WATER QUALITY AND PLANKTON POPULATIONS IN INTENSIVE MARINE SHRIMP CULTURE SYSTEM

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Introduction

Effective water management is crucial for intensive grow-out culture since it determines the final production of the system (Yusoff and McNabb, 1989). Water quality affects the abundance, species composition, health and productivity of aquatic organisms. Plankton has long been used as indicator of water quality. Some species of phytoplankton flourish in highly eutrophic waters while others are sensitive to organic/inorganic or chemical wastes (Clesceri et al. 1989). In badly managed systems, excessive nutrients from uneaten food, faeces and fertilisation, result in eutrophication of the pond water with frequent algal crash and anaerobic pond bottom. Accumulation of toxic compounds such as ammonia and hydrogen sulphide further deteriorates the water quality, resulting in low production. Therefore, the study was carried out to determine management instruments of controlling plankton populations in intensive ponds in order to maintain good water quality and optimise pond production.

Materials and Methods

A series of pond and laboratory experiments were carried out from 1997 to 1998 in intensive *Penaeus monodon* culture ponds in Kuala Selangor and in Universiti Putra Malaysia respectively. Enumeration, identification, isolation, bioassay tests, biochemical analyses and mass culture of different phytoplankton and zooplankton species were accomplished. Concurrently, feeding experiments and water quality monitoring were also carried out. All analyses were done following the standard procedures (Clesceri et al. 1989; Parsons et al. 1984; Hortz, 1984).

Results and Discussion

There were 30 and 15 different genera of phytoplankton and zooplankton respectively, that have been identified from the intensive shrimp culture ponds studied. Five species of phytoplankton and two species of zooplankton have been isolated, analyzed for biochemical content and maintained for culture. Results showed that plankton abundance and species composition depends largely on the nutrients available in the pond. Decreased zooplankton population and benthos were also noticed towards the end of the culture period as water quality deteriorates. As the water deteriorates, nuisance species of phytoplankton such as blue green algae, euglenoids and dinoflagellates dominate, leading to decreased zooplankton populations. It was found that blue-green formed approximately 90% of the total phytoplankton populations in ponds with eutrophic waters. In these ponds, green algae, diatoms and euglenoids together contributed less than 10% of the total phytoplankton. In less enriched ponds, diatoms were dominant contributing approximately 60%, whilst blue-green contributed less than 10% of the total phytoplankton. Culture ponds with eutrophic waters from the seas or estuaries (mainly as a result of self-eutrophication) show that blue-green alga was dominant throughout the culture cycle. This finding was supported by the results obtained from algal bioassay tests and zooplankton feeding preference experiment. Studies on nutritional analyses of different phytoplankton indicated that blue-green was found to be poorer in nutritional contents such as protein, essential amino acids, lipids and polyunsaturated fatty acids compared to diatoms or green algae. Further experiments in our laboratory illustrated that diatoms were readily ingested by copepods, whilst blue-green were not utilised. Thus, nutrients (phosphorus, nitrogen and silica) in ponds should be managed to promote the dominance of diatoms, which not only form important item in the aquatic food chain, but also contribute to the good water quality and high production of the pond.

Conclusions

Diatoms, green algae, blue-green algae, dinoflagellates and euglenoids are the common types of phytoplankton in brackishwater shrimp culture ponds in Malaysia. Their dominance depends on nutrient concentrations in the pond water. High loadings of nutrients result in the development of nuisance algae, water quality deterioration, low zooplankton growth and low shrimp production. Manipulations of nutrients can be accomplished to improve growth of beneficial phytoplankton species, resulting in good water quality and high shrimp production.

References

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