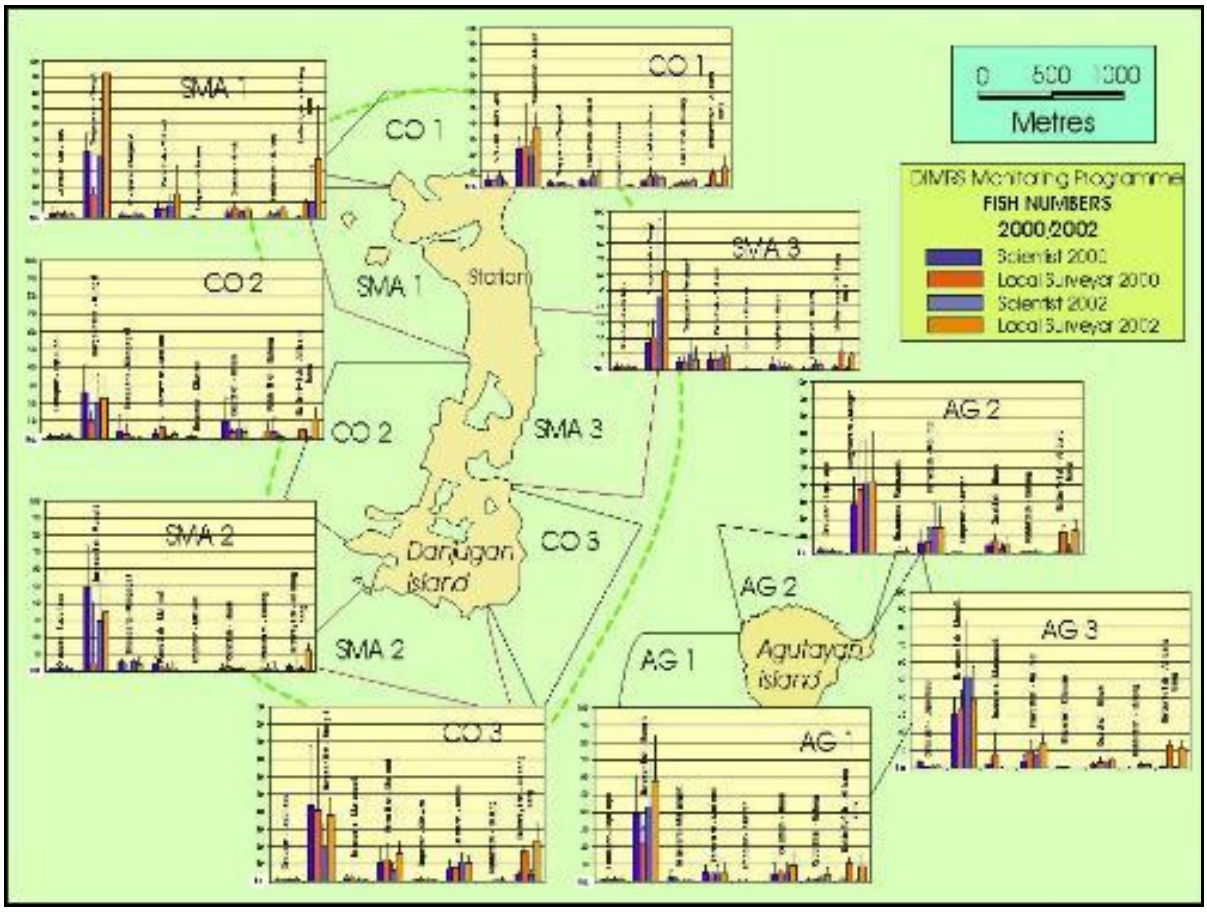
The benthic data set showed a general increase in hard coral cover throughout the area, but more pronounced in the special management areas (Figure 7). In 1998, Danjugan Island was exposed to an increase in water temperature for about one month, which caused coral bleaching in up to 90% corals down to 20m of depth. Approximately 70% of corals died as a result of the heat stress. The observed increase in coral cover is likely to show a recovery effect from this event. The SMAs were likely to have a higher recruitment of corals as higher numbers of herbivorous fishes graze algae on the substratum and thus provide a better habitat for settling corals.

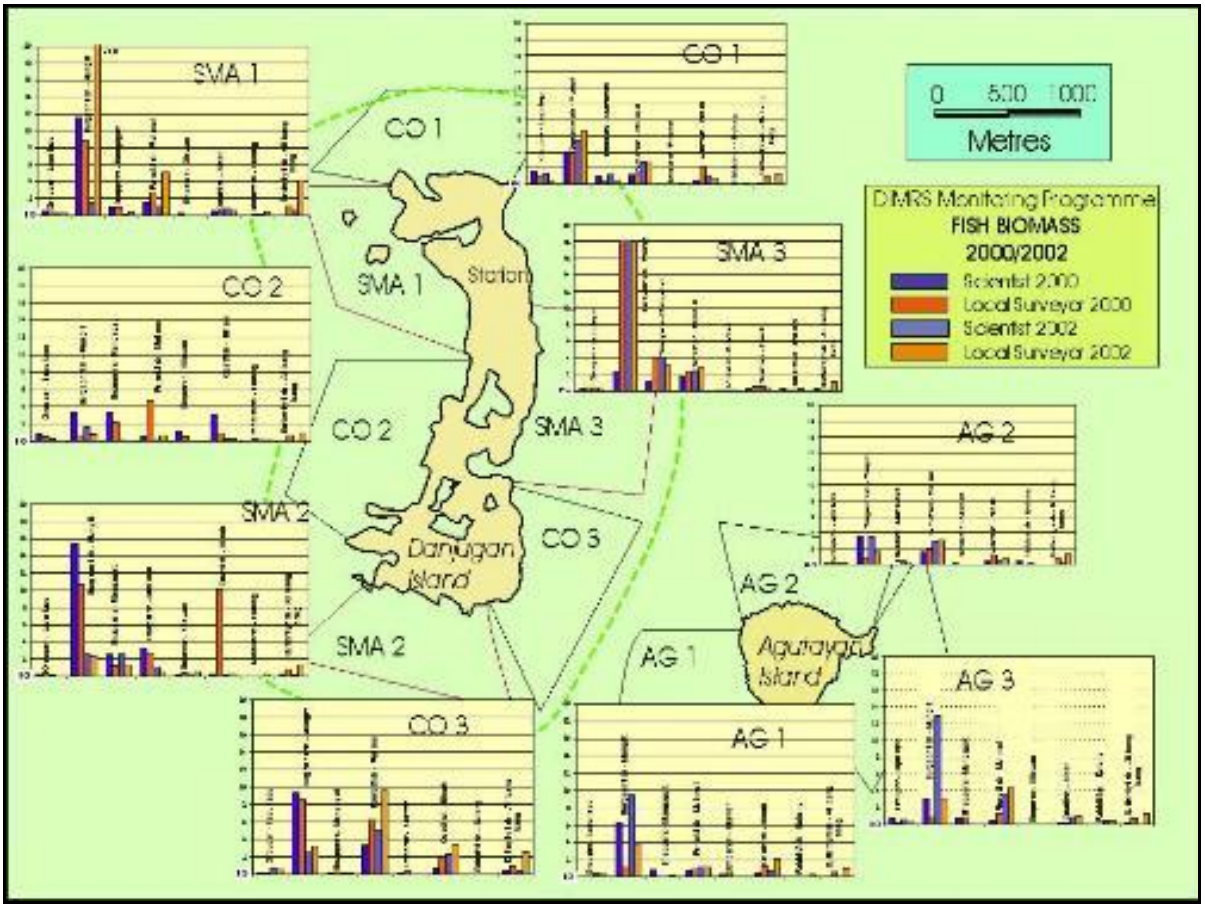
Fish numbers (Figure 8) and biomass (Figure 9) showed an increase in most families in the SMAs, and also in some of the control sites. The increase is not statistically significant for most families, however it appears that the marine reserve is efficient in providing a sanctuary for many species. Large size carnivores with large territories such as groupers (Serranidae) were only observed in very low numbers and they did not show and increase. These fish species are likely to be the most vulnerable to overfishing, to poaching and small SMAs might not cover their entire territory, allowing them to be caught when venturing outside an SMA. They are also cryptic and may not always be easily observed by visual census.

The local surveyors data compared well with the scientists data (see Figure 8 and 9). Any trends were usually consistent between both types of observers, with some exceptions. Problematic species were those that occur in large schools and are therefore difficult to count. The counts varied dramatically between the scientist and the local observers. Fishes that occur as single individuals, and carnivorous fishes targeted by fishermen, however, were recorded in very similar numbers by the scientist and the locals. This is likely explained by an inherent interest in those species, and knowledge about their habitat and behaviour residing with the local observers.

It is however not conclusive that the data derived from local researchers would show the same population trends in the same time frame as the researchers data. The magnitude of increase or decreases was quite different for most fish families, and the accuracy of positive identifications may vary as the local observer's attention is caught by a feature of interest. Local observers required a high degree of supervision. It is unlikely that local villagers will be able to carry out the monitoring programme without guidance by a trained scientist. Such guidance can be provided in the future by PRRCFI scientists who participated in the monitoring workshop and helped organise and run it. In the future they will be able to both use their own improved understanding of the methodology and a knowledgeable local surveyors workforce. Furthermore, there were participants from other parts of Negros Occidental who will be able to apply their new skills to the marine reserve they manage. The manager of Sagay Marine Reserve (Northern Negros Island, ca. 8 hrs by bus from Danjugan Island) participated and will transfer skills and concepts between both reserve management authorities.




SMA 1
CO 1
CO 1
0 500 1000
Metres
DMRS Monitoring Programme
FISH NUMBERS
2000/2002
Scientist 2000
Local Surveyor 2000
Scientist 2002
Local Surveyor 2002
CO 2
SMA 1
Station
SMA 3
CO 2
SMA 3
AG 2
SMA 2
Danjugan Island
CO 3
AG 2
AG 3
AG 1
Agutaya Island
CO 3
AG 1


SMA 1
CO 1
CO 1
0 500 1000
Metres
DMRS Monitoring Programme
FISH BIOMASS
2000/2002
Scientist 2000
Local Surveyor 2000
Scientist 2002
Local Surveyor 2002
CO 2
SMA 1
Station
SMA 3
CO 2
SMA 3
AG 2
SMA 2
Danjugan Island
CO 3
AG 2
AG 3
AG 1
Agutaya Island
CO 3
AG 1

Discussion

Monitoring programmes are recommended after establishment of a marine reserve, predominantly to assess its success in improving biodiversity, fish stocks and ecosystem function. Such monitoring studies usually aim to provide the knowledge needed for a possible adaptation of management, and in fact to assess if current management practises hold what they promised. In the case of the DIMRS MRP this is still a future goal, since the changes in the short time frame of 3 years were not yet sufficient to warrant the initiation of change. Also, practical, logistical and political considerations may make it unwise to consider a management change of a reserve that was already a lengthy and complicated thing to establish, in the light of data uncertainty.

The programme run in 2002 was a great success in training and data collection. The greatest achievement is no doubt the training of 9 locals and 2 PRCCFI staff in the monitoring process. For people from outside the adjacent villages the experience of Danjugan Islands reefs was beneficial for their understanding of how a marine reserve works. For instance Andy came from the neighbouring village Elihan whose people want to follow the example of Danjugan and establish a marine reserve. As a member of the fishermen's council Andy will be a valuable source of information for this village, both on the grounds of technical knowledge, but also being able to relay his impressions of fish stocks in an existing MPA. Other participants came from already established reserves such as Sagay Marine Reserve. One of the greatest achievements of the project was this broad approach to participants.

The programme also was suitable to validate the data collected by local trained non-scientists. The suitability of such data as a stand-alone trigger for management changes is doubtful. Analysis of data requires a person trained in such analysis, and the workshop had no scope to teach data analysis methods in a detailed manner. Team members entered data throughout the project, but with some persons using a computer for the first times in their lives it is unlikely that the advanced analytical methods used here will be useful for local data administration. Instead, basic drawing of results was shown and practised on blackboards and large paper placards. It is still unlikely that the participants will be able to replicate data analysis without further specific training and without the guidance of a scientist.

What happened after 2002 (March 2004)

Since I am revising this report now in March 2004, I thought it useful to add a few outcomes that were directly or indirectly inspired by this project. The DIMRS is still one of the strongest marine reserves in the Philippines.

- In late 2002, the DIMRS was voted the 'Best Managed Reef' in the Philippines by the Department of Environment and Natural Resources, Philippines, the Department of Agriculture and PhilReefs.
- PRRCFI received funding from UNEP in 2003 to continue their monitoring programme.
- The marine reserve in Elihan, south of Danjugan, has been put to the council for ratification.
- Using a newly established rating system of MPA's in the Philippines (White et al. 2003), the DIMRS rates as 'enforced' to 'sustained', fulfilling the criteria of site selection, biological survey, advanced education programmes, a formalised and functioning management council, a extant management plan, an approved ordinance, installed boundary buoys and surveillance, biophysical monitoring conducted with the assistance of community members and an allocated budget from the municipal government.
- In 2003, Leah May Lontes participated as a surveyor at the Natural Resource Assessment Survey project in Rongelap Atoll, Republic of the Marshall Islands. She will complete her degree in marine biology in April 2004.

Appendices

Appendix 1. Survey forms

Fish Monitoring: Danjugan Island Reserve & Sanctuaries – Local Researcher

Recorder:		Time down::	Time up:	Date:	Database Code
Air Temperature: °C	Water Temperature (depth): °C		Water Temperature (surface): °C		Weather: rain, overcast, clear sky

	Transect Code:																		
	Size class (cm	<5	5-10	10-20	20-30	30-40	>40	<5	5-10	10-20	20-30	30-40	>40	<5	5-10	10-20	20-30	30-40	>40
Goatfish	Hinok																		
Parrotfish	Mol mol																		
Bumphead, Tala-ongan																			
Surgeonfish	Mungit																		
Unicorn	Kumay																		
Grouper	Lapu lapu																		
Flagtail																			
Peacock																			
Humpback																			
“Honeycomb” spp.																			
Wrasses Large																			
Nap. wr	Mameng																		
Fusiliers	Solid,																		
Snappers	Mangagat																		
B& White	Dalaugoang																		
“Bluelined” spp.																			
Rabbitfish	Bulawis																		
Mackerels	Aloy																		
Barracuda	Bansa																		
Sweetlips	Lipti																		
Emperor	Kilawan																		
Longface emperor																			
Trevally	Puti-an,																		
	Baliling																		
Butterflyfish, Ali bang2																			
Other: (record large predator (e.g. sharks.))																			
Lobster	Banagan																		
Clam	Sali-ot																		

Benthic Monitoring: Danjugan Island Reserve & Sanctuaries **NAME:**

Site code		**Time down::**	**Time up:**	**Date:**	**Database Code**

#	Code	#	Code	#	Code	#	Code	#	Code
1		**21**		**41**		**61**		**81**	
2		**22**		**42**		**62**		**82**	
3		**23**		**43**		**63**		**83**	
4		**24**		**44**		**64**		**84**	
5		**25**		**45**		**65**		**85**	
6		**26**		**46**		**66**		**86**	
7		**27**		**47**		**67**		**87**	
8		**28**		**48**		**68**		**88**	
9		**29**		**49**		**69**		**89**	
10		**30**		**50**		**70**		**90**	
11		**31**		**51**		**71**		**91**	
12		**32**		**52**		**72**		**92**	
13		**33**		**53**		**73**		**93**	
14		**34**		**54**		**74**		**94**	
15		**35**		**55**		**75**		**95**	
16		**36**		**56**		**76**		**96**	
17		**37**		**57**		**77**		**97**	
18		**38**		**58**		**78**		**98**	
19		**39**		**59**		**79**		**99**	
20		**40**		**60**		**80**		**100**	

Appendix 2. Equipment provided

Soft corals ID guide
Remote Sensing Handbook
1001 Nudibranchs
Anemonefishes - Fautin &Allen

Dive gear

Regulator MK2 Plus / R190 ScubaPro
Regulator MK2 Plus / R190 ScubaPro
Regulator MK2 Plus / R190 ScubaPro
Regulator MK2 Plus / R190
ScubaPro

Occi R 190 ScubaPro
Occi R 190 ScubaPro
Occi R 190 ScubaPro
Occi R 190 ScubaPro

Mares Vector Jacket Dernier 1000
Mares Vector Jacket Dernier 1000
Mares Vector Jacket Dernier 1000
Mares Vector Jacket Dernier 1000

Beaver 3 gauge console
Beaver 3 gauge console
Beaver 3 gauge console
Uwatec 3 gauge console

Mask, Snorkel, Fins Sets x 10

Measuring Tapes 50m x 2

GPS

Appendix 3. Participants

Name:	**Gangex**
Real name:	Segfredo Estrelon Abong
Occupation:	Student
Date of birth:	5 September 1977
Residence:	Molocaboc, Sagay City, Negros Occ. 6122
Province:	Negros Occidental
Education:	BSc Fisheries (4th Year student)
Diver level:	Advanced Open Water
Tasks during survey:	Fish and Invertebrates Survey

Name:	**Rowena**
Real name:	Rowena A. Bais
Occupation:	Looking for job
Date of birth:	2 January 1979
Residence:	Had. Sangax, Brgy. Paraiso, Sagay City, Neg Occ. 6128
Province:	Negros Occidental
Education:	BSc Fisheries graduate
Diver level:	Advanced Open Water
Tasks during survey:	Benthic and Invertebrates Survey

Name:	**Bobbie**
Real name:	Jose Roberto Togle
Occupation:	Development Government Employee, Community Officer Sagay Marine Reserve
Date of birth:	27 April 1968
Residence:	Brgy. Old Sagay, Sagay City
Province:	Negros Occidental
Education:	BSc Commerce
Diver level:	Advanced Open Water
Tasks during survey:	Benthic and Invertebrate Surveys
Contact:	Office of the Sagay Marine Reserve, Sagay City, Negros Occ. Philippines. Tel. +63 (34) 488 0403

Name:	**Taba**
Real name:	Ronald A Tanjusay
Occupation:	Farming
Date of birth:	27 January 1975
Residence:	Inayauan, Cauayan, Negros Occidental, 6112
Province:	Negros Occidental
Education:	High School Graduate
Diver level:	Advanced Open Water
Tasks during survey:	Benthic Surveys

Name:	**Andy**
Real name:	Andy P. Orong
Occupation:	SK Chairman / Fishing

Date of birth:	15 October 1975
Residence:	Sabang Elihan, Cauayan, Negros Occidental, 6112
Province:	Negros Occidental
Education:	High School Graduate
Diver level:	Advanced Open Water
Tasks during survey:	Fish and Invertebrates

Name:	**Leah**
Real name:	Leah May G. Lontes
Occupation:	Student
Date of birth:	14 May 1983
Residence:	Bulata, Cauayan, Negros Occidental
Province:	Negros Occidental
Education:	BSc Marine Biology, 2nd Year Student
Diver level:	Open Water
Tasks during survey:	Benthic and Invertebrates Survey
Contact:	+63 (919) 3113064 (mobile), leanx14mb@yahoo.com

Name:	**Jojo**
Real name:	Romeo Matia-ong
Occupation:	Fish Dealer
Date of birth:	21 July 1977
Residence:	Bulata, Cauayan, Negros Occidental
Province:	Negros Occidental
Education:	College Sipalay – Automotive Mechanics
Diver level:	Rescue Diver
Tasks during survey:	Fish and Invertebrates Survey

Name:	**Rudy**
Real name:	Rudy Flores
Occupation:	Boat Operator
Date of birth:	20 February 1969
Residence:	Bulata, Cauayan, Negros Occidental
Province:	Negros Occidental
Education:	High School Graduate
Diver level:	Divemaster
Tasks during survey:	Fish Surveys

Name:	**Bhong Bhong**
Real name:	Celso Canete
Occupation:	Unemployed
Date of birth:	23 November 1974
Residence:	Bulata, Cauayan, Negros Occidental
Province:	Negros Occidental
Education:	High School Graduate
Diver level:	Divemaster
Tasks during survey:	Benthic Surveys

Name:	**Dodong**
Real name:	Ronald Busuamante
Occupation:	Compressor Technician
Date of birth:	N/a
Residence:	Bulata, Cauayan, Negros Occidental
Province:	Negros Occidental
Education:	High School Graduate, College
Diver level:	Rescue Diver
Tasks during survey:	Air fills

Name:	**Bing Bing**
Real name:	
Occupation:	Boat Operator
Date of birth:	N/a
Residence:	Bulata, Cauayan, Negros Occidental
Province:	Negros Occidental Education: High School Graduate
Diver level:	Advanced Open Water
Tasks during survey:	Boat driving

Item	**Date**	**Details**	**Origin**	**Price AUS$**	**Price Peso**	**Price Euro**	**Price £**	**Money Left £**
Currency converter! http://www.xe.com/ucc/full.shtml								
Soft corals ID guide	05-Jul-01	AIMS		66	0		26.4	4973.6
Remote Sensing Handbook	17-Jul-01	UNESCO				195	18.19	4955.41
1001 Nudibranchs	12 Sep-01	Neville	72				25.36	4930.04
Anemonefishes - Fautin &Allen	30-Oct-01	QLD museum	27.44				9.55	4920.49
Dive gear	15 Dec-01						1618	3302.49
Regulator MK2 Plus / R190 ScubaPro		*0100512890 Serial No*						
Regulator MK2 Plus / R190 ScubaPro		*0100512888 Serial No*						
Regulator MK2 Plus / R190 ScubaPro		*0100512891 Serial No*						
Regulator MK2 Plus / R190 ScubaPro		*?? (2000 model)*						
Occi R 190 ScubaPro		*0100324338 Serial No*						
Occi R 190 ScubaPro		*0100324358 Serial No*						
Occi R 190 ScubaPro		*0100324344 Serial No*						
Occi R 190 ScubaPro		*?? (2000 model)*						
Mares Vector Jacket Dernier 1000		*VOB 10489*						
Mares Vector Jacket Dernier 1000		*VOB 10488*						
Mares Vector Jacket Dernier 1000		*VOB 10487*						
Mares Vector Jacket Dernier 1000		*?? (2002 model)*						
Beaver 3 gauge console								
Beaver 3 gauge console								
Uwatec 3 gauge console								
ABC kits (mask, fin, snorkel, booties) x 10					20200		350	2952.49
T-Shirts x 20 100								2852.49
GPS						130	100	2752.49
Tape measures 50m x2				120			52.17	2700.32
International transfer to Philippines:								
Fuel		**Sum INT transfer**			**1287**		250	2450.32

Food		450	2000.32
Stipends and local travel		350	1650.32
Equipment (slates, styrofoam, ropes, wood)		100	1550.32
Education materials (paper, markers, display)		50	1500.32
Office (CDs, photocopying, trips to Kabankalan for email, etc)		70	1430.32
Fee for sending cash		17	1413.32
International Flight Maria Beger		800	613.32
Visa MB (extending visa beyond the standard 21 days, associated travel)		50	563.32
Domestic Flights MB (Australia: Townsville - Brisbane RT, Philippines: Manila - Bacolod RT)		310	253.32
Travel expenses (food in transit, overnight stay in Manila, taxi)		120	133.32
Travel insurance		100	33.32
Currency exchange losses	??	50	-16.67

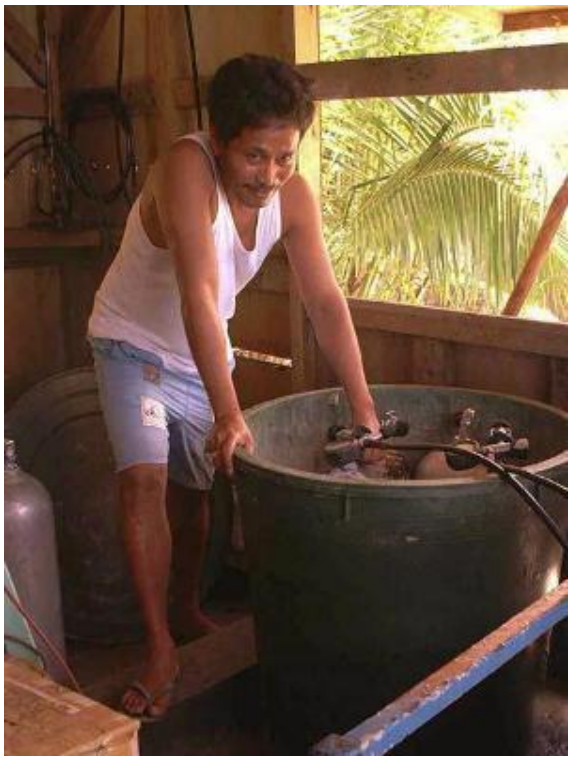
Images

Divers getting ready in the boat

Audience in presentation explaining the project to the DIMRS management council.

Presentation explaining the project to the DIMRS management council.

Divers leaving Danjugan's Shore



Dodong filling tanks

Fish used for size estimation exercise.

Divers

Trainees filling in their fish size estimates

Surveyors filling out forms after a survey dive

References

Agardy, T., P. Bridgewater, M. P. Crosby, J. Day, P. K. Dayton, R. Kenchington, D. Laffoley, P. McConney, P. A. Murray, J. E. Parks, and L. Peau. 2003. Dangerous targets? Unresolved issues and ideological clashes around marine protected areas. Aquatic Conservation-Marine and Freshwater Ecosystems **13**:353-367.

Alcala, A. C. 1998. Community-based coastal resource management in the Philippines: a case study. Ocean & Coastal Management **38**:178-186.

Allison, G. W., J. Lubchenco, and M. H. Carr. 1998. Marine reserves are necessary but not sufficient for marine conservation. Ecological Applications **8**:79-92.

Beger, M., A. R. Harborne, T. P. Dacles, J.-L. Solandt, and G. L. Ledesma. in review. A Framework of lessons learnt from community-based marine reserves and its effectiveness in guiding a new coastal management initiative in the Philippines. Environmental management.

Bohnsack, J. A. 1998. Application of marine reserves to reef fisheries management. Australian Journal of Ecology **23**:298-304.

Dayton, P. K., E. Sala, M. J. Tegner, and S. Thrush. 2000. Marine reserves: parks, baselines, and fishery enhancement. Bulletin of Marine Science **66**:617-634.

Gomez, E. D., P. M. Aliño, H. T. Yap, and W. Y. Licuanan. 1994. A review of the status of Philippine reefs. Marine Pollution Bulletin **29**:62-68.

Hastings, A., and L. W. Botsford. 2003. Comparing designs of marine reserves for fisheries and for biodiversity. Ecological Applications **13**:S65-S70.

Murray, S. N., R. F. Ambrose, J. A. Bohnsack, L. W. Botsford, M. H. Carr, G. E. Davis, P. K. Dayton, D. Gotshall, D. R. Gunderson, M. A. Hixon, J. Lubchenco, M. Mangel, A. MacCall, D. A. McArdle, J. C. Ogden, J. Roughgarden, R. M. Starr, M. J. Tegner, and M. M. Yoklavich. 1999. No-take reserve networks: Sustaining fishery populations and marine ecosystems. Fisheries **24**:11-25.

Rivera, R., and G. F. Newkirk. 1997. Power from the people: a documentation of non governmental organisations' experience in Community-Based Coastal Resource Management in the Philippines. Ocean & Coastal Management **36**:97-120.

Uychiaoco, A. J., P. M. Aliño, and A. L. Dantis. 2000. Initiatives in Philippine Coastal Management: An Overview. Coastal Management **28**:55-63.

White, A. T., A. T. Meneses, and M. F. Ovenden. 2003. Rating system for marine protected areas: an important tool to improve management. Pages 2-7 *in* DA-BFAR, editor. In turbulent seas: the status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines.