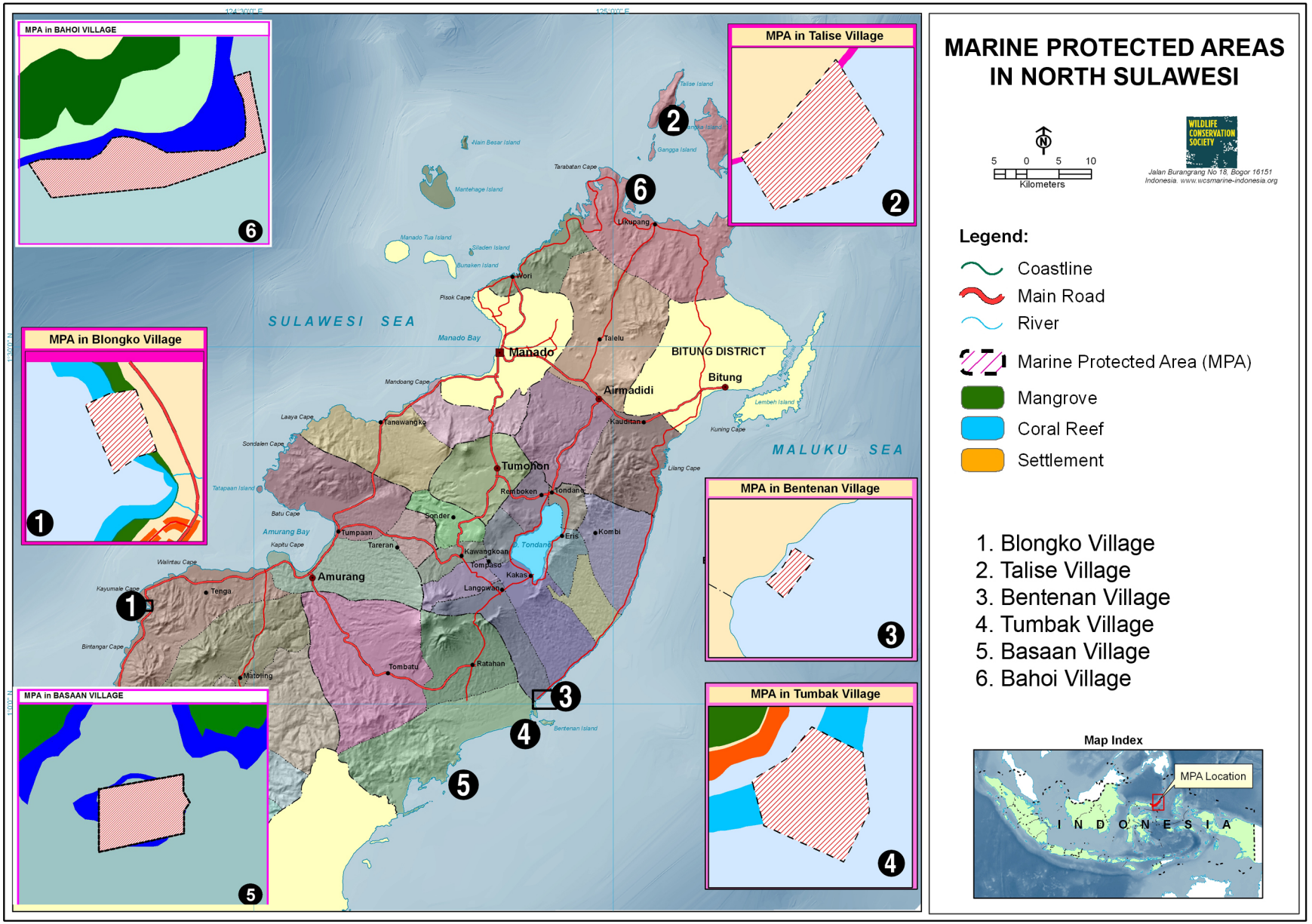
MANAGEMENT EFFECTIVENESS ASSESMENT OF MARINE PROTECTED AREAS IN NORTH SULAWESI

REPORT CARD 2010-2011

This report card summaries or findings on management effectiveness of six community based MPAs in North Sulawesi, highlighting gaps and recommendation

WILDLIFE CONSERVATION SOCIETY

INDONESIA MARINE PROGRAM


MARINE PROTECTED AREAS IN NORTH SULAWESI
Kilometers
5 0 5 10
WILDLIFE CONSERVATION SOCIETY
Jalan Burangrang No 18, Bogor 16151
Indonesia. www.wcsmarine-indonesia.org
Legend:
Coastline
Main Road
River
Marine Protected Area (MPA)
Mangrove
Coral Reef
Settlement
1. Blongko Village
2. Talise Village
3. Bentenan Village
4. Tumbak Village
5. Basaan Village
6. Bahoi Village
Map Index
MPA Location
I N D O N E S I A
MPA in BAHOI VILLAGE
MPA in Talise Village
MPA in Blongko Village
MPA in Bentenan Village
MPA in Tumbak Village
MPA in BASAAN VILLAGE
SULAWESI SEA
MALUKU SEA
BITUNG DISTRICT
Manado
Bitung
Airmadidi
Tumoiton
Amurang
Likupang
Wori
Talelu
Kauditan
Tanawangko
Remboken
Tondano
Sonder
Tumpaan
Tareran
Kawangkoan
Tompaso
Kakas
Langowan
Eris
Kombi
Tenga
Matoling
Tombatu
Ratahan
Talise Island
Gangga Island
Main Besar Island
Mantehage Island
Manado Tua Island
Siladen Island
Bunaken Island
Tarabatan Cape
Pisok Cape
Manado Bay
Mandoang Cape
Laaya Cape
Sondalen Cape
Tatapaan Island
Batu Cape
Amurang Bay
Kaptu Cape
Walintau Cape
Kayumale Cape
Bintangar Cape
Lembeh Island
Kuning Cape
Liang Cape
Bentenan Island
1
2
3
4
5
6

INDICATORS OF EFFECTIVENESS

The effectiveness of six community based Marine Protected Areas (CB-MPA) in North Sulawesi was assessed based on three main parameters: ecological (coral reef and reef fish resources), socio-economic, and governance condition. From ecological aspects we measure how well the MPAs providing protection to maintain or improve coral reef and reef fish resources, by comparing the condition between inside and outside of the MPAs. A Socio-economic aspect measures the efficiency, sustainability and equity of the MPAs. The governance condition identify the status and management of the MPAs.

ECOLOGY

The assessment of ecological condition for management effectiveness asessment was based on live coral cover, reef fish biomass and abundance condition. We compare the condition between inside and outside of the MPA to measure the impact of MPA in providing protection to maintain or improve its ecological condition.

No	Indicator	Unit of Measure	Score
1	Hard coral cover	Hard coral cover 2010 (%)	1, if the indicator in inside CBMPA is lower than outside 2, if the indicator in inside CBMPA is the same with outside 3, if the indicator in inside CBMPA is higher than outside
2	Fish abundance	Reef fish abundance 2010(ind/ha)	
3	Fish biomass	Reef fish biomass 2010(kg/ha)	

SOCIO-ECONOMIC

The assessment of socio-economic condition was conducted by using quantitative and qualitative data, and grouped into three main components: efficiency, sustainability, and equity.

Efficiency	Sustainability	Equity
• Changes of fish catch in the last 1 years • Changes of fish catch in the last five years • Changes in species composition from fish catch data • Changes in income • Perception of coral condition	• Perception of community support to zoning rules • Perception of the effect of zoning to fishermen • Knowledge of fisheries conflicts • Knowledge of: - Species restriction - Fishing gear restriction (bomb) - Fishing gear restriction (Cyanide) - Fishing gear restriction (other)	• Participation in: - Decision making - Rezoning • Knowledge of: - The purpose of national park - National park rules • Satisfaction with the management • Perception of the effect of zoning to natural resources

GOVERNANCE

Assessment on the governance condition aimed to identify the status and management of the MPAs. Governance assessment was conducted using the methods by White *et al*. (2006), and modified to accommodate local situation. Governance was assessed using 5 levels of management, as follows:

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 instituzionalized

HOW WE MEASURE THE EFFECTIVENESS ?

STANDARIZING THE DATA

Data of each parameters have different data range. Hence we need to standardize the data to make all data have the same range. All data was standardized into 0 to 1 data range. The formula used for standardizing the data is:

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

svij : standardized data
xij : data assessment
Min Xij : minimum value of the parameter-i at the component-j
Max Xij : maximum value of the parameter-i at the component-j
i : parameter (Socio-Economic, Ecology and Governance)
j : components on each parameter

AVERAGE OF STANDARIZED DATA

After data on each component within the parameters have been standardized, we calculated the average of each parameter. For socio-economic parameters, averaging conducted in tow steps, average for each component (efficiency, sustainability, and equity), before we combine the three parameters in one average value. Average was calculated with the following formula:

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

svi : average value of each parameter
svij : standarized data
i : parameter (socio-economic, ecology and governance)
j : components on each parameter

EFFECTIVENESS

Effectiveness values was calculated by averaging the values of each parameter, with the following formula:

$$E = \frac{\sum_1^i sv_i}{i}$$

svi : average value of each parameter
i : parameter (socio-economic, ecology and governance)
E : effectiveness

SCORE CARD

The last step is grading score card based on the value of the effectiveness. Effectiveness values are converted to a range of data ranging from 1 to 4. Conversion of data was calculated by the following formula:

$$SC = (E \times 3) + 1$$

SC : Score card value
E : Effectiveness

the final score then determined using A to D score as follows:

Score card value	Score
1	D
2	C
3	B
4	A

SUMMARY OF MANAGEMENT EFFECTIVENESS

The overall scores for each effectiveness parameter, overall effectiveness scores and grading for each of the 6 CB-MPAs are shown in Table A. Additional data on the indicators used to derive scores for socioeconomic, ecological and governance effectiveness parameters are included below.

Socio-economic Effectiveness

- Socioeconomic effectiveness of 6 community-based marine protected areas (CBMPA) ranged from 57% in Talise to 95% in Tumbak with an average of 65% across all CB-MPAs (Table A).
- Efficiency scores of CB-MPAs ranged from 48% in Talise to 68% in Bahoi with an overall average across the 6 CB-MPas of 54% (Figure 1).
- Sustainability scores of CB-MPAs ranged from 78% in Talise to to 98% in Benenten with an overall average across the 6 CB-MPas of 88% (Figure 1).
- Equity scores ranged from 46% in Talise to 64% in Bahoi with an overall average across the 6 CB-MPas of 53% (Figure 1).

Table A. Management effectiveness scores of 6 CB-MPA in North Sulawesi. Note that scores are based on standardizing data to scores from 0 to 1, and therefore scores represent overall % effectiveness of each parameter (ie. 0.52 = 52%) (see Herdiana et al. 2011 for more details).

Village	Socio-economic	Ecology	Governance	Mgt Effectiveness	Score
Bahoi	0.76	0.33	0.45	0.52	**B-**
Basaan	0.61	0.83	0.77	0.74	**B+**
Bentenan	0.67	0.33	0.68	0.56	**B-**
Blongko	0.65	1.00	0.84	0.83	**B+**
Talise	0.57	1.00	0.46	0.68	**B+**
Tumbak	0.95	0.17	0.65	0.59	**B-**
Average	0.70	0.61	0.64	0.65	**B-**

SUMMARY OF MANAGEMENT EFFECTIVENESS

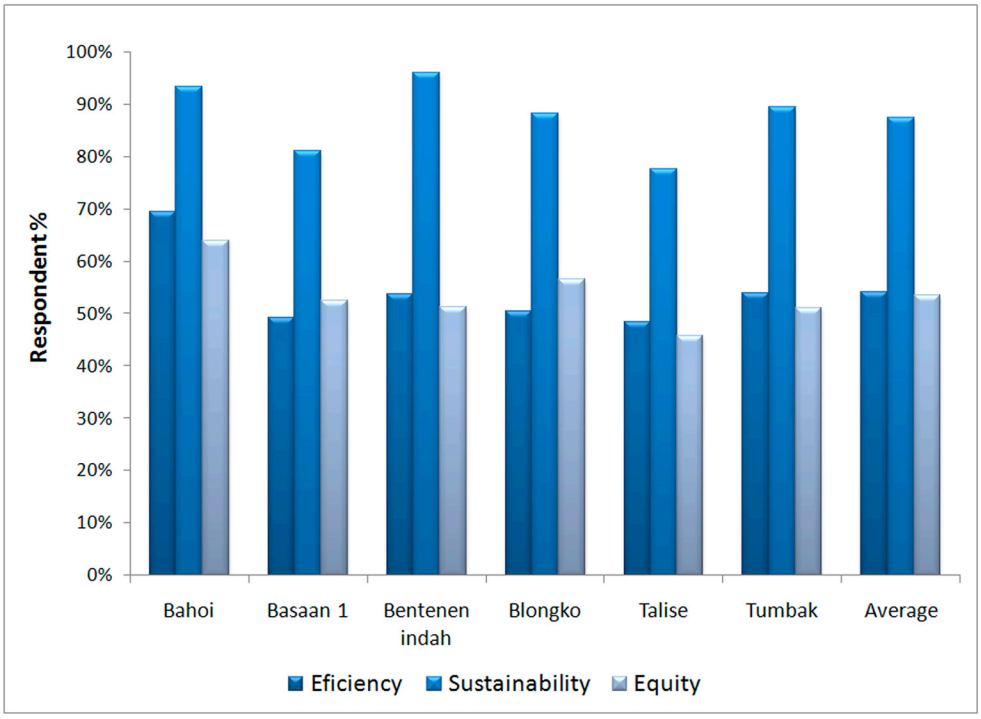


Figure 1. Community Perception on Efficiency, Sustainability and Equity.

Ecological effectiveness

Ecological effectiveness ranged from17% in Tumbak to 100% in Blongko and Talise, with an average of 61% across all CB-MPAs (Table A). Annex 1 provides graphs of all ecological indicators for each CB-MPA.

Governance effectiveness

The overall governance scores for each governance level, at each community based marine protected area (CB-MPA), are based on community respondents perceptions of the governance effectiveness of their CB-MPA (Figure 2). These are further discussed each CB-MPA Report Cards. For information on governance levels see Herdiana *et al*. (2011) (Management Effectiveness Protocol). Additional summary information of each CB-MPA are presented in Section 2 of this report.

- Governance effectiveness of the 6 CB-MPAs ranged from 45% in Bahoi to 84% in Blongko with an overall average of 64% across all CB-MPAs (Table 1).
- Overall management effectiveness of the CB-MPAs ranged from 52% in Bahoi to 83% in Blongko with an overall average of 65% across all CB-MPAs (Table 1).

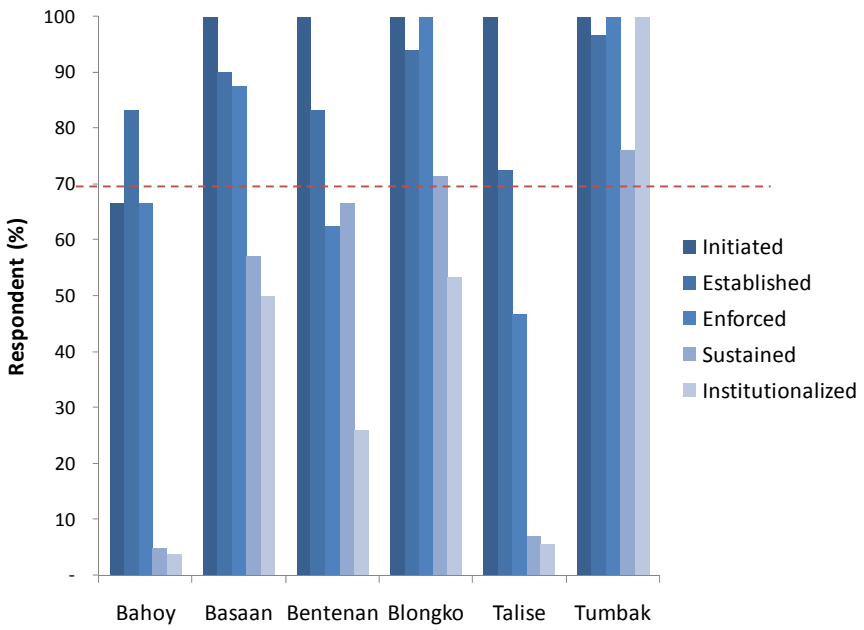
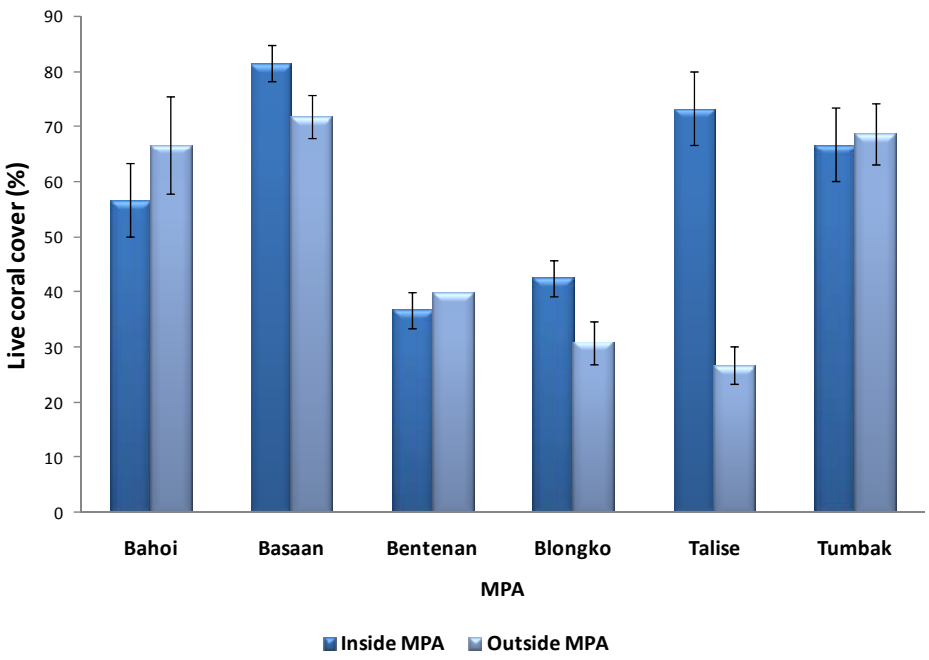


Figure 2. Comparison of management activities at each CBMPA

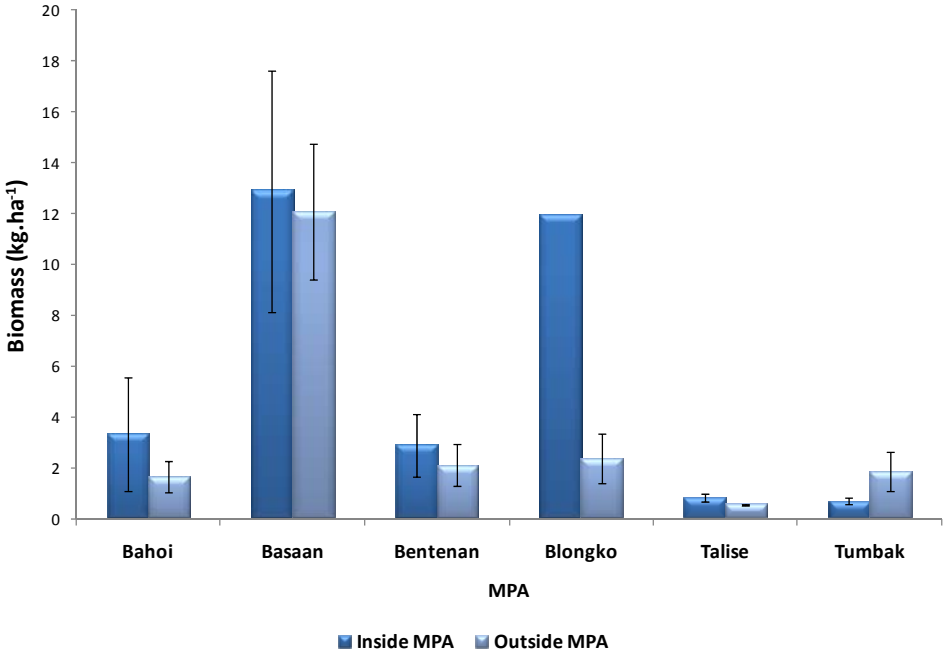
ANNEX 1

Live coral cover inside and outside MPAs

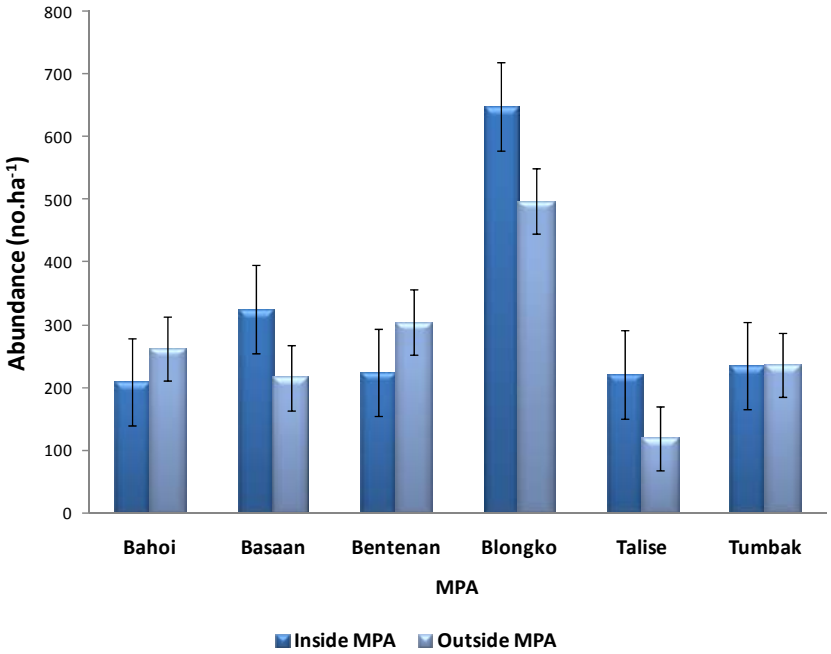


SUMMARY OF MANAGEMENT EFFECTIVENESS

Reef fish biomass inside and outside MPAs



Reef fish abundance inside and outside MPAs



MANAGEMENT EFFECTIVENESS ASSESMENT OF MARINE PROTECTED AREAS IN NORTH SULAWESI REPORT CARD 2010-2011

BAHOI

Bahoi village is located in the northern part of Likupang District in Minahasa regency, 34 km from the capital of North Sulawesi, Manado. The village is situated on the northern coastal area of North Sulawesi, with an area of 250 hectares (West Likupang in figures, 2008). This village is inhabited by 480 people with the Christian majority of ethnic Sangir and Minahasa.

Key Facts	
Date of MPA establishment:	April 20, 2003
Date of Management Plan establishment:	April 20, 2003
Description of location:	Part of Minahasa District, 80 km North of Manado
GPS location:	10 43,334'N-1250 1,402'E
Area of MPA (hectares):	5.4
Number of population (when established):	445
Major component of management plan:	1. Management of the marine sanctuary 2. Protection and rehabilitation of coral reef, mangroves, seagrasses 3. Increasing community incomes 4. Raising awareness of community concerning environmental protection 5. Improving community livelihood/production 6. Reducing erosion/sedimentation from land and farm areas
Enforcement:	Yes

Management action of coastal resources is a relatively new issue for the village and has been initiated by communities and governments through the Proyek Pengelolaan Sumberdaya Wilayah Pesisir Terpadu or Integrated Coastal Resources Management Project (PSWT). Planning and management of existing resources in the village is in line with Law no. 22 of 1999 on Local Government at that time. Bahoi village was chosen as one of 23 CB-MPAs in Western and Eastern Likupang by the PSWT Provincial Task Team at that time to get a management model that can be adapted in the village. A major issue in Bahoi is coral damage and ecotourism development. The management board was established in 1999, 200x, and implementation of the management plan began in April 2003.

ECOLOGICAL

Inside : 40.0
Outside : 43.3

LIVE CORAL COVER

Inside : 1380
Outside : 1573.3

FISH ABUNDANCE

Inside : 16.91
Outside : 7.49

FISH BIOMASS

0.33

SOCIO-ECONOMIC

0.76

GOVERNANCE

0.45

EFFECTIVENESS

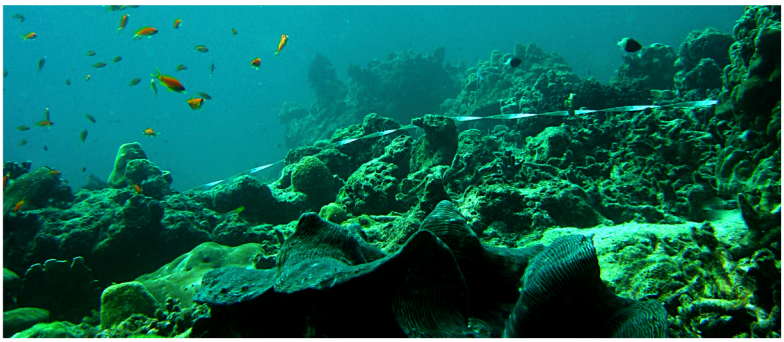
0.51

B-

Based on ecological, socioeconomic and governance conditions, Bahoi has relatively low effectiveness. The comparatively low ecological scores inside the MPA are possibly due to poor site selection during the establishment of the MPA. Community perceptions on socioeconomic parameters (efficiency, sustainability and equity) are relatively good, showing good community support for MPA management. The relatively low governance score, was due to very low governance levels 4 and 5 (enforced to institutionalized) (Fig. 2), with a low governance effectiveness score of 0.45, and a low overall management effectiveness score of 0.51. The results suggest that needs improvements in management capacity to support effective management.

MANAGEMENT EFFECTIVENESS ASSESMENT OF MARINE PROTECTED AREAS IN NORTH SULAWESI REPORT CARD 2010-2011

BASAAN



Basaan Village is located in the eastern part of the province, bordering Belang district on the northside and Bolaang Mongondow on the southside. On the eastside is bordering Maluku Sea, and on Tombatu district on the westside. The village is located 80 km from Manado, inhabited by 1178 population, with a majority of the farmers' livelihoods. Basaan Village is one of the villages that became JICA Pilot Project for the management of coastal resources, with the management of coastal resources in Basaan has now formed a community-based marine protected areas and areas of mangrove protection.

Key Facts	
Date of MPA establishment:	April 27, 2002
Date of Management Plan establishment:	April 30, 2002
Description of location:	Part of Minahasa District, 95 km south-eastern of Manado
GPS location:	00 53,279'N -124045,114'E
Area of MPA (hectares):	15.9
Number of population (when established):	1146
Major component of management plan:	1. Managing coral reefs 2. Improving community awareness and education 3. Improving fisheries and farming production 4. capacity building for local management board
Enforcement:	Yes

ECOLOGICAL

Inside : 62.9
Outside : 54.3

LIVE CORAL COVER

Inside : 2220
Outside : 1386.7

FISH ABUNDANCE

Inside : 248.7
Outside : 139.5

FISH BIOMASS

0.83

SOCIO-ECONOMIC

0.61

GOVERNANCE

0.77

EFFECTIVENESS

0.74

B+

Basaan has relatively highscores for all management effectiveness parameters. Ecological conditions inside the MPA are healthier compared to outside the MPA. Community perceptions on socioeconomic parameters (efficiency, sustainability and equity) are relatively good, showing good community knowledge and support for MPA management. Basaan has relatively high effectiveness for governance levels 1 to 3 and medium levels for governance levels 4 and 5 (enforced to institutionalized) (Fig. 2), with a high governance effectiveness score of 0.77, and high overall management effectiveness score of 0.74.

MANAGEMENT EFFECTIVENESS ASSESMENT OF MARINE PROTECTED AREAS IN NORTH SULAWESI REPORT CARD 2010-2011

BENTENAN

Benentan village is located in the northern part of Minhasa District, 95 km south-eastern of the capital of North Sulawesi, Manado. The MPA has an area of 3.9 hectares and the village is inhabited by 1204 people, the majority are Christian of Sangir and Minahasa ethnicity. The Bentenan Coastal Resources Development and Management Plan were formally approved on November 9, 1999 by village ordinance after a two-year participatory planning process. This plan is a joint management plan developed in coordination with Tumbak village. The plan addresses eight coastal resources management issues where specific objectives were set to achieve a vision of sustainable community development over a 25-year period. Management board was developed and formalize on September 6, 2000, and first implementation of the management plan was started in September 2000.

Key Facts	
Date of MPA establishment:	November 9, 1999
Date of Management Plan establishment:	November 9, 1999
Description of location:	Part of Minahasa District, 80 km south-eastern of Manado
GPS location:	1° 0'25.34"N - 124°54'0.00"E
Area of MPA (hectares):	3.9
Number of population (when established):	1204
Major component of management plan:	1. Managing coral reefs 2. Managing water supply and facility maintenance 3. Managing flooding/erosion in swamp/estuary 4. Improving environmental sanitation and health 5. Development of public tourism 6. Improving community awareness and education 7. Improving fisheries and farming production 8. Managing seaweed farming and sea space areas
Enforcement:	Yes

ECOLOGICAL

Inside : 20
Outside : 23.3

LIVE CORAL COVER

Inside : 1280
Outside : 1673.3

FISH ABUNDANCE

Inside : 13.9
Outside : 9.2

FISH BIOMASS

0.83

SOCIO-ECONOMIC

0.61

GOVERNANCE

0.77

EFFECTIVENESS

0.56

B-

Bentenan has relatively low scores for ecological conditions, with ecological conditions inside the MPA poor compared to outside the MPA. Community perceptions on socioeconomic parameters (efficiency, sustainability and equity) are relatively good, suggesting that community knowledge and support for the MPA management is fair to good. Benentan has high effectiveness scores for governance levels 1 to 2, medium scores for levels 3 and 4 and low score for governance level 5 (institutionalized) (Fig. 2). This results in a medium overall governance effectiveness score of 0.68, and a relatively low management effectiveness score of 0.56. More improvement is required for effective MPA management.

MANAGEMENT EFFECTIVENESS ASSESMENT OF MARINE PROTECTED AREAS IN NORTH SULAWESI REPORT CARD 2010-2011

TUMBAK

Tumbak village is located in Minhasa District, 34 km south east of Manado. The MPA has an area of 77.3 hectares and the village is inhabited by 1130 people, the majority are Christian of Sangir and Minahasa ethnicity. The Tumbak Coastal Resources Development and Management Plan was formally approved on November 9, 1999 by village ordinance after a two-year participatory planning process. This plan is a joint management plan developed in coordination with Bentenan village. The plan addresses eight coastal resources management issues where specific objectives were set to achieve a vision of sustainable community development over a 25-year period. Management board was developed and formalize on July 1, 2000, and first implementation of the management plan was started in July 2000.

Key Facts	
Date of MPA establishment:	November 9, 1999
Date of Management Plan establishment:	November 9, 1999
Description of location:	Part of Minahasa District, 34 km south-eastern of Manado
GPS location:	0°58'18.03"N - 124°53'14.45"E
Area of MPA (hectares):	77.3 (Reef) 77.0 (Mangrove)
Number of population (when established):	1130
Major component of management plan:	1. Managing coral reefs 2. Managing water supply and facility maintenance 3. Improving road infrastructure 4. Managing flood prone areas 5. Environmental sanitation 6. Development of public tourism 7. Improving community awareness and education 8. Managing mangroves 9. Improving fisheries and farming
Enforcement:	Yes

ECOLOGICAL

Inside : 56.7
Outside : 55.6

LIVE CORAL COVER

Inside : 1826.7
Outside : 1900

FISH ABUNDANCE

Inside : 4.1
Outside : 8.5

FISH BIOMASS

0.17

EFFECTIVENESS

0.59

B-

SOCIO-ECONOMIC

0.95

GOVERNANCE

0.65

Tumbak has comparable ecological conditions inside and outside the MPA which results in a low ecological score. Community perceptions on socioeconomic parameters (efficiency, sustainability and equity) are good, with community knowledge and support the highest of all 6 CB-MPAs. Tumbak has relatively high scores for governance levels 1 to 3, demonstrating enforced management (level 3), and low scores for governance levels 4 and 5 (sustained to institutionalized) (Fig. 2), with a medium governance effectiveness score of 0.65, and medium overall management effectiveness score of 0.59.

MANAGEMENT EFFECTIVENESS ASSESMENT OF MARINE PROTECTED AREAS IN NORTH SULAWESI REPORT CARD 2010-2011

BLONGKO

Blongko village is located in the northern part of Minhasa District, 115 km south of the capital of North Sulawesi, Manado. The MPA has an area of 16.3 hectares and the village is inhabited by 1251 people, the majority are Christian of Sangir and Minahasa ethnicity. The Blongko Marine Protected Area was established by village ordinance on 26 of August 1998. This was followed by the development of a Marine Sanctuary Management and Coastal Resources Development Plan that was formally approved on November 7, 1999 by village ordinance after a two-year participatory planning process. The plan addresses nine general coastal resources management issue areas where specific objectives were set to achieve a vision of sustainable community development over a 15-year period. Management board was developed and formalize on July 14, 2000, and first implementation of the management plan was started in July 2000.

Key Facts	
Date of MPA establishment:	August 26, 1998
Date of Management Plan establishment:	November 7, 1999
Description of location:	Part of Minahasa District, 115 km southern of Manado, closest city is Amurang - approximately 32 km.
GPS location:	1°14'32.99"N - 124°36'10.58"E
Area of MPA (hectares):	16.3
Number of population (when established):	1251
Major component of management plan:	1. Management of the marine sanctuary 2. Protection and rehabilitation of coral reef, mangroves, seagrasses 3. Increasing community incomes 4. Raising awareness of community concerning environmental protection 5. Community health and sanitation 6. Preventing coastal erosion and stream flooding 7. Improving community livelihood/production 8. Reducing erosion/sedimentation from land and farm areas 9. Implementation of the management plan by the village Coastal Management Board.
Enforcement:	Yes

ECOLOGICAL

Inside : 22.5
Outside : 18.5

LIVE CORAL COVER

Inside : 9080
Outside : 4540

FISH ABUNDANCE

Inside : 148.2
Outside : 16.4

FISH BIOMASS

1.00

SOCIO-ECONOMIC

0.65

GOVERNANCE

0.84

EFFECTIVENESS

0.83

B+

Blongko has relatively high scores for all management effectiveness parameters. Ecological conditions inside the MPA are healthier compared to outside the MPA. Community perceptions on socio-economic parameters (efficiency, sustainability and equity) are relatively good, showing good community support for MPA management. Blongko has relatively high effectiveness for governance levels 1 to 4, demonstrating sustainable management (level 4), and medium levels for governance level 5 (institutionalized) (Fig. 2), with a high governance effectiveness score of 0.84, and high overall management effectiveness score of 0.83.

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TALISE

Talise village is located in the northern part of Minhasa District, 50 km north of the capital of North Sulawesi, Manado. The MPA has an area of 22.0 hectares and the village is inhabited by 1902 people, the majority are Christian of Sangir and Minahasa ethnicity. The Talise Coastal Resources Development and Management Plan was formally approved on November 6, 1999 by village ordinance after a two-year participatory planning process. The plan addresses twelve coastal resources management issues where specific objectives were set to achieve a vision of sustainable community development over a 30-year period. Regarding the issue of resource use conflict between local communities and a pearl farm company, on 4 of May 2000, agreement of collaboration to manage resource use and protection between village and the company was signed. Management board was developed and formalize on August 25, 2000, and first implementation of the management plan was started in June 2000.

Key Facts	
Date of MPA establishment:	November 6, 1999
Date of Management Plan establishment:	May 4, 2000
Description of location:	Part of Minahasa District, in island 50 km northern of Manado
GPS location:	1°49'59.39"N - 125° 5'0.95"E
Area of MPA (hectares):	22
Number of population (when established):	1902
Major component of management plan:	1. Land Tenure 2. Resolving Sea Use Conflicts 3. Sustainable Forestry Management and Protection of Wildlife 4. Prevention of Coastal Erosion and Flooding 5. Drinking Water Supply 6. Improving Environmental Sanitation 7. Human Resources Development 8. Improving Farming Productivity 9. Management of Mangroves and Coral Reefs 10. Developing Eco-Tourism 11. Strengthening Community Awareness Concerning Natural Resources 12. Establishment of a Management Plan Implementation Committee
Enforcement:	Yes

ECOLOGICAL

Inside : 43.3
Outside : 16.7

LIVE CORAL COVER

Inside : 1146.7
Outside : 513.3

FISH ABUNDANCE

Inside : 3.2
Outside : 1.8

FISH BIOMASS

1.00

SOCIO-ECONOMIC

0.57

GOVERNANCE

0.46

EFFECTIVENESS

0.68

B+

Talise has a high score for ecological conditions, while community perceptions on socioeconomic parameters (efficiency, sustainability and equity) are fair, showing that improvements in community support for MPA management are needed. Talise has relatively high scores for governance levels 1 to 2, demonstrating established management (level 2), a medium score for governance level 3 and low scores for governance levels 4 and 5 (enforced to institutionalized) (Fig. 2). The low to medium socio-economic and governance effectiveness scores, result in a medium overall management effectiveness score of 0.68.