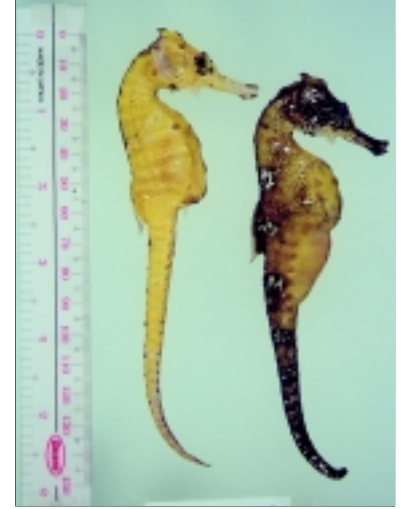




**Abalone from the AQD hatchery.** Note the green band, used as tag to identify hatchery-raised abalone, made by feeding the abalone with AQD's artificial feed. The feed contains seaweed pigments which, researchers say, may account for the band



The seahorse *Hippocampus kuda*, female and male, from AQD's production laboratory for marine ornamentals

## SEAFDEC/AQD's stock enhancement program

SEAFDEC/AQD organized its stock enhancement program in September 2000. It is one of five programs that is focused on addressing and prioritizing urgent aquaculture issues that are important to Southeast Asia. The need for stock enhancement is addressed in the Kyoto Declaration on Aquaculture (Sections 17 and 18) and the Bangkok Declaration on Strategy for Aquaculture Development (Sections 3.9 and 3.10) which underscored the considerable potential of stock enhancement in increasing fish supply from inland and coastal waters.

AQD's stock enhancement program is anchored on the propagation of resource organisms or modification of natural habitat and environmental conditions for recovery of depleted stocks and for increased production from natural grounds.

The stock enhancement program has two research components:

- 1 Adoption and refinement of seed production techniques for
  - Abalone *Haliotis asinina*
  - Top shell *Trochus niloticus*
  - Seahorse *Hippocampus* sp.
  - Other species appropriate for stock enhancement (eg. crabs)
- 2 Development of release, monitoring, and stock enhancement strategies with several projects on:
  - Habitat protection and modification (artificial reefs, marine reserves, seaweed reforestation)
  - Release of hatchery-reared juveniles (abalone, top shell, giant clams, etc)
  - Transplantation of broodstock (window-pane shell *Placuna placenta* or "kapis")
  - Co-management of resources

Likewise, the program has training and information components such as:

- 1 Seminars and training sessions on stock enhancement for fishers, local governments and non-government units
- 2 Production of manuals, videos, posters, and flyers to enhance people awareness of stock enhancement efforts

### Abalone

Abalone research at AQD has concentrated on the development of techniques for mass production of seed stock to enhance the dwindling natural population. In 1994, wild-caught abalone spontaneously spawned in the hatchery. Since then, production of juveniles in the hatchery has been achieved, followed by successful grow-out in floating sea cages, and the completion of the abalone life cycle in the hatchery in 1997. In 1998, artificial diet for juveniles was developed as well as grow-out rearing in tanks. More recently, studies focus on the development of artificial diets for broodstock maturation and spawning, and the refinement of seed production techniques. Natural spawning in tanks occurs every other week throughout the year but refinement studies are undertaken to increase egg hatching, larval settlement and postlarval survival rates to produce thousands of juveniles for release and stock enhancement. Juveniles are now "diet-tagged" and conditioned for release to their natural habitat. "Diet-tagging" is done by feeding batches of juveniles with an AQD formulated feed that produces a bluish-green shell band on the abalone. This band will serve as an identifying mark of hatchery-produced abalone that will be released to enhance wild stocks. 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.

### Top shell

AQD collaborates with a top shell hatchery (Iris Hatchery) in Puerto Princesa, Palawan. More than 3,000 top shell juveniles have been provided to AQD for diet-tagging; however, AQD will eventually be producing top shell juveniles from parent stocks from Sagay Marine Reserve (Negros Occidental), the pilot site for stock enhancement. Seedstock of another top shell species, *Tectus pyramis*, will also be produced because of its need and potential for stock enhancement.

### Window-pane shell

In 1990, AQD started research on the feasibility of restocking Panay



The top shell Trochus at AQD's mollusc hatchery. At far right is the giant clam

Gulf, a depleted “kapis” bed, with stocks from an abundant area. Panay Gulf still maintains the conditions necessary for the growth and development of “kapis.” Verification trials conducted in 1999 confirmed these results with the presence of juveniles, less than a year after restocking broodstock. However, gatherers collected the juveniles despite calls to allow juveniles to mature and breed several more generations. Added to this were illegal fishing activities (trawls and dredges) in the project site despite the deployment of markers and bouys. In August 2001, another batch of “kapis” breeders was stocked near the AQD station and protected by a stainless steel pen. AQD plans to hold more meetings with local officials and fisherfolk organizations to increase their understanding of the importance of the project and their role in its success.

#### Giant clam

AQD is collaborating with the University of the Philippines, Marine Science Institute (UP-MSI) for enhancing wild stocks of the giant clam *Tridacna gigas*. UP-MSI is distributing hatchery-produced giant clam juveniles to various areas in the Philippines in efforts to save and enhance the stocks of this endangered species. AQD is one of its partners. Recently, AQD received 500 *T. gigas* juveniles which will be initially stocked at AQD's Igang Marine Substation in Guimaras. Results will guide future stock enhancement efforts.

#### Seahorse

Seahorse research at AQD started in 1996 when an initial stock of 32 pairs of the spiny seahorse (*Hippocampus barbouri*) and 18 pairs of the lined seahorse (*H. erectus* or *H. kuda*) were transported from Luzon to AQD in Iloilo. Research has produced broodstock from hatchery seeds and several generations of offsprings of *H. barbouri* and *H. kuda*.

#### The AQD stock enhancement team

AQD researchers are now conducting resource as-

essments in preparation for the release and stock enhancement of abalone, top shell, and sea horse in some selected sites, initially the Sagay Marine Reserve, in order to establish baseline data and to prepare the local people for the stock enhancement activities.

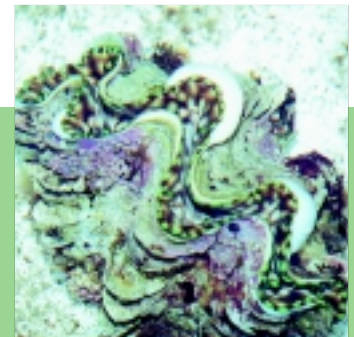
The AQD stock enhancement group meets once a month to discuss relevant issues, review progress and identify appropriate strategies to develop the stock enhancement program.

The researchers for each species are:

- **Abalone** SEED PRODUCTION: *WG Gallardo, RSJ Gapasin, AC Fermin*; ARTIFICIAL DIET DEVELOPMENT: *MB Teruel*; DIET-TAGGING, RELEASE AND MONITORING: *WG Gallardo*
- **Top shell** SEED PRODUCTION: *RSJ Gapasin, WG Gallardo* DIET-TAGGING, RELEASE AND MONITORING: *CL Marte, WG Gallardo*

- **Giant clam** OCEAN NURSERY AND RESTOCKING: *CL Marte, WG Gallardo*
- **Window pane oyster** RESTOCKING: *JM Ladja, DD Baliao and Technology Verification staff*
- **Sea horse** SEED PRODUCTION: *GH Garcia, LMaB Garcia*
- **Artificial reefs and marine reserves:** *LMaB Garcia, YP Tirol*
- **Seaweeds and seagrasses:** *AQ Hurtado*
- **Mangroves:** *JH Primavera*
- **Socioeconomics:** *SV Siar, DB Baticados, ND Salayo*

Program Leader: *WG Gallardo* ###



### SEAFDEC supports the Bangkok and Kyoto Declarations on sustainable development

*Bangkok Declaration and Strategy*<sup>1</sup>

#### Section 3.9 Applying innovations in aquaculture

The technologies for sustainable aquaculture development should provide a varied and adaptable “tool box” from which people can select and design the system which most effectively meets their needs and best fits the opportunities and constraints of the local environment. The delivery of such techniques requires efficient communication networks, reliable data on the merits and drawbacks of the various approaches, and help with the decision making process through which people choose their production systems and species.

As we move into the next two decades, water and land for aquaculture will become critical issues. New opportunities for aquaculture development will also emerge through improvements in science and technology for aquaculture systems.

The potential areas for further consideration include:

- technologies for sustainable stock enhancement and ranching programmes, and open ocean aquaculture;
- increased use of aquatic plants and animals as nutrients stripping;

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<sup>1</sup> NACA/FAO. 2000. Aquaculture Development Beyond 2000: the Bangkok Declaration and Strategy, Conference on Aquaculture in the Third Millennium, 20-25 February 2000, Bangkok. NACA, Bangkok and FAO, Rome. 27 p