



Grow abalone in ponds

Culture techniques of tropical abalone are largely based on the research done on *Haliotis diversicolor supertexta*, reports Padermsak Jarayabhand¹, a researcher at the Department of Marine Science at the University of Chulalongkorn in Bangkok. Most of the published literature have dealt with temperate species. But tropical abalone culture is similar to temperate abalone culture, with slight differences in detail.

Below are the steps in growing abalone in ponds as practiced by farmers in Taiwan². Taiwan has one of the most successful industries among abalone-producing countries, notes Hon-Cheng Chen of the National Taiwan University in Taipei.

stalled in the dikes so that incoming waves carry seawater into the pond and "used" pondwater is driven out the other end. This provides good circulation that clears away food residues and toxic substances. The pipes also regulate water level.

The pond bottom is concrete with cut rocks and oval stones neatly placed to serve as shelters for the abalone.

Some ponds may be situated onshore (at some distance from the sea). But pumps are needed to deliver clean seawater which can be expensive. Fluctuation in water temperature is extreme. Cage farming is another option, and is being studied at AQD (see page 18, this issue).

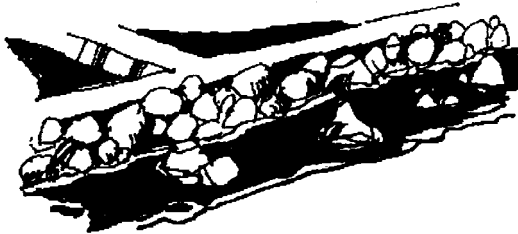
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CHOOSE A GOOD SITE. The best ponds are located on very exposed rocky shores. Check water temperature and salinity; the optimal ranges for best abalone growth are 24-30°C and 30-35 ppt.



2

CONSTRUCT abalone ponds in the intertidal zone (above the low tide mark). Pond size ranges 0.1 to 0.5 ha depending on topography, available area, and investment.



Most abalone ponds have concrete offshore walls wider than 1.5 m to prevent damage from typhoon and monsoon waves. Several 300-cm plastic pipes are in-

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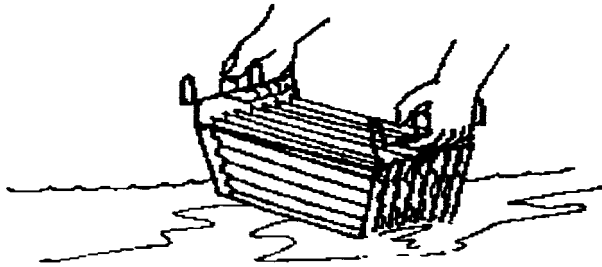
MAKE SURE the ponds are clean before stocking abalone juveniles. Get rid of clay sediment, fouling organisms, predators, and toxic substances.



4

STOCK abalone juveniles that are 15 mm or longer taken from the hatchery or stock sub-adults caught from the wild. (See also *Abalone R&D at AQD*, pages 18-23.) Stocking density is generally 150 to 250 per m². Note that very high stocking densities (500 per m²) cause slow growth and poor survival. It takes 6 months for juveniles to reach a market size of 6 cm shell length if stocked at 400 per m² but only 4 months if stocked at 200 per m².

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Juveniles and sub-adults may be cultured together to maximize the pond carrying capacity or pond space. The sub-adults are harvested when the juveniles need extra rearing space.

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TAKE CARE of the abalone stock by feeding them, cleaning the pond bottom every two months, monitoring constantly and preventing predation or diseases.



For feed, *Gracilaria* sp. is the only algae abalone farmers find convenient to use. It can be purchased cheaply in bulk. Other seaweed like *Ulva* are harvested only during summer and harvest is often tedious and time-consuming.

Feed *Gracilaria* to abalone every other day by scattering it evenly in the pond. While feeding, remove the crabs hiding in the fronds to avoid predation.

Feed conversion for *Gracilaria* is quite poor, about 12:1, but this rate still satisfies farmers because feed cost is at most 8% of the market price of abalone.



The growth rate of small abalone in ponds depends on their initial size with small abalone growing faster than large abalone. For 13- and 45-mm abalone, shell

growth after 6 months is 223% and 34% respectively. Small abalone grow fastest in the warmer months of April to September; slower growth occurs from October to March.



Infectious and epidemic diseases are not yet serious problems. Abalone are very hardy. Possible pathogens include *Vibrio*, *Pseudomonas*, *Flavobacterium*, and *Achromobacter*, these are endemic to shore waters. *Vibrio parahaemolyticus* has been reported to cause the death of *Haliotis discus hannai*.

Abalone would mostly die of the combined effects of stress, mantle injury when removed from the surfaces they are attached to, and lack of oxygen during air shipment. Mortality occurs often right after stocking.



About 50% of juvenile abalone have split shells. These abalone grow much slower than normal ones, reaching only 2 cm when the latter are already 5 cm. These are also vulnerable to predation. Although researchers have yet to determine exactly how or why split shells occur, they think carelessly brushing off abalone juveniles from its attachment injures the mantle. High temperatures during induced spawning and high concentrations of toxic substances in the pond may contribute. But these small splits can be healed after 2 months if rearing conditions are improved but not for large splits.

Researchers suggested the addition of calcium carbonate to speed up shell formation when they noted that split-shell abalone have lower concentrations of





calcium in the shell than normal abalone. The use of anaesthetics or thermal shock when removing or transferring juveniles may help prevent injury.

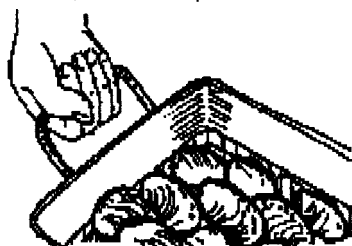
6 HARVEST abalone 4 months after stocking (for wild subadults) or after 6 months (for hatchery-produced juveniles). Ponds are either emptied or the abalone farmer goes SCUBA diving in large ponds. A diver can collect around 50 kg in 2 hours.



Survival of abalone depends on stocking density, size at stocking and pond management, but this is usually more than 70%.

Yield is usually 4.0 kg per m² of abalone sized 20-30 g each. However, market size varies depending on preference and season but it is usually larger than 4 cm. Farm-gate prices fluctuate all the time depending on supply and spawning season, ranging from US\$30 to \$40 per kg live weight. The larger the animal, the cheaper the unit price.

The annual rate of return on investment ranges 50% to 160% depending on survival, duration of operation, investment cost, and sale price. - **MTC**



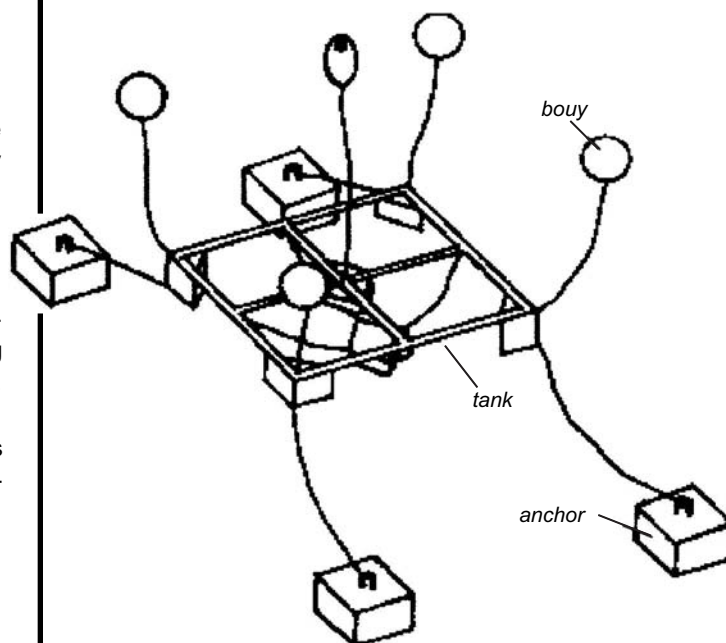
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¹P Jarayabhand and N Paphavasit. 1996. *A review of the culture of tropical abalone with special reference to Thailand.* **Aquaculture** 140: 159-168.

²H-C Chen. 1989. Farming the small abalone, *Haliotis diversicolor supertexta*, in Taiwan. In: KO Hahn (ed). *Handbook of culture of abalone and other marine gastropods.* CRC Press, Boca Raton, FL. p. 265-283.

Grow abalone spats in submersible tanks

Below is a submersible tank designed by Gil Su Yoon of the Department of Ocean Engineering of the National Fisheries University of Pusan, Korea. It is ideal for raising abalone spats to 20-30 mm shell length -- also called mid-term nursing of abalone -- in the open sea. The submersible tank is easy and safe to operate, and the cost of operation is low. However, construction is expensive, but Yoon notes that the submersible tank can be modified to reduce costs.



The design measures 10×10×1 m, and can be installed at 30 m depth. It can withstand 3-m waves coming every 8.5 sec and strong currents. - **MTC**

REFERENCE

Gil Su Yoon. 1995. *A preliminary study of a submersible facility for abalone spats.* **J. Korean Fish. Soc.** 28 (4): 435-442.