

The Culture of *Penaeus vannamei* and Other Exotic Shrimps in Singapore

Pang Kong Choi and Cho Yen Ling Serena
Marine Aquaculture Branch
Food Supply & Technology Department
Agri-Food & Veterinary Authority Of Singapore
5 Maxwell Rd, #01-01 Tower Block
MND Complex
Singapore 069110

ABSTRACT

This paper describes the overview of shrimp culture industry and the historical production of *Penaeus monodon*, *P. merguensis* and the *P. vannamei*. The production of shrimp reduced from 115 metric tonnes in 2002 to 46 metric tonnes in 2004. Imported shrimps to Singapore in year 2003 reached 21,157 metric tonnes and valued at \$129.57 millions. Domestic market alone required 16,359 metric tonnes and valued at \$106.5 millions. Exported shrimps which maintain at 4,913 metric tonnes are mainly the products from the shrimp processing industry and all the raw materials were imported from other countries. Shrimp culture in Singapore suffered significant losses in the 90s due to the Yellowhead Virus (YHV) and the White Spot Syndrome Virus (WSSV) and the reduction of production was also due to urbanisation. Under the Wholesome Meat and Fish Act, the existing laws and regulations are to ensure wholesome food safety. Sampling and testing of all type of fish and seafood products for preservatives as well as contaminants such as heavy metals and drug residues are carried out regularly. All imports of fish products shall comply with prevailing regulations laid down by the Agri-Food & Veterinary Authority of Singapore (AVA). Culture of *P. vannamei* commenced in 2002 and majority of the fry were purchased from Taiwan. The grow-out culture areas calculated at about 3 hectares and only 8 metric tonnes of live *P. vannamei* were produced. The labour and employment generated in shrimp culture are limited by less than 10 persons. R&D activities on *P. vannamei* and other exotic shrimps are not well established, only the monitoring of shrimp production on coastal areas and fishing catch for occurrence of exotic species have been investigated. The field survey of *Penaeus vannamei* culture that was conducted on two shrimp farms (Round concrete pond system and rectangular concrete pond system) showed the stocking biomass at 185 pcs/m³ and 120 pcs/m³, respectively. At the end of the 2-month culture period, the mean body weight of the shrimps reached 10g with the round pond with 60% survival rate and the rectangular pond with 72% survival rate. The biomass of the round pond was at 2.6 kg/m³ while the rectangular pond was 1.2 kg/m³. The results from both systems indicate the potential of *P. vannamei* culture in this region.

INTRODUCTION

The shrimp industry in Singapore began in the 80s and slumped in the 90s due to serious outbreaks of diseases and urbanisation. The dominant species that were cultured then were the black tiger shrimp (*Penaeus monodon*) and the banana shrimp (*P. merguensis*). *P. vannamei* was only introduced to Singapore in 2002. Due to their greater ease of culture, adaptability to the local environment, high growth performance with less protein requirements and better survival rate, production costs were lowered and they became the cheapest shrimps in the market. Experimental introduction of specific pathogen free (SPF) *P. stylirostris*, also known as “supershrimp,” was introduced into Singapore in 2001, however there has been no further development on this species since then.

RESULT & CONCLUSION

Overview of shrimp culture industry in Singapore

Shrimp production in Singapore reached 60 metric tonnes in early 2000 and increased to 114 mt in 2001 and 115 metric tonnes in 2002. The production of shrimp decreased from 115 mt in 2002 to 46 metric tonnes in 2004. The decline is mainly due to urbanization. *P. monodon* and *P. merguensis* were the two major species accounted for over 85% of total shrimp aquaculture production. The production of *P. vannamei* has increased from 6 mt in 2003 to 8 mt in 2004 (Figure 1). The overview of shrimp culture from year 2000 to 2004 and their historical production figures by species (quantity and value) are shown in table 1-4.1

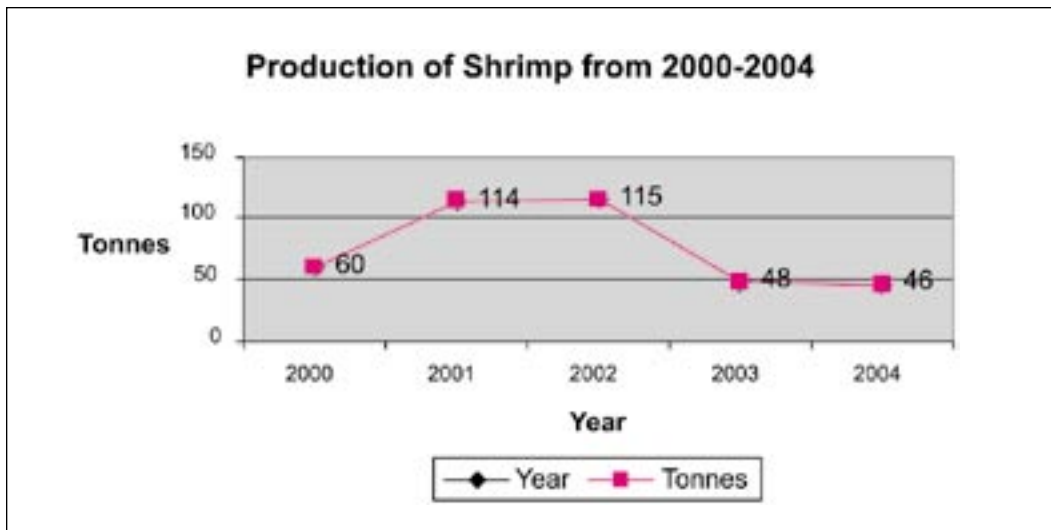


Figure 1: Production of shrimp from 2000-2004

Table 1: Shrimp Production of Singapore from 2000-2004

Year	2000	2001	2002	2003	2004
Tonnes	60	114	115	48	46
Value (\$'000s)	960.0	2050.0	1934.8	926.5	891.2

The historical production figures by species (quantity and value) are shown in Tables 2-4.

Table 2: *Penaeus monodon* Production from 2000-2004

Year	2000	2001	2002	2003	2004
Tonnes	8.0	78.0	11.8	21.0	19.1
Value (\$'000s)	232.0	1412.0	240.8	436.0	400.2

Table 3: *Penaeus merguensis* Production from 2000-2004

Year	2000	2001	2002	2003	2004
Tonnes	52	32	97	21	22
Value (\$'000s)	728.0	566.0	1595.4	391.5	346.0

Table 4: *P. vannamei* and *P. stylirostris* Production from 2000-2004

Year	2000	2001	2002	2003	2004
Tonnes	0	4	6	6	8
Value (\$'000s)	0	72.0	98.6	99.0	145.0

Shrimp export (quantity and value)

The export of shrimp in year 2003 was 4,913 mt valued at \$42.38 millions. Details of the export status are shown in table 5.

Problems in the shrimp culture industry

In the 90s, the shrimp industry in Singapore was perceived to be poor performance with slow growth rate and disease susceptibility of the major indigenous shrimp culture species. *P. monodon* and *P. merguensis* were virtually characterized by serious viral pathogens causing significant losses to the culture industries. In Asia, the native shrimp culture industries suffered heavy losses in 1992 first due to the Yellowhead Virus (YHV) and later in 1994 to White Spot Syndrome Virus (wssv).

Policy issues on the import and culture of exotic shrimps

Existing laws and regulations

An import permit issued by the Agri-Food & Veterinary is required for every consignment of fish products imported. Fish products refer to any of the varieties of marine, brackish water or fresh water fishes, crustacean etc.

Traders may apply for the permit by declaring the import through the TradeNet system. For fish products, documents such as invoices and airway bill would need to be submitted.

Imported fish products are subjected to inspections. Samples may be taken for laboratory analysis.

Status of implementation and enforcement

All imports of fish products shall comply with prevailing regulations laid down by the Agri-Food & Veterinary Authority of Singapore (AVA). Health requirements governing the importation of the high risk items are available on request.

Fish products may be transshipped at or exported from Singapore. The procedures to apply for such approvals are similar to that for import. The approved fee payable for the import, export and transshipment of fish products is \$18 per consignment.

AVA regularly samples and tests all types of fish and seafood products for preservatives as well as contaminants such as heavy metals and drug residues. In addition, AVA has stationed officers at the fishing ports to spot and take action against any illegal activities including the use of preservatives. Under the Wholesome Meat and Fish Act², any person who is convicted of selling or supplying fish or fish products that are adulterated is liable to a fine not exceeding \$50,000 or imprisonment for a term not exceeding 2 years, or both.

Culture of *P. vannamei* and other exotic penaeid species

History of introduction and Source of broodstock

P. stylirostris and *P. vannamei* were introduced into Singapore in years 2001 and 2002 respectively. The *P. stylirostris*, also known as "supershrimp," was introduced into various Asian countries from 2000 while no further developments were made in Singapore after 2001. For *P. stylirostris*, a hatchery was set up in 2001 and the broodstock was brought into the country directly from USA. The hatchery was unsuccessful and the operation was moved to Brunei. For *P. vannamei*, no hatchery was set up and the juveniles were purchased directly from Taiwan.

Grow-out culture and location of ponds and area used for culture

In Singapore, only one farm was used for *P. stylirostris* grow-out culture in 2001 and the farm produced 4 tonnes of shrimps before the operation was terminated. Two farms in Singapore have been actively involved in *P. vannamei* culture since 2002. The pond areas used for culture are about 3 hectares. The total production for the past three years was 18 mt sold to domestic live fish markets with selling prices ranging from \$16 to \$18 per kilogram. The field survey of *Penaeus vannamei* culture that was conducted on two shrimp farms in Singapore from September-December 2004 used a standardized economic questionnaire that included costs, returns and growers' perceptions of constraints.

Economic estimates were developed for representative production systems. Juveniles of *P. vannamei* were reared in two farms using different culture systems. The first farm used a round concrete pond with a water capacity of 700 metric tons while the second farm used a rectangular concrete pond with a water capacity of 2500 metric tons. The stocking biomass of the round tanks system was 185 pcs/m³ while the rectangular tanks system was 120 pcs/m³. At the end of the 2-month culture period, the mean body weight of the shrimps reached 10g with the round pond having a 60% survival rate and the rectangular pond having a 72% survival rate. The biomass of the round pond was at 2.6 kg/m³ while the rectangular pond was 1.2 kg/m³. The results from both systems indicate the potential of *P. vannamei* culture in this region.

Total annual production

The total production of *P. vannamei* in 2003 was 6 mt, valued at \$99,000 and 8 mt value at \$145,000 in 2004 (Table 4).

Domestic market and effect on shrimp volume and prices

Domestic market required 21,157 metric tonnes and valued at 129.57 millions annually (table 5). The price of the domestic market ranging from \$6 to \$12 dollars per kg depending on the sizes and freshness of the shrimp.

Quantity and value of exports

The processing industry will require 5,000 mt annually to support their processing products for export. The export quantity of shrimps and prawns in 2003 was 4,913 mt valued at \$42.38 millions. Details of the import and export are shown in Table 5³ on next page.

Labour and employment generated

So far only ten employments have been generated for culturing the shrimp.

R&D activities on *P. vannamei* and other exotic shrimps

Most of the R&D activities on *P. vannamei* and other exotic shrimps were carried out in early 2000s. As for the *P. monodon* and *P. merguensis*, lots of R&D studies have been carried out in the early 90s. Experimental study on shrimp hatchery also gained strong foothold during early 90s but none of the shrimp hatcheries were able to sustain through 2000.

Disease outbreak and management on *P. vannamei*

So far no major disease outbreaks have been found for the past three years.

Proposed guidelines for the introduction and culture of exotic shrimps

Currently, there is no specific guidelines for the introduction and culture of exotic shrimps. Only a standardized economic questionnaire that included costs, returns and growers' perceptions of constraints was used for the economic estimates and developed for representative production systems.

Table 5. Showing the import and export of shrimps & prawns in 2003

IMPORT & EXPORT OF SHRIMPS & PRAWNS 2003*	Export		Import	
	Tonne	\$'000	Tonne	\$'000
Shrimps & Prawns (Live, Fresh or Chilled)				
China	12	501	5	225
Indonesia	4	168	2,797	9,223
Korea Rep of	14	233		
Malaysia	655	3,694	6,535	39,328
Taiwan	25	248	10	75
Thailand		77	4,890	21,724
Saudi Arabia	21	56		
Vietnam Soc Rep of	8	218		
Others	11	199		
Total	750	5,394	14,303	71,323
Shrimps & Prawns (Frozen)				
Australia	87	1,273	50	1,093
Brunei	13	126		
China	11	50	1,045	6,342
Hong Kong	267	3,106		
India			102	1,157
Indonesia	1,191	8,761	3,207	20,037
Japan	678	9,164	15	257
Korea Rep of	16	213		
Malaysia	945	3,429	345	3,410
Myanmar			1,270	14,148
Norway			39	435
Taiwan	4	72		
Thailand	99	1,093	289	4,703
United States	211	2,859		
Vietnam Soc Rep of	15	77	388	5,844
Others	626	6,761		
Total	4,163	36,984	6,854	58,245
Grand Total of Shrimps & Prawns	4,913	42,378	21,157	129,568

* Source from Singapore Trade Statistic 2003

REFERENCES:

1. Quarterly Survey of Coastal and Inland Farming of Singapore 2000-2004 (unpublished results)
2. Wholesome Meat and Fish Act of Singapore
3. Singapore Trade Statistic 2003.