

# Aquaculture Development and the Environment: A Case Study in Thailand

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## Abstract

Aquaculture is the world fastest growing animal food-producing sector. World aquaculture production increased from less than 1 million tonnes per year in the early 1950s to 51.7 million tonnes in 2006, representing an annual growth rate of nearly 7 percent. In Thailand, aquaculture has developed considerably since the beginning of the century utilizing extensive and semi-intensive culture system with low production per unit area. Aquaculture plays more important role in food security and the economy of Thailand when intensive shrimp farming has been developed and expanded very rapidly during the mid 1980s resulting in sharp increased in aquaculture production. In 2003, aquaculture production of Thailand was 1.064 million tonnes and valued US\$ 1.46 billion contributing around one quarter of the total fisheries production and Thailand has been the world's leading exporter of fisheries products since 1993.

In the early state of aquaculture development in Thailand, both farmers and scientists emphasized only on how to improve culturing technique to get higher production per unit area, not much attention had been paid on environmental issues. When intensive shrimp culture started and rapidly expanded during the mid 1980s a large portion of mangrove areas were converted to shrimp farm either legally or illegally. The expansion of intensive shrimp farming generated a big input of organic matter in term of feed into the ecosystem resulting in high loading of organic matter and its decomposed products including nutrients and toxic metabolites through pond effluents. The deteriorated coastal ecosystem directly backfired to the shrimp culture industry. Mass mortality of culture shrimp was

first observed in the third year and quickly spread through the whole area of the Inner Gulf of Thailand which was the main shrimp culture area at that time. In response to the problem, farmers moved to the east coast which was facing the same problem three years later. Then major farming area was moved to the west coast and then finally to the coast of Andaman Sea which also facing the same problem after the period of three years. With all coastal areas already utilized and facing mass mortality problem, Thai shrimp farmers developed low salinity shrimp farming technique using closed culture system and moved into inland area in freshwater zone which become major shrimp production area for a few year before the recovering of culture areas in coastal zone.

Facing this problem, all sectors concerned came to realize that aquaculture will not be sustainable without a good environment. Studies had been carried out by both private sector and government institutes to utilize environmental management as a tool to make aquaculture sustainable. Closed and semi-closed water recirculation systems with modest production per unit area were adopted by most farmers. Direct dumping of pond sediment into public water is prohibited. Aquaculture pond effluent standard is established and medium size to large size farms are required to have effluent treatment pond. These reduce a lot of pollutant load into surrounding waters. In 1991, the Thai Government prohibited the use of forest land including mangrove. Poached mangrove areas were confiscated and replanted. Measures were established for the prevention and control of diseases outbreak including the switch of cultured species from *Penaeus monodon* to *Leptopenaeus vanamei* which is easier to produce brood stock in ponds for the production of disease free larva. With all these measures, major shrimp production areas are able to move back to coastal zone again.

Success and failure from the Thai experience indicated that in order to make aquaculture sustainable, environmental issues have to be included in the development plan. In the farm level pollutant load in the effluent should be reduced to minimum. In the whole coastal ecosystem, excessive input of

pollutant has to be managed to prevent their negative effects. Considering from major pollutants in pond effluents which include mainly of organic matter, nutrients and its toxic metabolites, the concept of bioremediation should be effectively applied both in farm level and in coastal areas in order to keep the systems in balance. These include the use of microalgae, aquatic plants, seaweeds and mollusks for water treatment in water recirculation system and the integrate system between aquatic plants or seaweeds or mollusks with fish or shrimp in both in farm level or in the whole culture area. Seaweed and mollusk culture themselves can be effective tools for bioremediation and should be integrated in the planning of sustainable aquaculture development along with shrimp or fish culture. Two shrimp farming areas in Thailand have been able to produced farmed shrimp continuously while other has to stop farming in certain period. The first farming area is at Kung Kaben Bay in Chantaburi province which utilizing mangrove for effluent treatment. Another farming area is at Bandon Bay in Surat Thani province which the bay area is being used intensively for mollusk culture. Seaweed and mollusk culture can also be effective tools for the remediation of deteriorated farming areas resulting from excessive in put of nutrients and organic matter.