MONITORING PROTOCOL

COMMUNITY BASED MPA MANAGEMENT EFFECTIVENESS IN NORTH SULAWESI

Yudi Herdiana
Irfan Yulianto
Sonny Tasidjawa
Fakhrizal Setiawan
Handoko A. Susanto

WILDLIFE CONSERVATION SOCIETY
INDONESIA MARINE PROGRAM

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Sonny Tasidjawa
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Handoko A. Susanto

Wildlife Conservation Society – Indonesia Marine Program
Jl. Burangrang No. 18, Bogor 16151 - Indonesia
Ph: +62.251.316307, 313651
Fax: +62.251.357347
Email: admin@wcsmarine-indonesia.org
www.wcsmarine-indonesia.org

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Contents

Introduction

1.1 What is a Marine Protected Area?

The first exchange of ideas about marine protected area (MPA) management occurred in 1962 during the first world conference on national parks in Seattle (Ray, 1999). The defintiton of marine protected areas have been refined and re-interpreted since 1962. Currently the term marine protected area describes any area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment (Pomeroy *et al*., 2004).

The protection can be managed by the establishment of marine parks, national parks, sanctuaries or preserves with various degrees of protection. Therefore the term MPA relates to an area that is regulated by certain policies and rules that are placed by either government agencies or local communities directly connected to the area.

1.2 How to approach the design of a monitoring program for MPAs

In promoting MPAs it is important that there is a good understanding of the conservation science underlying marine protection in terms of the factual foundation and long-term implications. Ignoring this may lead resource managers and policymakers to make ill-informed decisions regarding MPAs, resulting in poor MPA design and performance (Agardy, 2003).

In order to avoid this problem it is crucial to approach the establishment and evaluation of an MPA with conservation science. It is important to understand the dynamic of the marine ecosystem and design and evaluate the MPA based on information gained by scientific research.

We are now faced with difficult challenges regarding the implementation of effective MPA's because of interacting social, political and ecological systems that require management for MPA's to be effective. In order to evaluate the success of an MPA in protecting its habitats and suites of species, we have to have the means to evaluate the effectiveness of its regulations.

Baseline information is important to understand the spatial and temporal heterogeneity of ecosystems. When protecting a marine area we stop (or reduce) fishing pressure, at the same time as regulating other human activities. A large literature has developed hypotheses about the expected response of individuals, populations, communities and ecosystems to the establishment of marine protected areas (Charton and Ruzafa, 1999; Sale *et al*., 2005; Gell and Roberts, 2003; Roberts and Polunin, 1991)).

Many of the mechanisms supposed to work in a marine protected area have not yet been empirically demonstrated (Sale *et al*., 2005). One of the difficulties of achieving this task is that these mechanisms are subjected to confounding causal processes not directly related to protection. In effect, the forces that drive the spatial and temporal variation in community structure (species composition and richness, relative species' abundances, trophic organization, size structure, etc.) can be both physical (habitat structure, light and nutrient availability, currents and wave exposure) and biological (recruitment, predation, competition, mutualism and disturbance) in nature (Charton and Ruzafa, 1999). Layered on top of this are

the complex socio-economic drivers and governance systems that shape the use of living resources (eg. harvesting by fishing) (Hughes *et al*. 2002).

Baseline studies are aimed on determining the relative importance of such processes in influencing community structure (Menge and Farrel, 1989). The understanding of how marine protected areas work as a management tool can only be evaluated by the design of a monitoring program that clearly aims to compare different management options (namely protection vs. non-protection) by repeated sampling at different sites over a number of years. The data collected in such programs can be used to acquire evidence of the effects of management treatments in relation to natural variability and also be used to make informed decisions about adaptive changes in management if required.

1.3 WHY IS MPA MONITORING PROGRAM DIFFERENT TO OTHER MONITORING ACTIVITIES?

All monitoring programs should have a defined objective. It is advised to define the objective of the monitoring program rather than measuring everything in the hope that some of the data will provide useful information (English *et al*., 1997).

The monitoring program for a marine protected area should be designed to address the question of effects of management treatments to the ecosystems that it protects in the area. The complexity that arises from regulating an area that is used by different stakeholders need to be addressed as a whole and not exclusively on protecting the biodiversity of the ecosystem.

The causes of resource depletion can sometimes be traced to the marginalization of important stakeholders who feel excluded and withhold support for the protected area (e.g. Mak and Moncur, 1998). In these circumstances exclusion of key agents can undermine the management of these multiple use resources (Brown *et al.*, 2001). Therefore in designing a monitoring program for a marine protected area it is important to incorporate all the elements involved in the success of the regulations emplaced (ecological and social economic variables).

1.4 POINTS TO CONSIDER BEFORE DESIGNING THE MONITORING PROGRAM

During the formulation of a monitoring program it is important to define some points in the monitoring design, such as:

- **Goals**

  The short, medium and long term goals of the monitoring program should be defined before executing the monitoring activity. The goal of an MPA monitoring program should address questions such as the management effectiveness of regulations and rules.

  Monitoring programs are generally restricted by funding and logistic constraints and decisions have to be made on the intensity and extent of the program as long as it can still answer the question of management effectiveness.

- **Conservation Target**

  The purpose of establishing a marine protected area is to protect the ecosystem under threat. Therefore it is important to set conservation targets within the monitoring design that can indicate improved ecosystem conservation. It is not unusual that in one MPA there are several habitats or species under threat that that are in competition with one another or there are communities living in the area of protection that use the resources

of the area. The question that often arises is which strategy would achieve more sustainable conservation. Is it the protection of one species and sacrificing the other? Is it the full restriction of harvest and use of certain flora or fauna by community (pure habitat conservation) or a compromise of just limited use by the community (not pure conservation)? These elements need to be address in terms of priority.

- **Location**

  The site selection to perform the monitoring program needs to be justified based on previous baseline studies. All monitoring programs are restricted in funding, logistics and human resources, which also restrict the amount of effort that could be given to a monitoring program. Baseline studies could provide useful information on variability and the heterogeneity of the area to help decide the amount of site selected required for the assessment of management effectiveness and balance it with the amount of resources available to conduct the sampling.

- **Time**

  The sampling period also need to be justified based on previous baseline studies. Factors such as seasonal variability and weather should be considered when designing any monitoring program.

- **Equipment**

  The method chosen for the monitoring program should consider the equipment available. There are a number of simple sampling methods that are as good as complex methods that need high tech and expensive equipment. It is important to consider the budget when thinking of buying extra high tech and expensive equipment.

- **Methodology**

  This is the most crucial element of the monitoring design for it will determine the quality of assessment. The goal and objective of the monitoring program should be the main consideration when choosing the right method for sampling in a monitoring program.

  After that the amount of expertise of individuals that are conducting the monitoring should also be considered.

  The methods chosen for a monitoring program should be able to answer the questions of assessing management effectiveness in an MPA.

It is crucial to fit the monitoring points above with the results obtained from the baseline studies.

1.5 CONSIDER ADVANTAGES AND DISADVANTAGES FROM DIFFERENT DATA COLLECTING METHODS

There are many different methods available to quantitatively measure changes in tropical marine ecosystems and social economic perspectives of the community to evaluate the effectiveness of MPA management.

The most widely used methods in tropical marine science is compiled in English *et al*., 1997 where it describes different methods applicable for the different habitats existing in tropical marine ecosystems.

Each method has its own advantages and disadvantages. Its all comes down to the question asked, the amount of resources available and field conditions. It is not unusual to combine methods from 2 or more different methods.

1.6 MONITORING PROTOCOL FOR NORTH SULAWESI

The Wildlife Conservation Society (WCS) - Marine Program began activities in Indonesia in August 2002. Initial work involved evaluating coral reef management strategies in the Indo-Pacific coral reef areas which includes some conservation areas in Indonesia, i.e: Kakorotan Village, Blongko Village, Bunaken Marine National Park, Seribu Marine National Park, Karimunjawa National Park, Bali Barat National Park and Pemuteran Village. Since January 2003, WCS had officially been working in its capacity as the Marine Program Indonesia by cooperating with the Karimunjawa National Park Authorithy to re-design an effective management system for coral reef ecosystems within Karimunjawa National Park (KNP).

North Sulawesi is one of the provinces in Indonesia with extremely important coastal and small islands resources. Having an extensive coastline of about 1837 kilometers, the region is famous for its diversity of coral reef and fish species, vast mangrove forest, and also high diversity of seagrass. The area of lakes, rivers, and swamps comprise about 285 km^2, and the largest lakes are Lake Tondano and Lake Moat.

To succeed the decentralized management of coastal resources in Indonesia, Proyek Pesisir, a local NGO, facilitated a few models of coastal resource managementin North Sulawesi through the development of Community-Based Marine Protected Areas (CB-MPA). There are 21 CB-MPAs spread out in three regencies: North Minahasa, Southeast Minahasa, and South Minahasa Regency. However, since the program was discontinued in 2003, there has been no information regarding the progress of the CB-MPAs management.

WCS assists the government in improving the management of coastal and marine resources in Indonesia, particularly in North Sulawesi. In Manado, WCS collaborates with local governments in improving management effectiveness of Marine Protected Areas in surrounding Manado. One of the activities is to evaluate the status of coral reef management through a survey of ecological, socio-economic, and governance aspects.

The main objective of the monitoring program is to obtain information on ecological resources (eg. corals, reef fish), socio-economic factors, and governanceconditions at community based marine protected areas (CB-MPAs) in North Sulawesi. The main targets of the monitoring are:

- to quantify coral reef and reef fish conditions inside and outside the MPAs;
- to measure the socio-economic factors of each MPA;
- to measure the level of management and governance of each MPA.

The Monitoring Protocol

2.1 Coral Reef Substrate Monitoring

Goals

- To monitor coral and other benthic substrate (eg. macroalgae, soft coral) conditions and their composition in response to different management regulations.

Conservation Objective

- Maintain coral reef cover and diversity inside protected areas.

Survey Time and Location

- Coral reef substrate monitoring conducted annually and comparing inside and outside of MPAs.

Survey tools

- 17 m long, 10 mm diameter towing rope;
- Rope harness to attach to the rear of the boat;
- Manta board with fitted harness and attached pencil;
- Aerial map of the reef to be surveyed;
- Marker buoy (to mark where you stopped if the reef survey is not done at one time);
- Waterproof watch for timing each survey. It is useful if this has a countdown function.

Methods

1. Method description

Manta tow surveys involve towing a snorkeler behind a boat at a constant speed with regular stops to record data (e.g. every 2 minutes). This is the best method to obtain a general description of large reef areas or measures of broad changes in abundance and distribution of organisms and large-scale disturbance (cyclones, COTS, bleaching). This method is good for variables seen over long distances and for site selection (Fig. 1).

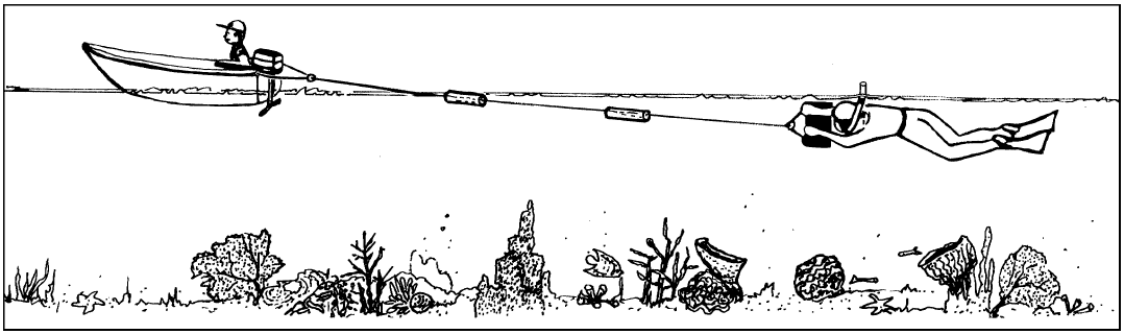


Fig. 1. Manta tow technique (Rogers *et al*., 1994)

2. Procedure

The manta tow method is conducted by the following steps:

i) The observer holds onto a diving plane made from marine plywood about 2-cm thick, with two indented handle grips near each corner at the top and a single handhold at the bottom. Attached to the board are a data sheet and a pencil (Fig. 2).

ii) The boat driver, equipped with an aerial photo or map of the reef, tows the observer across the reef (3 km per hour / 2 knots), making certain that all ecological zones of the reef are surveyed.

iii) Tow path is parallel to the reef crest over a 5-10 m depth so the maximum amount of slope is visible;

iv) The observer scans a width of 10-12 m depending upon visibility, reef gradient, distance from the bottom and the distribution and density of the organisms being counted

v) Towing should started from the edge of MPA or reefs; direction of towing determined by condition of wind, currents, or angle of the sun.

vi) Using a waterproof watch to time the intervals, the driver stops the boat every 1 minute so that the observer can record whatever data are needed for the survey. The driver records the location of each 1-minute tow, and begins the next when the observer signals readiness.

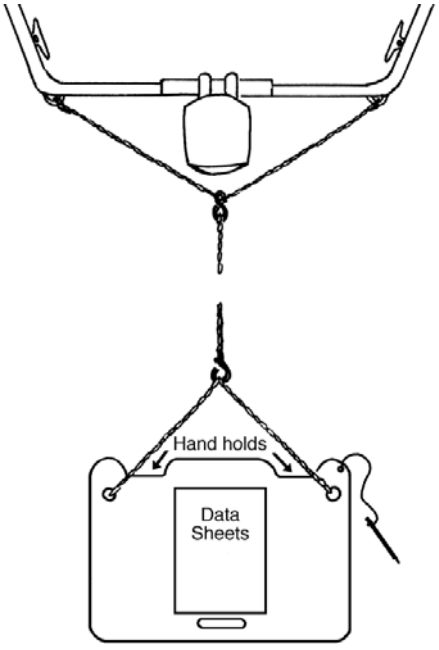


Fig. 2. Basic design of manta board (Rogers *et al*., 1994)

3 Information obtained

Data obtained during the monitoring for the MPA are:

i) Coral cover (percentage). Guidance to determined percentage of live hard coral cover or substrate cover is presented in Fig. 4.

ii) Dead coral, rubble, and sand (percentage) – See also Fig. 4

iii) Coral Bleaching (percentage) – See also Fig. 4

iv) Crown of thorn starfish - COT (number of animal)

Manta tow can also used to provide broad scale information on other benthic communities especially specific impacts, such as destructive fishing practices (percentage or area of damage); and key macro-invertebrates, such as *Diadema* or giant clams. Observers must be trained to estimate these abundance categories to ensure that estimations are consistent among observers.

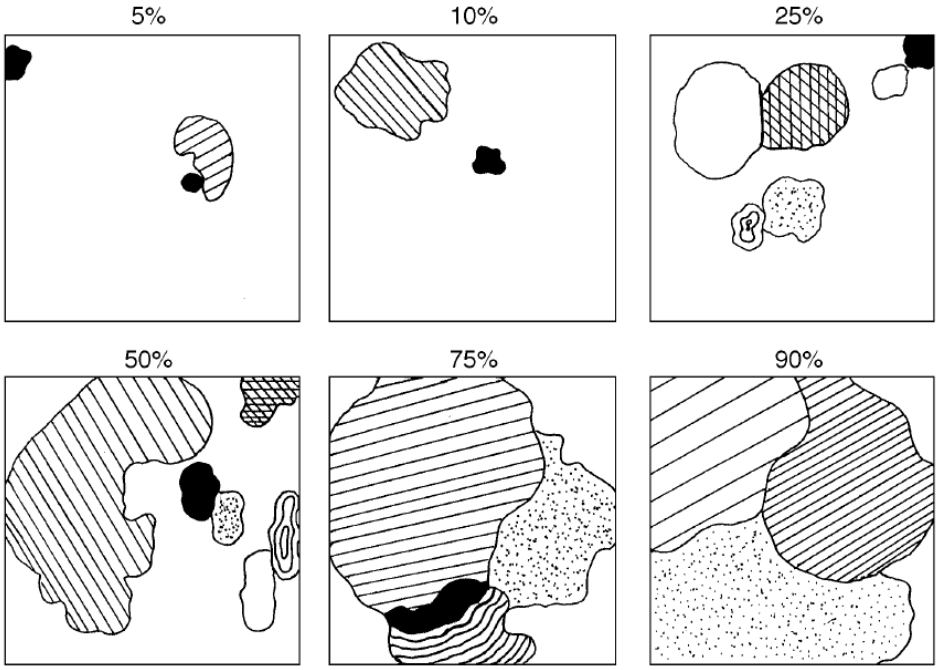


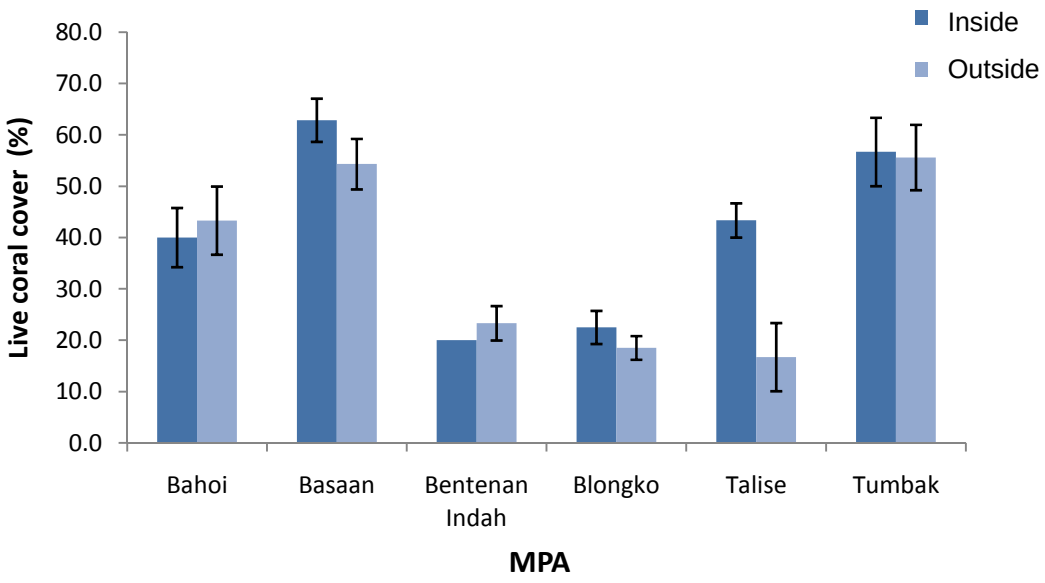
Fig. 3. Guidance for estimating percent cover (Rogers *et al*., 1994)

MANTA TOW DATA SHEET					
LOCATION:				DATE:	
OBSERVER:				START TIME:	END TIME:
TOW	SUBSTRATE COVER				OTHER FEATURES
	HC	SC	ALGAE	SAND	
1	30	10	20	50	
2	40	10	30	20	
3					
4					
5					
6					
7					

Figure 4. Sample of data sheet

Analysis

- Percentage hard coral and other substrate cover variables are derived from average of each tow replicates at of each site.
- Comparison of substrate (eg. live coral) cover variables inside and outside the CBMPAs (Figure 5).
- For coral cover and reef fish values (see section 2.2) mean values across all indicators are standardised and an average 'Ecological' score for each CB-MPA can be derived (see North Sulawesi CB-MPA Report Card 2010-11).



2.2 Reef Fish Monitoring

Goal

- To observe reef fish condition and identify changes in reef fish
- To monitor effective management of reef fish resources
- To observe the importance of seagrass habitat for reef fish nursery areas

Conservation Objective

- Increased reef fish biomass and abundance in protected areas and surrounds
- Maintain fish catch outside protected areas

Survey Time and Location

- Coral reef substrate monitoring conducted one time per year comparing inside and outside the MPAs.

Equipment

- 2 sets of snorkeling and SCUBA gears
- 2 pcs of 50 m tape measure
- Slate, UW sheet and pencils
- GPS to record survey sites

Methods

Parameters recorded during reef fish monitoring are: reef fish diversity and reef fish abundance/biomass at each site

- Fish monitoring using visual census method
- Reef fish abundance recorded at 2 x (5 m x 50 m) belt transect for fishes >10 cm, and at 2 x (2 m x 50 m) belt transects for fishes <10 cm length (Figure 6). For small fishes < 10cm, numbers of fish are recorded first along one side of the transect (1m x 50m) followed by the opposite side.
- Additional abundance and size of rare and large fishes are surveyed by swimming at 3 m and 12 m depth for about 500 m long, measured by GPS (Figure 6). The fishes recorded are rare fishes (i.e. *Bolbometopon muricatum*, *Cheilinus undulatus*, sharks, dolphins), groupers, snappers, and other large size target species (>40cm).
- Transects laid on outer edge or reef at 2 depths; on reef crest (2-3m) and reef slope (6-8 m).
- Variables recorded are reef fish species abundance and size categories based on total length (Figure 8) along each transect.
- Biomass ($kg.ha^{-1}$) of each species or family derived from abundance, size and reef area data.

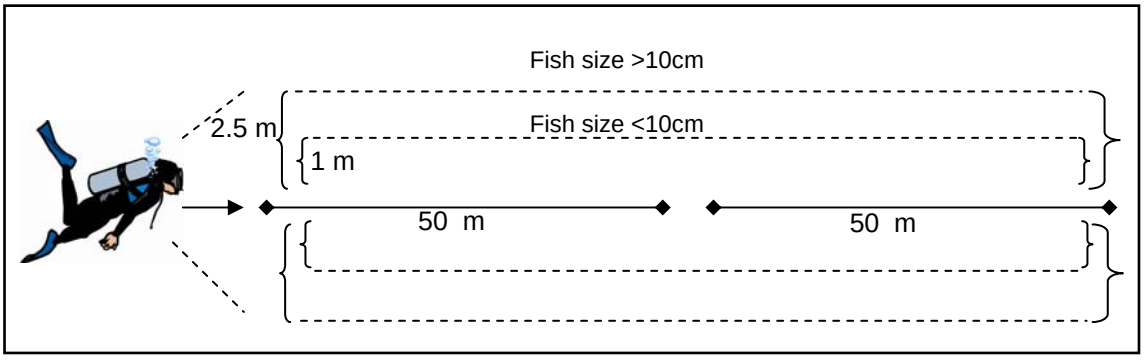


Figure 6. Transect width for reef fish biomass survey

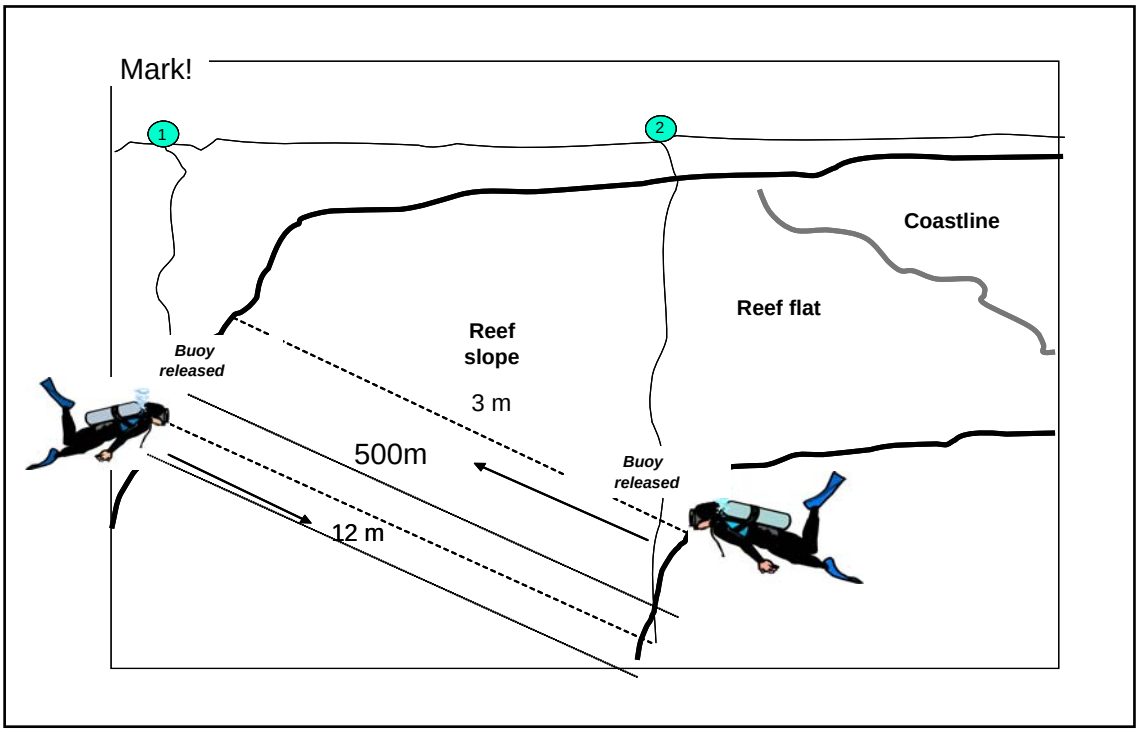


Figure 7. Specific reef fish observation and length > 40 cm

Reef Fish Survey

Date :		**Time** :			**Collector** :		
Location :		**Depth** :			**Transect** :		
Species	0 - 5 cm	5 - 10 cm	10 - 15 cm	15 - 20 cm	----------	35 - 40 cm	> 40

Figure 8. Reef fish data sheet sample

Analysis

- Reef fish abundance (no.ha^{-1}) among CB-MPAs (Fig. 9).
- Reef fish biomass (kg.ha^{-1}) among CB-MPAs (Fig. 10).
- For coral cover and reef fish values (see section 2.2) mean values across all indicators are standardised and an average 'Ecological' score for each CB-MPA can be derived (see North Sulawesi CB-MPA Report Card 2010-11).

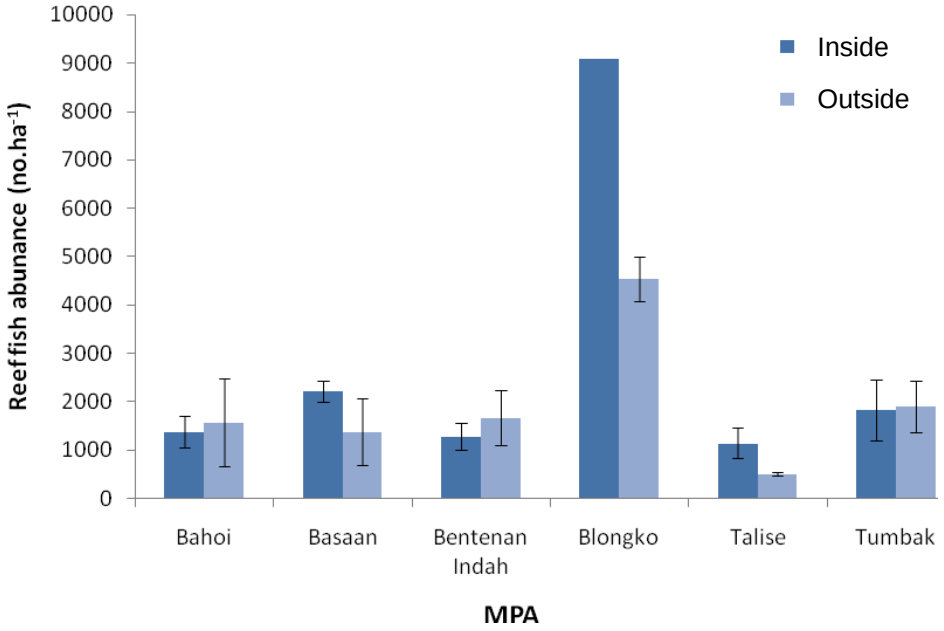


Figure 8. Reef Fish Abundance Inside and Outside CBMPA

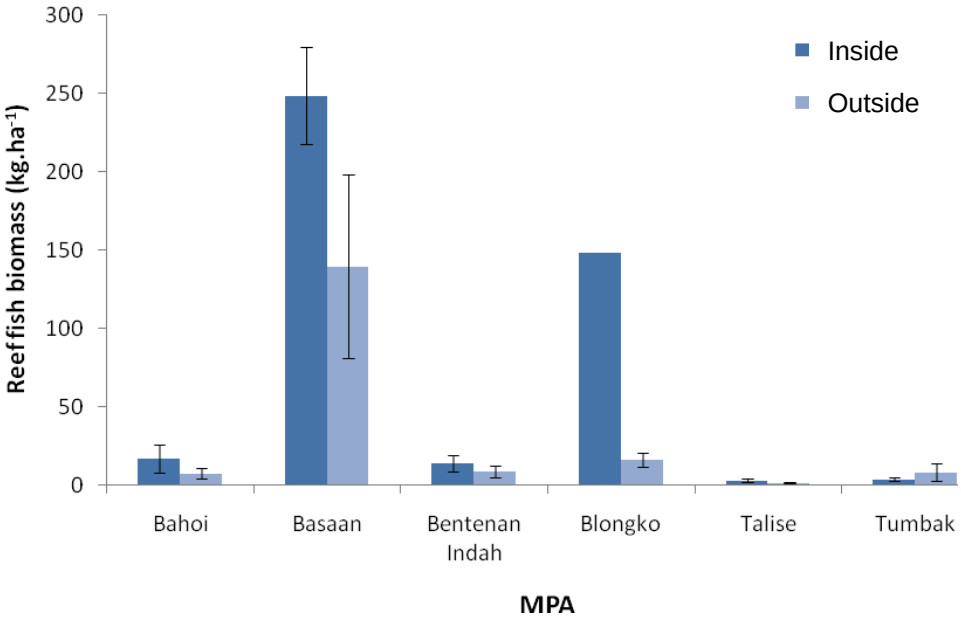


Figure 9. Reef Fish Biomass Inside and Outside CBMPA

2.3 SOCIO-ECONOMIC ASSESSMENT

Goal

To assess efficiency, sustainability and equity of socio-economic conditions of CB-MPAs

Conservation Objective

- MPA can provide economic benefit to local fishers
- Support and participation from local people on MPA management

Method

- Data collection for socio-economic conditions is conducted using non-random sampling methods. In this approach the team selects specific people as informants to gain a better understanding of the different viewpoints, attitudes, perceptions and concerns of the whole group.
- Interview survey was conducted in 6-targeted villages in North Sulawesi.
- A team of two people conducted the survey for each site.
- The first phase was to identify respondent targets such as people who are directly involved in the preparation of village management plans, management boards of MPA, the village government, community and public figures.
- Interview was conducted using a questionnaire that contained information on respondents, community involvement in local organizations, the trend of condition of coastal and marine resources, about the Coastal Resources Management Projects (Proyek Pesisir) and its programs, and the sustainability of the MPA program.
- Targeting 25 respondents for each village (150 respondents in total).
- All of indicators are presented in Table 1, and list of questions (indicators) are presented in Appendix 1.

Table 1. Socio-economic components (indicators) for the 3 parameters; Efficiency, Sustainability and Equity factors, used in the assessment of community based MPA (CB-MPA) management effectiveness.

Efficiency	Sustainability	Equity
1 Changes of fish catch in the last 12 months	1 Perception of community support to zoning rules	1 · Participation in: - Decision making - Rezoning
2 Changes of fish catch in the last five years	2 Perception of the effect of zoning to fishers	
3 Changes in species composition, obtained from fish catch data	3 Knowledge of fisheries conflicts	2 Knowledge of: - The purpose of MPA - MPA rules
4 Changes in income	4 Knowledge of: - species restriction - fishing gear estriction (cyanide) - fishing gear estriction (bomb) - fishing gear estriction (others)	3 Satisfaction with the management
5 Perception on coral condition		4 Perception of the effect of zoning to natural resources

- Each key question related to MPA management (Table 1) are scored using a Lichardt Scale of 1-4 or 1-5, where highest number represents the highest value/quality (e.g in question no 4.7, score 4 is given when a respondent answer: 'frequently involved in planning and management of MPAs').

Analysis

- The data of each parameter have different data ranges. Hence we need to standardize the data to normalize data to the same range. All data was standardized into a 0 to 1 data range using the following formula:

$$sv_{ij} = \frac{x_{ij} - min\ x_{ij}}{max\ x_{ij} - min\ x_{ij}}$$

sv_{ij} : standardized data for a given component (ie. indicator value of a respondent)
x_{ij} : value of indicator
$min\ x_{ij}$: minimum value of the parameter-i at the component-j
$max\ x_{ij}$: maximum value of the parameter-i at the component-j
i : parameter (Efficiency, Sustainability, Equity)
j : components (indicator) of each parameter

- After standardization of each indicator, the average of each parameter is calculated. For socio-economic parameters at a given CB-MPA, average values for indicators (eg. perception of coral condtion) may be conducted at the indicator level, the parameters (efficiency, sustainability, and equity), and then averaged across all 3 parameters for one value for each CB-MPA (see North Sulawesi CB-MPA Report Card 2010-11). Averages of values are calculated with the following formula:

$$sv_i = \frac{\sum_1^j sv_{ij}}{j}$$

sv_i : average value of each parameter
sv_{ij} : standarized data
i : parameter (Efficiency, Sustainability, Equity)
j : components (indicators) of each parameter

- Final value of assessment (ranges between 0-1) then presented in percentage value.

Analysis

- Efficiency, Sustainability, and Equity scores may be presented as percentage value
- Comparison of community perception on efficiency, sustainability and equity at 6 CB-MPAs (Fig. 10).

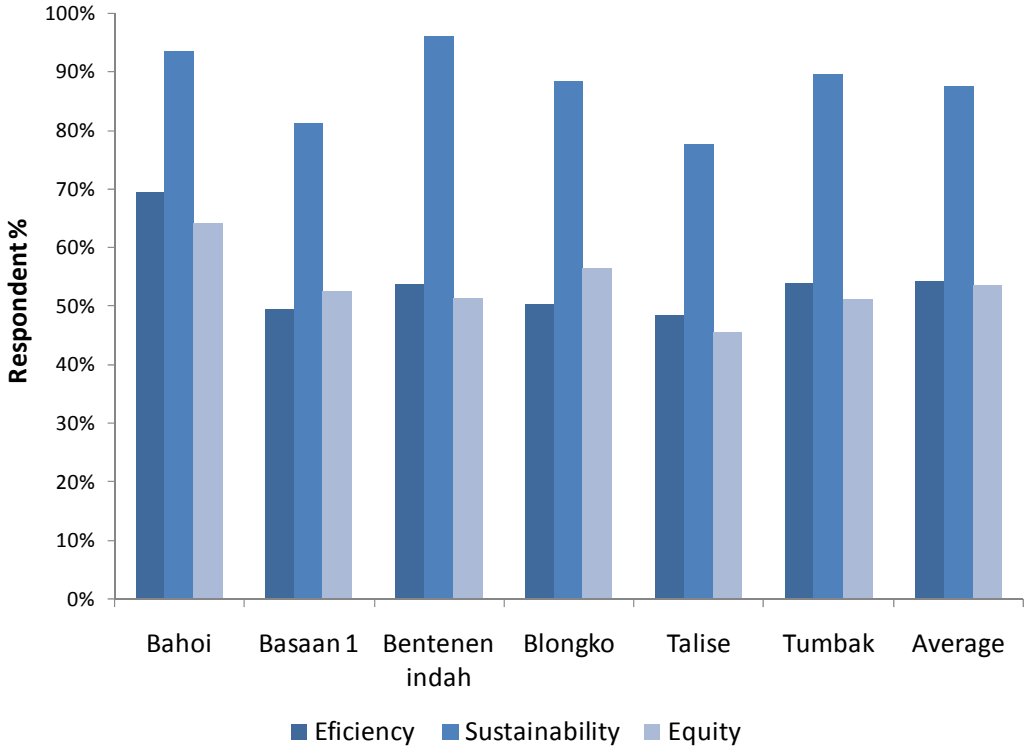


Figure 10. Community perceptions of Efficiency, Sustainability and Equity parameters at 6 CB-MPAs in North Sulawesi

2.4 GOVERNANCE ASSESSMENT

A list of governance indicators with which to obtain a 'Management Rating' for MPAs (White *et al*. 2006) was modified and tailored to local conditions (Appendix 2). This was used to assess the governance conditions of CB-MPAs in north Sulawesi.

Goal

To reveal how well the MPA is being managed. The results should be conveyed to the communities; positive results can be celebrated and negative results evaluated to identify management problems.

Conservation Objective

Improvement on MPA management in terms of: administrative processes, community support, infrastructures, and other management criteria.

Methods

Management assessment were conducted by identifying the condition of 5 levels of management (Appendix 2):

1. Marine protected area initiated
2. Marine protected area is established
3. Marine protected area is enforced
4. Marine protected area is sustained
5. Marine protected area is institutionalized

Indicators for improved management and enforcement such as administrative processes, community support, marker buoys and signs in place, and others can be measured and monitored by applying the MPA management rating system (Appendix 2). The scores were calculated by summing the 'yes' answers over the all questions of each management level, to evaluate the performance of governance in the MPAs, where each 'yes' answer given 1 point. Score of each level of management presented in percentage value, percentage of total score of each management to its maximum score (if all question get 'yes' answer)

Analysis

- Percentage of management levels at CB-MPAs presented and assessed (Fig. 11).
- For each management level average scores for each CB-MPA can be derived to develop an MPA governance indicator score (see North Sulawesi CB-MPA Report Card 2010-11).

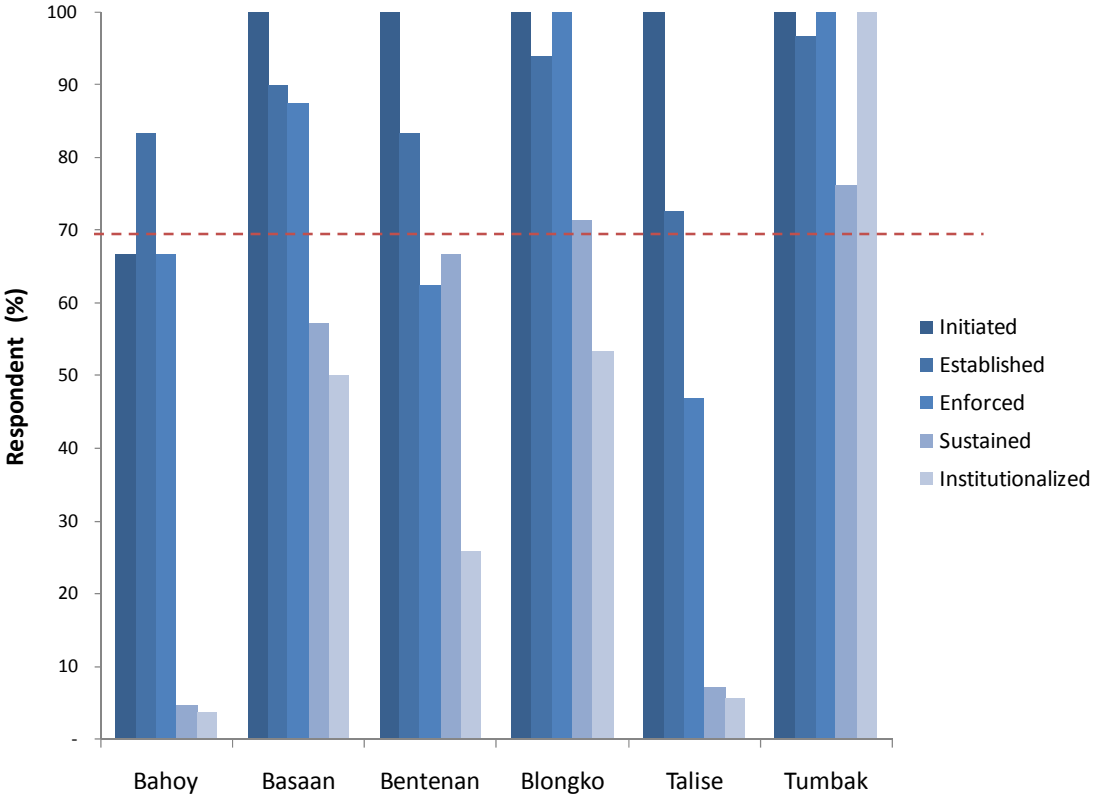


Figure 11. Comparison of management activities at each CB-MPA in North Sulawesi

2.5 SUMMARY

Summary of each indicators used in MPA management effectiveness in North Sulawesi is presented in Table 2.

Table 2. Summary of monitoring methods

	CONSERVATION OBJECTIVE	*MONITORING METHOD*	*MONITORING INDICATOR*
Substrate	Maintain coral reef cover and diversity in protection zone	Annual coral reef monitoring using manta tow method	Hard coral cover (%) Soft coral cover (%) Dead coral, rubble, and sand (%) Coral bleaching (if occurred) (%) Crown of thorn starfish (no)
Fish ecology	Increase reef fish in protected areas and surrounds	Annual reef fish monitoring using underwater visual census	Abundance (ind.ha-1) and biomass (kg.ha^{-1}) reef fish families and target species Fish trophic group ratios (eg. herbivore: carnivore biomass ratio)* Increase number/biomass of fish > 30cm* *To be assessed in future surveys
Socio-economic	• MPA can provide economic benefit to local fishers • Support and participation from local people on MPA management	Informant questionnaires/surveys	Efficiency, Sustainability, and Equity Parameters and Indicators
Governance	Improvement on MPA management in terms of: administrative processes, community support, infrastructures, and other management criteria	Management rating assessment (White *et al*. 2006)	Administrative processes, community support, marker buoys and signs in place, infrastructures, and other management criteria

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Appendix 1. Questioner of socio-economic assessment.

WILDLIFE CONSERVATION SOCIETY
INDONESIA MARINE PROGRAM

HOUSHOLD QUESTIONER
SOCIO-ECONOMIC ASSESSMENT
AT COMMUNITY BASED MPAs IN NORTH SULAWESI
MANADO 2010

Date: .....
Village: .....
Sub-district: .....
District: .....
Interviewer: .....
Respondent ID: .....

I. General information of respondent

1.1 Nama: .....
1.2 Sex: (L / P)
1.3 Age: .....
1.4 Martial Status: (Single/Married/Divorced/: .....)
1.5 Ethnic : .....
1.6 Lastest education: .....
1.7 Main occupation: .....
1.8 Other occupation: .....
1.9 Monthly income: Rp. .....
1.10 No. of family member (not including you): .....

Equity Factors

II. Involvement in Local Organization

2.1 Are you member of the following organization?

Organisasi	Membership		Position
	Yes	No	
1. Koperasi			
2. Karang Taruna (youth organization)			
3. Rukun Nelayan (Fisher group)			
4. Rukun Tani (Farmer group)			
5. Badan Pengelola DPL (MPA management board)			
6. Keamanan Laut (Sea Guard)			
7. Others:			

2.2 Have you involve in any village meeting??

[ ] Never

[ ] Rare

[ ] Fair

[ ] Often

2.3 Do you involve in decision making process of the village? [ ] Yes [ ] No

2.4 In a meeting that discuss village development, are you satisfied in the decision making process?

[ ] Satisfied
[ ] Neytral
[ ] Not satisfied, reason?
.....
..
.....

Efficiency Factors

III. Trends in the condition of costal and marine natural resources

3.1 Do you know the following coastal ecosystem?

[ ] Coral reef

[ ] Mangrove

[ ] Seagrass

[ ] Seaweed

[ ] Others: .....

3.2 Can you describe the condition of coral reef here?
[ ] Extremely damaged
[ ] Damaged
[ ] Fair
[ ] Good
[ ] Excellent

3.3 Can you describe the condition of mangrove here?
[ ] Extremely damaged
[ ] Damaged
[ ] Fair
[ ] Good
[ ] Excellent

3.4 Is there any problem related with coastal ecosystem here?
[ ] Pollution
[ ] Bomb, cyanide
[ ] Trawl and similar type of fishing gears
[ ] Erosion/sedimentation
[ ] Tourism

[ ] Overfishing
[ ] Others: .....

3.5 Who do you think have responsible in overcoming problems related with coastal ecosystem in your area?

[ ] Government [ ] Village institution
[ ] NGO [ ] Community
[ ] Others (mention): .....

3.6 Within last 5 years, how you describe the condition of fish catch?

[ ] Decrease significantly
[ ] Decreased
[ ] Normal
[ ] Increase
[ ] Increase significantly

3.7 Within last 5 years, how you decribe the species caught from fishing?

[ ] Less species of fish
[ ] Normal
[ ] More species of fish

3.8 Within last 5 years, how you describe your income?

[ ] Decrease significantly
[ ] Decreased
[ ] Normal
[ ] Increase
[ ] Increase significantly

IV. CRMP and its programs

4.1 Do you know about the Proyek Pesisir (CRMP)? [ ] Yes [ ] No

4.2 If yes, please describe what the CRMP has been done?

.....

.....

4.3 have you involved in the CRMP activities?

[ ] Never
[ ] Rare
[ ] Fair
[ ] Often

4.4 Do you know there is an MPA in your village? [ ] Yes [ ] No

4.5 Do yo know the purpose of MPA? [ ] Yes [ ] No

4.6 If YES, what are the purpose?

.....
.....

4.7 Did you involved in planning and management of MPA?

[ ] Never
[ ] Rare
[ ] Fair
[ ] Often

4.8 Do you know the regulation implemented in the MPA?

[ ] I don't know

[ ] I know a little

[ ] I know much

4.9 What do you think the current management of the MPA?

[ ] Not going well
[ ] Less going well
[ ] Going well
[ ] Still going well

Suatainability factors

V. Sustaining support for the CB-MPA

5.1 Do you think people accept and support the MPA?

[ ] No one support MPA (0%)
[ ] Few people support MPA (25%)
[ ] Some people support MPA (50%)
[ ] Almost all people support MPA (75%)
[ ] All people support MPA (100%)

5.2 What the impact of MPA for you?

[ ] Negative impact
[ ] No impact
[ ] Benefiting

5.3 Dou you aware of any conflict among fishers when fishing?

[ ] A lot

[ ] Rare

[ ] None

[ ] Don't know

5.4 Are blast or cyanide fishing still operated in MPA / here?

[ ] A lot

[ ] Rare

[ ] None

[ ] Don't know

5.5 Are fishers still fishing inside the MPA?

[ ] A lot

[ ] Rare

[ ] None

[ ] Don't know

5.6 Who do you think should continue the MPA's program and management after the CRMP finished?

[ ] Government [ ] Village institution

[ ] NGO [ ] Community

[ ] Others (mention): .....

5.7 What are the main obstacles to continue MPA management in this area?

[ ] Low education of community
[ ] Main occupation of locals
[ ] Low community interest on MPA
[ ] Government bureaucracy
[ ] Funding
[ ] Incentive for managers
[ ] Others (mention) .....

5.8 What are your suggestion to make MPA management can be well implemented:

.....
.....

THANK YOU

Appendix 2. Methodology for evaluating governance effectiveness in MPAs (White *et al*., 2006).

Level 1: MPA is initiated

No	Parameter	Actions	Yes/No
1a	MPA concept accepted	MPA was formed based on local initiatives through public consultation. Groups involved in the consultation include: fishers, social groups, other resource user groups, men and women "	
1b	Baseline surveys using standard methods are accepted for review and the determination of the MPA, use of participatory processes for MPA determination	The presence of bio-physical assessment report, the profile of coastal resources and community conditions	
1c	Locations were chosen based on studies	Locations are selected based on the results of basic studies and public consultation	
1d	Awareness program commencement / awareness to increase public knowledge about the functions and advantages of the MPA	Conducted a series (several times), educational activities / community counseling	
1e	The existence of a working group which serves as a temporary governing body	Core working group meet regularly and meetings are well-documented	
1f	The existence of the draft management plan		

Level 2: MPA is established

No	Parameter	Actions	Yes/No
2a	MPA accepted by community	Community acceptance is documented (eg letter, report attendance agreements etc.)	
2b	Rule of law has been approved by government	Rule of law must be implemented and consistent with the concept of equitable utilisation of resources	
2c	Regulatory body (Authority) formally endorsed	Management group has a legitimate mandate and recognised by the government	
2d	Management plan adopted by the community and government	The management plan is implemented and validated by the government	
2e	Commencement of management activities	Early in the MPA implementation activities such as establishment of surveillance systems, patrols and enforcement against violations are conducted	
2f	Biophysical monitoring conducted	Management staff trained to perform biophysical surveys using standardised methods	
2g	Implement activities to increase public understanding of MPA rules	MPA regulations disseminated to all communities, to increase public knowledge	

2h	Buoy / boundary marker buoy has been installed		
2i	MPA rules installed in strategic places (billboards, banners, etc.)		
2j	MPA outpost and other management structures		

Level 3: MPA is enforced

No	Parameter	Actions	Yes/No
3a	Synergistic educational programs capable of maintaining the level of community awareness and compliance	The existence of long-term educational programs implemented to support enforcement and the general objectives of MPA	
3b	Biophysical monitoring conducted regularly to measure habitat conditions and change	Monitoring conducted at least once a year using standard methods	
3c	Patrols and surveillance has been carried out collaboratively by groups that have been given a mandate by the voluntary involvement of communities	The existence of a regular schedule and rotation for maintenance and patrols, assisted by local community	
3d	Information board and pointer bounds, as well as boundary marker buoy managed	Allocation of government funding	
3e	Active management authority	Implement management plans; coordinate law enforcement activities' members regularly attend meetings, coordinate and participate in regular monitoring activities.	
3f	Funds from government or other sources allocated for MPA management	The existence of legal documents from the government or an agreement with the private sector to allocate funds to the MPA	
3g	Fishing effectively stop in core zone	The absence of reported violations in the core zone in the previous year	
3h	Illegal and destructive fishing have declined in the surrounding area of MPA	Reported violations occurred within a radius of 500 meters from the boundary MPA decreased by 50% in the previous year	

Level 4: MPA is sustained

No	Parameter	Actions	Yes/No
4a	MPA management plan updated through a participatory process	Revised management plan through participation of various stakeholders	
4b	Biophysical monitoring will be conducted annually (for 2 years or more) are supervised by the governing body and the results used as input for MPA management	The production of documented survey results using standard methods	
4c	Funds from government and other sources are allocated for the next 2 years	The existence of legal documents created by the local government or any funding agreement with the group to allocate funds for the MPA operations; the financial	

		statements	
4d	Park authority staff have been trained and have the capacity to independently manage the MPA	Governing body overseeing management activities (implementation, enforcement, funding, monitoring and evaluation, and coordinate activities with other partners)	
4e	Full current law enforcement system	A system of law enforcement and patrol activities take place a few years	
4f	Illegal and destructive fishing does not exist within and around the MPA	No violations were reported within a radius of 500 meters from the previous year MPA boundary	
4g	Environmentally friendly business activities, establishing sustainable funding strategies for tourism based visitation	The absence of reported violations in previous years	

Level 5: MPA is institutionalised

No	Parameter	Actions	Yes/No
5a	Educational programs and dissemination of information ongoing	Informal dissemination activities continue	
5b	MPA has strong political support from district governments	MPA provides institutional support to strengthen enforcement activities and collaboration	
5c	Revised management plan for adaptive management	The existence of legal documents created by the local government or any funding agreements to allocate funds for MPA operations; the financial statements of the MPA	
5d	Integrated management plans with development plans at district and provincial levels		
5e	Conducted an evaluation of ecological impacts and socio-economic	Review and analysis of the status of resources, socio-economy, changes in the local economy, trends in resource user groups. The report from this study have been published and disseminated to stakeholders	
5f	Revenues from business activities and user fees to continue	Sustainable management of the funding mechanism well established; transparency of financial statements	
5g	MPA works to educate the general public as to the comparative success of the MPA	The presence of lesson learned, documentation of stakeholder groups doing comparative studies, publications on MPA success stories	
5h	Initiated strategic development or improvement programs	Developing the scope and status of the MPA. MPA quality improvement activities such as habitat restoration and pollution abatement programs	