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ON CORAL REEFS, FISHERIES AND FOOD SECURITY
PHILIPPINES

THE MONITORING PROGRAM FOR BALIBAGO AND QUILITISAN MANGROVE PROTECTED AREAS

This publication was prepared by Maricar S Samson and Noreen Marie G Follosco with funding from the United States Agency for International Development's Coral Triangle Support Partnership (CTSP) (September 2011)

Cover photo: This mangrove forest is part of a Marine Protected Area in Ang Pulo, Verde Islands Passage, Phillipines. Photo: © CTSP / Tory Read

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Prepared by: Maricar S Samson and Noreen Marie G Follosco

For more information on the six-nation Coral Triangle Initiative, please contact:

Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security
Interim Regional Secretariat
Ministry of Marine Affairs and Fisheries of the Republic of Indonesia
Mina Bahari Building II, 17th Floor
Jalan Medan Merdeka Timur No 16
Jakarta Pusat 10110 Indonesia
www.thecoraltriangleintitiave.org

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The Monitoring Program for Balibago and Quilitisan Mangrove Protected Areas

I. Introduction

Mangrove ecosystems cover some 15 million ha worldwide with a third of total area found in Southeast Asia; likewise the Indo-Malay Philippine Archipelago boasts of 36-45 species of the 65 to 70 true mangrove species being recognized today (Polidoro et al, 2010; Spalding et al 2010). The Philippines is one of the countries with the most number of true – mangrove species (**Figure 1**). To date there are around 44 true mangrove species identified in the Philippines.

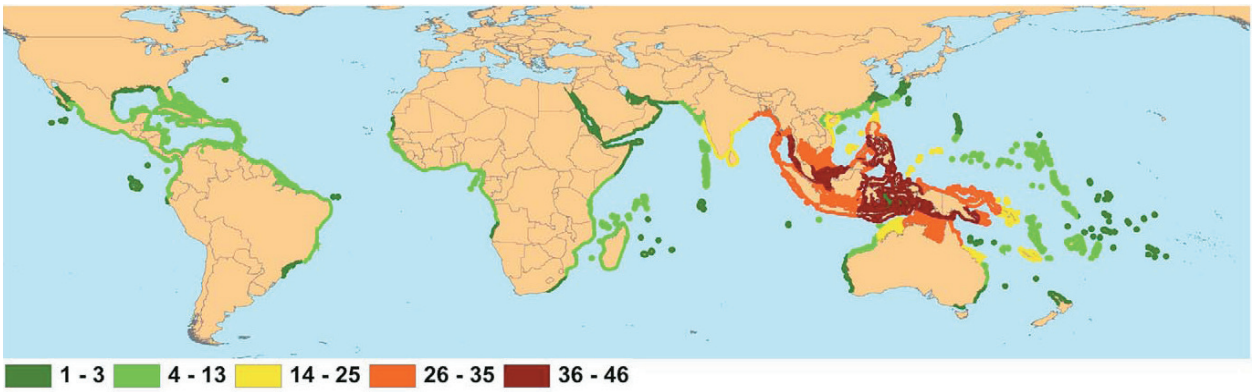

Figure 1. Number of species of mangroves around the world (as presented in Polidoro et al, 2010).

The value of ecosystem services that mangroves could contribute globally was estimated at US$1.6 billion per year in 1997 (as cited in Polidoro et al, 2010). Ecologically, these forests (1) provide habitat for many marine organisms (fish and invertebrates) and wildlife (birds and reptiles); (2) contribute to soil formation and coastline stabilization; (3) act as filters for upland run-off; and (4) produce large amounts of detritus, contributing to offshore productivity. The nursery value that this ecosystem provides imparts food and shelter to transient organisms like shrimp, fish, decapods and other marine organisms. Economically, mangrove areas are major sources of food and shelter. They are also the first line of defense against tsunami, strong waves, and typhoons. Now, its ecotourism value is providing income and job opportunities for many coastal areas around the world. Mangroves are also important socio-politically as it provides opportunities for various institutions to work together towards the development of management strategies for its protection, restoration and conservation. However, globally, around 10 to 40% of the species are threatened due to unsustainable anthropogenic activities and the looming effect of climate change (**Figure 2**).

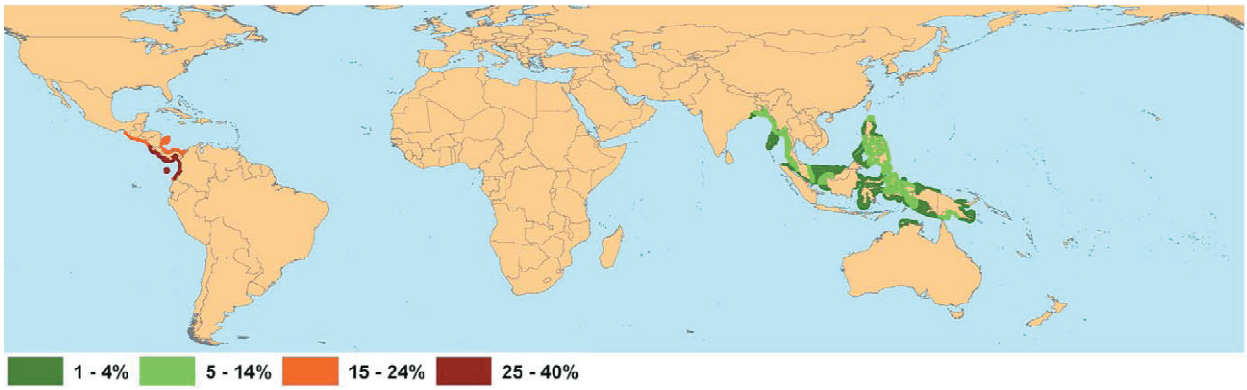

Figure 2. Percentage of threatened mangrove species around the globe (as presented in Polidoro et al, 2010).

Mangrove forests in the Philippines suffered the same fate of degradation for food and timber production (Primavera 1991, 2000; Melana et al 2000; Walters 2000, 2004) . **Figure 3** shows the decline in mangrove areas, from an estimated cover of 450, 000 hectares in 1918, the estimated area was reduced to 247, 400 hectares in 2003. However, these are mostly estimates of extent based on classified satellite images which lack ground validation. The present extent are also not classified as to whether these are natural mangrove areas or afforested areas such as seagrass beds and mud/tidal flats.

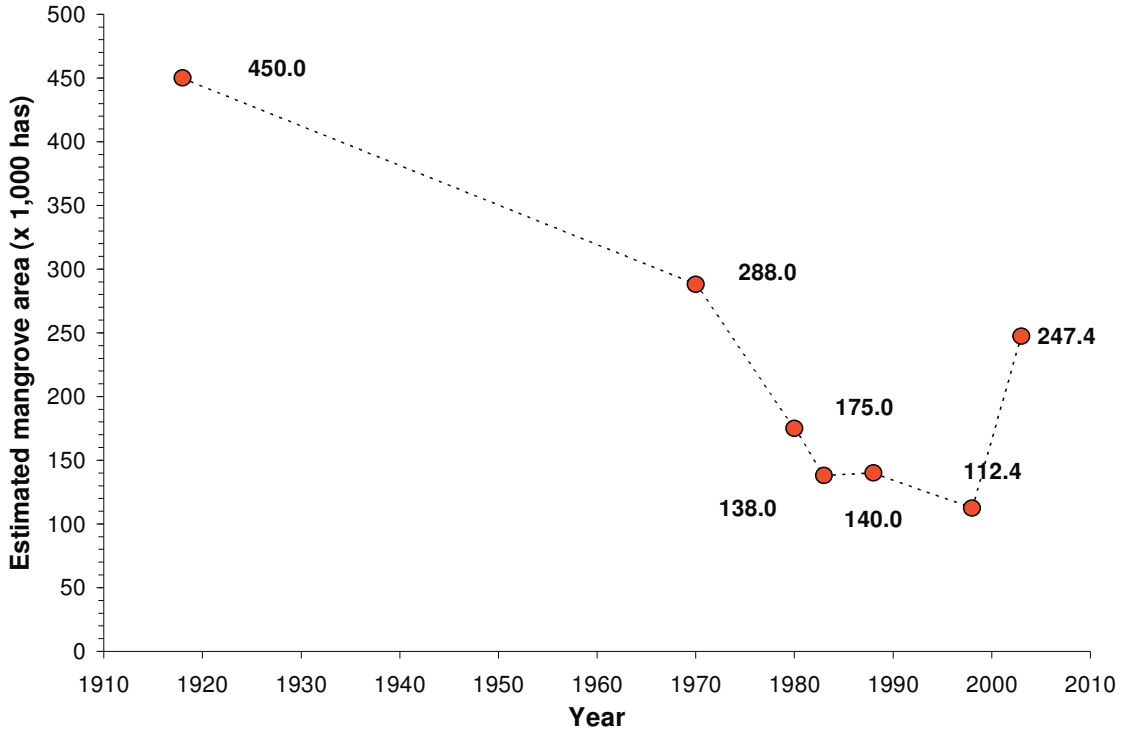

Figure 3. Decline in mangrove areas from 1918 (around 450,000 hectares) to 2003 (around 247, 362 hectares) (as presented in Samson and Rollon, 2011).

There had been efforts to increase the remaining mangroves in the Philippines, however, the success and sustainability of these mangrove management efforts were affected by a number of factors. The most critical of which is the lack of an ecological assessment of degraded mangrove areas prior to its rehabilitation. Understanding the individual species' ecology and biophysical condition (i.e. hydrology, substrate, topography, rate of sedimentation) of target sites were suggested as necessary steps in successful mangrove management (Lewis 2005; Primavera 2000; Melana et al 2000 (2)). However, in the Philippines the design of management programs were usually dependent on the most available area for planting, need for wood products, financial assistance and availability of seedling materials and laborers. Management efforts were mostly geared toward growing of mangroves in the most available space, which are usually the mudflat and seagrass areas. These areas are often preferred due to ease of access and less legal and institutional constraints in the implementation of the activity (Samson and Rollon, 2008).

The need to determine the extent and status of mangrove areas in the Philippines must be given proper attention in order to develop appropriate management strategies that will increase its resilience and adaptive capacity to climate change and increasing dependence on these ecosystem.

This project aims to establish a monitoring program for the mangrove protected areas in Balibago and Quilitisan, Calatagan, Batangas towards the formulation of adaptive management strategies to increase the resilience of these coastal ecosystems to climate change.

II. Rationale

Management of mangrove areas in the Philippines are extensive with varying levels of effort and success. The focus of most of the management activities were on mangrove planting with the objective of increasing the remaining hectarage of forests. These efforts, as noble as they were envisioned, would have achieved the intention of increasing mangrove forest however whether this increase is reflective of the reforested mangrove areas is uncertain. In 2007, the remaining mangrove areas in the Philippines was estimated at 289,350 hectares (DENR-NAMRIA 2007), a value which is 61% (176,950) higher than 1998 estimate. However, most of these are estimates based on satellite images that need to be validated on field. The remaining mangroves areas in the Philippines are continuously threatened by the prevalence of small scale illegal cutting practices, inappropriate mangrove planting activities, and the looming impacts of climate change. Of the ancillary impacts of climate change, it is the increase in sea level and increased storminess that may bring detrimental effects to these resources. However, the degree of vulnerability is heightened due to the paucity of information on their current status at the national and local level, hence appropriate management programs are not in place.

Information that will be important in assessing the vulnerability of mangrove areas to climate change include:

- Remaining extent of forest
- Extent and condition of degraded areas
- Species diversity and forest community structure; and
- Present management practices and problem and concerns affecting these mangrove areas.

This project was implemented primarily to develop monitoring plans for mangrove protected areas in Balibago and Quilitisan, Calatagan, Batangas towards the formulation of adaptive management strategies to increase the resilience of these coastal ecosystems to climate change. Corollary to this objective is the training of local partners in participatory tools for the assessment and monitoring of climates change impacts to mangroves, particularly to sea level rise, increased storminess, and increased precipitation.

III. The Twin Mangrove Protected Areas

The two mangrove protected areas in Balibago and Quilitisan, Calatagan were assessed on September 1 to 3, 2011. Details of the training and the participatory assessment are in Appendices 1 and 2. Appendix 3 includes the methodologies used in the assessment.

Balibago Mangrove Protected Area (CALMADA)

A. Present extent

The Balibago Mangrove Protected Area covers the entire mangrove forests within the barangay boundary. This fringing type of forest is around 19ha (Figure 4). Relative width of the forest extends to 150 to 200m with approximately 970m in length. The distance of the mangroves to the houses range sfrom 200 to 600m. Adjacent to these protected area are fishponds which is reported to be about 25ha, however 5ha of which are said to be abandoned (CI, 2010).

Figure 4. A Google satellite image of Balibago Mangove Protected Area and its adjacent fishponds and human settlements.

B. Species diversity

Of the 12 species that were identified to be present in the area, 9 species were recorded within the 5 monitoring plots that were established (Table 1). The most dominant of which is *Avicennia marina* which is present in all of the plots established (Figure 5). Plot 3 has the most number of species(n=6), with Plot 5 having only 1 species (*Avicennia marina*).

Table 1. Species identified in the monitoring plots established in Balibago and Quilitisan Mangrove Protected Areas.

	Balibago	**Quilitisan**
Aegiceras corniculatum	**X**	**X**
Aegiceras floridum		x
Avicennia alba	**X**	x
Avicennia marina	x	**X**
Bruguiera cylindrica	**X**	**X**
Bruguiera sexangula		x
Ceriops decandra	**X**	**X**
Ceriops tagal	x	x
Exoecaria agallocha	x	x
Lumnitzera racemosa		**X**
Nypa fruticans		x
Rhizophora apiculata	**X**	**X**
Rhizophora mucronata	**X**	**X**
Rhizophora stylosa	**X**	**X**
Sonneratia alba	**X**	**X**
Sonneratia caseolaris	**X**	x
Xylocarpus moluccensis		x
TOTAL	**12**	**17**
n species inside plots	**9**	**9**

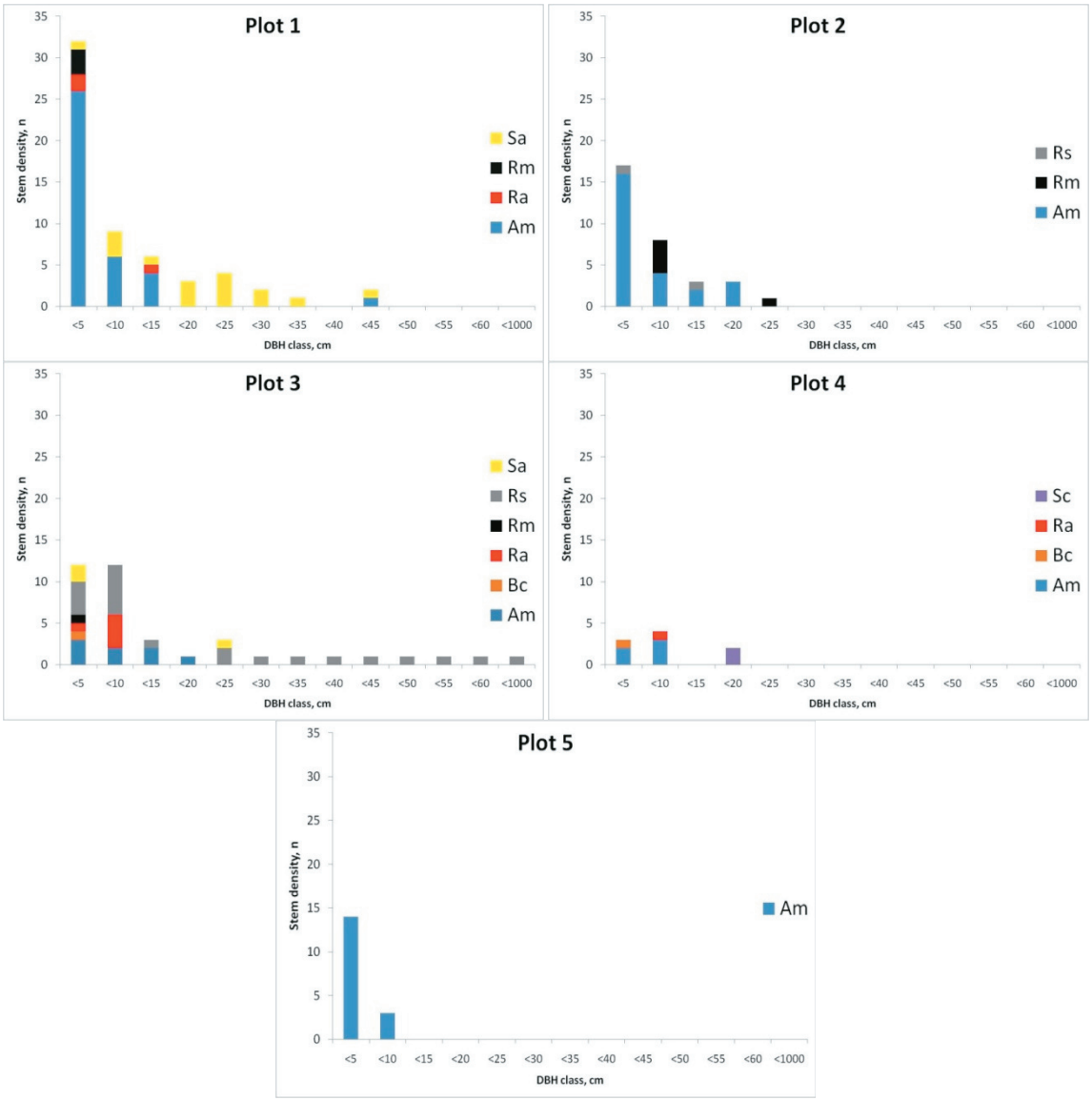

Figure 5. Stem density (n) within the 5 monitoring plots established in Balibago Mangrove Protected Area, 2 September 2011.

C. Community structure

In terms of the number of stems in each of the 10m x 10m plot (Table 2), Plot 1 (n=59) has the most number of stems counted with *Avicennia marina* as the most dominant species. Notable in Figure 5 is the different mix and dominance of species which may indicate the influence of various factors such as relative exposure to wave (Plot 1 and 2 are more exposed hence the dominance of *A. marina*) and concentration of planting activities (Plot 3 where *Rhizophora stylosa* is dominant).

Table 2. Stem density, basal area (m^2) and canopy cover (m^2) relative to the 10m x 10m monitoring plots in Balibago Mangrove Protected Areas, 2 September 2011.

	Latitude	Longitude	Stem Density	Basal area (m^2)	Canopy cover (m^2)
Plot 1	13.924650°	120.620617°	59	0.84	379.22
Plot 2	13.923833°	120.619883°	32	0.18	489.77
Plot 3	13.923700°	120.619750°	39	0.16	181.41
Plot 4	13.920917°	120.620833°	9	0.06	241.80
Plot 5	13.920700°	120.620883°	17	0.02	135.56

In terms of the basal area (Figure 6, Table 2), Plot 1 which is dominated by old trees has the highest basal area (0.84 m^2). The other plots has relatively low basal area cover which may be indicative of the prevalence of mangrove cutting practices in the previous years.

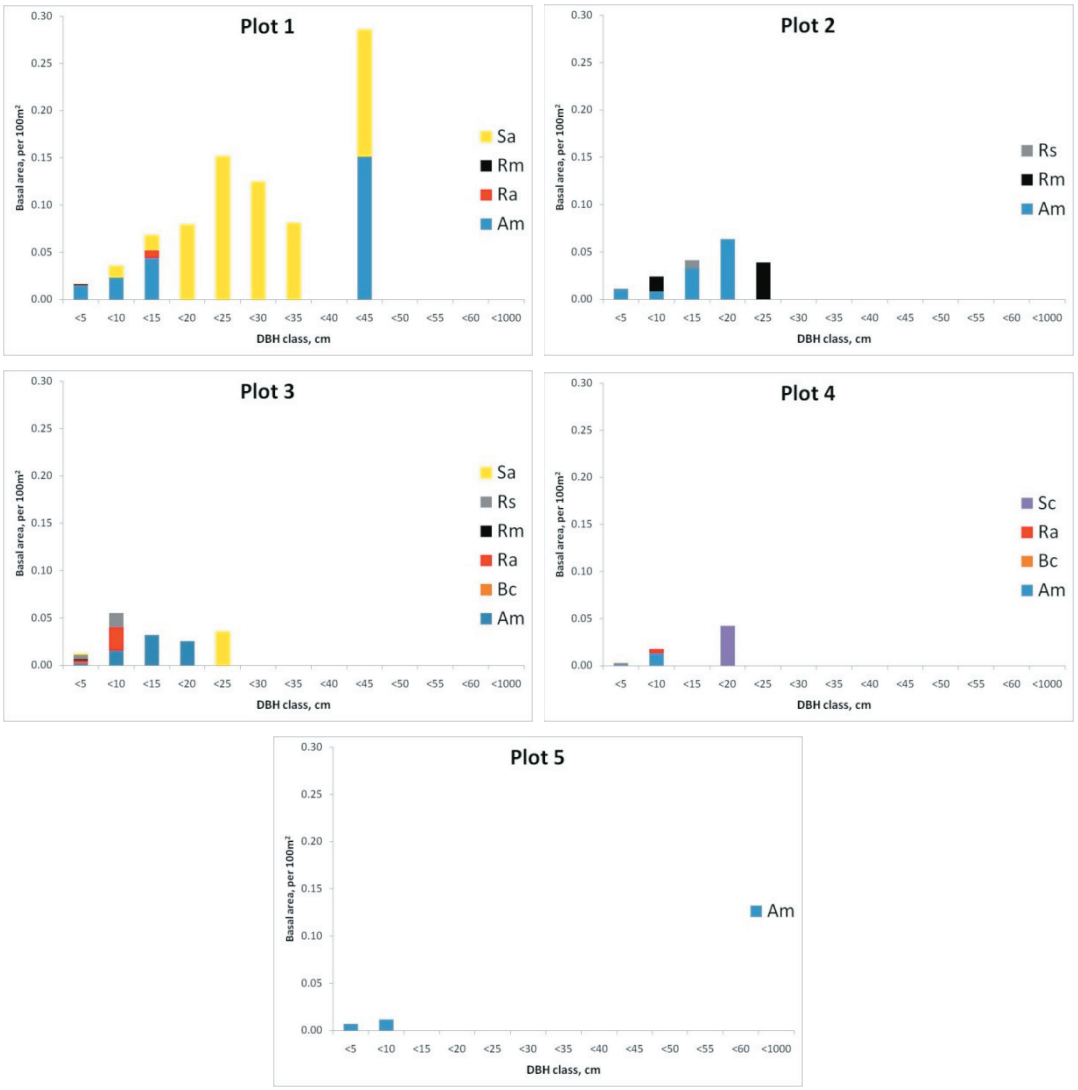

Figure 6. Basal area (m^2) in the 5 monitoring plots established in Balibago Mangrove Protected Area, 2 September 2011.

The relatively low canopy cover (195 to 490 m^2) in each of the 10m x 10m plot is indicative also of the prevalence of mangrove cutting practices in the previous years (Figure 7, Table 2).

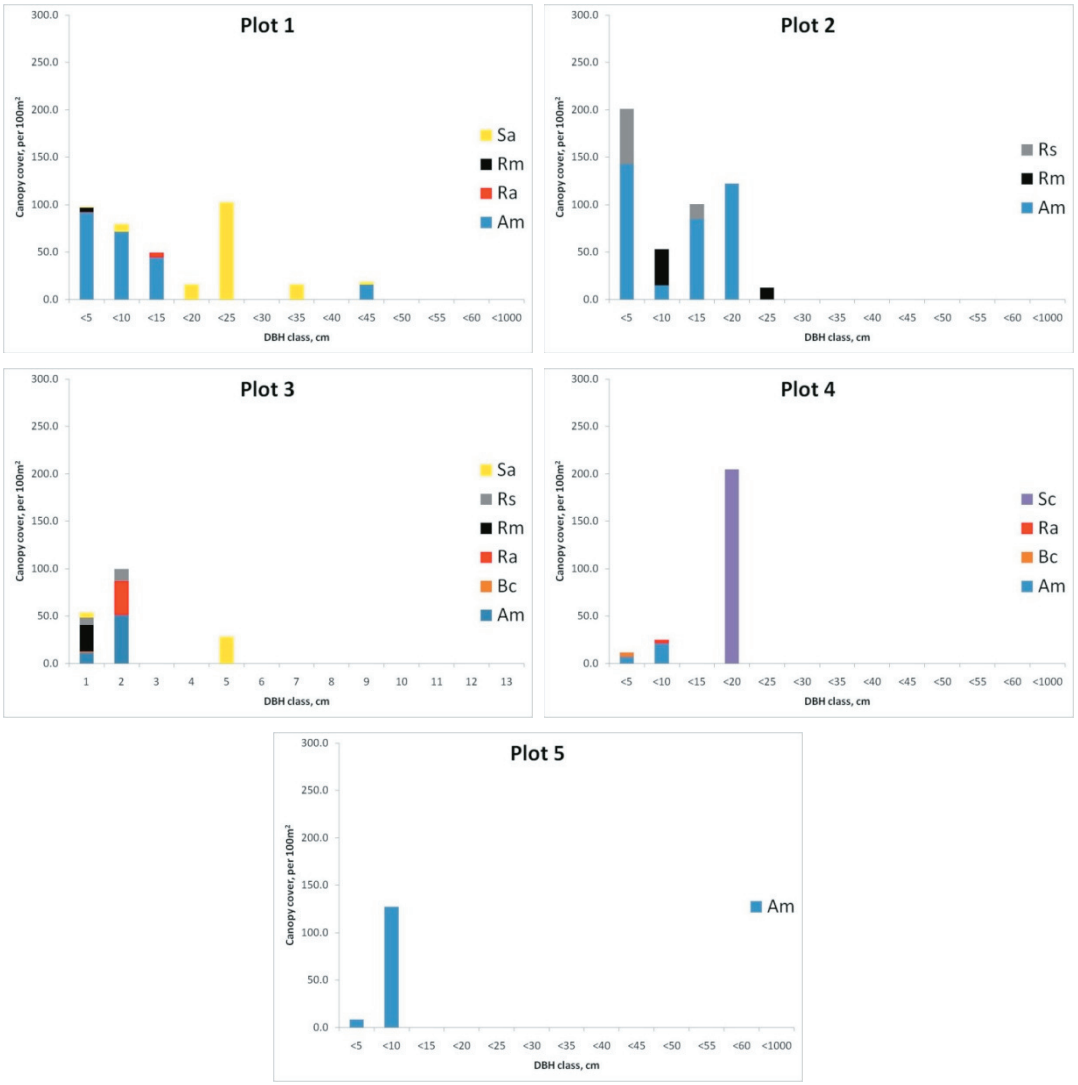

Figure 7. Canopy cover (per 100m^2) in the 5 monitoring plots established in Balibago Mangrove Protected Area, 2 September 2011.

In terms of the presence of seedlings, only 4 species namely *A. marina, R. apiculata, R. mucronata,* and *R. stylosa,* were recorded within plots (Table 3). Of these species, seedlings of *A. marina* were recorded in the 5 monitoring plots established.

Table 3. Presence of seedlings in the monitoring plots established in Balibago and Quilitisan Mangrove Protected Areas, 2 September 2011.

	Balibago					Quilitisan					
Plot	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**
Avicennia marina	x	x	x	x	x	x	x			x	
Ceriops decandra						x					x
Rhizophora apiculata	x	x	x			x					
Rhizophora mucronata		x	x	x							x
Rhizophora stylosa	x	x	x	x							x
Sonneratia alba									x		

D. Present management

The organization, **Cal**atagan **Ma**ngrove **D**evelopment **A**lliance (CALMADA) is primarily responsible for the management of the mangrove protected area in Barangay Balibago. CI-Philippines and the local government initially engaged 12 families to form the core group of the organization. Among the interventions that were implemented by the group include planting of mangroves (*Rhizophora* spp) in forest gaps and at the seafront; maintenance of planted seedlings; and prohibition of mangrove cutting. Three hectares of mangrove area were planted from 17 March to 9 April 2011.

E. Potential threats, issues and problems

Among the potential threats and issues that were identified by the core group are:

- Seaweeds and garbage entangling of planted seedlings;
- Proper waste disposal; and
- Identification of possible buyers of seedlings.

During the field visit, a potential improvement on present management efforts may be the proper timing of planting and use of appropriate seedlings to plant (*Rhizophora stylosa* vs *Avicennia marina*) especially at the seafront where species of *R. stylosa* were observed to be entangled with seaweeds and garbage. These species may grow well at the forest gaps behind the present mangrove area but not at the seafront as was observed during the field visit. Another potential area of improvement would be to minimize purchase of seedlings from other barangays but rather a concerted effort in increasing the propagation of locally available species such as *A. marina, S. alba, R. mucronata,* and *Ceriops decandra* which are considered as pioneering species and may then be used in reforesting the 5ha of abandoned ponds.

Quilitisan Mangrove Protected Area (TALIMUSAK)

A. Present extent

The Ang Pulo Mangrove Protected Area in Quilitisan is an overwashed type of mangrove forest. The present extent of the protected area is about 4ha, this is 24% of the total 17ha of mangrove areas in Quilitisan.

B. Species diversity

Though the protected is an overwashed type of mangrove forest, 11 species were recorded inside. Only 9 species were recorded in the 4 monitoring plots established in the protected area (Table 1). The first two plots that were established were at the southern end of the fringing forest in the mainland. Plot 6 which is situated inside the protected area has the most number of species (n=6) while Plot 1 which is at the seafront has only two species (Figure 8).

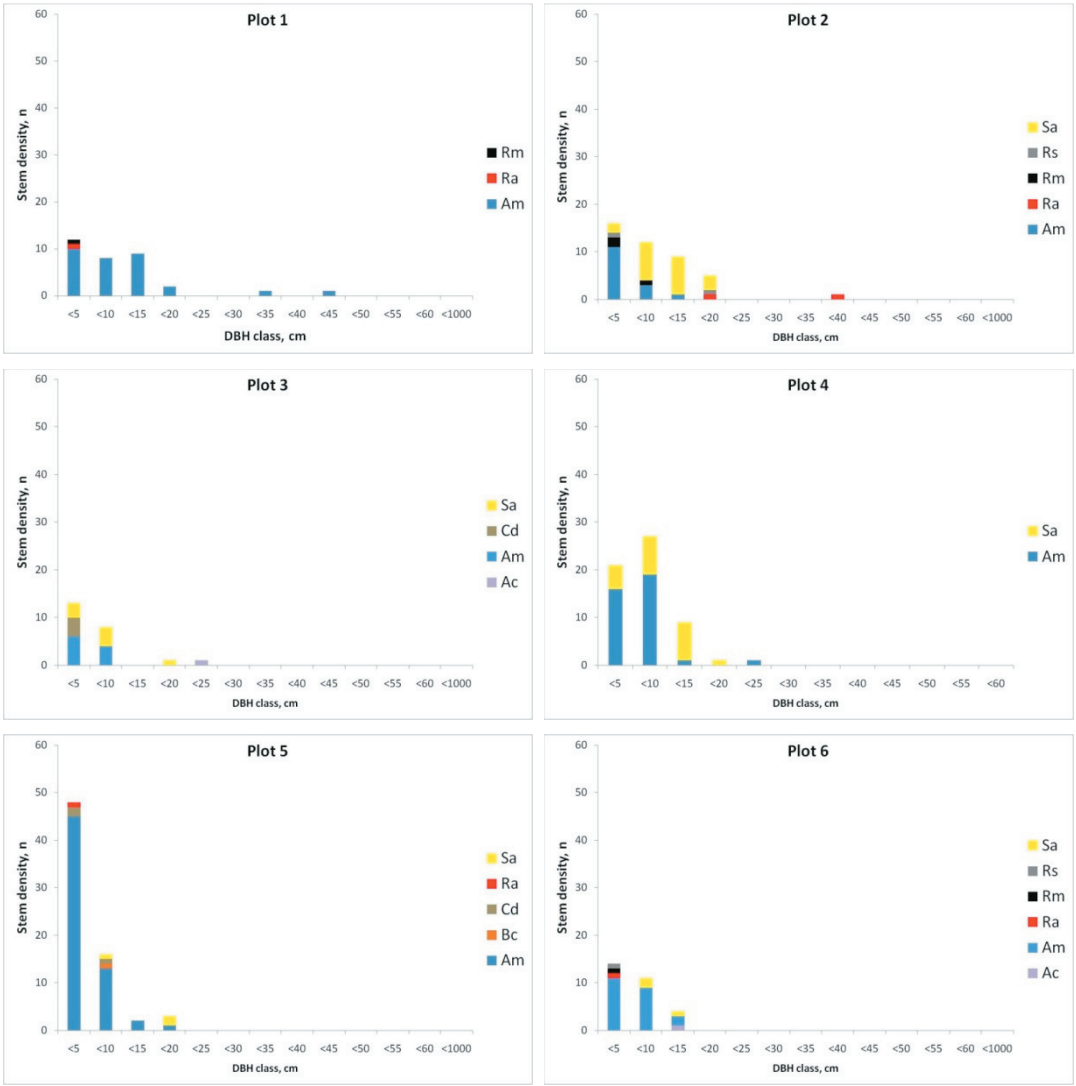

Figure 8. Stem density (n) in the 6 monitoring plots established in Quilitisan Mangrove Protected Area, 2 September 2011.

C. Community structure

In terms of stem density (Table 3), Plot 5 has the highest number of stems (n=69) counted inside the 10m x 10m plot, however most of these has a DBH of less than 5cm. Plots 1 and 2 which are part of the fringing mangrove area in the mainland has trees with more than 40cm DBH. As in Balibago, *Avicennia marina* is the most dominant species in all of the plots (Figure 8).

Table 3. Stem density, basal area (m^2) and canopy cover (m^2) relative to the 10m x 10m monitoring plots in Quilitisan Mangrove Protected Areas, 2 September 2011.

	Latitude	Longitude	Stem Density	Basal area (m^2)	Canopy cover (m^2)
Plot 1	13.881750°	120.617433°	33	0.45	9,508.96
Plot 2	13.881920°	120.617370°	43	0.38	14,525.35
Plot 3	13.885583°	120.616650°	23	0.10	110.65
Plot 4	13.885640°	120.616400°	59	0.27	225.68
Plot 5	13.885230°	120.616680°	69	0.20	214.21
Plot 6	13.885100°	120.616950°	29	0.08	535.82

In terms of basal area, Plot 1 has the highest value (0.45m^2) and stems with more than 40cm DBH were also recorded in this plot. Plot 3 has the lowest value of 0.10m^2 and the DBH of the stems inside the plot is less than 25cm (Table 3, Figure 9).

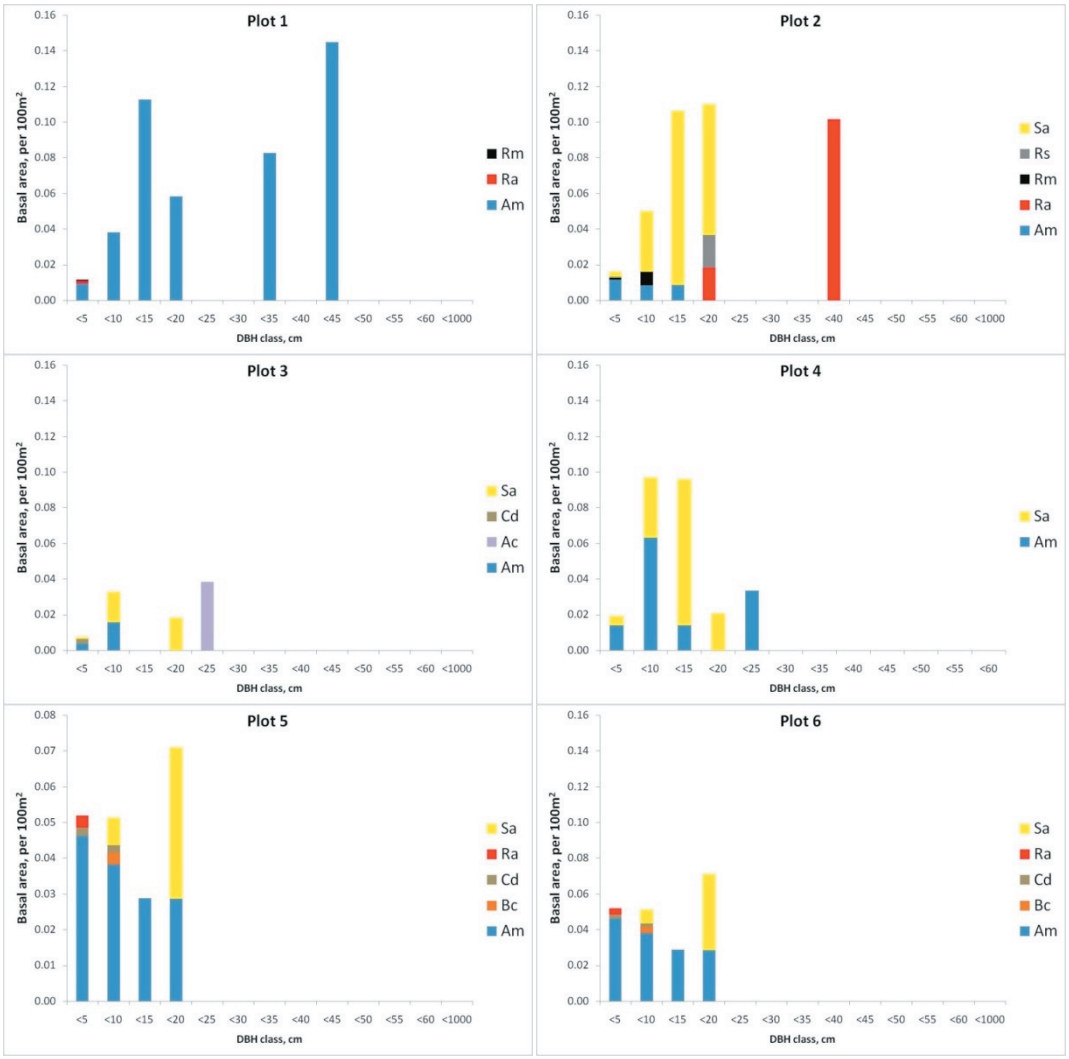

Figure 9. Basal area (m^2) in the 6 monitoring plots established in Quilitisan Mangrove Protected Area, 2 September 2011.

In terms of the canopy cover recorded inside the 10m x 10m monitoring plots, higher values were recorded in the plots not included in the protected area (Plot 2: 14,525.35m^2; Plot 1: 9,508.96 m^2). The plots inside the protected area has less than 500m^2 cover (Figure 10, Table 3).

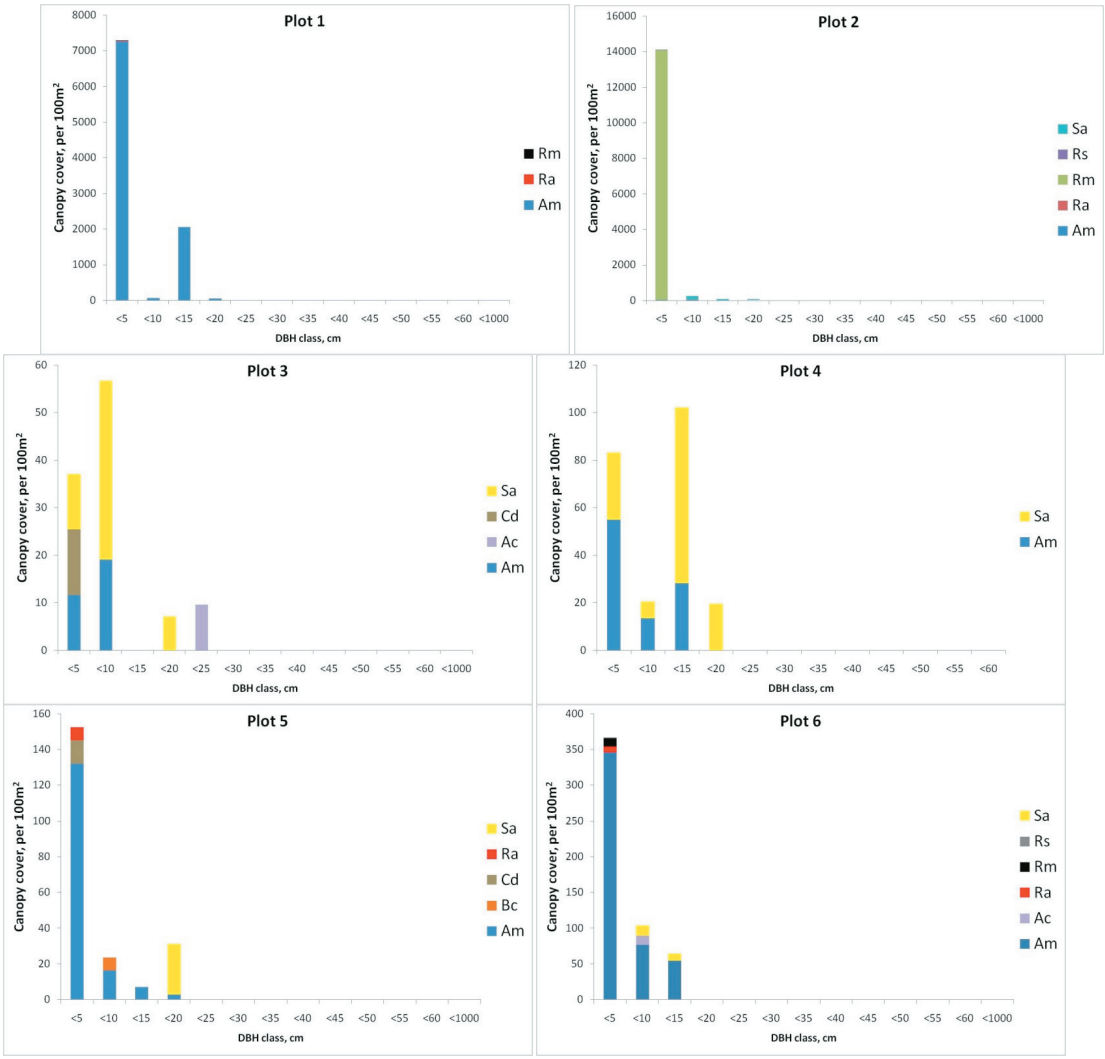

Figure 10. Canopy cover (m^2) in the 6 monitoring plots established in Quilitisan Mangrove Protected Area, 2 September 2011.

In terms of the presence of seedlings, more species were recorded in Qulitisan MPA, namely *A. marina, C. decandra, R. apiculata, R. mucronata, R. stylosa,* and *S. alba* (Table 3). Of these species, seedlings of *A. marina* were recorded in 3 of the 6 monitoring plots established.

D. Present management

The organization **Ta**gapangalaga ng **Li**kas-yamang dagat **mu**la **sa K**ilitisan (TALIMUSAK) is responsible for managing the mangrove protected area in Barangay Quilitisan. The protected area, referred to as "Ang Pulo," is now becoming a popular ecotourism attraction. This area attracts visitors from Manila and neighboring municipalities, more often this is visited by various organizations as part of their educational tours. At present the funds that were generated from visitors are being used for the maintenance of the walkways and honorarium for volunteers.

Members of TALIMUSAK benefitted a lot from the training programs that were given by CI-Philippines especially their skills on organizational and financial management, as such a more systematic reporting of visitors and finances were established.

E. Potential threats, issues and problems

As in Balibago, garbage, detached seaweeds and other debris brought about by waves into the mangrove protected area are considered major problems. Small scale cutting practices were also mentioned as a concern by the organization. More importantly, the organization expressed its concern on the sustainability of financing mechanism for its activities and volunteers.

Growth pattern of Rhizophora species

Information on the growth pattern of species planted in the protected areas may provide valuable inputs in improving reforestation strategies, i.e. site-appropriate species and timing of planting. The species of *Rhizophora* had beed used in the two MPAs in rehabilitating the degraded areas of mangrove forests. A closer look at the growth pattern of these species across plots revealed that *R. stylosa* has the longest intermodal length as compared to the two species (Figure 11), but its growth pattern across plots is not the same (Figure 12), such that it seems that this species do not grow best in areas at the seafront but rather in a mixed forest where its protected from waves and other disturbances by other mangrove species such as *A. marina* and *S. alba.* On the other hand the growth patterns of *R. apiculata* (Figure 13) and *R. mucronata* (Figure 14) seem to indicate that these species are growing in these fringing and overwashed types of forest, however, they are greatly affected by environmental parameters such as the monsoons such that during months of June to August, their intermodal length is relatively shorter.

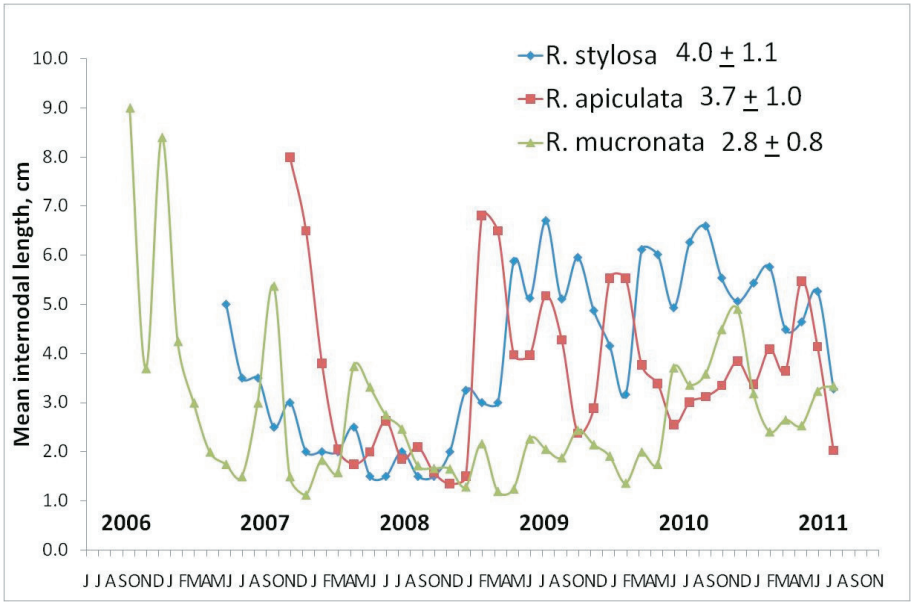

Figure 11. Mean internodal length of *Rhizophora* species in Balibago and Quilitisan Mangrove Protected Areas, 2 September 2011.

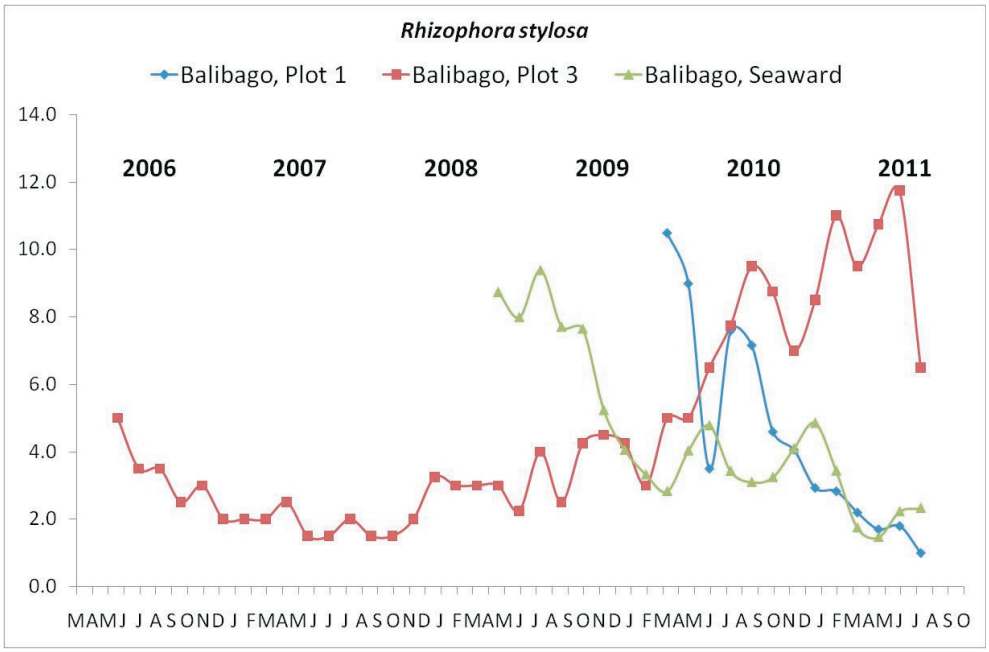

Figure 12. Mean internodal length of *Rhizophora stylosa* in Balibago and Quilitisan Mangrove Protected Areas, 2 September 2011.

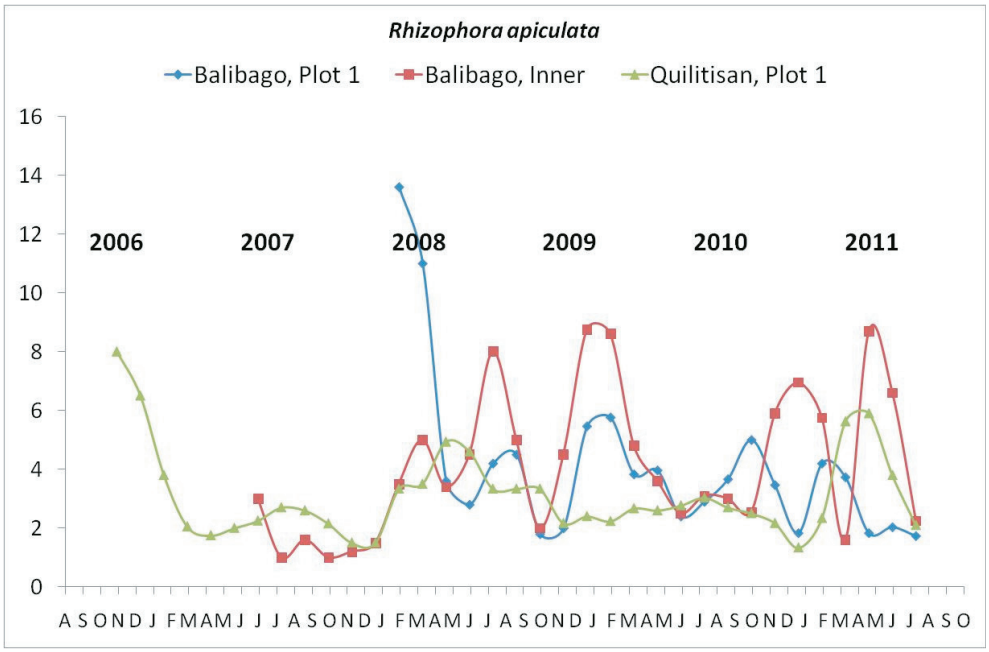

Figure 13. Mean internodal length of *Rhizophora apiculata* in Balibago and Quilitisan Mangrove Protected Areas, 2 September 2011.

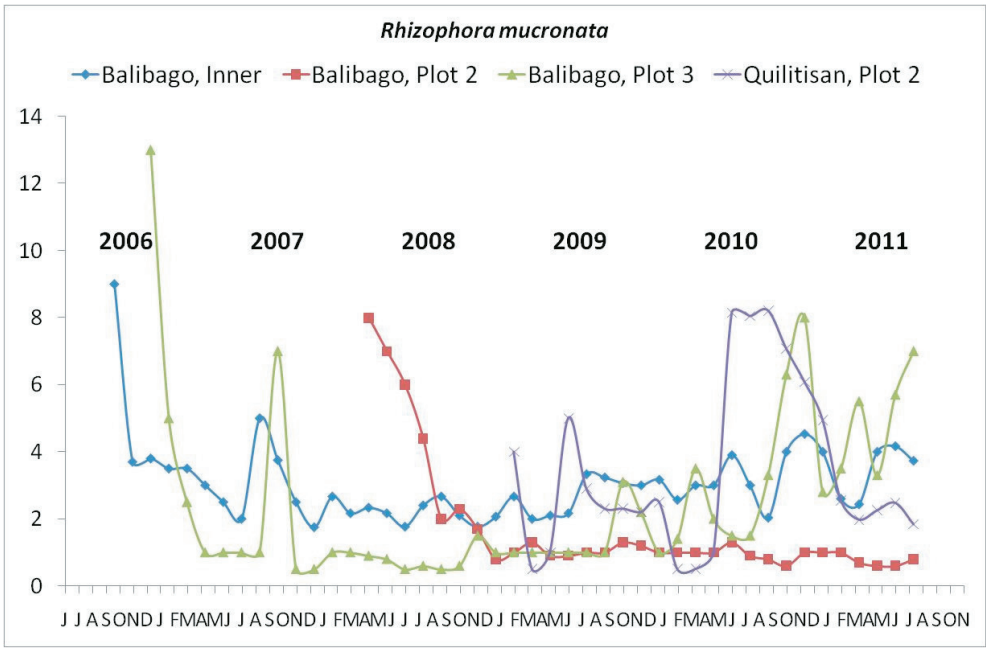

Figure 14. Mean internodal length of *Rhizophora mucronata* in Balibago and Quilitisan Mangrove Protected Areas, 2 September 2011.

IV. Monitoring Program

A workshop was conducted on September 23, 2011 towards formulating a mangrove monitoring pprogram for the Balibago and Quilitisan Mangrove Protected Areas. Documentation of the said workshop are in Appendices 4 to 7.

A. Objectives

The primary aim of this program is to monitor the ecological condition of the twin mangrove protected areas including its associated organisms, towards the formulation of adaptive management strategies to increase the resilience of these coastal ecosystems to climate change. In order to achieve this goal, monitoring plots were established in the two MPAs. The location of the monitoring plots is biased towards monitoring changes in the system that is brought about by climate change particularly the sea level rise, increased storminess and precipitation. Methodologies to assess sensitivity and vulnerability of mangroves to climate change may be divided into two: 1) detailed resource and habitat mapping; and 2) spatio-temporal profiling using age-reconstruction technique (Coultier et al. 2001; Duarte et al 2009). These two methods will help our coastal communities in answering climate change related questions such as:

- What is the potential extent of mangrove areas that will be vulnerable to climate change?
- What are the extenuating factors that may bring about changes?
- Will the mangrove areas be able to adapt to changes in climate?

B. Scope of the Monitoring Program

This program was formulated to assist CALMADA and TALIMUSAK organizations in monitoring the health and integrity of Balibago and Ang Pulo Mangrove Protected Areas, respectively. The information that will be gathered in this monitoring program will help the two organizations and the local government unit of Calagatan to formulate appropriate climate smart adaptive management strategies. In particular this program aims to address the climate change relevant issues and concerns outline in Table 4 of this document.

Table 4. Issues, problems and concerns in Balibago and Quilitisan Mangrove Protected Areas that are related to climate change.

Conservation/ Protection	Restoration/ Rehabilitation	Sustainable utilization	Plan Implementation			
			Political-Institutional	Organizational	Economic	Social
Decline in fisheries and mangrove-associated organisms	Degradation of adjacent seagrass areas		Implementation of and adherence to the rules and regulations of the organization			Lack of IEC on proper garbage disposal
Absence of a monitoring program for the ecological health of mangrove forests and its associated organisms		Planting of appropriate species of mangrove in target rehabilitation sites		Transparency in relation to sources and use of funds		Raise awareness on mangroves and their protection
Sedimentation in coastal areas that is impacting mangroves and seagrass beds	Absence of monitoring program for mangrove planting activities, particularly health of planted trees	Garbage and other debris (seaweed) problem		Proper utilization of funds		Lack of an IEC monitoring plan
	Absence of information on the total extent of mangrove protected area vs degraded area vs areas for rehabilitation			Confusion regarding management activities among members of the organization		
				Travel to other mangrove areas to see other species and improve skills in identification		

C. Mechanisms of the monitoring program

Details of the implementation scheme for the monitoring program is outlined in Table 5 of this document. Appendix 3 details the methodologies, forms, and requirements for the conduct of some of the tools identified in this document. It is important to note however that some of the tools that were identified to address the issues and concerns need further discussion and assistance from the local government units and other interested organizations, these includes the fisheries monitoring, IEC plan, and seagrass assessment.

Table 5. Details of the Balibago and Quilitisan Mangrove Protected Areas monitoring plan.

PRIORITY ISSUES and CONCERNS	OBJECTIVE OF MONITORING	TOOLS FOR MONITORING	FREQUENCY OF MONITORING	REQUIREMENTS	RESPONSIBLE PARTY
Decrease in catch: fish and mangrove associated organisms (Quilitisan and Balibago)	To determine the factors that contribute to the decline in catch To determine resources users.	Identification of present use of resources (Appendix 3.I.D)	Once, at the onset of implementation of the monitoring program	Paper Pens Questionnaire Interviewer/s Camera Tape recorder Permit/ request letters to be able to conduct the interviews	CALMADA TALIMUSAK
	To detect changes in fish and associated organisms stock inside the MPA.	* Fisheries monitoring will be conducted with CI	Monthly	Paper Pens Questionnaire Interviewer/s Weighing scale Flashlights (with batteries) Gasoline allowance (for easier access to distant sites) Calculator Permit/ request letters to be able to conduct the interviews Candies (as small incentives for the community members who agree to be interviewed)	
	To discover ways to increase catch				For consultation with experts or responsible agencies
Degraded mangrove areas	To determine changes in mangrove	Transect-plot method (Appendix 3.I.E)	Quarterly on the first year of		

PRIORITY ISSUES and CONCERNS	OBJECTIVE OF MONITORING	TOOLS FOR MONITORING	FREQUENCY OF MONITORING	REQUIREMENTS	RESPONSIBLE PARTY
	community structure thru time and patterns of recovery.		implementation; semi-annual in the succeeding years		
	To monitor growth patterns of planted trees in target rehabilitation areas.	Age reconstruction (Appendix 3.II)	Monthly (for the first year)	Tape measure Slates with pencils Scientific calculator	CALMADA TALIMUSAK
	To determine extent of present mangrove and degraded areas, as well as possible areas for rehabilitation	Detailed mapping of present and historical extent of habitat (Appendix 3.I.A); Mapping of present extent of habitat (Appendix 3.1.B); Determining the zonation of habitat (Appendix 3.1.C)	Once, at the onset of implementation of the monitoring program; but may be repeated if there are drastic changes in the mangrove ecosystem, such as reforestation of idle ponds.	Transect line/ 40-m rope Tape measure Slates with pencils	CALMADA TALIMUSAK
Lack of awareness regarding mangrove protection and proper waste disposal	To determine what information is necessary to increase community participation in mangrove protection and proper waste disposal; to determine how effective is the IEC campaign	IEC Plan (Needs to be drafted)			CALMADA and TALIMUSAK with assistance from the LGU and assisting organizations
Garbage, seaweeds, and colonizing marine invertebrates inside the MPA	To determine seasonality and type of debris that affects the health of mangroves and associated species inside the mangrove protected area.	International Coastal Clean-up data card (Appendix 8), add information on seaweed entanglement and algal bloon	Monthly	Forms Pens Survey personnel	CALMADA TALIMUSAK
Degradation of	To identify factors that	Seagrass assessment	Once		Assisting

PRIORITY ISSUES and CONCERNS	OBJECTIVE OF MONITORING	TOOLS FOR MONITORING	FREQUENCY OF MONITORING	REQUIREMENTS	RESPONSIBLE PARTY
seagrass areas	contribute to the loss of seagrass	Age reconstruction Demographic study: Quadrat method Coring method			organizations

D. Implementation schedule for 2012

Table 6: Proposed annual schedule of activities for the monitoring plan

MONITORING ACTIVITY	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC
Detailed resource and habitat mapping (for scheduling but should be done at the start of the monitoring program)												
Fisheries monitoring												
Mangrove community structure (transect-plot method)												
Age reconstruction												
IEC monitoring												
Garbage and seaweed monitoring												
Seagrass assessment												

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VI. Acknowledgements

Conservation International Philippines

Local Government Unit of Calatagan, Batangas

Calatagan Municipal Environment and Natural Resources Office

Calatagan **Ma**ngrove **D**evelopment **A**lliance (CALMADA)

Tagapangalaga ng **Li**kas-yamang dagat **mu**la **sa K**ilitisan (TALIMUSAK)

De La Salle – Lipa

De La Salle University – Manila

Ms. Morgan Chow, Peace Corps

Appendix 1. Documentation of the training on mangrove assessment and monitoring methods and establishment of monitoring sites in Balibago and Quilitisan, Calatagan, Batangas (1-3 September 2011 | Cafe Rhodora, Calatagan, Batangas)

TRAINING PROCEEDINGS

Contents

OBJECTIVES AND TRAINING DETAILS

The 3-day activity was conducted to

1) Train core members of the two organizations, namely, **Ta**gapangalaga ng **Li**kas-yamang dagat **mu**la **sa K**ilitisan (TALIMUSAK , Barangay Quilitisan) and **Cal**atagan **Ma**ngrove **D**evelopment **A**lliance (CALMADA, Barangay Balibago), on mangrove assessment and monitoring tools;
2) Establish monitoring sites within the mangrove protected areas; and
3) Collect baseline information on mangrove community structure and growth patterns of *Rhizophora* species.

This activity was conducted as an initial step towards the formulation of climate change monitoring plans for the two mangrove protected areas.

PARTICIPANTS

The majority of trainees were from Barangays Quilitisan and Balibago, particularly officers and members of TALIMUSAK and CALMADA. Representatives from the municipal government were also present, including those from the Office of the Municipal Environment and Natural Resources Officer and a member of the Peace Corps on duty in the Philippines. Faculty from De La Salle Lipa were also present, as well as two research assistants (one from CI – Philippines and another from the Marine Science Institute). Dr. Maricar S. Samson of De La Salle University facilitated the activity. The complete lists of participants for each of the three days appear in these proceedings as **APPENDIX 2**.

DAY 1

The first day consisted primarily of lectures on mangrove science, including taxonomy and field assessment methods. Planning for the field activity was carried out as a concluding activity for the day's agenda. Hand-outs for all lectures were distributed to the participants.

The first lecture "The Mangrove Ecosystem" was delivered by Dr. Samson. The following are key points from the discussion:

- The term “mangrove” may refer to either the plant or the forest.
- There are different types of mangrove forest: riverine, fringing, basin, riverine-fringing, and riverine-basin-fringing.
- Mangroves live in harsh environments, and are therefore, highly adaptable. Included in their morphological adaptations are: specialized root types; thick and succulent leaves (to avoid dessication); and seed/ propagule dispersal by seawater.
- Mangrove forests demonstrate zonation: the presence of particular species depends on the intertidal position or the position within the estuary.
- Mangroves show zonation because of propagule dispersal due to water movement, adaptation to physical gradients, and potentially anthropogenic factors.
- Management efforts have been problematic: afforestation, use of inappropriate species, and lack of an efficient and monitoring system.
- There are 44 mangrove species in the Philippines
- In the country, there are at least five threatened species, namely *Camptostemon philippinense*, *Aegiceras floridum*, *Ceriops decandra*, *Sonneratia ovata*, and *Avicennia rumphiana*.
- Based on satellite images, the present extent of mangroves is 289, 350 hectares.
- Of the present extent of mangroves, 75% are reported to be protected and 25% is alienable and disposable.
- Of the deforested area, no less than 15% are areas with expired FLAs.
- Mangroves provide important ecological and socio-economic services.
- Mangroves can be threatened directly (anthropogenic) or indirectly (natural disturbance). Threats can even include poor management actions.

In the second lecture “Mangroves and Climate Change,” Dr. Samson mentioned the following important details:

- Climate change may impact biodiversity in a variety of ways: increase in sea surface temperatures (SST); an increase in typhoon strengths and frequencies; an increase in sea levels; changes in salinity; and an increase in incidence of disease and predators.
- Climate change may cause mangroves to move seaward (progression), landward (retrogression), or disappear completely (extinction).
- Factors and levels of change will differ among habitats; for mangroves, particularly sea-level rise, an increase in typhoon strength and precipitation, an increase in air and water temperature, and an increase in CO_2, are climate-related factors with the greatest impact.
- It is believed that areas where mangroves are blocked by coastal development or steep topography are among the environments most vulnerable to climate change.
- On the other hand, areas with mangroves that are able to move landward and those surrounded by flourishing dense mangrove forests are least vulnerable to climate change.
- 5-14% of threatened mangrove species are found in the Philippines.
- Adaptation options to increase mangrove resilience to climate change include “no-regrets” strategies; establishing MPA networks that include mangrove and seagrass areas; and developing a monitoring and evaluation system.
- In the Philippines, best management strategies to enhance mangrove resilience are to use appropriate species in rehabilitation and allow mangroves to re-colonize abandoned fishponds (although this would involve a rather complicated process).

The third lecture was an introduction to mangrove taxonomy, particularly on species found in Calatagan, Batangas. Dr. Samson used the report “Mangrove assessment, nursery establishment, and rehabilitation in Calatagan, Batangas” (Conservation International – Philippines, 2010), the

handbook “Handbook of mangroves in the Philippines – Panay” (Primavera et al, 2004), and the book “World Atlas of Mangroves” (Spalding et al, 2010) as primary references. The key points of the lecture were as follows:

- Of the 44 mangrove species found in the Philippines, at least 24 have been observed in Calatagan.
- Mangrove habit: tree, shrub, palm, or fern.
- Features used in basic plant taxonomy are also applicable in mangrove taxonomy. Root type, fruit/ propagule, and flower are important morphological characteristics to be considered for mangrove identification.
- Representative mangrove genera, including *Avicennia*, *Sonneratia*, and *Rhizophora*, have been observed in Calatagan.
- Mastery of mangrove taxonomy is best achieved through “Practice, practice, practice.”

The final lecture of the day “Detecting impacts of climate change on mangroves” involved a discussion primarily on tools in mangrove assessment and monitoring. Dr. Samson considers the following essential points:

- The methods included in the lecture are designed to gain insights on the potential extent of mangroves that will be sensitive and exposed to changes in climate; and to assess the adaptive capacity of these ecosystems to climate change.
- Three basic techniques, specifically mapping, stock assessment, and age reconstruction, will be used in the assessment.
- The first set of questions (“What is the potential extent of mangrove area that will be affected by climate change?” and “How much is the degraded area that needs to be rehabilitated?”) can be answered by information obtained from mapping techniques, including the use of GIS and on-site mapping.
- The second set of questions (“What are the structural characteristics of the remaining forest?” and “Will the remaining forest be able to adapt to an increase in sea level? Increased precipitation? Increased storminess?”) can be answered through stock assessment techniques, particularly the transect-plot method. This method can provide information on dominance, density, basal area, and canopy cover.
- The third set of questions (“What is the growth pattern of the most dominant species?” and “Where are they growing fast?”) can be answered with data gleaned from the age-reconstruction technique.
- Use of appropriate tools is invaluable in achieving objectives.

The final activity for the day was a dialogue on preparations for the field assessment the following day.

DAY 2

On Day 2, the participants visited the field sites to apply the methods discussed the previous day. Specific objectives were to initially assess the mangrove protected areas, and to establish sites for monitoring. The monitoring plots established were biased towards detecting impacts of climate change, particularly, sea level rise, increased storminess and increased precipitation, on the mangrove protected areas. The species to be identified were based on the list indicated in the earlier mentioned report “Mangrove assessment, nursery establishment, and rehabilitation in Calatagan, Batangas” (CI-Philippines, 2010). Materials were provided for the participants.

In the morning, the participants assessed five plots in Barangay Balibago. These plots were selected as being representative of the species present in the CALMADA protected area. Data collection,

specifically that for age reconstruction, entailed considerations regarding the location of the plants: inner (landward) and outer (seaward). Nine of the 12 species enumerated in the CI-Philippines report were identified during this present visit.

Table 1. Mangrove species identified in the CALMADA Protected Area

SPECIES	Identified during the field visits for the CI-Philippines report (2010)	Identified during the September 2 field visit
1) *Aegiceras corniculatum*	X	X
2) *Avicennia alba*	X	?
3) *Avicennia marina*	X	X
4) *Bruguiera cylindrica*	X	X
5) *Ceriops decandra*	X	X
6) *Ceriops tagal*	X	
7) *Excoecaria agallocha*	X	
8) *Rhizophora apiculata*	X	X
9) *Rhizophora mucronata*	X	X
10) *Rhizophora stylosa*	X	X
11) *Sonneratia alba*	X	X
12) *Sonneratia caseolaris*	X	X
TOTAL	**12**	**9**

The second group of field sites, those of Barangay Quilitisan, were assessed after lunch. Six plots, also selected as representative of the TALIMUSAK protected area (Ang Pulo), were studied. Of the 17 species counted in the CI-Philippines report (2010), nine were identified during the September 2 field visit.

Table 2: Mangrove species identified in the TALIMUSAK Protected Area

SPECIES	Identified during the field visits for the CI-Philippines report (2010)	Identified during the September 2 field visit
1) *Aegiceras corniculatum*	X	X
2) *Aegiceras floridum*	X	
3) *Avicennia alba*	X	
4) *Avicennia marina*	X	X
5) *Bruguiera cylindrical*	X	X
6) *Bruguiera sexangula*	X	
7) *Ceriops decandra*	X	X
8) *Ceriops tagal*	X	
9) *Excoecaria agallocha*	X	X
10) *Lumnitzera racemosa*	X	
11) *Nypa fruticans*	X	
12) *Rhizophora apiculata*	X	X
13) *Rhizophora mucronata*	X	X
14) *Rhizophora stylosa*	X	X
15) *Sonneratia alba*	X	X
16) *Sonneratia caseolaris*	X	
17) *Xylocarpus moluccensis*	X	

TOTAL	**17**	**9**

DAY 3

Dr. Samson started off the day's activities with a brief recap of Day 2. She reiterated the methods employed during the field assessment; presented maps showing the established plots; and described the species assemblage encountered in each site. She also gave a preliminary discussion on the results obtained from the age reconstruction technique, details of which are discussed more comprehensively in the full report of this project. She further emphasized the need for more appropriate mangrove management strategies, drawing from the findings of the paper "Growth performance of mangroves planted in the Philippines" (Samson and Rollon, 2008).

To initiate the data analysis activity, Dr. Samson briefly lectured on the mathematical formulas needed to make the raw data more meaningful. She stressed that even with simple materials and basic arithmetic equations, it is already possible to gather and analyze data in relevant ways. The following are the equations included in her lecture, and used during the group activity:

- Diameter at breast height (DBH) = GBH / pi
- Basal area (m^2) = pi * [(DBH / 2) / 100]^2
- Canopy cover (m^2) = pi * crown^2

The participants broke out into two groups, according to their barangay. Each group was given the raw data for one plot. Actual figures gathered during the field assessment were for GBH, height, and crown. Trees were identified up to species level. The participants were then asked to transpose these data into the first four columns of the following table:

Species Name	GBH (cm)	Height (m)	Crown (m)	DBH	Basal Area	Canopy Cover

Using scientific calculators, they used the given equations to compute for the values needed for the last three columns. Some participants improvised and used the calculators on their cellphones. Apart from further demonstrating the ease in using the formulas, this also allowed them to finish the activity in a shorter amount of time.

In closing, Dr. Samson reviewed the next steps with the participants. She informed them that a workshop "Development of a mangrove monitoring plan for climate change adaptation in Calatagan, Batangas" was to be held on 23 September 2011. Its primary objective is to develop monitoring plans for mangrove protected areas in Balibago and Quilitisan, Calatagan, Batangas towards the formulation of adaptive management strategies to increase the resilience of these coastal ecosystems to climate change. In preparation for that activity, Dr. Samson asked each of the barangay organizations to put together a 30-minute presentation using the following guide questions:

- What are the issues and concerns within the protected area that can be answered in 1 year? In 5 years? In 10 years?

- What are the past and present management efforts being implemented in the area?
- Propose an annual schedule of activities, i.e. what is to be done on each month of the year? (Examples: stock assessment, mangrove maintenance, planting, entertaining visitors, buying seedlings, etc)
- How should these Protected Areas be promoted? (i.e. *Pinaka-bentahe ng Balibago/ Quilitisan?*)

Dr. Samson explained that knowing exactly what activities need to be done can help the community determine specific needs. She also prompted the participants to continue thinking about the data and begin coming up with ideas on how these can help them determine if their activities were successful. She also assured them she would be distributing the data worksheets in Excel format through CI-Philippines.

Finally, the participants were asked to give feedback regarding the training. This was an opportunity for them to share their experiences, exchange take-away lessons, and talk about further needs.

Ms Lucena Duman, vice-chair of TALIMUSAK, said that the age reconstruction technique was especially informative. She remarked that it was amazing that it was possible to determine the age of young trees, particularly those of the *Rhizophora* species. She also said that she better understands why CI-Philippines has directed efforts at mangrove management in their barangay.

Mr. Arturo Macalalad from the LGU said that he had some difficulty understanding the techniques during the lectures because he was from an upland barangay. He continued to say, however, that these were made more accessible to him during the actual fieldwork and data processing. He mentioned that he learned much during the training and was excited to share this new information with his own community.

While talking about the methods, the participants remarked that Ms Morgan Chow from the Peace Corps was also helpful in explaining the steps to them.

Ms Gloria Esguerra felt that her mind was refreshed because of the training. She recounted her thoughts on the first day where she wondered if they could do this on their own. She said that her mind changed during the field work because it was fun and the methods were actually easy to do. She also observed that the formulas for DBH, basal area, and cover are standards. She noted that the equations were easier to follow when it was explained why each of the steps needed to be done. She went on to say that more practice and application make these formulas better to comprehend.

Regarding the equations, Dr. Samson also suggested that younger community members could also assist with the basic math since these are lessons they regularly encounter in school.

Mr. Dionisio Gonzales from Barangay Balibago said that he learned valuable information about mangroves. He observed that the field methods taught him if the seedlings changed or grew since they were planted, and that it was possible to relate the measurement of internodes to their age. This was especially pleasing to him since he was present when the seedlings were planted.

At this point, Dr. Samson recommended that the Quilitisan community should also think about doing age reconstruction measurements for seedlings in both landward and seaward plots.

Mr. Gonzales also shared some of his observations on using different substrates for planting mangroves. He said that he and the other members of CALMADA initially experimented with different media: sand, mud, and sand with mud. They found that *bakawan (Rhizophora)* did not

grow well in sand alone, but fared better in sand with mud. He said that *kalapinay (Avicennia)*, on the other hand, showed good growth in sand.

Dr. Samson reminded the participants, though, that *Rhizophora* has difficulty growing in the low intertidal zone. This was seen somewhat in Plot 3 of Ang Pulo, which, Ms Esguerra mentioned, was planted by VIP guests.

The participants also mentioned the following needs to perform the monitoring:

- Slates with pencils
- Life vests
- Scientific calculators
- Laminated field guide

For her closing remarks, Dr. Samson acknowledged that technical support is necessary in initially setting up of the monitoring system. Expert decisions are helpful in establishing the plots, but the rest can be easily undertaken by the community. She lauded the barangays and their efforts, and added that the data gathered on field was good. She said that she would be able to effectively use it in telling a story about the protected areas. This was to be presented on the workshop on September 23.

Participants from both communities expressed their thanks for the lessons learned during the training. They admitted that they did not have previous knowledge regarding mangrove monitoring, and they agree that acquiring these technical skills is important for proper management.

APPENDIX 2: PARTICIPANT LISTS FOR 1-3 SEPTEMBER 2011

TRAINING ON CUMMUNITY-BASED MANGROVE MONITORING METHODS AND MANGROVE REHABILITATION ASSESSMENT IN CALATAGAN, BATANGAS

Calatagan, Batangas
1 September 2011

PARTICIPANTS	SIGNATURE
1. Name: Aster Caunceran Institution:Ang Pulo -Talimusak Mobile No.:	
2. Name: Annie Apolinar Institution:Ang Pulo -Talimusak Mobile No.:	
3. Name: Lucena Duman Institution:Ang Pulo -Talimusak Mobile No.:	
4. Name: Ruth Helen Ricasa Institution:Ang Pulo -Talimusak Mobile No.:	
5. Name: Gloria Esguerra Institution: Ang Pulo -Talimusak Mobile No.:	
6. Name: Edgardo Cudiamat Institution:Ang Pulo -Talimusak Mobile No.:	
7. Name: Dionisio Gonzales Institution: Ang Pulo -Talimusak Mobile No.:	
8. Name: Rommel Benitez Institution: Balibago-Calmada Mobile No.:	
9. Name: Ray Jun Magyaya Institution: Balibago-Calmada Mobile No.:	
10. Name: Leonardo Palma Institution: Balibago-Calmada	
11. Name: Bernardito Garcia Institution: Balibago-Calmada	

	PARTICIPANTS	SIGNATURE
	Mobile No.:	
12.	Name: Eping Benedictio Institution: Mobile No.:	
13.	Name: Celso Benitez Institution: Balibago-Calmada Mobile No.:	
14.	Name: James William Monreal Institution: Balibago-Calmada Mobile No.:	
15.	Name: John Christian Custodio Institution: Balibago-Calmada Mobile No.:	
16.	Name: Brandy Custodio Institution: Balibago-Calmada Mobile No.:	
17.	Name: Danilo Gamboa Institution: Balibago-Calmada Mobile No.:	
18.	Name: Arturo Macalalad Institution:LGU Mobile No.:	
19.	Name: Morgan Chow Institution: Peace Corps Mobile No.:	
20.	Name: Jun Jun Aleroza Institution: LGU Mobile No.:	
21.	Name: Rodolfo Alepusan Institution: Mobile No.:	
22.	Name: Anna Cubos Institution: CI Mobile No.:	
23.	Name: Jessie Delos Reyes Institution: CAPOCEAN Mobile No.:	
24.	Name: Bernardo Lunar Institution: DLSL Mobile No.:	
25.	Name: Marilyn Gonzales Institution: Ang Pulo-Talimusak Mobile No.:	
26.	Name: Cenon Gonzales Institution: Ang Pulo-Talimusak Mobile No.:	
26.	Name: Maricar Samson Institution: DLSU-Manila Mobile No.:	
27.	Name: Dexter Bugagao Institution: Balibago-Calmada Mobile No.:	

2 September 2011

PARTICIPANTS	SIGNATURE
1. Name: Aster Caunceran Institution:Ang Pulo -Talimusak Mobile No.:	
2. Name: Annie Apolinar Institution:Ang Pulo -Talimusak Mobile No.:	
3. Name: Lucena Duman Institution:Ang Pulo -Talimusak Mobile No.:	
4. Name: Ruth Helen Ricasa Institution:Ang Pulo -Talimusak Mobile No.:	
5. Name: Gloria Esguerra Institution: Ang Pulo -Talimusak Mobile No.:	
6. Name: Edgardo Cudiamat Institution:Ang Pulo -Talimusak Mobile No.:	
7. Name: Dionisio Gonzales Institution: Ang Pulo -Talimusak Mobile No.:	
8. Name: Rommel Benitez Institution: Balibago-Calmada Mobile No.:	
9. Name: Ray Jun Magyaya Institution: Balibago-Calmada Mobile No.:	
10. Name: Leonardo Palma Institution: Balibago-Calmada	
11. Name: Bernardito Garcia Institution: Balibago-Calmada Mobile No.:	
12. Name: Eping Benedictio Institution: Balibago-Calmada Mobile No.:	
13. Name: Celso Benitez Institution: Balibago-Calmada Mobile No.:	
14. Name: James William Monreal Institution: Balibago-Calmada Mobile No.:	
15. Name: John Christian Custodio Institution: Balibago-Calmada Mobile No.:	
16. Name: Brandy Custodio Institution: Balibago-Calmada Mobile No.:	
17. Name: Danilo Gamboa Institution: Balibago-Calmada Mobile No.:	
18. Name: Arturo Macalalad	

	PARTICIPANTS	SIGNATURE
	Institution:LGU Mobile No.:	
19.	Name: Morgan Chow Institution: Peace Corps Mobile No.:	
20.	Name: Marisol Laguardia Institution: DLSL Mobile No.:	
21.	Name: Severino Benitez Institution: Balibago-Calmada Mobile No.:	
22.	Name: Anna Cubos Institution: CI Mobile No.:	
23.	Name: Kubi Follosco Institution: UPD Mobile No.:	
24.	Name: Bernardo Lunar Institution: DLSL Mobile No.:	
25.	Name: Marilyn Gonzales Institution: Ang Pulo-Talimusak Mobile No.:	
26.	Name: Cenon Gonzales Institution: Ang Pulo-Talimusak Mobile No.:	
26.	Name: Maricar Samson Institution: DLSU-Manila Mobile No.:	
27.	Name: Dexter Bugagao Institution: Balibago-Calmada Mobile No.:	

3 September 2011

	PARTICIPANTS	SIGNATURE
1.	Name: Aster Caunceran Institution:Ang Pulo -Talimusak Mobile No.:	
2.	Name: Annie Apolinar Institution:Ang Pulo -Talimusak Mobile No.:	
3.	Name: Lucena Duman Institution:Ang Pulo -Talimusak Mobile No.:	
4.	Name: Ruth Helen Ricasa Institution:Ang Pulo -Talimusak Mobile No.:	
5.	Name: Gloria Esguerra Institution: Ang Pulo -Talimusak Mobile No.:	
6.	Name: Dionisio Gonzales Institution: Ang Pulo -Talimusak	

	PARTICIPANTS	SIGNATURE
	Mobile No.:	
7.	Name: Rommel Benitez Institution: Balibago-Calmada Mobile No.:	
8.	Name: Ray Jun Magyaya Institution: Balibago-Calmada Mobile No.:	
9.	Name: Leonardo Palma Institution: Balibago-Calmada	
10.	Name: Bernardito Garcia Institution: Balibago-Calmada Mobile No.:	
11.	Name: James William Monreal Institution: Balibago-Calmada Mobile No.:	
12.	Name: John Christian Custodio Institution: Balibago-Calmada Mobile No.:	
13.	Name: Brandy Custodio Institution: Balibago-Calmada Mobile No.:	
14.	Name: Arturo Macalalad Institution:LGU Mobile No.:	
15.	Name: Morgan Chow Institution: Peace Corps Mobile No.:	
16.	Name: Marisol Laguardia Institution: DLSL Mobile No.:	
17.	Name: Severino Benitez Institution: Balibago-Calmada Mobile No.:	
18.	Name: Anna Cubos Institution: CI Mobile No.:	
19.	Name: Kubi Follosco Institution: UPD Mobile No.:	
20.	Name: Bernardo Lunar Institution: DLSL Mobile No.:	
21.	Name: Marilyn Gonzales Institution: Ang Pulo-Talimusak Mobile No.:	
22.	Name: Maricar Samson Institution: DLSU-Manila Mobile No.:	
23.	Name: Dexter Bugagao Institution: Balibago-Calmada Mobile No.:	

Appendix 3. Tools to assess vulnerability of mangrove areas to climate change (adopted from RESILIENT SEAS Program's Training Manual, 2011)

Methodologies to assess sensitivity and vulnerability of mangroves to climate change may be divided into two: 1) detailed resource and elevation mapping; and 2) spatio-temporal profiling using age-reconstruction technique (Coultier et al. 2001; Duarte et al 2009). These two methods will help our coastal communities in answering climate change related questions such as:

1. What is the potential extent of mangrove areas that will be vulnerable to CC?
2. What are the extenuating factors that may bring about changes?
3. Will the mangrove areas be able to adapt to changes in climate?

The outline of discussion will be as follows:

I. Detailed resource and elevation mapping
   A. Mapping of historical and potential maximum extent of habitat
   B. Mapping of present extent of habitat
   C. Determining the zonation of habitat
   D. Identification of the present use of resources
   E. Stock assessment

II. Spatio-temporal profiling: age-reconstruction technique

I. DETAILED RESOURCE AND HABITAT MAPPING

The habitat and resources mapping methods are designed to determine the historical-potential maximum and present extent and zonation of habitats. Information that will be generated from these methods gives insights on the potential extent of habitats that will be sensitive and exposed to changes in climate.

Materials needed: topographical map (1:50,000), photocopy of topo map (A4 size), google map of target site, satellite image (if available), GPS, slates, pencil, colored pens, acetate, ArcView GIS software, MS Excel

A. Mapping of historical and potential maximum extent of habitat

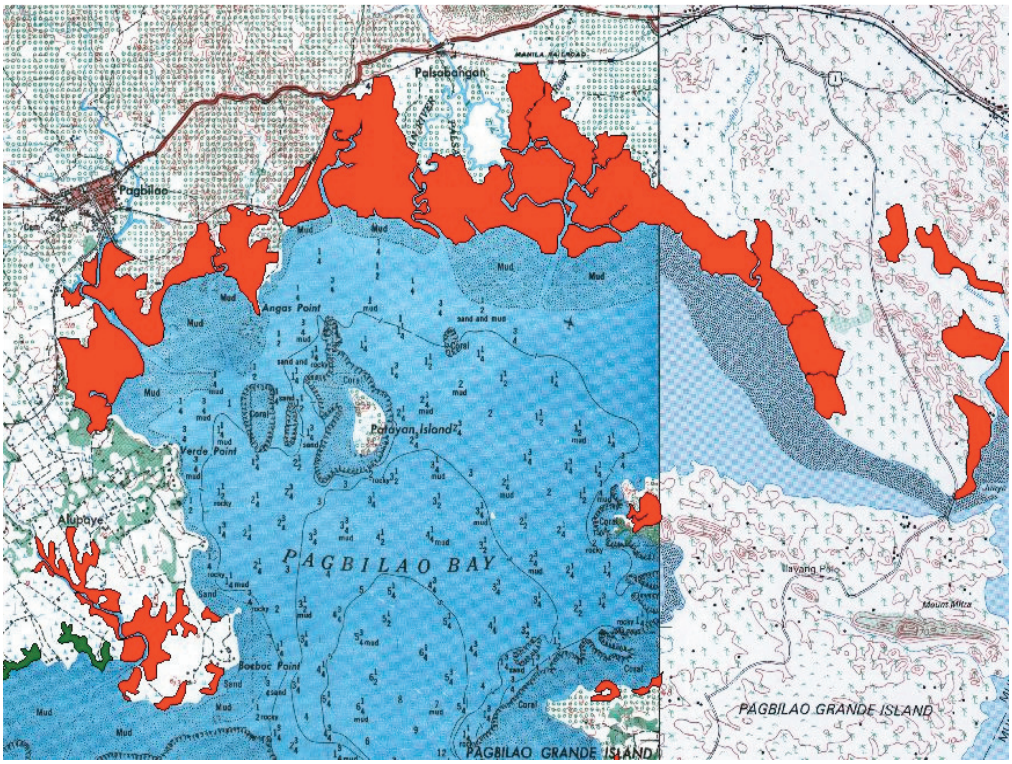
1. Obtain a 1:50,000 topographic map of the area from NAMRIA. An electronic file of the map (TIFF) is also available.

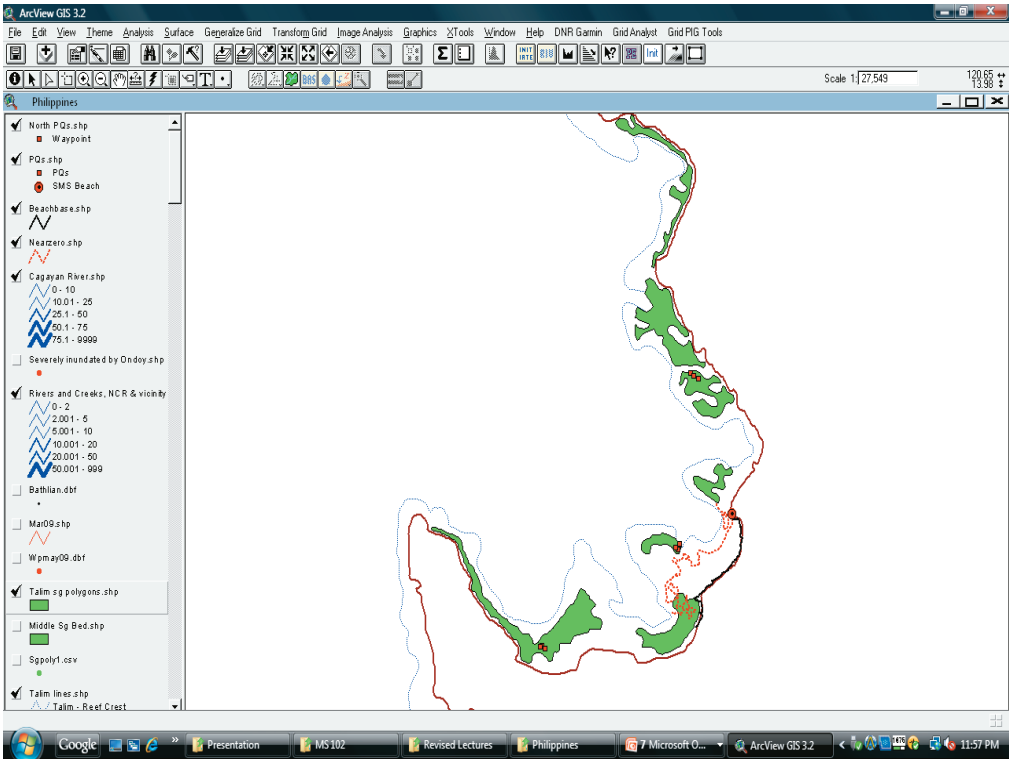
2. If there are no available electronic files, scan the target area using the highest resolution possible. The geographical

coordinate limits of the scanned area must be noted for plotting in ArcView GIS.

3. Plot the scanned map in ArcView GIS.

4. Using ArcView GIS, delineate the extent of habitat and resource-use (i.e. fishpond) by carefully digitizing each contour and/ or symbol that refers to the habitat and resource use on the map.





5. Determine the extent of each digitized category using the methods available in ArcView GIS.

6. Tabulate the results using the data sheet below.

Habitat/ resource use	Area (ha)	Notes
Ex. Sitio Ligtasin 1, Luyahan mangrove	10	Nypa
Ligtasin fishpond 1	1	

7. Consolidate the information generated using the data sheet below.

Habitat/ resource use	Area (ha)	Notes
Ex. Mangrove	10	Mostly nypa
Fishpond	25	
TOTAL		

B. Mapping of the present extent of habitat

1. On mangroves, using a GPS trace the contour of the forest by marking coordinates every 1-meter or 10-steps. Make sure that the mapping of the contour will end at the starting point. This is

best done during low tide. Take note of the species of mangroves found in the area.

2. Download the GPS coordinates and use ArcView to plot the contours.

3. Determine the extent of each contour using the methods available in ArcView GIS.

4. Tabulate the results using the data sheet below.

Habitat/ resource use	Area (ha)	Notes
Ex. Galvez mangrove	10	Ra,Rs,Sa
Galvez fishponds	25	25% active; mostly with FLAs

5. Consolidate the information generated using the data sheet below.

Habitat/ resource use	Area (ha)	Notes
Ex. Mangrove	10	Ra, Rs, Sa, Am
Fishpond	25	50% active
TOTAL		

6. As an example, the information from methods a and b may be presented as follow:

Town/City	Extent of mangroves, hectares			
	Historical, potential (% of total)	2000 satellite image (% of total)	forest loss	% reduction
Lucena	830.11 (14.2)	190.32 (10.6)	639.79	77.07
Sariaya	276.13 (4.7)	85.60* (4.8)	190.53	69.00
Pagbilao	1222.59 (20.9)	549.33 (30.5)	673.26	55.07
Padre Burgos	782.95 (13.4)	287.56 (16.0)	495.39	63.27
Agdangan	157.62 (2.7)	52.79 (2.9)	104.83	66.51
Unisan	356.55 (6.1)	186.58 (10.4)	178.97	47.67
Pitogo	554.46 (9.5)	69.02 (3.8)	485.44	87.55
Gumaca	57.04 (1.0)	17.68* (1.0)	39.36	69.00
Macalelon	389.04 (6.6)	73.39 (4.1)	315.65	81.14

Town/City	Extent of mangroves, hectares			
	Historical, potential (% of total)	2000 satellite image (% of total)	forest loss	% reduction
General Luna	281.24 (4.8)	30.80 (1.7)	250.44	89.05
Catanauan	527.25 (9.0)	101.65 (5.7)	425.60	80.72
Mulanay	88.52 (1.5)	51.90 (2.9)	36.62	41.37
San Francisco	335.59 (5.7)	102.26 (5.7)	233.33	69.53
Total for Tayabas Bay	5868.09	1798.88	4,069.21	69.53
Total for Calauag Bay	2,978.00	2409.17	568.83	19.10

C. Determining the zonation of habitat

1) On a mangrove area, lay the transect line or marked rope perpendicular to the shore. One may start from the landward area to the sea or whichever is doable at the time of survey.

2) Every 10m, note down the species of mangroves and associated organisms. The interval may be adjusted depending on the extent of mangrove area and change in the type of species assemblage. Take note of gaps, cuttings, river channels, fishponds that maybe found inside the mangrove area. Use the data sheet below to record observations.

Distance (m)	Mangrove species	Associated organisms	Notes
0	Nf	Crabs	
10	Cd, Bg		
20			Fishpond
30	Ra, Rs	Crabs	

D. Identification of the present use of resources

The resource-use mapping methods are designed to identify present use and potential threats to these habitats. This information will be valuable in assessing the potential impact and adaptive capacity of mangroves and seagrasses in the area to climate change.

1. Invite 8 to 10 resource persons from the community consisting of fishers (esp. those operating in mangrove areas), gleaners,

fish vendors, fish pond operator/ caretaker, MPDC and/or MAO, and representatives of industries operating in the coastal area.

2. Let the participants identify the different activities and resources within the seagrass and mangrove areas using the 1st three columns of table below.

Activity	Resources/ Catch	Location of activity	Rank of activities	Notes
Ex. Fishpond	Bangus	Matuod creek		
Crab pot	Mud crab	Galvez mangrove		

3. Rank activities according to level of economic importance.

E. Stock assessment

This method is designed to assess the present diversity, density, abundance, and community structure of mangroves and seagrasses in the area.

Transect-plot method

Assessment of mangrove habitats will be carried out using the transect-plot method described in English et al. 1994.

Materials needed: transect line/ pre-measured rope, tape measure, Handbook of mangrove species, slates, pencil, booties, GPS

1) In target sites, establish 10m x 10m plot, the number of such plots may range from 2 to 5 per site, depending on the seaward extent of the mangrove vegetation. In principle, the distribution of such plots should cover different forest types both parallel and perpendicular to the shoreline.
2) For each plot, count the total number of mature trees (depending on the species, but generally the diameter > 4 cm). For all mature trees, measure the girth at breast height, i.e., approximately 1.3 m from the ground; estimate the tree height; and crown diameter.
3) The density of saplings (diameter < 4 cm) within 5m x 5m subplots (if the density is high, else, the entire 10m x 10m was used) will also be determined.
4) Similarly, the density of seedlings (height < 1 m) will be determined using even smaller subplots (1m x 1m).
5) Use the data sheet below to record observations.

Species	Height (m)	GBH (cm)	Crown (m)	Notes

6) Compute for DBH (cm) = GBH/pi; basal area (m^2) = pi*((DBH/2)/100)^2; Canopy index (m^2) = pi*(crown)^2

   where pi is equal to 3.1416

7) The data may be presented as follows:

Table X. Occurrence of mangrove species in _____ surveyed on _____, 2010.

Species	Site 1	Site 2	Site 3	n sites	% of sites
Ex. Rhizophora apiculata	√		√	2	66.6
R. mucronata			√	1	33.3
R. stylosa	√	√	√	3	100
N. fruticans	√	√		2	66.6
n species	3	2	3		

Table X. Stem density (# trees per 10m x 10m plot) of mangroves at various sites in _____ surveyed on _____, 2010.

Species	Site 1	Site 2	Site 3	Mean
Ex. Rhizophora apiculata	10		20	10
R. mucronata			40	13
R. stylosa	10	5	15	10
N. fruticans	20	10		10
total tree density	40	15	75	
total n species	3	2	3	

Table X. Basal area (m^2 per hectare) of mangroves at various sites in _____ surveyed on _____, 2010.

Species	Site 1	Site 2	Site 3	Mean
Ex. Rhizophora apiculata	12.3		10.3	7.5
R. mucronata			15.1	5.0
R. stylosa	10.3	10.1	10.3	10.2
Nypa fruticans				
basal area, all species	22.6	10.1	35.7	
total n species	3	2	3	

Table X. Canopy index (ground cover of tree crowns relative to 10m x 10m plot) of mangroves at various sites in _____ surveyed on _____, 2010.

Species	Site 1	Site 2	Site 3	Mean
Ex. Rhizophora apiculata	12.3		10.3	7.5
R. mucronata			15.1	5.0
R. stylosa	10.3	10.1	10.3	10.2
Nypa fruticans				
canopy index, all species	22.6	10.1	35.7	
total n species	3	2	3	

II. SPATIO-TEMPORAL PROFILING

Age-reconstruction technique

Age-reconstruction techniques (Coultier et al. 2001; Duarte et al. 1999) will be applied to compare spatio-temporal patterns in growth of young (< 10 years old) *Rhizophora* trees between sites.

Materials needed: tape measure, slates, pencil

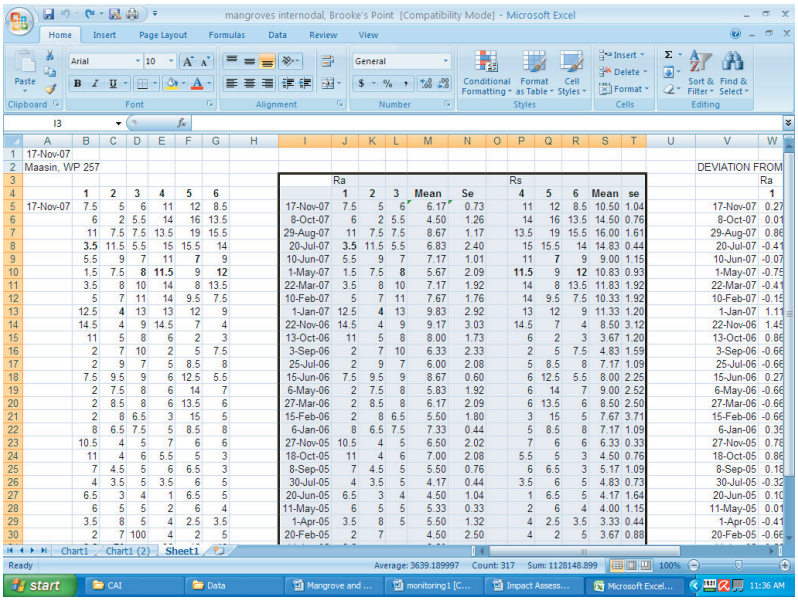
a) Determination of plastochron interval
   i. As plastochron interval (PI) estimates are crucial in the accuracy of these patterns, PI values will be determined in selected mangrove areas. For this, 30 to 100 young trees will be marked (N_{tot}) in each of the sites, and, after a period (observation period in days (OBS) of 4 to 5 months), the number of new leaf pairs will be counted (N_{new}). PI will then be calculated as: N_{tot} x OBS / N_{new}.

b) Measurement of plastochron interval
   i. Choose young *Rhizophora* (of the same species) trees, young trees without any branching and which could still be bent for ease of measurement.
   ii. From the youngest leaf node (that which possesses the new leaves), measure each internode down to the most visible internode.

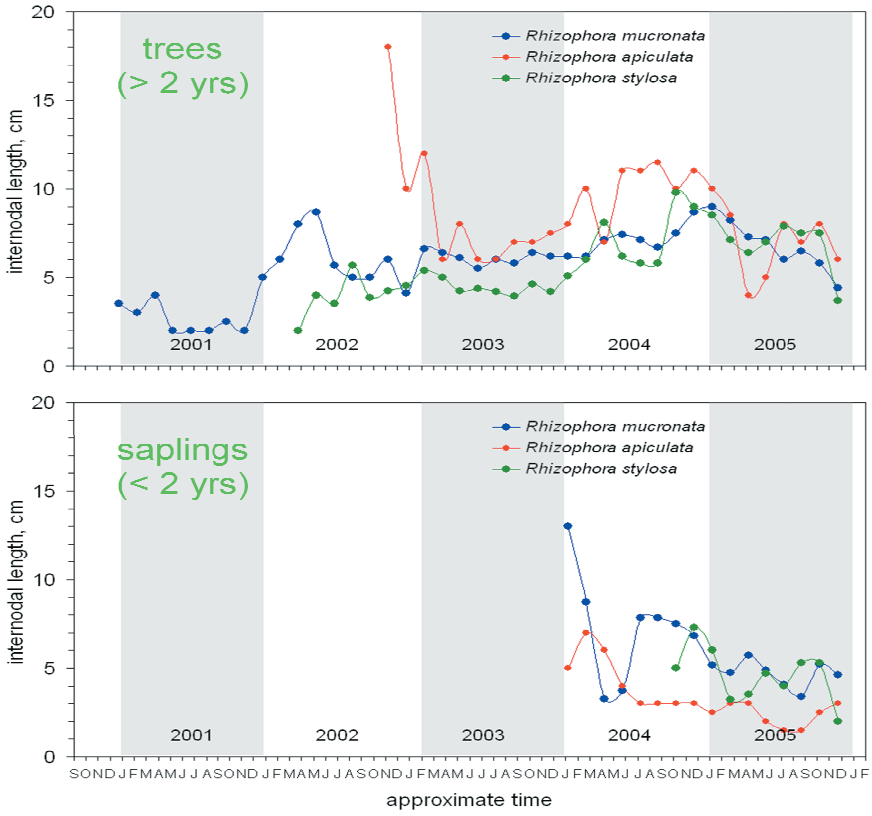
iii. Record observations using this sheet.

Internode no.	Length (cm)			
	Ra1	Rs1	Rs2	Ra2
1	1.5			
2	1.5			
3	1			
4	.5			
5	.5			

iv. The data may be encoded in Excel sheet as follows. The approximate date of the first measured internode will correspond to the day when the observation was made.



v. Data may be presented as follows by plotting the approximate age of the tree (x-axis) with each corresponding internodal length (y-axis).



Appendix 4. Development of a mangrove monitoring plan for climate change adaptation in Calatagan, Batangas (23 September 2011 | Café Rhodora, Calatagan, Batangas)

CONTENTS

1. WORKSHOP OBJECTIVE

The primary aim of the workshop was to develop monitoring plans for mangrove protected areas in Balibago and Quilitisan, Calatagan, Batangas towards the formulation of adaptive management strategies to increase the resilience of these coastal ecosystems to climate change (CC).

This activity was convened as a follow-up to the 3-day "Training on Mangrove Assessment and Monitoring Methods and Establishment of Monitoring Sites," which was also held in Calatagan, Batangas on 1-3 September 2011.

2. PARTICIPANTS

As in the earlier training, participants in the workshop were mainly community members from Barangays Quilitisan and Balibago. Particularly, these individuals are officers and members of the organizations TALIMUSAK and CALMADA. Ms Emelyn Custodio, the Municipal Environment and Natural Resources Officer (MENRO), and a staff member from her office were also present. Ms Evangeline Miclat, the program coordinator for the Coral Triangle Support Partnership (CTSP) – Conservation International-Philippines; Ms Marisol Laguardia, a mentee of the CTSP mentoring program; Dr. Severino Salmo, a mangrove expert associated with Central Luzon State University (CLSU); and two research assistants (one from CI-Philippines and another from the Marine Science Institute) were also in attendance. Dr. Maricar S. Samson of De La Salle University facilitated the activity. The complete list of participants for the workshop appears in these proceedings as **APPENDIX 5**.

3. WORKSHOP PROPER

The program for the day was as follows:

DATE/ TIME	ACTIVITY
8:00 – 8:30am	Opening program • Opening prayer • Expectation setting
8:30 – 9:30am	Sharing of initiatives, issues and concerns of CALMADA and Ang Pulo Mangrove MPAs
9:30 – 10:00am	Feedback of results (MS Samson)
10:00 – 11:00am	Workshop I: Identification of issues and problems related to mangrove management with emphasis on CC related issues and problems

DATE/ TIME	ACTIVITY
11:00 – 12:00nn	Reporting and critiquing for workshop I
12:00nn – 1:00pm	LUNCH
1:00 – 2:30pm	Workshop II: Mangrove monitoring plan
2:30 – 4:00pm	Reporting and critiquing of mangrove monitoring plan
4:00 – 5:00pm	Next steps

To draw a connection between the previous training and set the workshop in perspective, representatives from TALIMUSAK and CALMADA each gave a 30-minute presentation regarding management issues in their respective protected areas. The following guide questions were used in preparing these reports:

- What are the issues and concerns within the protected area that can be answered in 1 year? In 5 years? In 10 years?
- What are the past and present management efforts being implemented in the area?
- Propose an annual schedule of activities, i.e. what is to be done on each month of the year? (Examples: stock assessment, mangrove maintenance, planting, entertaining visitors, buying seedlings, etc)
- How should these Protected Areas be promoted? (i.e. *Pinaka-bentahe ng Balibago/ Quilitisan?*)

The organization TALIMUSAK is responsible for managing the mangrove protected area in Barangay Quilitisan. The protected area, referred to as "Ang Pulo," is maintained as a mangrove rehabilitation site and an ecotourism attraction. As the organization's treasurer, Ms Gloria Esguerra delivered the first portion of the TALIMUSAK presentation, which was a financial report for the years 2010 and 2011 (as of August). The following are a summary of figures from the report:

- Total income 2010: PHP 191,259.00
- Total expenses 2010: PHP 183,336.50
- Total income as of August 2011: PHP 84,500.00
- Total expenses as of August 2011: PHP 92,522.00 (Expenses include lending assistance to members and maintenance costs.)

Ms Esguerra said that generated funds are often used for construction and maintenance. Guest entrance fees have been helpful in raising funds for various needs including functioning bathrooms for visitors. She mentioned that the Office of the MENRO and Mr. Jessie delos Reyes have been very supportive, saying that they have been instrumental in bringing in more visitors.

Mr. Dionisio Gonzales, Chairman of TALIMUSAK, gave the main presentation. The following are key points from the report:

- Main concerns include the accumulation of garbage from various sources during the rainy season; poor weather conditions in August and September (*"tag-lumot"*); and cases of persistent mangrove logging. An additional but important issue is the build-up of sediments on the seagrass beds (*"Natatabunan ang seagrass."*)
- Recommendations to address these concerns are the installation of "break garbage," a net around the perimeter of Ang Pulo to prevent trash from drifting in; continued monitoring of young trees; promote the regulations that prohibits the cutting of mangroves by affixing more signs in the area.

- Current protective measures include an existing mangrove monitoring plan; continued reforestation; consistent monitoring of mangroves, especially when the weather conditions are harsh; and repeated cleaning of areas that have been polluted with garbage.
- Activities include everyday monitoring of the area by TALIMUSAK members and monthly organization meetings.
- More visitors are typically present during the dry months, particularly from December to May.
- Selling points of Ang Pulo are the considerable number of mangrove species in the area; healthy and robust trees; the willingness of TALIMUSAK members to manage the protected area; and the presence of extensive seagrass beds for gleaning.

PHOTO: TALIMUSAK Chairman Mr. Gonzales presents a report on current management efforts in Ang Pulo.

An encoded version of the visual aid, as used in the actual report, is **APPENDIX 6**.

The organization CALMADA is primarily responsible for the management of the mangrove protected area in Barangay Balibago. CI-Philippines and the local government initially engaged 12 families to start the organization. The relatively small number of families was intended as a core group, and there are plans to invite new members. Three hectares of mangrove area were planted from 17 March to 9 April 2011. This area is presently being maintained. Mr. James Monreal presented the report prepared by CALMADA, and emphasized the following details:

- An issue in the protected area that may be addressed in one year is improper disposal of garbage.
- There is a desire to increase the number of mangrove species in the protected area within the period of five years.
- CALMADA envisions that the present mangrove area will have progressed into a flourishing stand within ten years.
- Present management efforts include frequent visits to the area for cleaning and to monitor seedling growth; constant monitoring of the different mangrove species; and prohibition of mangrove logging.
- Annual schedule of activities:
  - *January – February:* Cleaning; removal of garbage
  - *March:* Observation/ monitoring of seedlings

- *April – May:* Harvesting propagules
- *June – August:* Cleaning; removal of garbage
- *September – October:* Observation/ monitoring of seedlings and existing trees
- *November – December:* Cleaning and construction of structural needs

- So far, seedlings sold have only included *bakhawan (Rhizophora)* and *kalapinay (Avicennia)*.

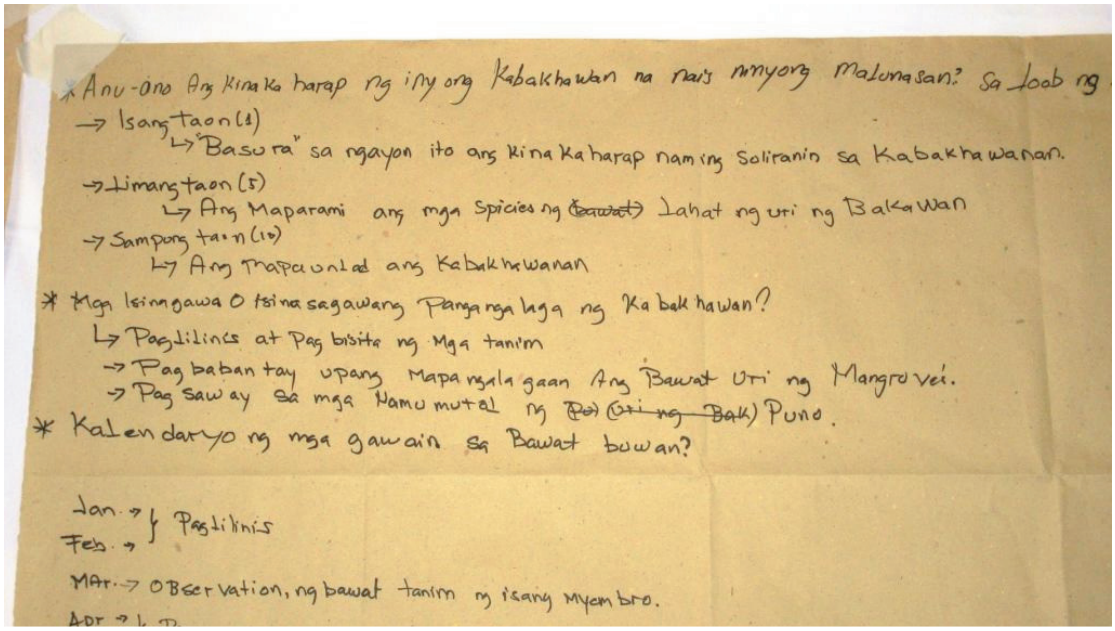


PHOTO: Issues in the CALMADA mangrove PA that may be addressed in one year, five years, and ten years.

Ms Custodio conveyed that an ordinance for the protected area is currently being processed. CALMADA now has a resolution draft, which is being reviewed and will later be passed on to the Sangguniang Bayan (SB). The LGU will continue to pursue this since the municipal Environmental Code requires coastal barangays to establish at least one MPA. There is also a proposed resolution at the municipal level, detailing environmental users' fees. After legal review, it is intended to be passed as an Executive Order and will not necessitate evaluation by the SB.

The visual aid used in the presentation was also encoded and is included here as **APPENDIX 7.**

After clarifying if there were no other questions or concerns regarding either report, Dr. Samson went on to present the results from the data obtained during the field visits on 2 September 2011. The findings, she remarked, indicated that many processes were already occurring despite the young age of the stands.

Dr. Samson structured the discussion in such a way that the results answered specific questions relating to the vulnerability of mangroves to CC. Particularly, she linked it to the Integrated Coastal Sensitivity, Exposure, and Adaptive Capacity for CC (ICSEACChange) Assessment Tool. It was noted that this was the first time the participants heard of the ICSEACChange.

Dr. Samson used Google Earth maps to remind the participants of where the plots are located within the protected areas. Graphs describing community structure and seedling growth were also presented. The following are key points mentioned during the discussion:

- The method used to assess community structure utilizes stem density rather than tree density.

- In both barangays, fast-colonizing mangrove species are present, particularly, *Avicennia marina* in Balibago, and *Ceriops decandra* and again *A. marina* in Quilitisan.
- In conducting the initial assessment, both barangays were able to obtain relevant information to accomplish ICSEACChange (Level 1), as well as a more detailed mangrove Vulnerability Assessment (Level 3). The latter is a work in progress, currently being developed by Dr. Samson and Dr. Rene Rollon. (This presentation was the first time it was presented.)
- Results for the age reconstruction technique showed that the young trees typically follow a seasonal growth pattern, where they display weak growth during the period from June to December and strong growth from March to May.
- In Barangay Balibago, *Rhizophora stylosa* seedlings in the seaward plot showed weak growth. Better growth was observed for counterparts in Plot 3, an inner plot.
- *Rhizophora apiculata* showed weak growth in Plot 1 of Ang Pulo, but demonstrated better seasonal growth in inner plots of the CALMADA protected area. *Rhizophora* species are known to have better chances of survival in the mid- to high- intertidal zones.
- There are many *Rhizophora mucronata* trees in Barangay Balibago, and it may be appropriate to increase their number. However, it should be remembered that, like other *Rhizophora* species, these trees will grow better in more landward sites.
- Mangroves can be impacted by both climate-related factors (increase in frequency and magnitude of tropical cyclones and changing patterns of precipitation), as well as local stresses (construction of fishponds).

PHOTO: Dr. Samson presents the results obtained from the field assessment on 2 September 2011.

Dr. Samson also prepared notes and observations from her experience in the protected areas. She communicated these to the participants as follows:

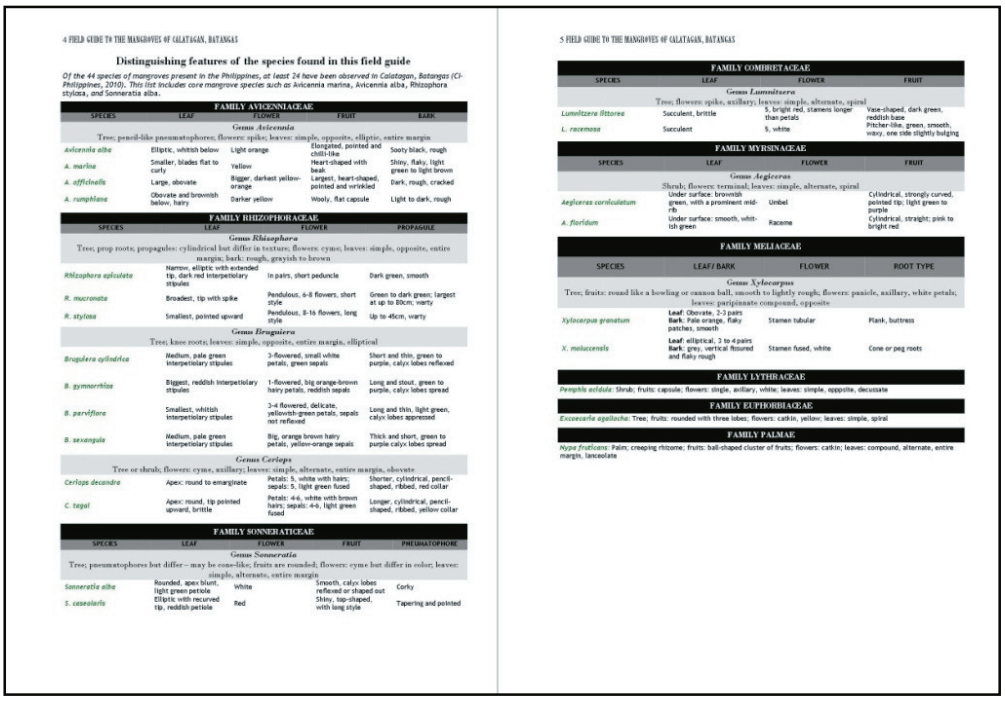
- The barangays' effort to plant in forest gaps is commendable.
- In planting *Rhizophora* species, it is important to remember to space seedlings at 1m X 1m at least (applicable to all species). Planting monospecific *Rhizophora stylosa* stands should be avoided. The barangays should consider maximizing their own seedling sources.

- The PO members' knowledge on different mangrove species is admirable. On the other hand, it may also be helpful to consider other identifying characteristics like substrate, position in zonation, etc because plants are very adaptable.
- Both MPAs already have management or business plans, but they need to be enhanced to incorporate CC. Also, the status of implementation should be monitored. One product for each barangay is acceptable, but there is a need to strengthen the objectives of the management intervention. The aims for Barangay Quilitisan are directed towards conservation and protection while that of Barangay Balibago is more focused on rehabilitation.
  **Ms Miclat offered that the incorporation of CC in management plans is a step up for mangrove rehabilitation. Presently, management considers mangrove function in terms of food security, economic benefits (ecotourism and sale of seedlings), and coastal protection. Now, however, there is a pressing need to find out if present management is taking into account how to respond to exacerbated coastal impacts due to CC. A monitoring plan provides the means to answer that question, as well as determine how effective the management is in general. Further, it can reveal if there is a need to enhance or re-do existing strategies. If such a need is perceived, the next step would be to mainstream climate-related strategies in existing management plans. Present conservation efforts are re-focusing objectives to prepare for the inevitability of CC.*
- The impacts of sedimentation are apparent in the protected areas.

In addition to the above observations, Dr. Samson also formulated a series of questions the management organizations should also reflect on:

- Are patterns, particularly those of seedling recruitment and growth, observed all year round?
- What are associated organisms? Do they appear at different times of the year? Is there a need to protect them as well?
- What is the impact of sedimentation? What is the rate of sedimentation? What species will be most efficient in stabilizing sediments?
- What is the impact of mangrove planting? On the substrate? On associated organisms? On the recruitment pattern?
  **The rehabilitation of degraded mangrove areas, including planting in historical mangrove sites, is a no-regret strategy.*
- What is the impact of visitors to the mangrove areas?
  **Should a quota be imposed to minimize human impacts?*

During the break, Dr. Samson presented a draft of the field guide to the mangroves of Quilitisan and Balibago prepared by Ms Noreen Follosco. The participants expressed that the guide would be very useful to them, but suggested that their local name for trees of the genus *Avicennia*, *"kalapinay,"* be added to the sections on those species. Dr. Samson said that she would review the draft and once finalized, copies will be laminated and given to the organizations for instruction and use in the field. She also suggested that, should the groups come into additional funds or assistance, it may be helpful to have a larger (i.e. flip chart) version of the material printed as a more effective teaching aid. It was emphasized that the guide is not for widespread distribution.



4 FIELD GUIDE TO THE MANGROVES OF CALATAGAN, BATANGAS

Distinguishing features of the species found in this field guide

Of the 44 species of mangroves present in the Philippines, at least 24 have been observed in Calatagan, Batangas (CI-Philippines, 2010). This list includes core mangrove species such as Avicennia marina, Avicennia alba, Rhizophora stylosa, *and* Sonneratia alba.

FAMILY AVICENNIACEAE

SPECIES	LEAF	FLOWER	FRUIT	BARK
Genus Avicennia				
Tree; pencil-like pneumatophores; flowers: spike; leaves: simple, opposite, elliptic, entire margin				
Avicennia alba	Elliptic, whitish below	Light orange	Elongated, pointed and chilli-like	Sooty black, rough
A. marina	Smaller, blades flat to curly	Yellow	Heart-shaped with beak	Shiny, flaky, light green to light brown
A. officinalis	Large, obovate	Bigger, darkest yellow-orange	Largest, heart-shaped, pointed and wrinkled	Dark, rough, cracked
A. rumphiana	Obovate and brownish below, hairy	Darker yellow	Wooly, flat capsule	Light to dark, rough

FAMILY RHIZOPHORACEAE

SPECIES	LEAF	FLOWER	PROPAGULE
Genus Rhizophora			
Tree; prop roots; propagules: cylindrical but differ in texture; flowers: cyme; leaves: simple, opposite, entire margin; bark: rough, grayish to brown			
Rhizophora apiculata	Narrow, elliptic with extended tip, dark red interpetiolary stipules	In pairs, short peduncle	Dark green, smooth
R. mucronata	Broadest, tip with spike	Pendulous, 6-8 flowers, short style	Green to dark green; largest at up to 80cm; warty
R. stylosa	Smallest, pointed upward	Pendulous, 8-16 flowers, long style	Up to 45cm, warty
Genus Bruguiera			
Tree; knee roots; leaves: simple, opposite, entire margin, elliptical			
Bruguiera cylindrica	Medium, pale green interpetiolary stipules	3-flowered, small white petals, green sepals	Short and thin, green to purple, calyx lobes reflexed
B. gymnorrhiza	Biggest, reddish interpetiolary stipules	1-flowered, big orange-brown hairy petals, reddish sepals	Long and stout, green to purple, calyx lobes spread
B. parviflora	Smallest, whitish interpetiolary stipules	3-4 flowered, delicate, yellowish-green petals, sepals not reflexed	Long and thin, light green, calyx lobes appressed
B. sexangula	Medium, pale green interpetiolary stipules	Big, orange brown hairy petals, yellow-orange sepals	Thick and short, green to purple calyx lobes spread
Genus Ceriops			
Tree or shrub; flowers: cyme, axillary; leaves: simple, alternate, entire margin, obovate			
Ceriops decandra	Apex: round to emarginate	Petals: 5, white with hairs; sepals: 5, light green fused	Shorter, cylindrical, pencil-shaped, ribbed, red collar
C. tagal	Apex: round, tip pointed upward, brittle	Petals: 4-6, white with brown hairy; sepals: 4-6, light green fused	Longer, cylindrical, pencil-shaped, ribbed, yellow collar

FAMILY SONNERATICEAE

SPECIES	LEAF	FLOWER	FRUIT	PNEUMATOPHORE
Genus Sonneratia				
Tree; pneumatophores but differ—may be cone-like; fruits are rounded; flowers: cyme but differ in color; leaves: simple, alternate, entire margin				
Sonneratia alba	Rounded, apex blunt, light green petiole	White	Smooth, calyx lobes reflexed or shaped out	Corky
S. caseolaris	Elliptic with recurved tip, reddish petiole	Red	Shiny, top-shaped, with long style	Tapering and pointed

5 FIELD GUIDE TO THE MANGROVES OF CALATAGAN, BATANGAS

FAMILY COMBRETACEAE

SPECIES	LEAF	FLOWER	FRUIT
Genus Lumnitzera			
Tree; flowers: spike, axillary; leaves: simple, alternate, spiral			
Lumnitzera littorea	Succulent, brittle	5, bright red, stamens longer than petals	Vase-shaped, dark green, reddish base
L. racemosa	Succulent	5, white	Pitcher-like, green, smooth, waxy, one side slightly bulging

FAMILY MYRSINACEAE

SPECIES	LEAF	FLOWER	FRUIT
Genus Aegiceras			
Shrub; flowers: terminal; leaves: simple, alternate, spiral			
Aegiceras corniculatum	Under surface: brownish green, with a prominent mid-rib	Umbel	Cylindrical, strongly curved, pointed tip; light green to purple
A. floridum	Under surface: smooth, whitish green	Raceme	Cylindrical, straight; pink to bright red

FAMILY MELIACEAE

SPECIES	LEAF/ BARK	FLOWER	ROOT TYPE
Genus Xylocarpus			
Tree; fruits: round like a bowling or cannon ball, smooth to lightly rough; flowers: panicle, axillary, white petals; leaves: paripinnate compound, opposite			
Xylocarpus granatum	Leaf: Obovate, 2-3 pairs Bark: Pale orange, flaky patches, smooth	Stamen tubular	Plank, buttress
X. moluccensis	Leaf: elliptical, 3 to 4 pairs Bark: grey, vertical fissured and flaky rough	Stamen fused, white	Cone or peg roots

FAMILY LYTHRACEAE

Pemphis acidula: Shrub; fruits: capsule; flowers: single, axillary, white; leaves: simple, opposite, decussate

FAMILY EUPHORBIACEAE

Excoecaria agallocha: Tree; fruits: rounded with three lobes; flowers: catkin, yellow; leaves: simple, spiral

FAMILY PALMAE

Nypa fruticans: Palm; creeping rhizome; fruits: ball-shaped cluster of fruits; flowers: catkin; leaves: compound, alternate, entire margin, lanceolate

PHOTO: Pages 4 and 5 of the field guide draft version.

3a. <u>Workshop I</u>: Identification of issues and problems related to mangrove management with emphasis on climate change related issues and problems

To begin the workshop, Dr. Samson instructed the plenary group to write down issues and problems related to mangrove management with particular focus on climate-related concerns. Each idea was to be written on a metacard and then attached to a table that classified whether issues were concerned with Conservation/ Protection, Restoration/ Rehabilitation, Sustainable Utilization, or Program Implementation. Issues under Program Implementation were to be classified further as Political-Institutional, Organizational, Economic, or Social. **<u>Table 1</u>** summarizes the results of the workshop.

A plenary discussion also facilitated by Dr. Samson immediately followed the workshop activity. The following are key points mentioned:

- In assessing the growth pattern of the mangroves, details such as how often it needs to be conducted should be clarified.
- The loss of mangrove associated species needs to be quantified. Monitoring can provide information that can be used to determine no-take months. The question is how such monitoring should be undertaken.
  **Lampshells were discussed as an example of mangrove associated organisms being consumed and sold.*
- Dr. Jurgenne Primavera, the premiere mangrove expert in the country, found that the present ratio of mangrove to fishpond is 0.5 to 1. If the habitat is to respond successfully to CC, the ratio should be 4 mangroves to 1 fishpond. It is hoped that areas undergoing mangrove rehabilitation will at least go beyond the prescribed 0.5. This will be invaluable in addressing the continuous degradation.
- Maps describing the present mangrove extent in Calatagan, Batangas are being prepared by CI-Philippines. Information includes the area of fishponds relative to mangroves. These will soon be available for distribution.

- Because maps can show changes in mangrove areas, they can reveal actual results from the rehabilitation efforts. Visual evidence can be encouraging to coastal managers and practitioners. In addition, spatial knowledge of the area will allow for quick valuation in the event of a disaster (e.g. oil spills). This will also provide a baseline so that it is easy to determine how much of the area is in need of rehabilitation or protection.
- Sedimentation patterns are the result of complex processes, but there are simple studies that can also be conducted by the POs.
- Monitoring garbage and seaweed entering the protected areas is already being done; more detailed efforts just need to be incorporated.
- Barangay Quilitisan already has a business monitoring plan in place because of the livelihood dimension of the rehabilitation program. It would also be appropriate for members of Barangay Balibago to develop an economic monitoring plan of their own.
- IEC on proper garbage disposal and mangrove protection can be done during regular community meetings. Is this also possible to conduct for the entire municipality?
- There are five hectares of abandoned fishponds in Balibago. There is still a need to identify an action for these areas.
  **Ms Custodio said that the presence of titled but unproductive ponds is a common issue in Calatagan, but has not been reported in Quilitisan and Balibago.*
- There is a recognized need among the participants to protect the adjacent habitats (i.e. seagrasses) as well.

PHOTO: For Workshop I, participants write issues on metacards then attach them to a template.

When the participants finished indentifying their issues, Dr. Samson asked them to consider which of these could be addressed with the establishment of a monitoring plan; and which CC related issues needed to be prioritized.

1. *Which of the issues and problems on climate change can be addressed with the establishment of a monitoring plan?*

- IEC monitoring
- Community structure
- Growth patterns (Possible with the aid of appropriate tools such as scientific calculators [c/o CI-Philippines])
- Mapping (Possible with the aid of a GPS; the Bantay Dagat do have GPS that may be borrowed)
- Monitoring associated organisms (Possible if there are prepared forms or established methods; a constant log was also suggested for this; CI-Philippines has already done a survey on birds in Ang Pulo)

*There is a need for technical assistance for further training in seagrass monitoring methods; and assessment of sedimentation patterns and impacts.
**Dr. Samson suggested that a "twin" system be established between the two barangays. One barangay could assist the other in implementing activities, especially if that barangay had greater capacity in that particular pursuit.

2. *What are the climate change related issues that need to be prioritized?*

Barangay Quilitisan:
- Decrease in fisheries catch/ mangrove associated organisms (shells, clams, etc)
- Lack of awareness on proper waste management and the importance of mangrove protection

Barangay Balibago:
Monitoring of mangrove transplants and nursery

3b. <u>Workshop II</u>: Mangrove Monitoring Plan

Upon identification of priority CC issues, the plenary moved on to Workshop II. Dr. Samson asked the participants to formulate monitoring objectives in relation to these issues. She then asked them to consider what monitoring tools were best suited to fulfilling these objectives, and how often these tools should be applied. In addition, she had the participants identify specific needs for each monitoring activity. Finally, the people or groups who might be responsible for implementing each monitoring action were identified. **<u>Table 2</u>** summarizes the results of the activity. Additional comments and points of discussion are also included in the table as italicized notes. **<u>Table 3</u>** is the proposed annual schedule of activities.

Table 1: Management concerns with emphasis on climate change related issues and problems in Barangays Quilitisan and Balibago (Results of Workshop I)

Conservation/ Protection	Restoration/ Rehabilitation	Sustainable utilization	Plan Implementation			
			Political-Institutional	Organizational	Economic	Social
Decline in fisheries and mangrove-associated organisms	Increase in mangroves, but loss in seagrass	Degradation of seagrass beds	Implementation of and adherence to the rules and regulations of the organization			Need IEC on proper garbage disposal
Need to monitor mangrove community structure	Need to continuously maintain and monitor mangroves	Need to plant more mangroves in the correct areas		Transparency in relation to sources and use of funds		Need IEC to raise awareness on mangroves and their protection
Need to monitor mangrove-associated organisms	Need to maintain and monitor newly planted trees/ young trees; to monitor growth patterns	Garbage problem		Proper utilization of funds		Need for an IEC monitoring plan
Need to assess sedimentation patterns/ impacts	Need to map protected mangrove area (knowledge of degraded and rehabilitated area			Confusion regarding management activities among members of the organization		
				Travel to other mangrove areas to see other species and improve skills in identification		

Table 2: Outline for a mangrove monitoring plan with focus on climate change-related issues for Barangays Quilitisan and Balibago (Results of Workshop II)

PRIORITY CC ISSUE	OBJECTIVE OF MONITORING	TOOLS FOR MONITORING	FREQUENCY OF MONITORING	REQUIREMENTS	RESPONSIBLE PARTY
1. Decrease in catch: fish and mangrove associated organisms (Quilitisan and Balibago) *The Balibago community has noticed an increase in their own fisheries (relative to the state in recent years).*	To determine the factors that contribute to the decline in catch	Interviews *FGDs also good	Once	▪ Paper ▪ Pens ▪ Questionnaire ▪ Interviewer/s ▪ Camera ▪ Tape recorder ▪ Permit/ request letters to be able to conduct the interviews	CALMADA TALIMUSAK
	▪ To determine who among the community are dependent on the mangroves ▪ To detect if there is a change (increase/ decrease) in fish and associated organisms stock inside the MPA *The participants recognize that different species appear during different times of the*	▪ Fisherfolk registration (municipal level) ▪ Landing monitoring ▪ Fisheries monitoring (community to provide site-based information) ▪ Interviews (members of the community who are known to fish in the mangroves) *It was clarified that these activities will be carried only to find out if the mangrove can support the need, not to prevent people from fishing*	Monthly *The participants also suggested considering such factors as the lunar cycle and the rainy season.*	▪ Paper ▪ Pens ▪ Questionnaire ▪ Interviewer/s ▪ Weighing scale ▪ Flashlights (with batteries) ▪ Gasoline allowance (for easier access to distant sites) ▪ Calculator ▪ Permit/ request letters to be able to conduct the interviews ▪ Candies (as small incentives for the community	CALMADA TALIMUSAK

PRIORITY CC ISSUE	OBJECTIVE OF MONITORING	TOOLS FOR MONITORING	FREQUENCY OF MONITORING	REQUIREMENTS	RESPONSIBLE PARTY
	year (panahon ng likas).	*there.*		members who agree to be interviewed)	
	To discover ways to increase catch *(need for more detailed studies)*				
2. Damaged mangroves (Quilitisan and Balibago) *In Balibago, the current practice is to immediately plant seedlings in damaged areas. Member of the community often return after two days to check if the sapling survived.*	To identify means to recover damaged mangroves *(need for more detailed studies)*				
	To determine if the newly planted seedlings survive	Age reconstruction	Monthly (for the first quarter)	▪ Tape measure ▪ Slates with pencils ▪ Scientific calculator	CALMADA TALIMUSAK
	To verify if the damaged mangrove areas have been recovered	Transect-plot method	Quarterly	▪ Transect line/ 40-m rope ▪ Tape measure ▪ Slates with pencils ▪ Scientific calculator	CALMADA TALIMUSAK
3. Lack of awareness regarding mangrove protection and proper waste disposal	To determine if IEC campaign is effective	IEC monitoring	Always: ▪ Maintain a logbook of IEC campaigns ▪ Maintain a record of offenders *Ms Custodio reported that there are funds and a plan to deputize Bantay MPAs this October. It*	▪ Logbook ▪ Coordination with deputized wardens	CALMADA TALIMUSAK

PRIORITY CC ISSUE	OBJECTIVE OF MONITORING	TOOLS FOR MONITORING	FREQUENCY OF MONITORING	REQUIREMENTS	RESPONSIBLE PARTY
			would be possible for them to assist in recording the number of offenders.		
4. Garbage, seaweeds, and colonizing marine invertebrates inside the MPA	To determine peak seasons for algal blooms and trash accumulation	International Coastal Clean-up form, with focus on mangroves	Monthly	▪ Forms ▪ Pens ▪ Survey personnel	CALMADA TALIMUSAK
5. Loss of seagrass cover	To identify factors that contribute to the loss of seagrass	▪ Seagrass assessment ▪ Age reconstruction ▪ Demographic study: ○ Quadrat method ○ Coring method (+, -, =) ▪ Ms Custodio shared that, in Calatagan, seaweed farmers have been known to eliminate seagrass to make space for their farms.	Once		Assisting organizations

Table 3: Proposed annual schedule of activities for the monitoring plan

MONITORING ACTIVITY	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC
1. Mangrove fisheries interview *To be done with CI Fisheries monitoring												
2. Landing surveys												
3. Mangrove community structure (transect-plot method)												
4. Age reconstruction												
5. IEC monitoring												
6. Garbage and seaweed monitoring												
7. Seagrass assessment???												

After Workshop II, Dr. Samson gave a brief lecture on the ICSEACChange to initially introduce the tool to the communities of Balibago and Quilitisan. Following an introductory lecture by Dr. Wilfredo Licuanan of De La Salle University, she emphasized the following points:

- The Philippines' high vulnerability to CC is given by the population's great dependence on coral reefs, a low capacity to adapt to reef loss, and high exposure to integrated reef threats (i.e. climate impacts, as well as local stresses)
- An integrated Vulnerability Assessment can be useful in adaptive management and assessment of management; identification of specific adaptation measures; prioritization of key areas; determination of CC stressors of higher potential impact; and valuation.
- Vulnerability assessments may be valuable to and can be conducted by municipal and city LGUs (for planning); NGAs (for synoptic planning and resource allocation); and assisting institutions, like universities and NGOs.
- The VA can best be accomplished by individuals with specific skills: data collectors, planners, and assisting individuals (experts).
- Vulnerability is a function of Sensitivity, Exposure, and Adaptive Capacity.
- Each factor is assessed through the use of specific variables, which are listed in a rubric to be scored based on a prescribed system. In the Sensitivity rubric, for example, one determining variable is how much of the original mangrove areas are left. If less than 25% of the mangroves were lost, the assigned score can be either 1 or 2. If the area lost is between 25% and 50%, the score can be either 3 or 4. Finally, if more than 75% of the original area is lost, the score is 5. For areas with no mangroves, the default score would be 5. Each variable has specific thresholds and corresponding scores. Typically, a high score indicates high sensitivity. Different variables are considered for Adaptive Capacity, and its own scoring system is adopted.
- The scores for each factor are then consolidated based on conceptual relationships. The resulting value is the score for Vulnerability. This score is then reinterpreted as Low, Medium, or High.
- In assessing an area's vulnerability to CC, it then becomes possible to determine appropriate adaptive management actions.

- Barangays Balibago and Quilitisan have already obtained data that can help them accomplish the mangrove portions of the ICSEACChange rubrics.

In concluding the day's agenda, representatives from both barangays expressed their thanks at having learned much during the lectures and workshop discussions. They also requested a hard copy of the full report for easy access to the data.

Dr. Samson also gave a few closing remarks, thanking CI-Philippines for focusing their efforts on the otherwise overlooked mangrove and seagrass habitats. She was also pleased with the enthusiasm of the participants, remarking that this can be very heartening when teaching.

In her own closing talk, Ms Miclat thanked Dr. Samson for her involvement in the project and noted the presence of Dr. Salmo who is being engaged to share in writing his experiences with the CTSP. She also took the opportunity to update the participants on current efforts being undertaken by CI-Philippines:

- They are initiating a similar mangrove rehabilitation program in Lubang and Looc to replicate the success in Calatagan. Representatives from those municipalities are scheduled to visit Calatagan on 25-26 October. This will be an opportunity for the communities of Balibago and Quilitisan to share their experiences and lessons learned.
- DLSU has been engaged to conduct an assessment in Lubang, which will determine when planting can begin. Once rehabilitation has been initiated, it may be possible for representatives from Balibago and Quilitisan to visit.
- A glass-bottomed boat is being acquired for Barangay Quilitisan.
- A national-level discussion to identify actions regarding abandoned fishponds is being convened. Representatives from national government agencies, including DENR, BFAR, DILG, and DAR; non-government agencies, including CI-Philippines; assisting technical persons and institutions; and other various stakeholders will be attending. The agenda will include dialogues on how to cancel FLAs that are no longer in use; strategies to recover destroyed mangrove areas; and management options (as of now, community-based forest management c/o DENR). The results of this meeting will be communicated to the local managers.

In her closing statement, Ms Custodio said that it was still necessary to clarify the role of the LGU in mangrove protection. She stated that there is difficulty in delineating jurisdiction, the LGU with only minimal involvement. They have assisted with planting, but can further contribute in management. She concluded by saying that while she is thankful for the continued aid of NGOs like CI-Philippines, she envisions a time when conservation efforts and related undertakings can survive beyond outside assistance.

APPENDIX 5: Complete participant list

	PARTICIPANTS	AFFILIATION
1.	Arturo Macalalad	LGU
2.	Annie Apolinar	TALIMUSAK
3.	Aster Caunceran	TALIMUSAK
4.	Lucena Duman	TALIMUSAK
5.	Ruth Helen Ricasa	TALIMUSAK
6.	Edgardo Cudiamat	TALIMUSAK
7.	Leonardo Palma	
8.	Ray Jun Magyaya	CALMADA
9.	Bernardito Garcia	CALMADA
10.	James William Monreal	CALMADA
11.	Severino Benitez	CALMADA
12.	Gloria Esguerra	TALIMUSAK
13.	Anna Cubos	CI-Philippines
14.	Marilyn Gonzales	TALIMUSAK
15.	Dionisio Gonzales	TALIMUSAK
16.	Marisol Laguardia	De La Salle Lipa
17.	Kubi Follosco	MSI
18.	Ma Emelyn Custodio	LGU
19.	Evangeline Miclat	CI-Philippines
20.	Sev Salmo	CLSU
21.	Maricar Samson	DLSU

APPENDIX 6: TALIMUSAK Report

1. Ano ang mga kinakaharap na suliranin ng inyong kabakhawan na nais ninyong malunasan sa loob ng isang taon? Limang taon? Sampung taon?

SULIRANIN	LUNAS
Sa loob ng panahon 'pag masama ang panahon, ay ang walang tigil na pagpasok ng basura na kung saan-saan nagmula	Ang lunas na nakikita ng Management ng Ang Pulo ay malagyan ng Break Garbage (net na nakaharang sa kabuuan ng Ang Pulo)
Ang pagdating ng buwan ng taga-lumot (August at September)	Patuloy na monitoring sa maliit na bakhawan
Ang mga taong pasaway na panakaw na pumuputol ng bakhawan	Inalam ng Management ng Ang Pulo ang ordinansa tungkol sa pagbabawal ng pamumutol ng bakhawan at nagpapagawa ng signages tungkol dito

2. Mga isinasagawang pangangalaga sa bakhawan
    a. May mangrove monitoring plan na tayo
    b. Tuluy-tuloy na reforestation
    c. Patuloy na pagmomonitor sa mga itinanim na bakhawan, lalo na't sa buwan ng paglumot at may masamang panahon
    d. Patuloy na paglilinis sa mga areas ng bakhawan na pinapasukan ng mga basura
    e. Patuloy na pagmomonitor at pagbibigay babala sa mga taong patuloy na namumutol ng bakhawan

3. Kalendaryo ng bawat gawain sa bawat buwan
    a. Araw-araw ay may nakatalagang duty ang Management ng Ang Pulo
    b. May monthly meeting ang Ang Pulo tuwing end of the month

4. Kailan maraming bisita o bumibili ng seedlings?
    Ang buwan ng tag-araw o summer (December to May)

5. Ano ang pinaka-bentahe ng Ang Pulo?
    a. Nasa Ang Pulo ang may pinakamaraming species ng mangrove
    b. Malulusog at malalago na mga puno ng bakhawan
    c. Ang willingness ng TALIMUSAK ay naka-focus na sa mga mangroves sa loob ng Ang Pulo
    d. May maluwang na seagrass o gleaning areas

APPENDIX 7: CALMADA Report

1. Anu-ano ang kinakaharap ng inyong kabakhawan na nais ninyong malunasan sa loob ng:
    a. Isang taon?
       Basura: sa ngayon ito ang kinakaharap naming suliranin sa kabakhawan
    b. 5 taon?
       Ang maparami ang mga species ng lahat ng uri ng bakhawan
    c. 10 taon?
       Ang mapaunlad ang kabakhawan

2. Mga isinagawa o isinasagawang pangangalaga ng kabakhawan?
    a. Paglilinis at pagbisita ng mga tanim
    b. Pagbabantay upang mapangalagaan ang bawat uri ng mangrove
    c. Pagsaway sa mga namumutol ng puno

3. Kalendaryo ng mga gawain sa bawat buwan?
    a. January – February: Paglilinis
    b. March: Observation ng bawat tanim ng isang miyembro
    c. April – May: Pangunguha ng mga punla
    d. June –August: Paglilinis
    e. September – October: Pangangalaga sa mga itinanim na bakhawan
    f. November – December: Paglilinis at mano-mano paggawa

4. Kailan maraming bisita o bumibili ng seedlings?
   September to January: Every Saturday ang studyante ng Icc ay bumibili at nagtatanim ng mga bakhawan

5. Ano ang pinakabentahe ng inyong mangrove protected area?
   Sa kasalukuyan, ito palang ang aming nabebenta:
    a. Bakhawan
    b. Kalapinay

INTERNATIONAL COASTAL CLEANUP™ DATA CARD

Data collected during The Ocean Conservancy's International Coastal Cleanup™ is used to educate people and create solutions to the problems of solid waste and litter. Through partnerships with business, government, environmental groups, and citizens, we are helping to change the behaviors and practices that create debris. Thank you for being part of this very important process.

20TH ANNIVERSARY
International Coastal Cleanup
The Ocean Conservancy

CLEANUP LOCATION

Type of Cleanup: • Shoreline/Beach • Underwater

Location of Cleanup: State_____ Country_____

Zone or County Cleaned:_____

Beach Site Name:_____

Today's Date: Month_____ Day_____ Year_____

Name of Coordinator:_____

Number of People Working on This Card:_____

Distance Cleaned:_____miles or_____km

Number of Trash Bags Filled:_____

Total Estimated Weight Collected:_____lbs. or_____kgs.

NAMES OF PARTICIPANTS IN YOUR GROUP

If you are interested in becoming a member of The Ocean Conservancy and/or joining our Ocean Action Network (OAN) to make your voice heard on important ocean conservation issues, please check the box(es) below your name and address. ***Thank you for helping to protect our oceans!***

1. Name:_____ Age:_____
Address:_____
City:_____ State:_____
Zip Code:_____ Country:_____
Phone: (_____) _____
Email:_____
I would like information on: • The Ocean Conservancy • The OAN

2. Name:_____ Age:_____
Address:_____
City:_____ State:_____
Zip Code:_____ Country:_____
Phone: (_____) _____
Email:_____
I would like information on: • The Ocean Conservancy • The OAN

3. Name:_____ Age:_____
Address:_____
City:_____ State:_____
Zip Code:_____ Country:_____
Phone: (_____) _____
Email:_____
I would like information on: • The Ocean Conservancy • The OAN

4. Name:_____ Age:_____
Address:_____
City:_____ State:_____
Zip Code:_____ Country:_____
Phone: (_____) _____
Email:_____
I would like information on: • The Ocean Conservancy • The OAN

ENTANGLED ANIMALS: (• Dead or • Alive). List all entangled animals found during the Cleanup. Tell us what they were entangled in (fishing line, rope, net, etc.) _____

WHAT WAS THE MOST PECULIAR ITEM YOU COLLECTED?_____

The following national and international organizations endorse and/or support the International Coastal Cleanup:

- U.S. Environmental Protection Agency
- IUCN – The World Conservation Union
- Intergovernmental Oceanographic Commission (IOC) of the United Nations' Educational, Scientific, and Cultural Organization (UNESCO)

Please return this card to your area coordinator or mail it to:

The Ocean Conservancy Office of Pollution Prevention and Monitoring
1432 N. Great Neck Road, Suite 103
Virginia Beach, VA 23454 USA

Phone (757) 496-0920 Fax (757) 496-3207
www.oceanconservancy.org

100% post-consumer recycled paper. Chlorine free.

ITEMS COLLECTED

The Ocean Conservancy
www.oceanconservancy.org

Human-made debris, trash and litter...

- Harms the environment & wildlife
- Causes communities to lose money
- Threatens human health & safety
- Looks bad!

Think about where all this debris comes from and how **we** can prevent it!

Please pick up all debris found on the beach. Record information on only the items listed below.

Keep a count of your items using tick marks and enter the item total in the box. **Example:** [8] **Beverage Cans** 𝍸 III

SHORELINE AND RECREATIONAL ACTIVITIES

(Debris from beach-goers, sports/games, festivals, litter from streets/storm drains, etc.)

- [ ] Bags
- [ ] Balloons
- [ ] Beverage Bottles (plastic) 2 liters or less
- [ ] Beverage Bottles (glass)
- [ ] Beverage Cans
- [ ] Caps, Lids
- [ ] Clothing, Shoes
- [ ] Cups, Plates, Forks, Knives, Spoons
- [ ] Food Wrappers/Containers
- [ ] Pull Tabs
- [ ] 6-Pack Holders
- [ ] Shotgun Shells/Wadding
- [ ] Straws, Stirrers
- [ ] Toys

OCEAN/WATERWAY ACTIVITIES

(Debris from recreational/commercial fishing and boat/vessel operations)

- [ ] Bait Containers/Packaging
- [ ] Bleach/Cleaner Bottles
- [ ] Buoys/Floats
- [ ] Crab/Lobster/Fish Traps
- [ ] Crates
- [ ] Fishing Line
- [ ] Fishing Lures/Light Sticks
- [ ] Fishing Nets
- [ ] Light Bulbs/Tubes
- [ ] Oil/Lube Bottles
- [ ] Pallets
- [ ] Plastic Sheeting/Tarps
- [ ] Rope
- [ ] Strapping Bands

SMOKING-RELATED ACTIVITIES

- [ ] Cigarettes/Cigarette Filters
- [ ] Cigarette Lighters
- [ ] Cigar Tips
- [ ] Tobacco Packaging/Wrappers

DUMPING ACTIVITIES

- [ ] Appliances (refrigerators, washers, etc.)
- [ ] Batteries
- [ ] Building Materials
- [ ] Cars/Car Parts
- [ ] 55-Gal. Drums
- [ ] Tires

MEDICAL/PERSONAL HYGIENE

- [ ] Condoms
- [ ] Diapers
- [ ] Syringes
- [ ] Tampons/Tampon Applicators

DEBRIS ITEMS OF LOCAL CONCERN

(Identify and count 3 other items found that concern you)

- [ ]
- [ ]
- [ ]

CORAL TRIANGLE
INITIATIVE
ON CORAL REEFS, FISHERIES AND FOOD SECURITY
PHILIPPINES