CHAPTER I

INTRODUCTION

Water and sediment quality management has been considered the most important aspects of pond aquaculture for many years, but less attention has been given to the management of pond bottom soil quality. There is increasing evidence that the condition of pond bottom and the exchange of substances between soil and water strongly influence water quality (Boyd, 1995).

In fact, properties of the pond bottom soil (sediment) and process occurring at the bottom soil and in the soil-water interface and very important regarding the well being and growth of fish or shrimp in the pond. Nutrients and organic residues tend to accumulate at the bottom and are, to some extent, removed from the water phase. However, an excessive accumulation beyond what could be defined as the carrying capacity of the sediment may result in the deterioration of the pond system. Such development seems to be of special importance for shrimp culture, since shrimps live in the soil-water transition zone. Reaction and flux within and across the water-soil interface are very significant in natural aquatic system and even more in intensive aquaculture system (Boyd and Massaut, 1999).

Several studies have also shown that the pond sediment of shrimp aquaculture areas is enriched in organic matter (Maguire and Allen 1986; Boyd, 1990; Pillay, 1992; Smith 1993; Hopkins *et al.*, 1994), due mainly to the overuse of nutrients. Therefore, earthen shrimp pond is usually considered as a eutrophic ecosystem. Moreover, anaerobic condition usually occurs in the sediment of intensively stocked and fed shrimp ponds. This process is more pronounced with the increase in pond intensification. The

development of anaerobic conditions therefore constrains production and is a barrier to further intensification (Hopkins *et al.*, 1994).

An understanding in soil property and soil ecosystem could be substantially useful in pond management in which it directly affects water quality and health of the cultured species. In general, microorganisms play an important role in the dynamics of sediment environment, particularly in biogeochemical cycle, biodegradation, and food web (Nedwell, 1984; Leahy and Colwell, 1990). Investigations on the composition of microbial communities are an important step in understanding the role of bacterial population in biogeochemical process. Therefore, the biodiversity and activities of sediment microbial communities draws the great interest in microbiological and ecological studies.

Analysis of soil bacterium community has been limited in the past because only a minor proportion of the microbial population is cultivable (Avnimelech and Ritvo, 2003). When the number of cells in an environmental sample are directly counted under microscopes and compared with the number of cells successfully cultivated from the sample, it was found that anywhere from 90% to 99.9% of the cells were uncultured, and therefore evade identification. Thus, bacteria in nature characterized by cultivation methods have contained a large bias in an unknown direction. It was realized that genes and other molecules present in an environment are completely defined by the organisms living there, so that an inventory of appropriately chosen molecules (such as the small subunit rRNA) is equivalent to an inventory of the organisms (Avnimelech and Ritvo, 2003).

An understanding of relationship between bacterial community and sediment characteristics in shrimp pond throughout the culture period will be an initial step to understand the pond bottom ecosystem. This information is necessary for the improvement of shrimp pond management with special emphasis on the optimum carrying capacity and therefore leads to the sustainable development of environmental friendly intensive shrimp pond.

Scope of study

This study consisted of two parts. The first part investigated the change of sediment characteristic as well as bacteria community dynamic in shrimp pond sediment, starting from the shrimp released date until the shrimp harvested date. The second part was an additional laboratory experiment on nitrogen conversion by bacteria in the sediment from shrimp pond.

Objectives

1. To determine the bacterial community and sediment characteristics in shrimp pond sediment throughout the culture period.
2. To determine the nitrogen conversion via nitrification and denitrification process in sediment from shrimp pond.
3. To find the correlation between sedimentary bacteria and sediment characteristics in shrimp ponds.