BFAR-CHED Philippine National Aquasilviculture Program (PNAP) in Bataan

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Abstract

Under the Philippine Aquasilviculture Program, the Bataan Peninsula State University (BSPU) rehabilitated denuded mangrove resources, established aquasilviculture technology demonstration projects as a livelihood option for fisherfolks (while caring for the mangroves they had planted) and established community-based multi-species hatcheries to increase endemic fish species in the area.

The BPSU was able to (a) plant 183, 300 mangrove seedlings where 85.96% survival was noted a year after, (b) establish 16 units aquasilviculture projects for the livelihood of the beneficiaries (planting that earned the beneficiaries P1,338, 731.90); and (c) establish community-based multi-species hatcheries that already produced an estimated 1,030,502,400 eggs of various fish species, thus increasing the wild fishery resource in the area.

The program is expected to bear potential impacts on our environment and to the lives of the marginalized people of our community through the collaborative efforts of the Bureau of Fisheries and Aquatic Resources (BFAR), the Commission on Higher Education (CHED), BPSU, Local Government Units (LGUs) and the fisherfolks.

Keywords: aquasilviculture, mangrove propagules, community-based multi-species hatchery

Introduction

The decline in mangrove resources that serve as habitat for various fishery species has reached 383, 000 hectares from 1918- 1995 (Melana *et al.*, 2000), which means that the Philippines lost 76.6% of its mangrove areas for less than a century with an estimated national deforestation rate of 4,432ha/year between 1951 and 1988. This was brought about by overexploitation by coastal dwellers, conversion to settlements, agriculture, salt beds and industry (Baconguis *et al.*, 1993: Primavera, 1995). Apart from the foregoing, conversion to aquaculture is recorded as the major cause since around half of the 279, 000 ha of mangroves lost from 1951- 1988 were developed into culture ponds. According to the Philippine Council for Agriculture,

Forestry and Natural Resources Research and Development PCAFNRRD in 1991 around 95% of the brackishwater pond in 1952- 1987 were derived from mangroves. Likewise, according to the DENR 1995 statistics, conversion to fishponds, prawn farms, salt ponds, reclamation and other forms of industrial development have reduced the mangrove area to 117,700 ha (Melana *et al.*2000).

This very alarming loss of our mangrove resources is causing the deterioration of sea grass and coral reef ecosystem. About 70% of the Philippine coral cover has been destroyed, with about 25% still in good condition and only about 5% in excellent condition, which resulted to decline in the productivity of coastal fisheries. An estimated 670 kg reduction in fish catch per hectare of mangrove forest that is clear cut had been recorded by the Coastal Resources Management Project in1998.

In line with its mandate under Republic Act No. 8550 or the Philippine Fisheries Code of 1998, BFAR aims to achieve food security, promote sustainable development of fisheries resources, and reduce poverty incidence among fisherfolk and other disadvantaged groups. The Commission on Higher Education (CHED), on the other hand, is mandated, through Section 8 of Republic Act 7722 (the Higher Education Act of 1994), to identify, support and develop potential centers of excellence in program areas needed for the development of world-class scholarship, nation building and national development and direct or redirect purposive research by institutions of higher learning to meet the needs of agro-industrialization and development.

The Government of the Republic of the Philippines, through BFAR and CHED in collaboration with the academe and local government units concerned, is implementing the Philippine National Aquasilviculture Program, (PNAP) which aims to ensure resource sustainability, to attain food security and to alleviate poverty.

A Memorandum of Agreement (MOA) has been entered into by the BFAR and the CHED to implement the said Program. On 16 December 2011, Bataan Peninsula State University (BPSU) signed a Memorandum of Agreement with BFAR3 as one of the selected State Universities and Colleges to implement the PNAP in the province of Bataan.

Objectives

The main objective of this undertaking is to implement the PNAP in order to rehabilitate denuded mangrove resources and to increase survival of mangroves through the participation of fisherfolk organizations and the local government units. This project involves capacity building seminars and trainings, provision of livelihood and improvement of capture fisheries by increasing the fish population in the area for sustainable fisheries development, food security and poverty alleviation.

Specifically, this program aimed to plant 183,300 mangroves along coastal areas of Manila bay, establish 16 units aquasilviculture technology demonstration projects for the livelihood of the fisherfolks and to set up community-based multi-species hatcheries.

PROGRAM CONCEPT

1. Resource/habitat Rehabilitation

1.1. Site Selection/ Validation

1.1.1. Through the Project Management Office (PMO), priority areas for habitat or resource rehabilitation were pre-identified. These include:

a. Key Biodiversity Areas (KBAs) in the province as recommended by the CENRO/PENRO.
b. Abandoned, Underdeveloped and Underutilized Fishpond Lease Agreement (AUU FLA) areas as identified in accordance with the joint administrative order on the reversion of AUU FLA areas.
c. Areas identified for reforestation/afforestation or covered by the tenurial arrangements by the DENR.
d. Areas covered by co-management agreement between the DA, DENR and LGUs.

The sites identified were validated by the PMO in terms of:

a. Willingness of the community to participate;
b. Technical suitability;
c. Mangrove species thriving in the area; and
d. Accessibility

1.2. Standard Planting Design

Spacing and design

A standard distance of 1.5 m x 2.0 m between mangrove propagules was observed, and at least 3,000 mangrove propagules needed to be planted in every hectare and that no more than 30% of the area devoted to aquasilviculture.

1.3. Budgetary Requirement and Payment Scheme

The standard cost for resource/ habitat rehabilitation were as follows:

a. P1.50 per mangrove propagule (ready for planting) gathered by the beneficiary ;
b. P2.00 per mangrove propagule planted with corresponding support stake with length of at least 2 feet and 2 inches width; and
c. P2.50 for each fully grown and live mangrove tree after one year from planting.

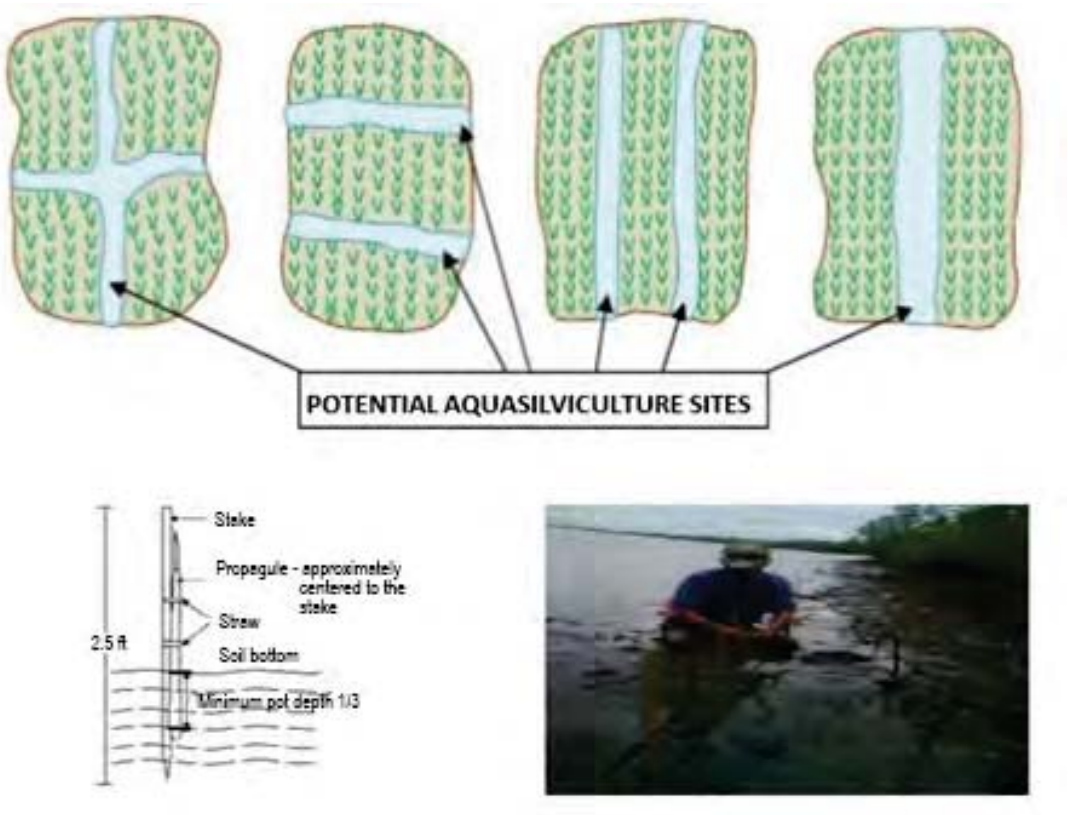

Figure 1. Planting design as prescribed in the implementing guidelines.

1.4. Selection of Beneficiaries

The PMO in consultation with the local government units and the FARMCs identified and maintained a list of qualified project beneficiaries guided by the following criteria:

a. Bonafide resident fisherfolk in the area/ project site;
b. Willingness to participate in the program and abide by the terms and conditions therein;
c. Preferably those identified and included in DSWD list of marginalized sectors

2. Aquasilviculture Projects

2.1. Site Selection/ Validation

Areas identified for aquasilviculture were validated by the PMO as to its appropriateness and suitability for such purpose.

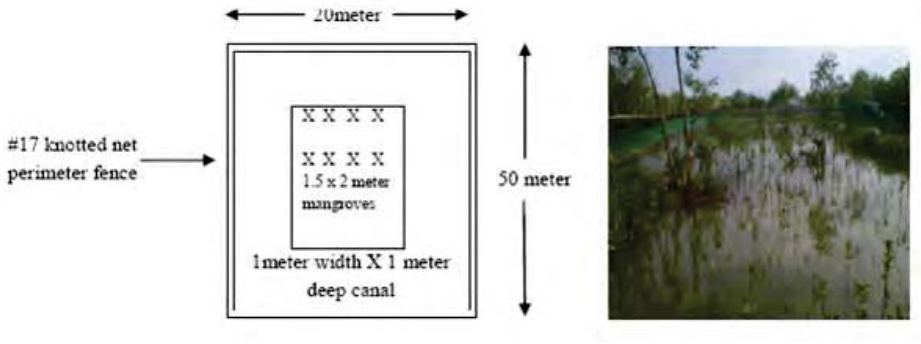

Figure 2. Layout of a 1,000 m^2 aquasilviculture technology demonstration project.

2.2. Standard Size and Design

No more than 30% of the area with mangrove was recommended for aquasilviculture. The suggested area was preferably 1,000 square meters per unit aquasilviculture on dead creeks, water canals and area with enough water even during low tides.

2.3. Budgetary Requirements and Payment Scheme

The total amount of P65, 000.00 was allocated as support for the establishment of the individual aquasilviculture technology demonstration project. The support will cover the following:

a. Fencing materials (nets, ropes, etc.)
b. Labor support (for excavation)
c. Portion of the farm inputs (seed stocks and feeds)

2.4. Selection of Beneficiaries

Those who participated in the resource rehabilitation activity were identified as the primary beneficiaries of the aquasilviculture projects.

2.5. The commodity species for aquasilviculture production was determined after the site suitability evaluation.

3. Community-based Multi-species Hatchery (CBMSH)

The CBMSH is a strategy that was intended to:

a. Conserve, save and protect eggs of various species that are gravid when captured from the wild;
b. Take advantage of the natural productivity of the environment in the post-larval rearing and nursery of targeted species;

c. Increase the population of targeted species in the wild through stock enhancement; and
d. Utilize the abundant seed supply of targeted species for use in aquasilviculture.

3.1. Site Selection/ Validation

The PMO in collaboration with the SUC identified priority hatchery areas based on the following:

a. Existing/ operational hatcheries- were encouraged to operate utilizing the project fund to augment the operation giving priority to the multi-species hatchery project;
b. Existing/Non-operational hatcheries- were put into operation utilizing the allocated funds with counterpart funding from the SUC as per MOA including manpower complement;
c. Non-existing hatcheries- were established following the suggested design utilizing the allotted funds with the counterpart contribution from the SUC as per MOA and by considering the following criteria:

1. Required area/site was at least 1,000 square meters with at least flat/ plain terrain;
2. Availability of unpolluted marine water;
3. Availability of sea water with stable salinity not lower than 35 ppt;
4. Availability of spawners/ breeders;
5. Near aquasilviculture production areas;
6. With existing electricity;
7. Accessible to land and water transport; and
8. Availability of fresh water for domestic use

3.2. Hatchery/ Nursery Lying-in Concept

This was done through the introduction or development of a system of collecting gravid target species from fishermen, allowing them to spawn and nurse the larvae inside a designed structure under controlled conditions, until they reached the stage where they can be released into the natural habitat.

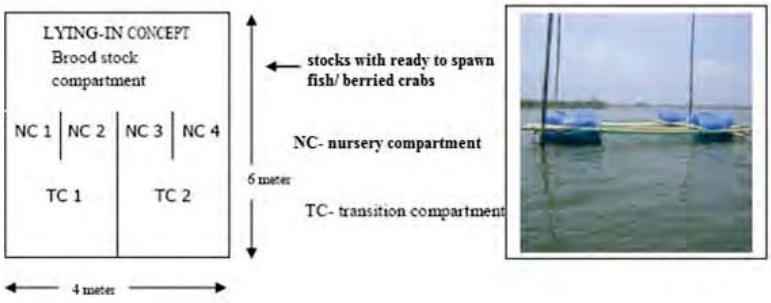

Figure 3. Recommended layout of lying-in hatchery/nursery concept.

PROJECT ACCOMPLISHMENTS

Right after the orientation regarding the implementing guidelines of the program, the project management office and the BPSU team wasted no time, hence accomplished the following during the implementation of the PNAP in the province of Bataan:

Pre- Implementation Phase

Program Orientation. Representatives from SUCs and other participating schools in Region 3 were oriented on the implementing guidelines of the PNAP at the BFAR 3 Regional Office in Maimpis, City of San Fernando, Pampanga. It was followed by a national orientation on 25 May 2012 in Sariaya, Quezon by the BFAR Director, Atty. Asis Perez.

Coordination with PENRO and LGUs. Right after the regional and national orientation, coordination was made with the PENRO and LGUs of Bataan through their Municipal Agriculture Offices to conduct orientation about the PNAP with their respective Municipal or City Fisheries and Aquatic Resources Management Council (M/CFARMC).

Table 1 presents the current Mangrove areas in Bataan based on the data provided by the DENR- PENRO. Out of 177 km coastline in Bataan, only 121.08 hectares of mangrove areas have remained or still exist as fish habitat in the province.

Orientation of Fisherfolks. There were about 637 fisherfolks coming from 28 organizations in the municipalities of Orion, Orani and City of Balanga that were oriented about the implementing guidelines of the program.

Fisherfolks profile. Table 3 shows the profile of fisherfolk beneficiaries taken prior to the start of the project for the implementors to have an initial data on their present status. Out of the 637 fisherfolks oriented about the PNAP, 95.77% were males and only 4.23% females. As regards to their civil status, 83.46% were married while 4.42% were separated, 7.5% were single and 4.42% were widows/widowers.

Identification of Project Beneficiaries. There were 16 fisherfolk organizations selected as beneficiaries of the program based on the following criteria:

a. Bonafide resident fisherfolk in the area/project site;
b. Willing to participate in the Program and abide by the terms and conditions therein;
c. Preferably, they were identified and included in the list of marginal sector of the DSWD

Conduct of Trainings and Seminars. Capacity building seminars that include resource protection and rehabilitation, constituency building, leadership and value formation trainings were conducted to strengthen the capabilities of the project beneficiaries.

Signing of Memorandum of Agreement. A formal agreement was signed between BPSU represented by the university president, Dr. Delfin O. Magpantay, and the respective chairs or leaders of the selected 16 fisherfolk organizations. Stipulated in the MOA are the roles and responsibilities of each party in the implementation of the project.

Area Validation. After the final identification of the mangrove areas to be

Table 1. Present mangrove areas in Bataan (DENR-PENRO, 2011).

City/ Municipality	Barangay	Lot. No.	Area (has.)	Total per Barangay (has.)	Total per Municipality (has.)
Limay	Alangan	1	0.9	0.9	**0.9**
Orion	Daan Pare	1	4.7	4.7	
	Ormoc	1	0.87	0.87	
	Sto. Domingo	1	2.51	2.51	
	Sta. Elena	1	2.52		
		2	3.19	5.71	**13.79**
Pilar	Bantan Malake	1	0.95	0.95	
	Bantan Munti	1	0.76	0.76	
	Balut	1	6.4	6.4	
	Wawa	1	1.06		
		2	0.3		
		3	0.4		
		4	0.34		
		5	0.45		
		6	1.73		
		7	1.64	5.92	**14.03**
City of Balanga	Tuyo	1	4.45	4.45	
	Puerto Rivas	1	5.53		
		2	0.62	6.15	
	Tortugas	1	13.93	13.93	**24.53**
Abucay	Mabatang	1	3.14		
		2	5.23	8.37	
	Wawa	1	1.74		
		2	2.17	3.91	
	Capitangan	1	5.1	5.1	**17.38**
Samal	Sta. Lucia	1	1.35		
		2	0.75		
		3	0.61	2.71	
	Sapa	1	2.63	2.63	
	East Calaguiman	1	2.83	2.83	**8.17**
Orani	Kabalutan	1	8.9	8.9	
	Tapulao	1	0.07		
		2	2.61		

Table 2. Number of fisherfolks oriented on PNAP per locality.

Locality/ Barangay/ Municipality/ City	Date of Orientation	Number of fisherfolks who attended
Pantalan Luma, Orani, Bataan	August 22, 2012	43
Tenejero, Orani, Bataan	August 22, 2012	108
Centro I & II, Orani, Bataan	July 31, 2012	46
Wawa, Orani, Bataan	July 30, 2012	27
Kaparangan, Orani, Bataan	July 26, 2012	51
Calero, Orani, Bataan	July 25, 2012	20
Pantalan Bago, Orani, Bataan	July 24, 2012	20
Pantalan Luma, Orani, Bataan	June 27, 2012	35
Pantalan Luma (Iguana), Orani, Bataan	June 20, 2012	74
Pantalan Luma (Iguana), Orani, Bataan	June 19, 2012	51
Pantalan Luma (Dulo), Orani, Bataan	June 18, 2012	39
Pilapil, Orani, Bataan	June 15, 2012	50
Pulo/Kabalutan, Orani, Bataan	June 13, 2012	40
Balanga City FARMC	June 14, 2012	15
Orion, Bataan	June 8, 2012	18
TOTAL		**637**

Table 3. Profile of fisherfolks showing the average sex, civil status, highest educational attainment, average number of years in fishing, fishing equipment used and their average monthly income.

Sex:	
Male	95.77%
Female	4.23%
Civil status:	
Married	83.46%
Separated	4.42%
Single	7.5%
Widow/widower	4.42%
Highest educational attainment:	
Elementary	56.04%
Secondary	36.46%
Vocational	4.17%
College	3.33%
Average number of years in fishing	21-25 years
Kind/ Type of fishing equipment used:	
Gill net	79.63%
Boat	13.49%
Lift net	4.76%
Hook	1.06%
Fishing rod	0.79%
Fish trap	0.27%
Average monthly income	P2,000-P4,000

Table 4. Fisherfolk organizations selected as project beneficiaries.

Name of Organization	Number of Members
1. Samahan ng mga Mangingisdang Nagkakaisa (SAMANA), Pantalan Luma, Orani, Bataan	42
2. Samahan ng mga Mangingisda sa Dulo (SAMADU), Pantalan Luma, Orani, Bataan	27
3. Samahan ng mga Mangingisda sa Kaparangan (SAMAKA), Kaparangan, Orani, Bataan	48
4. Samahan ng mga Mangingisda sa Wawa (SMW), Wawa, Orani, Bataan	31
5. Samahang Mangingisda ng Pantalan Luma (S.M.P.L.), Pantalan Luma, Orani, Bataan	49
6. Kapatirang Mangingisda at Makakaikasan ng Centro I & II (KAMMANCE), Centro I at Centro II, Orani, Bataan	52
7. Makakalikasan at Mangingisdang Kinikilala sa Iguana (MMAKISIG), Pantalan Luma, Orani, Bataan	27
8. Gabay Mangingisda ng Calero (GAMACA), Calero, Orani, Bataan	22
9. Samahan ng Magdaragat ng Pulo (S.M.P.), Sitio Pulo, Kabalutan, Orani, Bataan	21
10. Pulo Fisheries Development Cooperative (PuFiDeCo), Sitio Pulo, Kabalutan, Orani, Bataan	16
11. Kaisahan sa Kaunlaran ng mga Mangingisda ng Pilapil (KAKAMPI), Palihan, Orani, Bataan	50
12. Samahang Mangingisda ng Tenejero (SaMaTe), Tenejero, Orani, Bataan	108
13. Samahang Mangingisda ng Pantalan Bago (SMPB), Pantalan Bago, Orani, Bataan	15
14. Municipal Fisheries and Aquatic Resources Management Council (MFARMC), Orani, Bataan	15
15. BPSU Aquamarine Research & Development Center, Kabalutan, Orani, Bataan	8
16. BALANGA CITY Fisheries and Aquatic Resources Management Council (CFARMC), Puerto Rivas, City of Balanga	10
TOTAL	**541**

Table 5. Mangrove areas identified, validated and qualified for resource rehabilitation.

Location	Area Identified	Area Validated	Qualified	Remarks
Balanga City:				
Puerto Rivas	10	10	0	Mangrove already established
Tortugas	15	15	0	Use for bird sanctuary
Sibacan	30	30	20	Abandoned fishponds
Orani:				
Kaparangan	10	10	5	With existing mangroves
Pantalan Luma	15	15	10	Only pagatpat/palapat mangrove spp. are present
Kabalutan	10	10	10	Denuded mangrove area
Pulo	30	30	20	Denuded mangrove area
BPSU ARC	3	3	2	To use as a model site for the project
TOTAL	**123**	**123**	**67**	

rehabilitated, the project management team together with the fisherfolk representatives and the municipal agriculturist of their respective municipalities conducted an actual site validation to evaluate each area based on the willingness of its community to participate; technical suitability; mangrove species thriving in the area; and accessibility.

Out of 123 hectares identified and validated, there were only 67 hectares that met the criteria as stipulated in the implementing guidelines of the program, forty seven from Orani, Bataan and 20 hectares in Sibacan and Puerto Rivas in Balanga City.

Identification of Mangrove Rehabilitation Sites. Priority areas for habitat or resource rehabilitation were pre-identified after each orientation with considerations such as: a) identified priority key biodiversity areas (KBAs) in the province to be recommended by the CENRO/PENRO, b) abandoned, undeveloped and underutilized FLA areas as identified in accordance with the Joint Administrative Order on the reversion of AUU FLA areas, c) areas identified for reforestation/aforestation or covered by the tenurial arrangements by the DENR, and d) areas covered by co-management agreement between DA, DENR, and LGUs.

IMPLEMENTATION PHASE

Project I. Mangrove Resources Rehabilitation Project

A. Collection of Mangrove Propagules. Fisherfolks including their family members collected mature mangrove propagules of "Bakawang Lalaki" or "Bakawang Babae" as specified in the guidelines.

B. Inventory/ Counting of Collected Planting Materials. In order to insure the validity of the actual number of collected mangrove propagules, fisherfolks were instructed to tie their propagules in bundles of 100 pc per bundle during actual counting.

C. Payment of Mangrove Propagules. Right after the actual counting of the mangrove propagules collected by the fisherfolks, the necessary papers were prepared for the immediate release of payment done 5-10 days after.

D. Planting and Staking. The suggested standard planting design and procedure indicated in the implementing guidelines were followed by the fisherfolks during planting. A bamboo stake measuring 2.5 feet by 2 inches was tied for each propagules during planting to serve as protection from water current. A planting distance of 1.5 m x 2 m was followed in open areas while patch planting was made in areas where there were existing mangroves.

E. Resource Protection and Maintenance. Fencing and putting up of billboards were done to ensure that the reforested areas will not be damaged by intruders. The billboards showed the provisions of Republic Act 8550 penalizing those causing damage or destruction of mangrove forest/resources.

Project II. Aquasilviculture Techno Demo/ Livelihood Projects

A. Identification and organizing of beneficiaries

As stipulated in the guidelines, beneficiaries for the livelihood projects

were from those who participated in the Mangrove Resources Rehabilitation activity. Instead of awarding the livelihood projects (Aquasilviculture) to individual fisherfolks, the Project Management Office decided to give the project to 16 fisherfolk organizations, so that even their members will benefit from the income that would be derived from their aquasilviculture techno demos.

B. Site Identification, Validation and Establishment

The project team together with the beneficiaries identified and validated 24 possible sites for the aquasilviculture projects that included one in Puerto Rivas, Balanga City, 22 in Orani, Bataan and one at the BPSU Aquamarine Research Center. There were sixteen (16) sites for aquasilviculture that qualified based on the criteria set forth in the implementing guidelines of the program.

C. Training of Project Beneficiaries

Prior to the establishment of the livelihood component of the program, which is the Aquasilviculture techno demos, the following fisherfolks attended a ten day training at the National Brackishwater Aquaculture Technology Research Center in Pagbilao, Quezon from October 15- 24, 2012:

1. Mr. Avelino V. Capuli- Chairman, MFARMC Orani
2. Mr. Reynaldo Lalican- KAKAMPI
3. Mr. Florencio Cruz- SAMATE
4. Mr. Conrado Mallari- S.M.P.L.
5. Mr. Jimmy de Jesus- SAMANA
6. Mr. Cipriano Adena- SMW
7. Mr. Hector Catahan- SMPB
8. Mr. Rodolfo Tala- SAMADU
9. Mr. Jose Sally Raymundo- PuFiDeCo
10. Mr. Rodrigo Libanan- S.M.P.
11. Mr. Rolando Benavente- GAMACA
12. Mr. Rico Alfonso- SAMAKA
13. Mr. Mario Cubacub- MMAKISIG
14. Mr. Roman Roque- KAMMANCE
15. Mr. Armando Tolentino- CFARMC Balanga City
16. Mr. Richard Deldoc- BPSU AMRC

D. Establishment of Livelihood Projects (Aquasilviculture Techno demos)

Each of the identified fisherfolk organization was provided with the materials needed for the establishment of their Aquasilviculture technology demonstration project to raise mud crabs and other fish species as their source of livelihood while taking care of the mangroves they planted.

A standard 20 m x 50 m design was followed to cover an area of 1,000 square meters within the rehabilitated mangrove area. Each unit was provided with 500 tilapia fingerlings, 300 crablets and 300 milkfish fingerlings for their initial stock and a corresponding amount for feeds.

Project III. Community-based Multi-Species Hatchery (CBMSH)

A. Site Identification and Validation

The project team initially identified the possible sites for the CBMSH; the in-land base was situated at BPSU Orani Campus or at the BPSU Aquamarine Research Center, the other two, which adopted the Lying- in concept was in barangay Salaman, Bagac, Bataan along the West Philippine Sea and in Orani, Bataan along Manila bay. Upon validation, the In-land based hatchery which is supposed to be situated

Table 6. Total number of mangrove propagules collected and planted, including the estimated area covered and percent that survived one year after planting.

Location	Number collected & planted	Estimated area covered (has.)	No. survived after a year	Percent survival	Remarks
Balanga City:					
Sibacan	25,950	6.67	15,570	60.00	
Puerto Rivas	30,000	11.98	27,000	90.00	
Orani:					
Kaparangan	31,467	10.49	29,264	93.00	
Pantalan Luma	20,000	6.67	18,600	93.00	
Kabalutan	49,300	16.28	44,000	89.25	
Pulo	26,583	8.86	23,127	87.00	
TOTAL	**183,300**	**61.10**	**157,561**	**85.96**	
Amount paid	**P641,550.00**		**P393,902.50**		

Table 7. Fisherfolk organizations identified as project beneficiaries for the livelihood (Aquasilviculture) component of the program.

Name of Organization	Number of Members
1. Samahan ng mga Mangingisdang Nagkakaisa (SAMANA), Pantalan Luma, Orani, Bataan	16
2. Samahan ng mga Mangingisda sa Dulo (SAMADU), Pantalan Luma, Orani, Bataan	10
3. Samahan ng mga Mangingisda sa Kaparangan (SAMAKA), Kaparangan, Orani, Bataan	9
4. Samahan ng mga Mangingisda sa Wawa (SMW), Wawa, Orani, Bataan	16
5. Samahang Mangingisda ng Pantalan Luma (S.M.P.L.), Pantalan Luma, Orani, Bataan	11
6. Kapatirang Mangingisda at Makakaikasan ng Centro I & II (KAMMANCE), Centro I at Centro II, Orani, Bataan	15
7. Makakalikasan at Mangingisdang Kinikilala sa Iguana (MMAKISIG), Pantalan Luma, Orani, Bataan	15
8. Gabay Mangingisda ng Calero (GAMACA), Calero, Orani, Bataan	16
9. Samahan ng Magdaragat ng Pulo (S.M.P.), Sitio Pulo, Kabalutan, Orani, Bataan	15
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15. BPSU Aquamarine Research & Development Center, Kabalutan, Orani, Bataan	8
16. BALANGA CITY Fisheries and Aquatic Resources Management Council (CFARMC), Puerto Rivas, City of Balanga	10
TOTAL	**216**

at BPSU Aquamarine Research Center did not pass the criteria stipulated in the implementing guidelines of the program. Hence, the project monitoring team suggested that the CBMSH could be constructed in BPSU Orani Campus where there are already 5 units of existing concrete tanks. However, hauling of sea water for use in the hatchery was required.

B. Project Coordination

After the sites were validated and found suitable, the project team identified the fisherfolks in barangay Salaman, Bagac, Bataan who will be the project partners/ beneficiaries in the hatchery. Hence, coordination with the municipal mayor of Bagac, Bataan, Hon. Rommel del Rosario thru the Municipal Agriculture Officer, Mr. Baltazar T. Manducdoc was needed.

C. Orientation of Project Partners/ Beneficiaries

An orientation regarding the concept of the hatchery was conducted by the project team to fisherfolk beneficiaries or partners for them to know the concept of allowing gravid or mature fish species to spawn and hatch their eggs in the open, the strategy adopted in order to increase fish population in the area.

D. Construction of Lying-in Hatchery

The fisherfolks started the construction of lying- in hatcheries one week after the orientation. They were provided with a project plan together with the necessary supplies and materials for the project.

The project team started buying the gravid female mud crabs and blue crabs collected by fisherfolks in the area and these were allowed to spawn in the hatchery.

E. Construction of an Inland-based Hatchery

An inland-based multi-species hatchery was constructed in BPSU Orani Campus where the existing 5- units concrete fish tanks were situated. These were used as part of the breeding/ rearing tanks for holding different fish species for seed production. As such, stocks were produced for the aquasilviculture projects and for the enhancement of fish population in mangrove forests being established by the project beneficiaries of the PNAP. Table 9 shows the list of procured gravid/ berried mud crabs and blue crabs that spawned in the lying- in hatchery together with the estimated number of eggs produced from January 17, 2013 to December 31, 2013.

Monitoring and Evaluation

Regular weekly monitoring of the conditions of the newly planted mangroves as well as the whole mangrove area was done to insure higher survival.

Monthly reports of the major accomplishments of the project including disbursement of funds were regularly submitted to the regional office of the Bureau of Fisheries and Aquatic Resources in Region 3.

Promotion and Information Dissemination of the Program

The strategies and accomplishments of BPSU regarding the implementation of the Philippine National Aquasilviculture Program (PNAP) were promoted through

the conduct of forums in the Municipal Hall of Orani, Bataan attended by Vice-Mayor Godofredo Galicia and the Municipal Council members, including the barangay chairmen of the coastal barangays of the municipalities involved. Other activities during its implementation were uploaded in the Orani MFARMC Facebook page. These were also presented in the following conferences / symposia to showcase the achievement of BPSU in the implementation of the PNAP in Bataan:

1. 1st International Organic Agriculture Conference of the International Society for Southeast Asian Agricultural Sciences (ISSAAS) in Pampanga Agricultural College
2. 3rd National Biennial Conference of the Philippine Association of Extension Program Implementers, Inc. (PAEPI) in the Lyceum University of the Philippines
3. 9th BPSU Abucay Campus R & D In-house Review at BPSU Abucay Campus on October 18, 2013- awarded as the **BEST PAPER for Development Category**
4. 24th CLARRDEC Regional R & D Symposium at Philippine Carabao Center, Science City of Munoz, Nueva Ecija - awarded as the **2nd BEST PAPER for Development Category**

The project was also visited by the following:

1. Nineteen (19) representatives from the Pamantasan ng Lungsod ng Maynila Center for University Extension Services on February 19, 2013
2. Ten (10) Chairpersons of the Municipal Fisheries and Aquatic Resources Management Council of Bataan on March 19, 2013
3. Seven (7) Media Team of Cong. Albert Garcia
4. Six (6) Master of Science in Agriculture students of BPSU on March 23, 2013
5. Forty (40) Faculty and employees of BPSU Orani and Abucay campuses
6. Seven (7) MFARC officers from Limay, Bataan
7. Twelve (12) BS Agriculture Engineering students and faculty of BPSU Abucay campus
8. Thirteen (13) Fisherfolk including two Municipal Councilors and the Municipal Agriculture Officer from Samal, Bataan for a cross-visit

SUPPORT DEVELOPMENTAL ACTIVITY TO ENHANCE PNAP IN BATAAN

Training on fish processing

A "Kaalamang Pangkabuhayan para sa mga ginang ng tahanan ng mga Mangingisda sa Bataan" was approved and funded by the BPSU Gender and Development (GAD). A training on fish processing such as boneless "tinapa" making, fish drying, sardines making, fish fillet, gourmet and the likes scheduled once a month for the selected housewife of fisherfolk beneficiaries was conducted by food processing experts from Orani campus in support of the PNAP. Right after each batch of 5 finished their training, the processing materials including a small amount of capital were awarded to them to enable them to start their business. A total of 35 beneficiaries were trained by BPSU experts and awarded P2, 500.00 each for their starting capital.

Table 8. Reported income from the beneficiaries' aquasilviculture projects during the first cycle of operation.

Beneficiary Organization of Fisherfolks	Stocks No.			Harvest (pc)	Kg Harvested			Amount (P)
	Mud crab	Milk fish	Tilapia	Mud crab	Milk fish	Shrimp	Blue crab	
1. KAMMANCE	300	300	500	85	58	13.3	12.7	26,052.00
2. MFARMC	300	300	500	178	40	17	13	11,913.00
3. SAMAKA	300	300	500	296	41	11	22.5	19,670.00
4. SMT	300	300	500	42	22.5	24.5	27	24,200.00
5. SMW	300	300	500	258	12.9	16	20	21,250.00
6. SAMADU	300	300	500	212	46	21	27	23,550.00
7. SMPL	300	300	500	198	38	26.2	19	16,260.00
8. SAMANA	300	300	500	324	54	19.5	28	30,050.00
9. MMAKISIG	300	300	500	170	39	18	24	24,590.00
10. GAMACA	300	300	500	232	51	25	16.5	27,180.00
11. SMPB	300	300	500	123	11.2	9.3	16	15,047.00
12. BPSUAMRC	300	300	500					
13. KAKAMPI	300	300	500	234	66	24	34	28,180.00
14. PUFIDECO	300	300	500	102	8.8	11.1	8.6	11,787.40
15. SMP	300	300	500	265	17.5	4.3	25	23,550.00
16. SAMAKA**	550							
INCOME FROM AQUASILVICULTURE								303,279.40
INCOME FROM MANGROVE RESOURCES REHABILITATION								1,623,139.00
INCOME FROM GRAVID MUD CRABS & BLUE CRABS								98,195.00
TOTAL INCOME DERIVED FROM THE PROGRAM								**2,024,613.40**

* Stocks were raised in the BPSU fishpond

**Stocks had escaped when nets were damaged by poachers

Table 9. Total number of collected and procured gravid/berried females for spawning.

Species	Number of pieces	Cost (P)	Total number of fry/ fingerlings/ crablets produced
Mud crabs*	124	12,400.00	248,000,000
Blue crabs**	1,557	38,925.00	778,500,000
Native mud crabs	2	200.00	4,000,000
Crablets (Giant crab)	1,100	4,670.00	
Giant mud crabs	10	1,100.00	
Milkfish	4	20,000.00	
Sea bass	4	20,000.00	
Red tilapia	25	500.00	1,800
Nile tilapia	25	500.00	600
Fresh water eel	10		
Fresh water crabs	60		
TOTAL		**98,195.00**	**1,030,502,400**

*Estimated for an average of 2M eggs/ gravid mud crab (Pelan and Grubert, 2007)

**Estimated for an average of 0.5M eggs/ gravid blue crab (Kamrani *et al.*, 2010)

Table 10. List of trained beneficiaries for the livelihood on Fish Processing funded by BPSU GAD.

Date of Training	No.	Trained Beneficiary	Address	Loan Granted	Remarks
7/23/2013	1	Angelina Agustin	Palihan, Orani, Bataan	P2,500.00	
	2	Adelina Brioso	Palihan, Orani, Bataan	P2,500.00	
	3	Josie Baltazar	Palihan, Orani, Bataan	P2,500.00	
	4	Teresita Lacap	Palihan, Orani, Bataan	P2,500.00	
	5	Ailina Suspene	Pulo, Orani, Bataan	P2,500.00	
	6	Cecilia Guevarra	Pulo, Orani, Bataan	P2,500.00	
	7	Angela Guevarra	Pulo, Orani, Bataan	P2,500.00	
	8	Alicia Raymundo	Pulo, Orani, Bataan	P2,500.00	
	9	Marilyn Lalican	Pulo, Orani, Bataan	P2,500.00	
8/29/2013	10	Jennifer Pago	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
	11	Mylene Yere	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
	12	Joanne del Rosario	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
	13	Jesusa Lajara	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
	14	Alpay Flores	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
10/7/2013	15	Bonifacia Mendenilla	Almasen, Hermosa, Bataan	P2,500.00	
	16	Emelita Nuqui	Almasen, Hermosa, Bataan	P2,500.00	
	17	Caroline Salas	Almasen, Hermosa, Bataan	P2,500.00	
	18	Leonor Mintal	Almasen, Hermosa, Bataan	P2,500.00	
	19	Remedios Cruz	Almasen, Hermosa, Bataan	P2,500.00	
	20	Benny Aguilar	Almasen, Hermosa, Bataan	P2,500.00	
	21	Rosalinda Villaruel	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
	22	Vivian del Rosario	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
	23	Rosette Sanchez	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
	24	Rosalie del Rosario	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
	25	Marilyn Luega	Sitio Salaman, Pag-asa, Bagac, Bataan	P2,500.00	
11/7/2013	26	Ma. Victoria Cordova	Limay, Bataan	P2,500.00	
	27	Marissa Nuquera	Limay, Bataan	P2,500.00	
	28	Editha Esma	Limay, Bataan	P2,500.00	
	29	Matilde Fernando	Limay, Bataan	P2,500.00	
	30	Rose C. Santos	Limay, Bataan	P2,500.00	
	31	Antonia P. Bueno	Limay, Bataan	P2,500.00	
	32	Leticia Salandanan	Limay, Bataan	P2,500.00	
	33	Veronica Cauayan	Limay, Bataan	P2,500.00	
	34	Erlinda Pare	Limay, Bataan	P2,500.00	
	35	Joanne Guache	Limay, Bataan	P2,500.00	
	35			**P87,500.00**	

PROBLEMS AND RECOMMENDATIONS

I. Mangrove Rehabilitation Project

1. High mortality of mangroves planted in Kaparangan, Orani, Bataan mostly due to monsoon flood. A and, according to our project beneficiaries, mangrove mortalities may have been caused by other fisherfolks .

Solutions made: Replanting was done by the project beneficiaries and frequent visitation and patrolling were conducted.
Signages were also placed to inform other fisherfolks.

II. Aquasilviculture Techno Demo Project

1. Limited amount allotted for the materials for fencing of the aquasilviculture techno demo.

Solution made: Aquasilviculture techno demos were established in cluster of twos(2), threes (3) and fours(4) within mangrove rehabilitated sites.

2. One fisherman (a former MFARMC Officer) complained about the techno demo to the Barangay Captain of Kaparangan, Orani, Bataan; the complaints were elevated to Mayor Benjamin Serrano resulting to the temporary suspension of the establishment of the techno demo.

Solution made: An orientation was made at the SB Hall of the Municipality of Orani, Bataan together with the Municipal Vice-mayor, councilor Rome Sicat, Barangay Captains of Palihan, Pantalan Luma, Pantalan Bago, Kabalutan and Kaparangan, MFARMC Officers, Representatives from BFAR 3 and the project team.

3. Nets of 10 units aquasilviculture techno demo structures were intentionally destroyed by an unidentified individual causing the stocks to escape to the other unit.

Solution made. The incident was reported to the Orani PNP and to the concerned officials of BPSU and BFAR 3. BFAR 3 replaced the stocks in the damaged aquasilviculture projects to help the fisherfolks recover their losses.

Summary

The Philippine National Aquasilviculture Program, a BFAR-CHED collaborative project, aimed to rehabilitate our mangrove forests and at the same time improve the welfare of the marginalized sector, specifically the fisherfolks through resource rehabilitation & livelihood provisions.

Bataan Peninsula State University, after having been given the chance to implement the PNAP oriented 637 fisherfolks from 28 accredited fisherfolk organizations in Bataan. After a thorough selection of beneficiaries following the criteria set therein 16 fisherfolk organizations signed a Memorandum of Agreement with their respective Chair or Leader.

The said project beneficiaries had accomplished their targets within a period of nine (9) months only. They collected

and planted a total of 183, 300 mangrove propagules covering approximately 61.10 hectares with 85.96% survival along the coastal areas of Orani and City of Balanga, Bataan where the fisherfolks earned P1,035,452.50 additional income.

They also established 16 units aquasilviculture technology demonstration projects and raised mud crabs, milkfish, blue crabs and shrimps while caring for the mangroves they planted. They reported a total of P 303,279.40 sales from their aquasilviculture projects.

An Inland Based Multi-species hatchery as one of the components of the program, has produced fingerlings of fish species local to the area. When the fingerlings reached the recommended sizes these will be released along the mangrove forest to grow. Two hatcheries were also established to allow gravid fish species being caught by the fisherfolks to lay their eggs and grow in the open, a strategy of increasing fish population and improving fish catch of the fisherfolks.

An estimated 778.5 million blue crabs and 248 million mud crab eggs were spawned through the hatchery and 4,002, 400 fingerlings produced in the Inland based hatchery, were allowed to grow in the open sea to increase their population in the area.

Conclusion

The decline of mangrove resources in our country has significantly reduced the productivity of coastal fisheries due to a continuous decrease in fish capture by the fisherfolks. This is an alarming scenario that could be prevented through the collaborative efforts of the government, the academe and the most affected sectors of our society, the marginalized fisherfolks.

The strategies used in the implementation of the PNAP in Bataan were found effective due to very high survival of planted mangroves. The presence of aquasilviculture technology demonstration projects along rehabilitated mangrove areas significantly helped increase survival of mangroves since fisherfolk beneficiaries were always in their aquasilviculture projects. Fish catch according to some interviewed fisherfolks is also increasing due to continuous spawning of fish in the hatchery.

If the 61.10 hectares of mangrove areas rehabilitated during the first phase of the PNAP will reach its full potential as fish habitat, an estimated 40,937 kg of fish per year will added to the fish catch of the fisherfolks.

Even if only 1% of the 1,030,502,400 spawned or laid eggs of the mud crabs and blue crabs survived, that means around 10.3M of these species will be growing in the wild and may be harvested by the fisherfolks.

If all fisherfolks in our country will be as organized and as eager as those in Bataan, there will be no reason why this government program will not succeed. They are now very much aware that if mangrove areas will be rehabilitated and properly protected, fish capture will definitely increase.

Recommendation

Various sectors of our society should do their part in improving and protecting our coastal resources. Efforts should be exerted to hasten rehabilitation of more mangrove

areas to increase fish habitats coupled with the establishment of Community-based Multi-species hatcheries such as the lying-in concept hatchery in every fish farming community of the country.

Research should also be conducted to determine the rate of survival of each fish species being allowed to hatch in the open and/or in mangrove areas.

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References

Baconguis SR, Ociones FT, Panot IA, Lavega RM, Siapno FE, Carino CR, Holgado DY and Reyes FM. 1993. A Guidebook on the Mangroves of Puerto Galera. Ecosystems Research and Development Bureau, Department of Environment and Natural Resources, College, Laguna, Philippines.

Kamrani E, Sabili A and Yahyavi M. 2010. Stock Assessment and Reproductive Biology of the Blue swimming crab, *Portunus pelagicus* in Bandar Abbas Coastal Waters, Northern Persian Gulf. 201 Journal of the Persian Gulf (Marine Science)/Vol.1/No.2/December 2010/11/11-22.

Melana DM, Atchue III J, Yao CE, Edwards R, Melana EE and Gonzales HI. 2000. Mangrove Management Handbook. Department of Environment and Natural Resources, Quezon City, Philippines, through the Coastal Resource Management Project.

Pelan M and Grubert M. 2007. The Life Cycle of Mud crab.

Primavera JH. 1995. Mangroves and brackishwater pond culture in the Philippines. Hydrobiologia 295: 303-309.

Suggested Readings

Baconguis SR, Cabahug Jr DM and Alonzo-Pasicolan SN. 1990. Identification and inventory of Philippine forested-wetlands resource. Forest Ecology Management 33/34: 21-44.

BFAR-CHED. 2011. Implementing Guidelines for the Implementation of the Philippine National Aquasilviculture Program (PNAP).