

## Abalone Aquaculture for Stock Enhancement and Community Livelihood Project in Northern Palawan, Philippines

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### **Abstract**

One of the interventions to feed the poorest of the poor fisheries sector in the country is the provision of livelihood in the form of mariculture of high value marine species. In the Philippines, livelihood in rural areas is largely linked to resource depletion, hence it is wise not only to provide livelihood to the community but also to encourage them to conserve and enhance the resources. As part of the revised R&D program, the Western Philippines University partnered with NGO and existing projects to embark on a community-based environment-concerned livelihood project, using hatchery bred abalone, although top shell was also considered for stock enhancement. This is in an on-going project thus, preliminary phases such as abalone production and cage-based grow-out as well as subsequent project plans will be discussed. The objectives of this study were to: (a) share the implementing experiences in this project, (b) identify success and failure drivers of the project, (c) explain the conceptual framework for the MPA-based stock enhancement to be used in this project, and (d) give recommendations to improve the implementation and ensure the success of the project.

The following activities have thus far been conducted: (a) development of criteria for cage micro-site selection; (b) writing of proposal and provision of financial assistance for hatchery juvenile production through a partnership MOA; (c) presentation of site survey results to beneficiaries and stake holders; (d) conduct of trainings on abalone grow-out culture to POs; (e) development and improvement of training module; (f) signing of conservation agreement; (g) giving of cage materials and juveniles to people's organizations; (h) on site coaching; and (i) partial monitoring. The next activities include improvement in juvenile production, conduct of researches on abalone nutrition, and development of market and value chain flow analysis. The conceptual framework for community-managed stock enhancement will follow that of the Department of Environment and Natural Resources-ICRMP, of which the stock enhancement project is anchored on the management of marine protected areas or MPAs.

The steps in all the activities were documented and while the project was in progress, performance of the participants in training were measured, the training module was improved, the training approaches were revised according to needs, and the growth and survival of juvenile abalone were monitored. The problems identified were low production of juveniles, insufficient food for grow-out, political squabbles, social preparation, and delay in implementation schedule. Recommendations to improve or resolve the problems encountered were also presented in this paper.

**Keywords:** abalone, community-managed stock enhancement, training

## Introduction

It is common knowledge that fishermen are the poorest in this country, followed by farmers and children. Thus, aside from the Western Philippines University's (WPU) academic concerns, the University's R and D plan (2014-2018), focuses on fishermen and farmers of Palawan as primary beneficiaries.

One of the interventions to feed the poorest of the poor among the coastal fisheries sector in the country is to provide them livelihood in the form of culture of high value marine species. Success through this mode is manifested in the fact that their engagement in seaweed farming has given them supplemental incomes. However, shell fish culture can be more economically viable and stable. Moreover, apart from this being a promising mariculture product for fisherfolk, such commodities are more resilient to diseases and climate change.

The abalone *Haliotis asinina* called locally as “*sobra-sobra*” or “*kapinan*” has become a popular marine commodity both to fishermen and marine product traders for the past decades. This is primarily due to its high market price and demand. It costs 350 pesos per kilogram in the local market of Palawan, 400 pesos in the Southeast Asian Fisheries Development Center (SEAFDEC) and as high as 3,000 pesos per serving at restaurants in Ongpin, Metro Manila. Abalone meat is known as a delicacy served in prestigious restaurants and hotels in Asia. It has a soft delicious taste, while the shell is used in many decorative items and ornaments. The demand for this shell has become so great that it was overextracted from the wild, resulting to a situation where the abalone's natural process of reproduction could not cope up with the stock's decline. Thus, breeding local abalone

is one of the strategies pursued to conserve the species and/or population(s).

Abalone is number three in the priority list of marine stock enhancement species for the Philippines (Gonzales, 2005). In Palawan, coral reefs have been devastated by gleaners and shell collectors turning coral reefs “upside down” in search for abalones. The abalone population has remarkably dropped, in a manner that fishermen have been pressured not to do massive collections since 2012. According to traders Palawan's production of wild abalone has drastically decreased from 100 metric tons in 1997 to 2 metric tons in 2011 (Pagliawan, pers. comm.), (Figure 1).

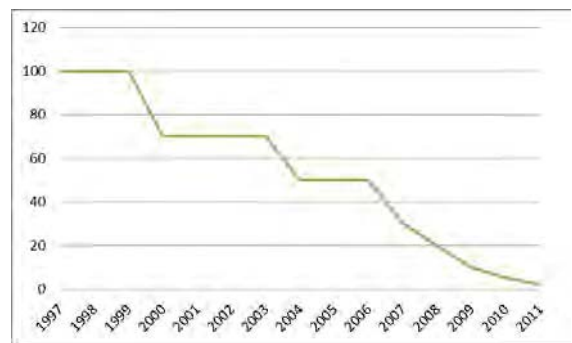


Figure 1. Production (tons) of wild abalone in Palawan for 15 years (1997-2011).

The graph suggests that Palawan alone can produce 100 tons of abalone a year, while in 2008, only 200 mt was exported from the country which was less than half of the average annual production between 1900 and 2005 (Baobao and Roslinda, 2013). Hongkong was said to be the largest buyer of abalone meat. The decrease in production was attributed to over harvest of the wild population of abalone and destruction of their habitats.

Dwindling wild abalone populations can be restored through stock enhancement. The barangay-based stock enhancement

has been tested in Honda Bay (Gonzales *et al.*, 2006). In the Philippines, livelihood in rural areas is sometimes linked to resource depletion, it is wise not only to provide livelihood to the community, but also to encourage them to conserve and enhance the resources. Stock enhancement is a coastal and fisheries management tool to increase and sustain the biomass of certain population, especially in cases where the population is depleted or over exploited. Stock enhancement is also sometimes referred to as restocking (Gonzales, 2005). It is a recommendable follow through project for Marine Protected Areas (MPAs).

### **Why Abalone?**

Since abalone has high market demand both locally and internationally, it has become a potential source of livelihood for fish farmers. In addition, the presence of an abalone hatchery facility and the breeding technology capability in WPU ensures the continuous production of abalones. This shall likewise make the propagation and survival of the wild species amidst threats from human activities.

Abalone reared in cages is a viable livelihood for coastal fishers. The survival and growth of abalone shells will not require costly feeding by the farmers since it is fed with algae from the wild, opening a window for another source of income for the fishermen, which is seaweed production.

Cage culture of abalones is essentially producing organic abalones which could support the food security apart from the prospects of presenting this as a delicacy for tourists.

Abalones graze on algae attached on the surface of dead corals. Dead corals devoid

of algae have greater chances of recovery since new coral polyps could readily attach and grow on clean surfaces of the dead reefs. Additionally, abalone is a good candidate for stock enhancement since it is less mobile, and could readily be introduced to the other island provinces of Region 4B (MIMAROPA).

Abalone mariculture projects could readily involve women as well as indigenous peoples with great potential for project partnerships with the private sector (Private Public Partnership).

This paper presents the on-going experiences in the implementation of the community-managed abalone project. As such, the objectives of this study are to:

1. identify problems encountered by the project,
2. explain the conceptual framework for the MPA-based stock enhancement, and
3. give recommendations to improve the implementation and success of the project

### **Materials and Methods**

#### ***Main Project Activities:***

Fund sourcing - WPU entered into a Memorandum of Agreement on the implementation of the abalone project with the Malampaya Foundation Incorporated (MFI) that funded part of the production expenses, training and grow-out of abalone. WPU also partnered with the LGUs and POs for their cage grow-out culture. Other MOAs between POs, LGUs, and MFI were forged regarding environmental conservation, while pursuing livelihood projects.

Site selection – Since northern Palawan is a heavily fished area, the situation affects the income of fishermen, thus northern Palawan coastal communities were given priority by the project. The other criteria for selection of project sites were the suitability of the site for high abalone survival, growth and dispersal apart from the successful reproduction of abalone in the area. Considering the priorities of the partner agency (MFI) to serve the communities along the Malampaya gas project, sites selected were Coron, Culion, Linapacan, El Nido, and Taytay. Social preparations of the beneficiaries were done by NGOs and LGUs. Orientation of the

project was done during the site survey in the area. The survey covered interviews with fishermen/coastal dwellers regarding species and locations for mariculture, stock enhancement, and or marine protected areas (MPAs). A combination of key focal person and focus group discussion interviews were conducted on site as the situation permits.

Presentation of site survey results to beneficiaries and stakeholders - Results of the survey were presented in a forum in Barangay sessions, PAMB, and municipal SB sessions (Figure 2).



Figure 2. Survey team facilitating mapping and zoning of Brgy. Bulalacao MPA at Bulalacao Barangay Hall.



Figure 3. Training on construction of floating cage for abalone culture conducted in Linapacan, Palawan from September 16-21, 2013.

**Training on cage construction and grow-out culture to communities** (Figure. 3)

Two SEAFDEC lecturers in abalone aquaculture were invited by WPU to conduct enhancement training and share technologies on abalone cage culture with WPU faculty members and technicians from April 12 to 13, 2013. Subsequently, WPU trainers conducted a series of training for community members in selected project sites in 2013 (Figure 3). Training sessions were conducted in three mariculture sites, two in Taytay; and one in Linapacan. Around 30 trainees were trained per site. The main part of the training was the construction of baskets/cage and a demonstration on how-to grow the abalone

in cages, to marketable size. Participants were also taught how to pack, transport, and market their abalone products. In addition, participants were trained to manage their income from the project.

The selection of the trainees was based on the following criteria:

1. must be an identified beneficiary of the project,
2. must be a legitimate residence of target municipality/barangay.
3. MFI coordinators in identified municipalities,
4. Academic institution on-site (if qualified)



Figure 4. MOA signing on environment conservation among LGUs, POs, and MFI.

The primary objective of the community training was to provide the participants basic knowledge on CRM and how to carry-out abalone mariculture livelihood. At the end of the course, the participants will be able to:

1. describe the objectives, principles, components, and dynamics of CRM;
2. demonstrate the construction operation and maintenance of a floating cage, and
3. explain the grow-out system of the abalone culture.

The Course had the following main modules: Module I -Introduction to CRM; Module II- Biology, ecology, and hatchery of abalone; Module III-Grow-out of abalone; Module IV-Floating cage construction, Cage buoyancy, Sinkers/anchorage; Module V-Harvest, package, and transport of products, and Module VI-Marketing and book keeping.

## **Results and Discussion**

### ***Monitoring of abalone growth and survival in cages***

The monitoring of abalone growth and survival for the project was erratic. Some of the fishers were not able to properly monitor the abalone in cages. They depended on WPU and its project staff during monitoring. Hence, although abalones were raised in cages in August 2013 the first organized monitoring was done in November 2013.

**Breeders from the wild:** As of 29 January 2014, a total of 40 breeders were gathered from the wild. These were placed in a floating cage in Canique, Taytay,

Palawan in August 2013. No mortality among the shells was observed until January 2014. Shell length ranged from 46 to 90 mm and the weight ranged from 10 to 149 grams. The average shell length of the abalone was 73 mm, while the average weight was 87.5 grams. No gonad was observed in the abalones during the January 2014 sampling.

With their sizes which are over the ideal spawning size of 50-60 mm shell length, these individuals may not spawn anymore or have poor spawning performance. It is recommended that they be sold and the proceeds used to buy younger adult individuals with more spawning vigor.

**Juveniles from WPU:** The shell length of juveniles sampled in August 2013 ranged from 18-28 mm. After five months of rearing in cages, the length ranged from 33 to 46 mm (Figure 5). The average shell length of WPU juvenile abalones increased from 23.3 in August 2013 to 39.4 mm in January 2014. The average shell length of juveniles had an increment of 16.13 mm within five months of culture, having a growth rate of 3.25 mm per month. Among 15 individuals, one male (37.5 mm shell length) and one female (37.0 mm shell length) were with ripe gonads. The average weight of the juveniles was 13.3 grams.

Juveniles in basket number 2 consisted of 80 three-month old individuals with shell lengths ranging from 10 to 21 mm. with an average of 13.9 mm in shell length. These abalones were deployed for grow-out in Pamantolon on January 28, 2014. The average weight of each shell was 1.25 grams.

**SEAFDEC juveniles:** The shell lengths of juveniles deployed in November 2013 ranged from 8.5 to 18.5 mm, while after



Figure 5. WPU abalone, above and SEAFDEC abalone, below; showing the original size (white line) from deployment till January 2014. Note the meat of abalones above and below.

two months of rearing in cage the length ranged from 15.9 to 33.5 mm in January 2014. The average shell length of SEAFDEC juvenile abalones increased from 14.5 mm in November 2013 to 25.0 mm in January 2014. The average shell length of juveniles has an increment of 10.54 mm within two months of culture, having a growth rate of 5.27 mm per month. However, the average weight of the juveniles was only 3.7 grams, much lower than WPU abalones. Mortality was 10 individuals.

**General information:** SEAFDEC abalones have faster growth rate (5.27 mm/month) than WPU abalones (3.25 mm/month). However, the meat of juvenile abalones from SEAFDEC was lean/slim compared to WPU's. SEAFDEC abalones have less meat with relatively larger shell,

while WPU has relatively more meat. This may be because SEAFDEC abalones are still in the process of adjusting with its environment and food since they came from Guimaras Island and ate different species of algae. However, the genetic profile/ pool of the respective abalone populations should be investigated.

The next monitoring should be in March 2014. Since the newly delivered abalones are the smallest in size, size grading should be done

### ***Conceptual Framework for MPA-based Stock Enhancement Initiative***

Stock enhancement is a coastal and fisheries management tool to increase and sustain the biomass of certain populations, especially in cases where the population is depleted or over exploited. Stock enhancement is also sometimes referred to as restocking (Gonzales, 2005). It is a recommendable follow through project for Marine Protected Areas (MPAs). It answers the question on what happens after the establishment of MPA and MPA network. Most of the coastal management projects usually conclude with the enforcement of MPAs and network laws.

Stock enhancement focuses on the restoration of species and resources in primary coastal habitats like mangrove swamps, seagrass beds, coral reef, etc., which were overexploited. It is a proactive conservation effort wherein while waiting for the spillover effect of MPA core zone, community members may be given specific areas for stock enhancement/livelihood (Figure 6), which they can manage, harvest, and derive income from. This way, while protecting and enhancing biodiversity, POs can have a quicker benefit from MPA.

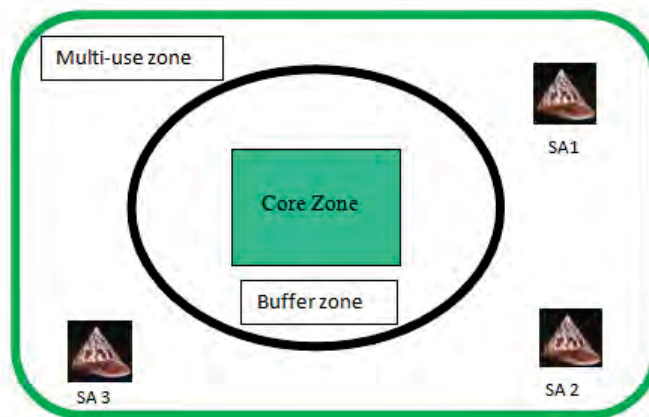


Figure 6. MPA with zoning, showing potential areas for community livelihood/stock enhancement (SA) in the multi-use zone.

After MPAs were established and zoned, the time lag between the establishment and the spill-over effect of protection becomes a challenge to MPA managers and community implementers, particularly in enforcing MPA rules and regulations. This concept aims at hastening the enhancement and restoration of depleted resources in primary coastal habitats. It is a proactive conservation effort that keeps MPA implementers and supporters actively and continuously involved while waiting for the spillover effect from the MPA core zone.

Since MPA-based stock enhancement will restore marine resources faster, it is more attractive to community members because they expect it to bring quicker and more direct benefits to them. This intervention is relatively unique to ICM in the sense that it is seldom applied as an integral part of MPA management.

Considering the importance of resource conservation project/livelihood to MPAs, a guide was developed on how to plan, implement, and manage resource conservation/stock enhancement/livelihood projects in MPAs. The document brings directions on how to proceed

with MPA – based resource conservation projects/stock enhancement, including criteria for project proposal evaluation in selecting and screening proposals from communities.

#### ***Summary of benefits from the MPA-based stock enhancement approach***

1. It can be a follow through project for MPAs and its network;
2. It aims to restore depleted population of target species in identified coastal habitat (e.g., coral, reef, seagrass beds, mangrove swamps), and at the same time extend livelihood to communities;
3. It helps in promoting greater impact to the communities by having their own area of restocking, while waiting for the MPA spill-over effect. Restocking will be done inside and outside MPAs, as well as identified areas for restocking to be managed and owned by POs or Family Groups.
4. It can respond to issues and problems indicated in the ICM or MPA plans. (less income, open access, capability building, etc.)



5. It provides a potential solution to low income, poaching, open access, limited management, and technical capability, identified in many ICM and MPA initiatives, and
6. It protects the habitat while enhancing the stock and generate income.

### ***Problems Encountered***

1. Limited production of juvenile abalone;
2. Inconsistent food supply for cage grow-out;
3. No IEC materials;
4. Weak marketing strategy; and
5. Weak monitoring

### ***Conclusion***

Although equipped with hatchery, technology, manpower, there were outstanding technological problems particularly in juvenile production and food consistency in the grow-out. There were unexpected problems that have emerged in the process. With the above concerns, the project is still hopeful to continue, by attempting to provide solutions to the identified problems.

### ***Recommendations to Problems Encountered***

1. Limited production of juvenile abalone
  - a. Improve spawning performance of abalone breeders;
  - b. Explore/study spawners from other areas, especially from Taytay Bay and Liminangcong;
  - c. Seek assistance from SEAFDEC;
  - d. Build capability of technicians. Training in SEAFDEC (include on-site trainings); and

- e. Expand and improve the facilities and human resources.
2. Inconsistent food supply for cage grow-out
  - a. Conduct experiments/ studies on Gracilaria culture;
  - b. Resource mapping of brood stock and algal food from the wild;
  - c. Conduct characterization of host habitat to potential algal food for juvenile shells; and
  - d. Investigate the discrepancies in growth rate of SEAFDEC and WPU juveniles. Consult SEAFDEC.
3. No IEC materials
  - a. Produce/print IEC materials (Training Manual and Livelihood brochure); and
  - b. Compendium of potential wild algal food for abalone grow-out system.
4. Weak packaging/processing technology identified
  - a. Identify potential packaging/processing for the product.
5. Weak marketing strategy
  - a. Develop value chain analysis for abalone from Palawan.
6. Weak monitoring
  - a. Continued skill development to fish farmers.

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