IMPACT OF SHRIMP POND EFFLUENT ON OYSTER CULTURE ACTIVITIES: NATURAL SEED ABUNDANCE AND ECONOMICS

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Abstract

The over development of shrimp culture in several countries has profoundly disturbed surrounding ecosystems through the release into natural waters of effluent loaded with nutrients and suspended solids. The excessive discharge of effluents from intensive grow-out ponds, which exceed the capacity of natural processes to assimilate them, might affect the sustainability of oyster farming. A study conducted at two sites in Phang-nga province, Thailand showed that natural oyster seed and farmer income were significantly reduced at Kok-Klai canal over a period of seven years, following the introduction of shrimp culture. The reduction is attributed to wastewater discharged from shrimp ponds. The settlement of oyster larvae, survival and growth of spat and grow-out oyster in oyster farms also decreased due to the release into the canal of a large volume of untreated effluent from shrimp farms. The total number of oyster farms was reduced by 30%, while the average price of the oyster seed increased by 50-60%. In the oyster culture area of Tha-Sai canal there were no observed impacts from the discharge of wastewater from shrimp ponds as the canal has more slope and a higher rate of tidal flushing. In Tha-Sai canal, freshwater intrusion during the rainy season had a greater impact on the survival of spat and grow-out oyster than the release of pond effluent. The total number of oyster farms did not decline at Tha-Sai, but the average price of oyster seed increased by 50-60% when compared with the past five years.

Keywords: Shrimp culture, Oyster culture, Mangrove forest, Coastal area.

Introduction

Marine shrimp culture has become a high revenue earning sector in coastal aquaculture. Production has shifted from extensive to intensive culture since artificial propagation techniques became economically practical (Bray and Lawrence, 1992). As shrimp farms become more intensive, water quality problems created by farm effluents increase. The effluent quality and quantity produced by marine shrimp farms has been monitored in Thailand (Lin et al., 1991; Chaiyakum et al., 1992; Macintosh and Phillips, 1992; Briggs and Funge-Smith, 1993; Songsangiinda and Tunvilai, 1993; NACA, 1994; Tookwinas et al., 1994; Tunvilai et al., 1994). This effluent is discharged into natural water bodies, usually with little or no treatment. Major environmental problems resulting from shrimp pond effluents are eutrophication, deterioration of water quality, increase in sedimentation (Briggs, 1993; Phillips et al., 1993) and chemical and antibiotic residues (Menasveta and Jarayabhand, 1995). The effects of effluent on receiving waters have been summarized (Phillips et al., 1993; Jenkins, 1995; Tanyaros, 2001). The release of effluent affects not only natural waters and
fisheries, but other aquaculture sectors, such as mollusc farming. The large volume of wastewater discharged from the shrimp ponds has the potential to impact oyster culture activity. The objective of the present study was to assess the impact of shrimp pond effluent on oyster farming, based on farmer knowledge and opinion. Empirical information was required to be of use for the further planning and management of shrimp pond effluents for the sustainability of oyster farming.

**Materials and Methods**

1. **Study area**

Oyster farms in Kok-Klai and Tha-Sai canals, located along the coast of the Andaman Sea in Thupput district, Phang-nga province, provided sites for the study. These areas are an important source of natural oyster seed, supplying oyster farms in several areas in southern part of Thailand. In the past seven years the surrounding area has been converted to intensive shrimp farming. Most of the shrimp farms directly discharge pond effluent into natural water bodies with little or no treatment prior to release. This has led to confrontations between the shrimp farmers and oyster farmers.

2. **Data collection**

Participatory methods were used to gather a wide range of qualitative data from all of oyster farmers at the household level in each of the culture areas. Information was gathered regarding problems and constraints experienced by oyster farmers, natural seed production and trends, income and the economics of oyster seed collection. The aim was therefore to use participatory methods to gain a broad understanding of the oyster culture activities of each culture area. Following the collection of information in qualitative study, a survey questionnaire was developed to collect quantitative data regarding the livelihoods of oyster farmers at the household level. This provided an opportunity to survey a representative sample of oyster farmers and to determine their livelihood activities and their wealth status since shrimp farming began.

**Results and Discussion**

A survey of oyster farmers showed that, to their knowledge, wastewater discharged from shrimp ponds was having a negative impact on oyster farming activities in Kok-Klai canal. The settlement of oyster larvae, survival and growth of spat and grow-out oyster were reduced when compared with the past seven years before shrimp culture activities began. Farmers felt that the decrease might be the result of a large volume of untreated effluent from shrimp farms being discharged into the canal. The effluent water from shrimp ponds includes the water released during rearing to control the quality of water in the ponds as well as the discharged during harvesting and preparation for a new crop. The discharge of effluent water, pond sludge, and pond cleaning water, high in nutrients, high in organic matter and low in dissolved oxygen may lead to changes in receiving waters coastal ecology. Studies have shown that the discharge of pond effluent has led to water quality deterioration in near shore coastal areas (NACA, 1994; OEPP, 1994; Jenkins, 1995). Effluent water from shrimp ponds not only contains biological waste products, it also contains the chemicals and antibiotics that have been used during production, as well as their derivatives. These
may affect the ecology of the receiving waters. A comparative study on water quality, and benthic and pelagic fauna between tiger prawn culture and non-culture areas in Thailand has been studied by Tunsakul et al. (1994). The authors concluded that effluents from shrimp farm had effects on water quality which further controlled the abundance of pelagic and benthic communities in the adjacent area. However, the degree of impact from shrimp pond effluents depends on topography of each area (Menasaveta and Jarayabhand, 1995). The sludge or bottom sediment in a shrimp pond after harvest is composed of polluted organic matter. Tunvilai et al., (1992) state that sludge contains high levels of hydrogen sulfide, ammonia-nitrogen and organic matter. If the sludge drained directly into a public canal it would have a significant effect on the coastal environment. Results obtained from the survey suggested that the mixed solids and liquid waste from a pond after harvest were released directly into the public canal. This may have a severe impact on oyster culture in the mangrove zone of the Kok-Klai canal. At present, more than 30% of oyster farms at Kok-Klai canal have ceased production of oysters. Farmers have taken up work in other sectors, even though the price of oyster seed has increased by 50-60% (oyster size 5-7 cm in length).

The oyster culture area of Tha-Sai canal was having a non-negative impact on oyster farming activities from wastewater discharge from shrimp farms because the canal has more slope and high tidal flushing. The wastes from shrimp pond effluent are diluted at high tide and introduced to the open sea at low tide. The water quality in the canal is therefore of better quality than Kok-Klai canal. Miller (1994) found that the potential effect of effluent loading on receiving water varies according to the local oceanographic condition. The survival of spat and grow-out oyster in Tha-Sai canal was mainly dependent on the intrusion of freshwater during the rainy season rather than the impact of shrimp pond effluent.

In Thailand, regulation of shrimp farming was introduced, but there has been a poor response to the directive to register all farms greater than 8 ha and to construct effluent settlement ponds. Small shrimp farms with water areas less than 8 ha in Thailand represent more than 80% of all shrimp farms. They are not covered by the regulation and the majority of these farms continue to discharge untreated effluent. This is one of the main reasons that the shrimp farming industry in Thailand is currently unsustainable. Many recommendations have been made to improve the practice of shrimp farming in Thailand, but they require that the government promote recovery of the environment where deterioration has occurred, through farmer cooperation in controlling farm management practices and the discharge of effluent into receiving canals; it is likely to be difficult to reach agreement on the terms of coordination. A monitoring program for analysing the chemical properties of coastal waters in the both study sites should be made. The data generated will be distributed to nearby farmers to advise them of coastal water quality and to encourage them not to drain water of poor quality from their shrimp ponds.

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