

STOCK ENHANCEMENT PROGRAM OF SEAFDEC AQUACULTURE DEPARTMENT

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■ BACKGROUND

Stock enhancement is one of SEAFDEC Aquaculture Department's four regular programs that are focused on addressing urgent issues in aquaculture in Southeast Asia. SEAFDEC/AQD formally started its stock enhancement program in September 2000 but as an activity, it had its start in 1991 as part of the Community Fishery-Management Project undertaken in Malalison Island, Culasi, Antique (west central Philippines). The importance of stock enhancement was articulated as early as 1969 in the Kyoto Declaration on Aquaculture (Sections 17 and 18) and was affirmed in 2000 in the Bangkok Declaration and Strategy for Aquaculture Development (Sections 3.9 and 3.10) and then 2001 during the ASEAN-SEAFDEC Conference on Sustainable Fisheries for the New Millennium. One of the ten-point recommendations in the Millennium Conference reads: "Promote re-stocking activities (seed release programs) from hatchery-produced stocks and/or wild collected sources in areas where they are considered to be feasible, particularly in localities operating within a regime of rights-based fisheries."

■ PROGRAM COMPONENTS

The stock enhancement program of SEAFDEC/AQD has two research components:

1) Adaptation and refinement of breeding and hatchery production techniques of appropriate species for stock enhancement

The breeding component brings together previous works on the propagation of the abalone (*Haliotis asinina*), top shell (*Trochus niloticus*), window-pane oyster (*Placuna placenta*), and seahorses (*Hippocampus barbouri* and *H. kuda*). Other species such as grouper and siganid which have developed hatchery technologies are being evaluated for their suitability for stock enhancement.

2) Development of strategies for release and stock enhancement of appropriate species
Research studies are aimed at determining the optimum release method, animal size, season, habitat and density that will result in high survival, growth and reproduction of the released animal

The stock enhancement program also has training and information components such as:

1) Seminar and training on stock enhancement for fishers, local government units and non-government organizations.

2) Production of information materials such as flyers to enhance people's awareness of stock enhancement efforts.

■ ABALONE

Abalone is a high value species of gastropod mollusk that inhabits rocky and coral reefs. Its large "foot" is one big muscle that is sold either frozen or canned and is highly prized in Chinese cuisine. Due to its high market demand, over-harvesting from the wild could result in its depletion, thus, stock enhancement in protected areas is necessary.

SEAFDEC/AQD started its research on abalone in 1993 with the aim of developing and refining hatchery and grow-out culture techniques. With the development of hatchery technology, abalone juveniles can now be mass produced. For stock enhancement purposes, juveniles are 'diet-tagged' by feeding them with artificial diet for 3-4 weeks followed by seaweed-feeding. The bluish-green shell band produced through artificial diet feeding serves as a permanent marker of hatchery-produced abalone when released to the wild. Efforts are also being made to produce and release first generation offspring of wild spawners from the release sites to maintain genetic integrity of natural stocks.

SEAFDEC/AQD researchers have evaluated potential stock enhancement sites in Panay and Negros Islands and have selected Sagay Marine Reserve in Negros Occidental as pilot stock enhancement site. Preliminary releases of hatchery-produced abalones in Sagay Marine Reserve have produced encouraging results. This research aimed at determining the optimum release size, habitat, season and density will be continued with funding support from the International Foundation for Science (IFS).

■ TOP SHELL

The top shell, *Trochus niloticus*, is another highly valuable gastropod mollusk. Its mother-of-pearl shell is used in the manufacture of buttons and other shellcrafts. The uncontrolled harvesting of top shell from the wild has resulted in the decline of natural stocks.

SEAFDEC/AQD started its research on top shell in 2000 with some broodstock obtained from Iris Marine Development Corporation which operated a *Trochus* hatchery in Palawan. SEAFDEC/AQD reared these broodstock and was successful in inducing them to spawn (see SPC *Trochus* Information Bulletin #9, p. 14). Thousands of juveniles have been produced and diet-tagged in preparation for release. Last February 2003, more than 3,000 top shell juveniles were brought to Palawan for release in a marine sanctuary in Binduyan, Puerto Princess. The initial release was carried out by the participants of the training course on Fish Sanctuary and *Trochus* Shell Resources Management conducted by the BFAR-Fisheries Resource Management Project (FRMP) in Palawan. SEAFDEC continues its efforts to refine the seed production techniques to enable mass production of seeds for stock enhancement.

■ WINDOW-PANE SHELL

The window-pane shell *Placuna placenta* is a bivalve mollusk whose shells are used as lampshades and other shellcrafts marketed locally and internationally. The reported decline in natural stocks prompted SEAFDEC/AQD to resume its research on the species in 1990. SEAFDEC/AQD researchers have succeeded in propagating the species in the hatchery. The juveniles can be nursed to larger sizes in tanks so they can survive better

in nature once released. Initial attempts gave also been made to restock the depleted beds along the Gulf of Panay by releasing both immature and breeding stocks collected from a neighboring island. Close collaboration with the concerned local government has also resulted in the closure of the stock enhanced area to all forms of gathering so that a viable breeding population can be established. However, with the discovery of the juveniles by the fisherfolk, gathering was difficult to control. Closer cooperation of the fisherfolk and local government and the establishment of a permanent protected area are necessary so that a breeding population will always be available to repopulate the area.

■ GIANT CLAM

SEAFDEC/AQD is collaborating with the Marine Science Institute of the University of the Philippines (UP MSI) in the restocking of giant clams *Tridacna* spp. UP MSI is distributing hatchery-produced giant clam juveniles to various parts of the Philippines in efforts to save and enhance the stocks of this endangered species. SEAFDEC/AQD received *Tridacna gigas* juveniles from UP MSI in October 2001 and these were reared in tank and ocean nurseries and then restocked in coral reefs in SEAFDEC/AQD's Igang Marine Substation in Guimaras Island. Restocked giant clams are growing well and the remaining giant clams in cages will be restocked in other protected areas such as Sagay Marine Reserve in Negros Occidental.

■ SEAHORSE

Commanding a good price either in live form for the aquarium or in dried form for traditional Chinese medicine, seahorse gathering in the Philippines and other parts of Southeast Asia is a good supplemental livelihood activity. However, since uncontrolled gathering will deplete the natural stocks, seed production and stock enhancement techniques should be developed, coupled with other conservation measures.

Seahorse research at SEAFDEC/AQD started in 1996. Seahorse juveniles have been produced so that SEAFDEC/AQD now has at least second generation hatchery-bred animals in captivity. Sites are now being assessed where seahorse juveniles may eventually be stocked.

Program Proposal

**SEA RANCHING AND STOCK ENHANCEMENT PROGRAM
FOR FOOD SECURITY IN SOUTHEAST ASIA**

■ **BACKGROUND/RATIONAL**

Overfishing, destructive fishing methods, and weak law enforcement are among the major causes of the decline of fishery resources, resulting in food insufficiency. There is a need to increase fish supply and augment income for increasing human population. Releasing hatchery-produced seeds into protected areas is one method of resource or stock enhancement. The Kyoto Declaration on Aquaculture (Sections 17 & 18). The Bangkok Declaration and Strategy for Aquaculture Development (Sections 3.9 and 3.10) and The ASEAN-SEAFDEC Conference on Sustainable Fisheries for the New Millennium held in Bangkok, Thailand on November 2001 recognized that sea ranching and stock enhancement have the potential to increase fish supplies. The Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region includes restocking of commercially important fish species as part of resource enhancement programs. Southeast Asian countries can learn from other countries with developed technologies for sea ranching and stock enhancement, and adopt and develop these for local species with high commercial value.

■ **SPECIFIC OBJECTIVES**

1. To assess the past and present sea ranching and stock enhancement strategies and programs in southeast Asia, Japan, US, Europe and other countries

2. To develop and verify ecologically sound strategies for sea ranching and stock enhancement of suitable species of mollusks, crustaceans, and fishes.

3. To assess the economic feasibility and acceptability of developed technologies.

4. To transfer developed and verified sea ranching and stock enhancement strategies to SEAFDEC member Countries

METHODS/DESCRIPTION

The program will use hatchery technologies developed at SEAFDEC/AQD and elsewhere for many species of mollusks, crustaceans, and fishes. It will have the following projects and activities:

1. A workshop to assess the state-of-the-art of sea ranching and stock enhancement. Experts from other countries will be invited.

2. Research and development of strategies for mass production of quality seeds, sea ranching and stock enhancement of suitable species. Technology should be research-based and shall include socioeconomic considerations (i.e. social acceptability and economic viability).

3. Verification of developed technologies for sea ranching and stock enhancement through pilot testing.

4. Training and information on developed and verified technologies for sea ranching and stock enhancement.

■ **DURATION**

5 years (2004-2008)

■ **SCHEDULE OF ACTIVITIES**

2004 – Workshop to assess existing technologies and identify suitable species for sea ranching and stock enhancement in Southeast Asian region

2005-2008

Research studies:

A. Quality Seed Production

1. Screening of suitable species for sea ranching and stock enhancement.

2. Seed quality improvement and health management.

3. Genetic management and characterization of wild and hatchery-produced Stocks

4. Behavioral conditioning (predator avoidance, food search etc.)

B. Release and stock enhancement strategies

1. Appropriate marking or tagging methods
2. Resource and ecological assessment of potential sites
3. Habitat protection and rehabilitation, etc.
4. Experimental releases to develop effective release strategies (optimum release size, season, habitat, and stocking density)
5. Released stock management strategies
6. Evaluation of stock enhancement effectiveness

C. Socio-economics

1. Economics of producing and releasing seeds for stock enhancement
2. Socioeconomic indicators of suitable sites for sea ranching and stock enhancement
3. Social acceptability of sea ranching and stock enhancement strategies
4. Management strategies for increasing and maintaining stocks

D. Technology verification

1. Pilot testing of sea ranching and stock enhancement technologies developed Recently in AQD (e.g. abalone) and in other countries
2. Monitoring and evaluation of the effectiveness of sea ranching and stock enhancement.

2006 – Workshop to evaluate developed technologies

Continue research and verification studies.

2007 – Production of manuals and information materials

Continue research & verification studies

2008 – Conduct of training programs for SEAFDEC Member Countries

■ **BUDGET**

<u>Year</u>	<u>Amount (US Dollars)</u>
2003	110,000
2004	120,000
2005	130,000
2006	140,000
2007	150,000

■ **EXPECTED OUTPUT**

1. Socially acceptable and economically viable sea ranching and stock enhancement strategies (e.g. habitat protection/rehabilitation, release of hatchery-produced Juveniles, co-management of resources).

2. Manuals and other information materials on sea ranching and stock enhancement.

3. Training modules on sea ranching and stock enhancement.

4. Trained staff of government fisheries agencies on methods of sea ranching and stock enhancement.