BORANG PENGESAHAN STATUS TESIS@

JUDUL: TRADITIONAL PRACTICES, CONTEMPORARY PERSPECTIVES AND POLICY REVIEW IN SHRIMP FARMING, IN SABAH, MALAYSIA

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TRADITIONAL PRACTICES, CONTEMPORARY PERSPECTIVES AND POLICY REVIEW IN SHRIMP FARMING IN SABAH, MALAYSIA

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PERPUSTAKAAN
UNIVERSITI MALAYSIA SABAH

THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

BORNEO MARINE RESEARCH INSTITUTE
UNIVERSITY MALAYSIA SABAH
2007
SUPERVISOR’S DECLARATION

TITLE: TRADITIONAL PRACTICES, CONTEMPORARY PERSPECTIVES AND POLICY REVIEW IN SHRIMP FARMING IN SABAH, MALAYSIA

DEGREE: DOCTOR OF PHILOSOPHY

VIVA DATE: 27 DECEMBER 2007

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The materials in this thesis are original except for quotations, excerpts, summaries and references, which have been duly acknowledged.

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17 JANUARY 2008
ACKNOWLEDGEMENTS

I would like to thank my supervisor Prof. Dr. Saleem Mustafa for his unwavering guidance and support throughout this study and for critically and constructively reviewing this thesis, his infectious enthusiasm and hard work has kept me focused in my quest this past three years.

I thank the Public Service Department of Malaysia for awarding scholarship through grant JPA H 0605168. Thanks also to the Public Service Department of Sabah and Department of Fisheries Sabah for granting the study leave.

I am grateful to my colleagues in the Department of Fisheries Sabah for their assistance in furnishing data, reports, and information for this study.

Thanks to all the Borneo Marine Research Institute lecturers, staff, and postgraduate students for their encouragement, hospitality and friendship.

I am indebted to my family for their unconditional support, love and prayers.

Alhamdulillah, praise to Allah.
ABSTRACT

TRADITIONAL PRACTICES, CONTEMPORARY PERSPECTIVES AND POLICY REVIEW IN SHRIMP FARMING IN SABAH

Disease and effluent management continue to be the most challenging task for shrimp farmers in Sabah causing enormous economic losses, driving some farmers to abandon the farming entirely. Effluent and disease issues will need to be examined in order to develop better approaches to suggest the most effective ways of dealing with problems in shrimp farming. Information about successful economic choices and how and where does shrimp farming placed in the overall aquaculture policy is also essential. Understanding such complex issues requires a holistic process which integrates scientific and technical variables with social science method. The aim of this study was to assess practices with regard to disease and effluent management in conventional shrimp farming including elements of successful microeconomic parameters to investigate the economic strengths and policies to support its sustainability. This study was designed to collect primary and secondary data through 1) case study observation in ten shrimp farms on the west coast of Sabah, 2) mail survey questionnaire, 3) a case study based on a micro economic model to synthesize microeconomic strengths, and 4) policy analysis to assess some macroeconomic factors and development strategies for shrimp farming. Data collected in mail survey were managed and analyzed using the Statistical Package for Social Sciences (SPSS Version 11.5) software. Primary and secondary data collected were analyzed qualitatively based on logical approach; variables observed were grouped into themes to achieve the objectives. The microeconomic parameters included in this case study were cost of development, feed, fertilizers, chemical, post-larvae, farming period, feed conversion ratio, yield, and labor cost. A critical construction of policy analysis is presented regarding institutional support specifically the role of the Department of Fisheries Sabah for development and initiatives towards sustainable shrimp farming. This study provided the first empirical data that will pave the way for proposing the most effective means of dealing with shrimp health scares in Sabah. Results show that despite practicing some disease management criteria, shrimp farming continues to lag behind in disease exclusion and even taking reactive steps when infectious diseases strike their farm. Findings in this thesis supports identifying underlying issues affecting shrimp farming in Sabah which are not prepared for the battle against disease threats and lacks prudent measures in environmental management. Production variables synthesized in this case study had demonstrated a strong link between efficient shrimp farm management and microeconomic choices that could result in financial success. The policies established so far are based on a broader view of aquaculture development with very little attention awarded to how exactly sustainability and responsible shrimp farming is to be tackled effectively. It is concluded that any policy formulation and expansion plan for shrimp farming should involve farmers directly and must be based on a consultative, participatory and farmer-first approach.
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<th>Full Form</th>
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<tr>
<td>BMP</td>
<td>Best Management Practices</td>
</tr>
<tr>
<td>cm</td>
<td>centimeter</td>
</tr>
<tr>
<td>CP</td>
<td>Charoen Pokphand</td>
</tr>
<tr>
<td>DOFS</td>
<td>Department of Fisheries Sabah</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>FCR</td>
<td>feed conversion ratio</td>
</tr>
<tr>
<td>g</td>
<td>gram</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>ha</td>
<td>hectare</td>
</tr>
<tr>
<td>HACCP</td>
<td>Hazard Analytical Critical Control Point</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards of Organization</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram</td>
</tr>
<tr>
<td>L</td>
<td>liter</td>
</tr>
<tr>
<td>mg</td>
<td>milligram</td>
</tr>
<tr>
<td>ml</td>
<td>millimeter</td>
</tr>
<tr>
<td>mt</td>
<td>metric tonne</td>
</tr>
<tr>
<td>NACA</td>
<td>Network of Aquaculture Center in Asia Pacific (NACA)</td>
</tr>
<tr>
<td>PCR</td>
<td>Polymerase Chain Reaction</td>
</tr>
<tr>
<td>PL</td>
<td>post larvae</td>
</tr>
<tr>
<td>RM</td>
<td>Ringgit Malaysia</td>
</tr>
<tr>
<td>SIRIM</td>
<td>Standards and Industrial Research Institute of Malaysia</td>
</tr>
<tr>
<td>SPLAM</td>
<td>Sijil Perladangan Ladang Akuakutur Malaysia</td>
</tr>
<tr>
<td>SPF</td>
<td>specific pathogen free</td>
</tr>
<tr>
<td>SPR</td>
<td>specific pathogen resistant</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Sciences</td>
</tr>
<tr>
<td>SS</td>
<td>settleable solids</td>
</tr>
<tr>
<td>TDM</td>
<td>Total Design Method</td>
</tr>
<tr>
<td>TSS</td>
<td>total suspended solids</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nation Environmental Program</td>
</tr>
<tr>
<td>VAS</td>
<td>Vertical Artificial Substrate</td>
</tr>
<tr>
<td>WB</td>
<td>World Bank</td>
</tr>
<tr>
<td>WSSV</td>
<td>White Spot Syndrome Virus</td>
</tr>
<tr>
<td>WWF</td>
<td>World Wildlife Fund</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

1.1 Traditional Practices in Shrimp Farming

Disease problems and environmental issues in shrimp farming have caused worries about the sustainability of traditional farming practices (Otoshi et al., 2005). Persistent disease and environmental threats originating from traditional practices have also caused concern in Sabah. Conventional practices are rooted strongly in the operational system, lacking in modernization and the best health care standards. If this continues, it will contribute to negative environmental impacts and greater challenges in disease management. Incorporating contemporary perspectives in traditional practices with modern techniques in effluent and disease management is the way forward and key to sustainable shrimp farming.

Similar to other aquaculture activities, qualitative and quantitative description of the characteristics of shrimp farming in Sabah is inadequate. Very little information is available regarding the general trend in dealing with environmental and disease issues and general farm management practices. There is no empirical study to address effluent and health related issues. This is the first comprehensive empirical study that could provide baseline data based on ground realities. It is important to offer evidence-based approach for consideration of policy makers to offer guidelines to ensure that the shrimp farming develops on informed decisions.

Profiles of farm characteristics and managers are essential indicators that should be taken into account to ensure that all development programs and extension services fit the industry needs and could be appropriately delivered. A thorough assessment of the farming practices will provide a basis for recommendations for the most viable way of producing shrimp consistent with the sustainability criteria.

Over the years, shrimp farming in Sabah has witnessed the evolution of farm production in applying various techniques. However, maintaining stringent environmental-friendly production and high standards of disease management in the farm is a major challenge to every farmer. Because shrimp farming involved the
application of technological systems and the exploitation of natural resources, it is also important to address the human dimension of it.

The vulnerability of environmental and biological resources in shrimp aquaculture and its association with the total operation depend largely on farmers' decision of choice weather to operate in a commendable manner or fall into reap-and-run attitude. Farmers have to be alert and be well prepared to deal with environment and disease management issues. Disease threats come from multiple factors whereby the pathogens are horizontally or vertically transmitted as a result of poor site selection, absence of high health stock, lack of quarantine regulation, inadequate technical skills, and poor pond management. Obviously, microeconomic choices made by farm managers will have big influence on the effluent and disease management, the volume of production, and financial success of the shrimp farms.

Economic choices made by stakeholders play the biggest role in sustainable shrimp farming. The decision to continue with shrimp production lies on the financial perspective, whether it is profitable and worthwhile to carry on. It begins with the site selection, choosing the right species, adopting the farming system, overall farm management, up to the stage of marketing the products.

Good economic decisions are necessary for farmers to stay in business and to carry on with their production. Microeconomic decisions at the farm level are important to ensure that the shrimp farms maintain the parameters of success to counter any internal and external disease threats and environmental challenges. Therefore, a study of microeconomic choices will be helpful in outlining the parameters of success for viable shrimp farming. It will present information for shrimp farmers to refer to and assist them in making microeconomic decisions to stay in business.

For the last ten years, shrimp farmers in Sabah have been battling with disease problems. In the absence of biosecurity and high level of environmental management strategy, traditional shrimp farming will continue to be considered a high-risk business. Therefore, for the shrimp aquaculture to be ecologically and economically sustainable, the production phase has to be synergized with recent technology and has to depend on the equilibrium between human capability and
resource availability. Better approach is needed to establish the best feasible ways of dealing with disease threats and keeping the farm away from any health risks.

Environmental impacts and challenges of disease and marginal quality of post-larvae are some of the limiting factors for shrimp industry to expand further. Some farmers claim to be adopting modern approaches while others continue operating in a production system that works for short-term economic benefits. The production of shrimp is vulnerable to outside forces, be it on the macro or micro levels, some are beyond farmers ability to deal with, especially so when the farm is operated on a conventional system.

Record of stakeholders’ participation in policy formulation and the status of the implementation of Responsible Aquaculture and Better Management Practices for the shrimp farms in Malaysia is not available. The burden of progression to move towards environment-friendly production and technically feasible farming systems that adopt a high level of disease management rests on all stakeholders. In order for the shrimp farms to succeed in combating diseases and maintaining environment-friendly systems, cooperation between all stakeholders should be in place to ensure the sustainability and economic viability of this sector. Consequently, examining existing policy for responsible sustainable shrimp farming could be useful in offering appropriate and intervention approach to ensure the shrimp industry continue to be a viable option.

1.2 Shrimp Farming in Sabah
A study conducted by Department of Fisheries and Network of Aquaculture Centers in the Asia Pacific (NACA) in 1996 indicated that in 1994 there were 140 shrimp farms in Sabah (Department of Fisheries Sabah and NACA, 1996). After more than a decade, the number dropped to 72 shrimp farms (in 2005). Most commonly shrimp farms are operated at a semi-intensive and small-scale level, concentrated mainly on the east coast of Sabah. The production system typically changes 5% water for the first month, 10% in the second month and 20%-50% during the third and fourth months (Department of Fisheries Sabah and NACA, 1996).

The production of tiger shrimp, *Penaeus monodon*, in Sabah has been encouraging in the past ten years. Shrimp is considered a very important contributor
to the aquaculture production. Development programs for shrimp farming are targeted at increasing production, foreign exchange earnings, and uplifting the socioeconomic standard of farmers. They have contributed to the expansion of shrimp farming in Sabah. Shrimp aquaculture has played an important role in meeting the demand of fresh shrimp for the local seafood industry in Sabah. It has also created economic opportunities for other related supporting activities such as the hatcheries, feed producers, packaging, processing, retailers, exporters, and aquaculture consultants.

1.3 The Disease Issues
Since 1995, losses due to White Spot Syndrome Virus (WSSV) in the Malaysian shrimp industry are estimated to be US$25 million annually (Yang et al., 2001). This infection was first noticed in 1998, believed to be due to the illegal entry of post-larvae from a neighboring country (Lai, 2002). Since then it has continued to pose a serious threat to shrimp industry in Sabah. Disease threats have caused some farmers on the east coast to close their farm after experiencing major economic loses. Generally, farmers are trying to prevent the entry of pathogens and threat of disease by acquiring specific pathogen-free post-larvae supplied by local hatcheries, tested by Polymerase Chain Reaction (PCR) method for WSSV. Recent approaches to the technical aspect of shrimp farming have included site selection, proper pond management, disease prevention, water management and effluent treatment. However, there is no report to indicate that these preventative procedures are practiced by shrimp farmers in Sabah. Despite the threats and outbreaks of diseases, untreated pond effluents and poor pond management still constitute the typical practices in the traditional systems.

1.4 The Economic Importance
With the increase in world population and purchasing power of industrialized nations, the demand for shrimp in the international market continues to grow. Customer spending capabilities in some of the Asian “Tiger economies” such as Singapore, Hong Kong and Malaysia have played bigger role in providing market, influencing higher demand for shrimp. In the context of Sabah seafood exports, farmed shrimp will continue to lead the exports of crustaceans in support of the declining catch of the marine shrimp.
Trade and production statistics are testimony to the importance of shrimp industry for Sabah (Table 1.1 and Table 1.2). In terms of value, Sabah earned about RM401 million in 2003 from exports of seafood, and shrimp shared almost 50% (RM188 million) of the total value, while record of wholesale value of shrimp aquaculture for that year was RM86.6 million, about 20% of the total value of shrimp exports (Department of Fisheries Sabah, 2005a).

Department of Fisheries Sabah record shows that the production of farmed shrimp in Sabah has increased from 2064 metric tones in 2000 to 5441 metric tones in 2001, while in 2002 and 2003 it dropped to 2889 metric tones, and 2865 metric tones, respectively. Despite the decline in production, Sabah continued to be among the top four producer states in Malaysia.

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export</td>
<td>RM383 (36,002 mt)</td>
<td>RM392 (40,535 mt)</td>
<td>RM446 (58,502 mt)</td>
<td>RM401 (56,684 mt)</td>
<td>RM439 (64,062 mt)</td>
</tr>
<tr>
<td>Import</td>
<td>RM46 (8746 mt)</td>
<td>RM50 (8919 mt)</td>
<td>RM57 (11,806 mt)</td>
<td>RM61 (12,504 mt)</td>
<td>RM103 (13,798 mt)</td>
</tr>
<tr>
<td>Balance of trade</td>
<td>RM337</td>
<td>RM342</td>
<td>RM389</td>
<td>RM340</td>
<td>RM336</td>
</tr>
</tbody>
</table>

Source: Annual Fisheries Statistics 2004, Department of Fisheries, Sabah

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of ponds</td>
<td>1,492</td>
<td>1,819</td>
<td>1,752</td>
<td>2,073</td>
<td>1,894</td>
</tr>
<tr>
<td>Production (metric tones)</td>
<td>2,064</td>
<td>5,441</td>
<td>2,889</td>
<td>2,865</td>
<td>2,241</td>
</tr>
<tr>
<td>Wholesale Value (RM million)</td>
<td>RM60</td>
<td>RM163.2</td>
<td>RM92.4</td>
<td>RM86.6</td>
<td>RM73.7</td>
</tr>
</tbody>
</table>

Source: Annual Fisheries Statistics 2004, Department of Fisheries Sabah

Shrimp farming is still very much favored as one of the sectors that will continue to contribute to aquaculture production. In spite of several reported cases of large-scale economic losses, new comers to shrimp farming continue to increase. Sabah has the competitive advantage to significantly increase the shrimp production. It has readily available human resources, suitable areas, basic technology and locally available shrimp broodstock to support the hatcheries. Sabah is strategically located for export route to Japan, Hong Kong, Brunei and other Asia-Pacific countries.
Appropriate proactive measures will be needed to ensure that these advantages are maintained and managed professionally. It is widely recognized that the economic viability of shrimp farming can only continue if environment-friendly technology is used that the vitally important ecological links are not threatened or degraded.

1.5 Natural Resources use in Shrimp Farming

Shrimp farms are normally built on environmentally sensitive coastal areas in a sandy or clay soil behind mangrove forests using several engineering techniques to build ponds. Environment-friendly shrimp farming requires the farmer to understand the ecosystem processes and optimum level at which the natural resources could be exploited.

Upon selection of the type of species and the type of farming system to operate, farmers will prepare ponds with good water quality before stocking. Maintaining water quality throughout the farming period is utterly important for high economic returns at the end of the farming period. This requires basic and good knowledge of physical parameters of water quality standards, prevention of diseases, management of feed, and treatment of waste.

Because of its favorable economic returns, the tiger shrimp has always been the first choice in Sabah. This species is indigenous to this region; it fetches high market value and its hatchery and farming techniques have been available for many years. Farmed shrimp are fed with high protein feed pellets. Only a small amount of feed digested and retained by the animal while the remaining amount of dissolved and particulate matter are left as pond waste, and when released outside it could have negative effects on the receiving water.

The production process of shrimp farming is not without environmental implications and there is a need to use methods that are based on careful management, striking a balance in the ‘consumption’ of biological and environmental resources to achieve the best economic outcome. Most shrimp farmers in Sabah discharge waste from ponds during and after each crop cycle (Department of Fisheries Sabah and NACA, 1996). Such practices have enormous negative impacts on the environment. Therefore, appropriate evaluation and understanding of the existing farm practices is a key to development of a workable and suitable policy.
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