

Social Preparations Towards Community-based Approach to Stock Enhancement in Sagay Marine Reserve, Philippines

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Abstract

Stock enhancement involves a set of management approaches which include the release of hatchery-produced aquatic organisms to enhance or restore fisheries. Stock enhancement of various species has a long history in developed countries and it showed that releases have the potential to yield substantial benefits for various fishery stakeholders. While the biological objectives of stock enhancement were often successfully achieved in most of these enhancement initiatives, some results showed that actual social gains in terms of yields, distribution of benefits and institutional sustainability are often inconclusive. The high cost of stocking accrues to the government which means these are supported by public funds. Meanwhile, benefits are dissipated across various stakeholders, some of them did not at all contribute and participate in the stocking program. In such government-initiated and publicly-funded stock enhancement programs, the lack of sense of stewardship among direct fishery stakeholders was observed to have contributed to a vicious cycle of excessive extraction of fishery resources for individual economic benefits.

Developing countries such as the Philippines would be confronted by budgetary limitations if it has to adopt the stocking strategies applied in developed countries. Thus, with reference to the success of co-management approaches for managing fishery resources in the Philippines, a community-based strategy for enhancement of fishery stocks was explored. SEAFDEC/AQD, with support from the Government of Japan Trust Fund, initiated a community-based approach to stock enhancement in Molocaboc, an island *barangay* or village within the Sagay Marine Reserve (SMR). The initiative aims to ensure that its goals and strategies are within the social milieu of local stakeholders, i.e. fisherfolks are without financial assets to contribute or pay for the enhancement of the fishery and stock enhancement is often not a priority approach to address fishery resource depletion for most local governments. However, the social assets of fishing communities could be explored to implement stock enhancement. This paper describes the social preparation executed from 2007 to 2011 in order to orient a fishing community such as Molocaboc towards a successful enhancement of overfished species. Initially, the project focused on donkey's ear abalone *Haliotis asinina* to provide an example for other species. Abalone or '*kapinan*' in the vernacular is one of the over-extracted fishery resources in Sagay City. It is one of the high-priced catch among fishers in coastal communities in the Philippines. High buying prices compared with other fish catch motivated small-scale fishers to target abalones and caused its overfishing.

Keywords: co-management approaches, fishery resources, Philippines, social preparation

Introduction

Stock enhancement and restocking are potential measures that could either reduce the time needed to rebuild certain capture fisheries to a more productive level, or increase the productivity of some 'healthy' fisheries (Bell *et al.*, 2006). Stock enhancement primarily involves the release of cultured juveniles into wild population to augment the natural supply of juveniles from wild spawners as well as mature stocks derived from releases of hatchery-reared juveniles and optimize harvests by overcoming recruitment limitation (Bell *et al.*, 2008). Restocking, on one hand, is the process of restoring the spawning biomass of severely depleted populations of fish and shellfish to a level where they can once again provide regular, substantial yields (Bell *et al.*, 2005). Purcell (2004 as cited by Bell *et al.*, 2006) noted that restocking could also be achieved by aggregating and relocating adults of some species. Sea ranching is also an alternative way to increase productivity from fisheries habitats, wherein, animals are released for harvest at a larger size. Both stock enhancement and restocking are likely to be effective for some coastal invertebrate fisheries because the shallow inshore distribution and sedentary behavior of the species involved can create self-replenishing populations on a relatively small spatial scale (Bell *et al.*, 2005).

Stock enhancement programs were initiated as a fisheries management option in developed countries where governments prioritize and allocated funds for research and its actual implementation. The small-scale enhancement trials being done in the Philippines cannot compare with the magnitude of the releases in developed countries. These enhancement initiatives

in developed countries could provide fundamental principles, lessons and motivations for adopting a fishery resource enhancement strategy for a developing country like the Philippines. For example, Japan stocked scallops *Patinopecten yessoensis* (Uki, 2006) and flounder *Paralichthys olivaceus* (Kitada and Kishino, 2006; Tomiyama *et al.*, 2008); China on shrimp *Penaeus chinensis* (Wang *et al.*, 2006); United States on red drum *Sciaenops ocellatus* (Leber, 2004); Australia on barramundi *Lates calcarifer* (Loneragan *et al.*, 2013) and Norway on lobster *Homarus gammarus* (Tveite and Grimsen, 1995 cited in Bell *et al.*, 2005).

Community-based strategies were applied in some of the abovementioned large-scale stock enhancement programs. In the stocking of one million hatchery-reared Japanese flounder juveniles annually since 1996 in Fukushima Prefecture in Japan (Tomiyama *et al.*, 2008), fishers pay 5% of their landings to fund the community-based enhancement program. Fishers also consented not to catch flounders <30 cm total length to sustain the economic gains from investments in stock enhancement. However, the economic benefits from the program declined due to reduced recapture rates and lower market prices of fish. In spite of negative net economic benefits, the stock enhancement program cannot be easily terminated because it has effectively demonstrated the importance of fishery management to fishers. Thus, it is a concern on how fishery stocking programs can be made flexible and effective in order to optimize either economic or social benefits. More recently, the approach to marine stock enhancement further emphasized the need for an integrated view of the role of enhancement within fisheries management systems, noting the

stakeholder participatory and scientific approach (Lorenzen *et al.*, 2010).

In the stocking of scallops in Hokkaido, Japan, the success of stocking was attributed to the presence of cooperatives tasked to plan and implement effective use of fishery resources, aside from the fulfillment of biophysical factors such as ideal habitat, effective methods and sedentary attribute of scallops. Some of the activities developed by the fisheries cooperatives are: a) fixed levy-rate on the value of scallops harvested by each fisherman to generate funds to support future fishery management efforts; b) monitoring the attributes of the scallop population (e.g. density and survival of juveniles, and growth-rate of sub-adults in the rotational fishing area); c) production of a specified number of juveniles for release by the members of the cooperative; and d) training courses for new members on the production and harvesting of scallops must be completed before new members start fishing (Masuda and Tsukamoto *et al.*, 1998; Drummond, 2004, as cited by Bell *et al.*, 2006).

The stocking of shrimp *Penaeus chinensis* in China in 1991 yielded cost-benefit ratios up to 1:9 (Wang *et al.*, 2006). These economic benefits were largely due to substantial support from the central government and facilitated by an easy access to the existing aquaculture infrastructure. Relevant local governments also required the beneficiaries of release programs to contribute to the costs of releasing hatchery-reared juveniles. However, the implementation of the user-pay systems have been difficult in some regions such as in Bohai Sea because of the large area covered and the complexity of multi-provincial and multi-level administrations. In other smaller regions such as in

Haiyangdao and Qinghai, the identification of the beneficiaries and the collection of appropriate fees to cover the cost of stock enhancement were easier. Hence, the study concluded that rebuilding the wild shrimp fishery by implementing conventional management measures supplemented by stock enhancement may present a more cost-effective approach to increasing prawn production than aquaculture because the yield from farming of shrimp is achieved with a huge consumption of resources and at a great cost.

In the Philippines, there were initial efforts in 1996 to 2001 to re-establish the spawning populations of sea urchins in Bolinao in Pangasinan by exploring complimentary outcomes of private investments in the grow-out culture of sea urchins *Tripneustes gratilla* in sea cages and restocking of hatchery-produced juveniles in unprotected seagrass areas (Junio-Meñez *et al.*, 2008). As a follow-up activity in 2004 to 2006, higher population densities, higher incidence of recruits and steady increase in the catch per unit effort of gatherers showed that the grow-out culture in cages combined with sustained efforts of the fishing community to protect and implement harvest regulation to ensure steady recovery of the wild population proved to be a cost-effective strategy for re-establishing effective spawning populations. The cage culture operators obtained income from sale of harvested sea urchins, while those without cages benefitted from gleaning sea urchins from spill-overs.

In early 2000, stock enhancement of mollusks was identified to be one of the priority research areas at SEAFDEC/AQD to complement emerging coastal resources management initiatives that will secure food and livelihoods in fishing communities. In

2005, SEAFDEC/AQD, with funds from the Government of Japan-Trust Fund (GOJ-TF), started to collaborate with the Protected Area Management Board-Sagay Marine Reserve (PAMB-SMR) of the City of Sagay in Negros Occidental to implement a research program on *Resource enhancement of internationally threatened and over-exploited species in Southeast Asia through stock release*. These species include giant clam *Tridacna gigas*, abalone *Haliotis asinina*, sandfish *Holothuria scabra*, and sea horse *Hippocampus* spp. The program included a study on the socioeconomic analysis of stock enhancement of threatened marine species in SMR, initially with a focus on abalone because seed production and nursery techniques are already developed at SEAFDEC/AQD (Capinpin *et al.*, 1999), studies on release strategies have commenced in SMR (Gallardo *et al.*, 2003; Lebata-Ramos *et al.*, 2013), and economic benefits for fisherfolks can be attained from trade of these species.

This paper describes the social preparations executed from 2007 to 2011 in order to orient a fishing community such as the remote island barangay of Molocaboc towards a successful stock enhancement of abalones in areas within the SMR. A community-based approach to stock enhancement is proposed to be executed and tested in this project considering the social milieu of the stakeholders in the stock enhancement of abalone, i.e. stakeholders have limited financial resources to contribute to funds for seed release programs, reluctance of local governments to prioritize and allocated public funds for stock enhancement, and the need to improve income and access to food among fisherfolk faced with depleted resources.

Methods

The Sagay Marine Reserve was selected to host the study on stock enhancement of threatened and over-exploited species since there is abalone fishery in the area, its catch is dwindling, and the recovery of enhanced stocks would benefit from and perform better in protected environment (Maliao *et al.*, 2004). The key activities under this study are: 1) reconnaissance and baseline socioeconomic survey of the SMR and its fishing communities in cooperation with the SMR staff; 2) capacity-building for fisherfolk-stakeholders through information, education and communication (IEC); 3) strengthening of fisherfolk organization through formation of Barangay Fisheries and Aquatic Resources Management Council (BFARMC); and 4) establishment of a community-based stock enhancement demonstration site.

To provide basis for detailed project planning, the baseline survey of 60 fishers was implemented in selected six (6) coastal barangays and two (2) island barangays in February 2007. The respondents were chosen through stratified proportionate random sampling based on number and distribution of fishers in coastal barangays in Sagay City. The outcomes of the survey led to the selection of and focus on Barangay Molocaboc for the implementation of subsequent action-oriented activities intended to identify strategies for managing released stocks. The IEC activities were conducted in Barangay Molocaboc and in other relevant areas in Sagay City mostly in 2008. Networking with and identifying the roles of various stakeholders in stock enhancement such as fishers, traders, LGU officers at barangay and city levels, local academe and other relevant people's organization

were consensually determined through a series of meetings in 2009. Fisherfolks were organized into BFARMC in November 2010. Capacity building relevant to stock enhancement were implemented by training ten (10) fishermen-members of the BFARMC on abalone and sandfish seed production and nursery techniques at SEAFDEC/AQD in Tigbauan, Iloilo in 2011. Finally, the community-based stock enhancement demonstration site for abalone and sandfish was established in the intertidal flats of Molocaboc Dacu upon consensus among fisherfolks represented by BFARMC, Barangay Molocaboc LGU, PAMB-SMR and SEAFDEC/AQD.

Results and Discussions

Social preparations to introduce, inform and condition stakeholders towards active participation in community-based stock enhancement of abalone and sandfish as a fishery resource management strategy were conducted in Barangay Molocaboc from 2007 to 2011. The social preparation activities conducted in the study site are categorized as: 1) reconnaissance and baseline socioeconomic survey of fisherfolks; 2) conduct of information, education and communication activities; 3) formation and strengthening of fisherfolk organization; and 4) establishment of the community-based stock enhancement demonstration site.

1. Reconnaissance and baseline socioeconomic survey

The Sagay Marine Reserve 10.90°N, 123.42°E covers 32,000ha of coastal waters north of Sagay City mainland. It encompasses protected reef areas not habited by human population, namely; Carbin, Panal and Maca Reef. It also

includes the island Barangay of Molocaboc with a population of 4,189 residing in three component islands called Molocaboc Dacu, Diut and Matabas (Figure 1). Of the 25 barangays of Sagay City, a baseline survey of 80 fishers was conducted in February 2007 in selected coastal barangays, namely Bulanon, Himoga-an Baybay, Old Sagay, Taba-ao, Vito and Poblacion; and in the island barangay of Molocaboc. The survey respondents reported about the declining catch of all species, i.e. 1 to 20kg in 1995, to the present catch at less than 5kg per 1 to 6-hour fishing trip. More so, there is increasing fishing pressure due to the worsening economic situation among the growing number of population in fishing communities within the SMR.

The survey respondents noted that fishery resources used to be abundant and that most fishers noted to have been part of the irresponsible exploitation of these resources. They recalled the declaration of the SMR in 1995 which have changed their fishing activities and areas because of the imposition of rules and regulations to protect the vast area of Sagay's coastal waters. There have been changes in target fishing grounds reported by fishers during the survey and prior to the declaration of the SMR. In spite of the protection, fishers reported continuing decline in catch due to a combination of fishing pressure. Only 17% of the survey respondents in 2007 were aware of stock enhancement as a fisheries management option. The fishers welcomed the concept when explained during the survey but were oblivious of the mechanisms on how and who will implement stock enhancement in Molocaboc. The survey showed the need to inform the stakeholders on the principles, importance, stocking strategies, present trade-offs and future benefits from stock

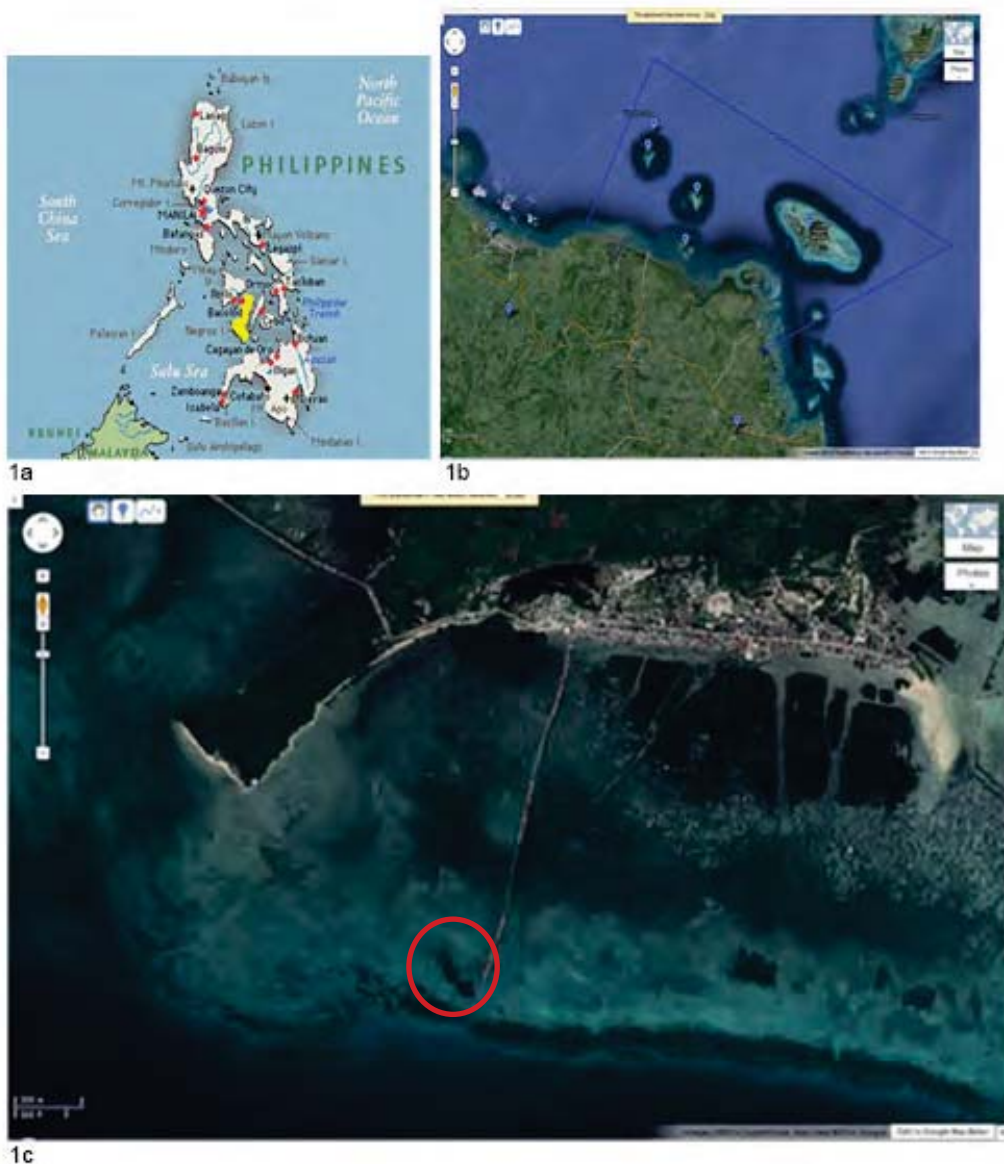


Figure 1a. Map of the Philippines showing the location of Negros Occidental province (marked yellow) in central Philippines; 1b. Aerial view of Sagay Marine Reserve demarcated by blue line in northern part of Sagay City in Negros Occidental; and 1c. Aerial view of Barangay Molocaboc showing the area of the community-based stock enhancement demo-site on the coral patch on left side at end of the 2-km footwalk.

enhancement in order to obtain the cooperation and participation of fishers and other stakeholders towards a successful stock enhancement initiative.

A multi-stakeholder consultation activity called *Participatory Action Plan Development (PAPD)* was conducted on

13 May 2008 to complement the baseline survey in February 2007. The PAPD enabled 41 stakeholder-participants categorized as fishers, local government or barangay officers, women gleaners, stockers/traders, and fishers to come-up with a community resource map, priority list of problems and corresponding

solutions relevant to Sagay fisheries and the proposed collaboration on community-based stock enhancement. The PAPD outcomes enabled stakeholders to analyze their problems that potentially relate to stock enhancement initiatives in SMR. The PAPD process identified problems that were categorized as environmental, economic and socio-political. The most recognized environmental problems are: 1) flood and rising sea level experienced by the island dwellers during calamities, and 2) destruction and declining catch in intertidal flats due to mining of shells for handicrafts. Economic problems are: 1) low income from fishing due to declining catch, and 2) lack of market outlet and capital among handicraft makers. Meanwhile, the socio-political problems are about the limitations associated poor implementation of existing fishing rules and regulations that prohibit the use of illegal fishing gears such as compressor, fine mesh nets, triple nets and cyanide fishing. The PAPD results showed the fisherfolks in Molocaboc as confronted by declining catch and deteriorating economic incentives for fishing. However, fishers lack skills and opportunities to shift jobs away from fishing; and stock enhancement was perceived to offer solutions to their problems. Moreover, the local socio-political support to implement stock enhancement is limited and benefits are often attained after substantial periodic lags. Therefore, fisherfolks requested for other livelihoods to be developed to generate income for fishers affected by regulations to support stock enhancement.

In view of the potential of ecotourism as source of alternative livelihood in fishing communities, the fisherfolks were introduced to a seminar on ecotourism initiatives and opportunities in Sagay on

13 May 2008 in coordination with the Sagay City Tourism Desk. The seminar introduced ecotourism concepts and presented the Sagay City webpage to create awareness among 47 fisherfolk-stakeholders on non-resource extractive service-oriented livelihood options that may benefit local fishers. A tourist survey was also conducted in 2007 to understand the profile of visitors that will provide basis for designing and promoting ecotourism programs involving fishers. The survey showed that the top sites to visit are Cabin Reef and local resorts with preferred recreation activities such as swimming (27% of respondents), strolling in the beach (26%) and eating seafood (15%). The awareness levels of the tourist-respondents on abalone (13%) and giant clam (42%) are, however, low in comparison with corals (91%), star fish (73%), sea horse (61%) and sea cucumber (36%). The presence of these species in the waters of Sagay elicited interest among tourist, either as species to see in diving or snorkeling sites or as food in local restaurants for non-prohibited marketable species.

2. Information, education and communication (IEC)

In response to the outcomes of the baseline survey which showed low levels of awareness and understanding of stock enhancement of abalone among stakeholders, IEC activities were continuously conducted in Barangay Molocaboc and other relevant areas in Sagay City. Information seminars with resource persons from SEAFDEC/AQD were held in March 2008 on the biology of abalone and giant clams, which were prioritized for stock enhancement. The seminar informed the fisherfolks and SMR personnel on abalone seed production and

grow-out technology, and on the progress and significance of the giant clam stock enhancement experiments of SEAFDEC/AQD. In particular, the seminar informed the fishers on the life cycle and growth stages of these species with emphasis on the various implications of some fishing practices on recruitment and growth of fish stocks. The fishers were made aware of the spawning and larval development of donkey's ear abalone based on SEAFDEC/AQD research results (Capinpin *et al.*, 1998). Following several stakeholder consultations, an ordinance that regulates the harvesting, consumption and trade of abalones was proposed and promulgated on June 2010 by the Barangay Council of Molocaboc. The project stakeholders adhere that the ordinances, in particular the abalone catch size regulated to be >6cm shell length, will allow replenishment and promote sustainable fisheries. It is also expected to compliment the forthcoming project on abalone stock release. IEC activities also included the preparation of posters about coastal fisheries management, compliance to fishing regulations and the importance on stock enhancement in SMR. These posters were displayed and explained in local fairs and exhibits such as the Sinigayan Festival every March.

The seminar on the biology of sea cucumbers and the potential of sandfish and sea horse for stock enhancement in SMR was conducted on 25 November 2010. To develop understanding and skills for stock enhancement and prepare them for the community-based demo-site, ten fisherfolks were sent to SEAFDEC/AQD in Tigbauan, Iloilo for an introductory hands-on training in hatchery and nursery techniques. Five fisherfolks were trained on abalone and another five on sandfish for five (5) days for each species.

3. Strengthening of Fisherfolk Organization

The role of fishermen's organization is critical in community-based stock enhancement projects. However, at the start of the project, there is no active fishermen's organization in Molocaboc. The organization of the Fisheries and Aquatic Resources Management Council (FARMC) at various levels from the barangay, municipality or city, provincial and national levels is promulgated through Fisheries Administrative Order (FAO) 196 - Series of 2000 of the Bureau of Fisheries and Aquatic Resources (BFAR). This Order promulgates the rules and regulations for the fisherfolk empowerment program of the government and to achieve sustainable development of fisheries and aquatic resources, attain food security and eradicate poverty among the coastal and inland fishing communities. The provisions of Section 68-79 and other related provisions of Republic Act 8550 otherwise known as the Philippine Fisheries Code of 1998 provided the basis for the formation and functioning of the Barangay Fisheries and Aquatic Resources Management Council of Barangay Molocaboc (Molocaboc BFARMC) which constitute the association of fisherfolks and similarly interested parties in the locality.

This stock enhancement project has been instrumental in forming the Molocaboc BFARMC on 24 November 2010. The organizational structure and relationships between BFARMC and other entities, including SEAFDEC/AQD and this project have been discussed with the fishers and other stakeholders. Thus, six groups of stakeholders agreed to collaborate to establish, maintain and sustain the *semilyahan* (Table 1).

Table 1. Roles and responsibilities agreed by stakeholders to maintain and secure the stock enhancement demonstration site in Barangay Molocaboc, Sagay Marine Reserve, 2010.

SMR/ Municipal LGU	Barangay Molocaboc LGU/BFARMC/ Youth Organization	SEAFDEC/AQD	Academe/ Schools (e.g. NONESCOST)	Community (preferably through peoples' organization)	Traders, stockers
Assist partners: SEAFDEC, community, barangay LGU	Assure & provide manpower to secure demo site	Research, technical assistance & training in biophysical & socioeconomics aspects of fisheries resource enhancement	Assist in data gathering	Revitalize POs-MAMFA with assistance from LGU/SMR	Support and encourage compliance to ordinance on catch size regulation
Community organizing	Enforcement of barangay ordinance	Initial supply of seeds in demo site	Assist and complement in IEC activities	Actively cooperate in community projects	Practice fair pricing
Law enforcement (security of demo farms)	Follow-up implementation of IEC activities	Provide scientific information in drafting fishery ordinances, resource management and aquaculture livelihood		Disseminate and comply with ordinance	Provide market information to SMR and SEAFDEC as requested (price, volume, quality, etc.)
Resources management planning	Assist in monitoring			Provide labor (<i>bayanihan</i> style)	Contribute in purchase or acquisition of materials for pen construction
Project monitoring	Coordinate with municipal LGU, SMR, BFARMC				
Conduct/ support IEC	Enjoin participation of youth and "purok" leaders				
Benchmarking of resources (abalone and sea cucumber population, natural food, predators) in demo site	Provide logistics when needed (e.g. food for manpower securing demo-site)				
	Provide permit to SEAFDEC to collect broodstocks				

4. Establishment of Community-based Stock Enhancement Demonstration Site

In response to the outcomes of the socioeconomic baseline assessment survey in February 2007 and a follow-up survey in 2009 which showed the need to improve awareness about stock enhancement as a fisheries management option among fisherfolks, the community-based abalone and sandfish stock enhancement demonstration site was established in January 2011 in the coralline intertidal flats, approximately 4,000sq m and located less than two (2) km from the shoreline of Molocaboc Dacu (Figure 2). The location of the demo-site, locally called by fishers as *semilyahan* or spawning area, was

nominated and finally selected by the local fisherfolk members of the BFARMC on the basis of the following criteria defined by the stakeholders: 1) biophysical suitability for stock enhancement of abalone (i.e. presence of at least few wild abalone and sufficient branching corals with encrusting algae as described in Lebata-Ramos *et al.*, 2013); 2) visibility and accessibility to serve its purpose as stock enhancement demo-site; 3) safety for BFARMC members who volunteered to be on overnight duty to guard the demo-site against poachers; and 4) compliant to the multiple use zoning policy of the PAMB-SMR and Barangay Molocaboc (i.e. located in prescribed mariculture area not in navigational area).

An assessment of the nominated site started in February 2011 by visual inspection of the corals and search for wild abalone samples every month from February to June 2011 during neap tide. Abalone catch ranged from 0 to 2 individuals per month with fishing effort comprised of 3 divers simultaneously searching the nominated demo-site for one hour. The stakeholders therefore decided to proceed with the establishment of the demo-site. Basic preparations include the installation of floating signage marked with “*Semilyahan, Bawal Manginhas*”, meaning “spawning area, gleaning is prohibited” to inform about the purpose of the demo-site. The demo-site was also demarcated by buoys and ropes installed by BFARMC.

On June 2011, the first trial release of 514 pieces of tagged hatchery-bred abalone juveniles in the community-based stock enhancement demo-site was participated by stakeholders such as the BFARMC, local government officials, SMR staff and some interested men and women residents in Barangay Molocaboc. The local stakeholders proposed and agreed to secure the demo-site from poachers. Every month or two weeks depending on the number of volunteers, BFARMC members sign-in in pairs to be on overnight duty from 6pm to 6am. The volunteers established their guarding protocol which include signing of guarding log-book, bringing of flashlight, whistle and food provisions and logging of incident report in record book kept by the President of the BFARMC. The volunteers were informed that they have no police power, hence, poaching incidents should only be deterred and reported to authorities such as the local government official of Barangay Molocaboc who will in turn process the incident as appropriate.

Conclusions and Recommendations

Stock enhancement programs are often constrained by prohibitive implementation cost and reluctance of local governments to prioritize and allocate public funds for such purposes. This study demonstrated that small-scale enhancements can be initiated through community-based strategies. A network of strategically contiguous small community-based stock enhancement sites which can be afforded in the Philippine setting, may therefore serve some purposes similar to well-funded large-scale enhancements in developed countries. These release sites, called as *semilyahan* by fisherfolks in Barangay Molocaboc in Sagay Marine Reserve in Negros Occidental are designed to generate spill-overs that will provide future benefits in terms of “catch-for-subsistence” for many marginalized gleaners and fishers in small fishing communities.

The study showed that the decision and implementation of stock enhancement and the definition of its objectives and relevance involves the strong engagement with stakeholders. The determination of social preparation activities requires and involves continuous consultation with stakeholders through a variety of methods such as survey interviews, IECs, formation and strengthening of fisherfolk organization, and the actual establishment of stock enhancement demo-site accessible to the public. The activities tested in this study showed that the formulation of social preparation activities for stock enhancement should be founded on the following principles: 1) community-specific strategies, 2) responsive to local social settings and needs, and 3) consultative and participatory across various stakeholders.

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