

Thailand's shrimp revolution

By James Wyban

Thailand is the world's leading shrimp farming nation exporting the most shrimp in terms of volume and value. It is the top supplier of farmed shrimp to the US and Japan. Traditionally, the Thai shrimp industry farmed black tiger shrimp, *Penaeus monodon*. Since 2001, the Thai industry has undergone a dramatic transformation and switched species to farming Pacific white shrimp, *P. vannamei*. It is now the world's leading supplier of white shrimp. This article describes the key factors that drove this revolution in shrimp farming in Thailand.

Thailand started farming shrimp in the 1970s, using locally available *P. monodon* broodstock captured from the sea to produce post larvae in land-based hatcheries for pond stocking. By the early 1990s, Thailand emerged as the world's leading farmed shrimp producer and exporter based on *P. monodon* production.

A combination of factors allowed the Thai shrimp industry to develop into a well-organized, fully-integrated shrimp industry. All components for successful shrimp farming are well represented including technology at all levels in shrimp hatcheries, farms, feed companies and processing plants as well as international marketing companies.

A diverse collection of entrepreneurial businesses and several multinational public companies create a competitive business climate leading to innovation and increasing productivity. Financing for the industry is substantial through several large publicly-traded companies (Charoen Pokphand Foods Ltd, Thai Union Frozen and others) as well as bank financing. Government support for the industry is through R&D and extension by Department of Fisheries and University research programs.

A strong market focus

The Thai shrimp industry has a strong market focus with many processing and exporting companies to distribute Thai shrimp worldwide. Thailand's Mahachai shrimp auction provides an excellent outlet for independent farmers at competitive auction prices for their products. Daily auction prices are text-messaged industry-wide. Several Thai companies have well established marketing companies in major import markets (US, Japan, Europe).

Slowing of production

In the 1990s, disease problems increased risks and slowed industry expansion. Yellow head (YHV) and white spot viruses (WSSV) severely impacted production. Government-sponsored research and extension helped the industry adjust and manage around these diseases. These viruses were most often introduced through the wild broodstock supply. Despite these problems, the Thai industry maintained its position as the number 1 shrimp producer. In 2001, Thailand's *P. monodon* production peaked at 280,000 tonnes.

Since 2001, *P. monodon* farmers faced a new disease called Monodon Slow Growth Syndrome (MSGs), characterized by slow growth leading to smaller harvest size and lower prices. The cause of MSGs is still unknown. This slow growth problem with *P. monodon* set the stage for SPF *P. vannamei* introduction. Farmers were looking for a lower risk, reliable way to make money farming shrimp.

Testing of SPF broodstocks

Limited SPF *P. vannamei* broodstock imports were first tested in 2001. Results were impressive with stable, consistent results; high survivals and fast growth to 20 g in 100 days with uniform size distribution at harvest (2-3 size classes). The SPF shrimp were tolerant to higher densities than *P. monodon* – up to 2.5 kg/m² and there were lower incidences of mass mortalities.



The industry lobbied to allow more broodstock imports in 2002. More farm trials followed and 2002 also saw tests of 'homegrown' or 'F1 broodstock'. Farmers soon found that most growth and production advantages of true SPF *P. vannamei* were lost using 'home grown or F1 broodstock'. Slower growth and large size variation and more disease events were typically experienced with F1 stocks.

White shrimp production in 2002 jumped to 20,000 tonnes. Figure 1 illustrates the rapid increase in *P. vannamei* production (yellow bars) between 2002 and 2006 while *P. monodon* production (red bars) rapidly declined. In 2006, *P. vannamei* represented over 98% of total production entering the shrimp auction and production may reach 400,000 tonnes.

Progressive Thai farmers now produce 20-30 tonnes/ha/crop using SPF and TVR *P. vannamei*. Table 1 compares the relative production numbers and profits between species in Thai shrimp farms. These data clearly showed that the driving force of Thailand's change from farming *P. monodon* to farming *P. vannamei* is the superior production economics with *P. vannamei*. Crop value and profits (USD/ha) with *P. vannamei* are 2-3 times greater than with *P. monodon*. Reliability of production (avoidance of disease) is also higher with SPF *P. vannamei*.

Table 1. Comparison of production parameters and profits between typical *P. monodon* and *P. vannamei* production systems in Thailand (in USD).

Parameter	<i>P. monodon</i>	<i>P. vannamei</i>	% Difference
Density (PL/m ²)	40-50	120-200	300%
Crop duration (days)	110-140	105-120	27%
Harvest size (g) (#/kg)	22-28 (40/kg)	21-25 (42/kg)	5%
Yield tonnes/ha/crop	8	24	300%
Crop value (USD/ha)	45,000	96,000	220%
Crop costs (USD/ha)	32,000	60,000	
Production profit (USD/ha)	13,000	36,000	280%

Thailand's success

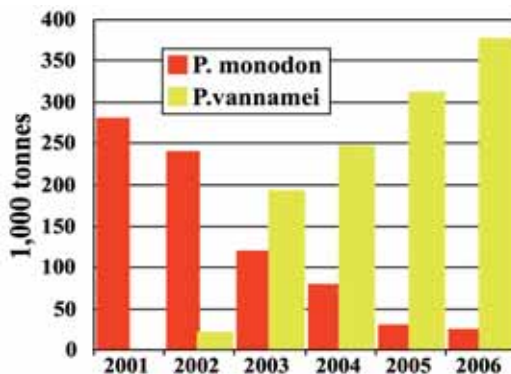
A key factor of Thailand's success with *P. vannamei* is their controlled broodstock imports to ensure sufficient supplies of true SPF *P. vannamei* broodstock. A permit to supply broodstock is required from Thai Department of Fisheries (DOF). Thai law requires that broodstock suppliers are certified SPF producers with a two-year history of SPF production and US-government certification. Based on DOF records, High Health Aquaculture is the leading supplier of SPF broodstock to

Thailand. A DOF Code of Conduct (COC) certification is required for a Thai hatchery to import SPF broodstock.

A recent trend in Thai *P. vannamei* farming is multi-cropping from high stocking densities (200/m²) leading to a local supply of small farmed-shrimp (100 pieces/kg) which is replacing a traditional fishery product. Industry consolidation is another trend with large integrators testing a contract-farming business model. Thailand's revolution in shrimp farming largely benefited from the domestication and breeding of SPF *P. vannamei* by US companies.

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Figure 1. Thailand annual shrimp farming production by species



Raising the bar By Zuridah Merican

Through HHT, Dr James Wyban will bring up the quality of Thai shrimp to be the best in the industry.



In late 2005, Thai Union Feed Mill (TFM), a leading shrimp feed producer in Thailand, part of the Thai Union Frozen Foods Ltd (TUF) conglomerate and High Health Aquaculture (HHA) of Hawaii signed a joint venture agreement to develop a hatchery to produce specific pathogen-free (SPF), fast-growing, Taura-virus-resistant shrimp nauplii and post larvae in Thailand. The joint venture, named High Health Thailand (HHT) is capitalized at USD 11 million.

Land acquisition and construction of the hatchery at the site at Khao Pilai beach in Phang Nga, Southern Thailand began in 2006 and was completed in April 2007. HHT will produce and distribute the highest quality SPF post larvae available in Thailand. HHT has a production capacity of over 300 million post larvae/month using SPF GxTVR™ broodstock from HHA in Hawaii. Hatchery production will be managed by HHA personnel.

As Managing Director of HHT, Dr James Wyban (also President of HHA), oversees all aspects of technology and business at the hatchery. In this on site interview, he explains how it all started and how SPF *P. vannamei* will lead to the industrialization of the farmed marine shrimp industry in Thailand and subsequently the region.

AAP: Can you tell us how this joint venture came about?

JW: We like to think of the JV as a good marriage with both parties bringing their special assets, skills and resources to the venture. HHA brings shrimp breeding technology, shrimp production, high quality/high value products and concepts and skills. It also brings its knowledge of the Thai farmed shrimp industry. We have been active in the Thai market as the leading SPF broodstock supplier since 2001. The Thai industry has confidence in our reputation and brand. TFM brings the substantial resources and knowledge of the TUF group to the partnership. TFM has in a short time developed as a top shrimp feed producer. It has a good position and reputation in shrimp farming.



I see this as an ideal partnership of a leading feed company with TFM's strong customer base and sales force and coupled with the advanced SPF hatchery and operations protocol developed and designed by HHA. We started to structure the partnership in 2005. Land acquisition and facility design were done in early 2006 followed by start of construction in May 2006. As you can see, it has been fast. I am very pleased that in less than a year, the hatchery will be completed.

AAP: on your part, why a post larvae business?

JW: The post larvae business is a significant part of the industry, much larger than broodstock with a huge turnover. It is big business in Thailand. The broodstock business has been good for us but the demand for broodstock from Hawaii is limited. We wanted to be more integrated into the industry. In HHA strategic planning, we intended to develop a hatchery and we targeted Thailand. At the same time, TFM had decided to develop a hatchery company. Both companies had this common goal so we decided to work together.

As a listed company, TUF has a large market presence in the US, Japan and EU and needs a reliable supply of shrimp with consistent quality and results. TUF is answerable to its shareholders and it cannot gamble with

shrimp farming using traditional production methods. It has to go industrial, producing feed, seed, processing and marketing internationally. As the industry intensifies, profitability is the issue. To be competitive, it is critical to get every pond not only in production but performing well. This investment will secure the future for both HHA and TUF.

HHT will exclusively use HHA's SPF GxTVR™ broodstock from Hawaii. GxTVR™ are SPF (disease free) and selectively bred for fast growth crossed with resistance to Taura Virus Syndrome. They were developed over 10 years of work and is our most advanced *P. vannamei* stock today.

AAP: At what stage is the project?

JW: Originally we wanted to have a smaller facility and work phase by phase. Despite the higher costs, we decided on the complete facility as you see now. The scale of the facilities is tremendous. We have several rows of 'greenhouse type' buildings holding tanks for all aspects of rearing from nauplii to PL12 production. Two buildings are used for algal and live feed production. All buildings are fully enclosed for biosecurity. Biosecurity was centre stage in our designs and is now in operations. The buildings are well separated and we avoided planting grass which could attract insects. We have seawater reservoirs and effluent treatment ponds to avoid any environmental impact. Most of the materials for construction were sourced within Thailand. We invested heavily in water filtration equipment as we use super high water quality standards.

We have started production. The first experimental batch of PL12 were harvested and sent out on Songkran Festival day in April. We are happy that we could do this on such an auspicious day for Thailand. We expect full production by June 2007.

AAP: What are your aspirations for HHT?

JW: With HHT, we intend to produce the very best PL available and to raise the bar for the whole industry. We intend to put the issue of quality first in the Thai industry. This will transform the industry. The industry will need to move to an industrial level following the way of the poultry industry. It will be led by large corporate companies and independent farms.

We will be at the top of this market as a reliable supplier of quality shrimp. Our success will be clear by the end of 2007. I am very confident that what we are doing will transform the industry. We will give the producers the very best post larvae they have ever seen.

I believe that the industry in Thailand is moving towards more investment and a technical base where people need more reliable results. This is only possible when you have clean, (disease-free) post larvae

and selected for specific production traits. We do a large amount of work to make sure that the composition of our animals are the best possible.

The use of home grown broodstock reared in open ponds and usually contaminated with one or several virus, is not the way for the industry to grow. The old style culture model using whatever is available at least cost with little concern for biosecurity is always a risk and is more like gambling than an industrial process.

I believe the industry will learn that to get top performance, they will need to go to a credible source. At HHA, we believe in doing things the right way with no short cuts. This will be replicated at HHT.

AAP: How do you see the future of farmed marine shrimp in Thailand and the region? Can there be a perfect sustainable system for all in Asia?

JW: To answer this, we first need to look at the global market for marine shrimp. It is a big market and growing. However, the market for food is changing with people wanting safe and nutritious high quality food. It has to be clean and come from sustainable means of production.

Shrimp farming must fit into this scenario. We have to focus on production following the model of the poultry industry - industrialized and led by corporate companies integrating breeding, feed production, processing and marketing. We will need to develop the model based on technology which can be transferred to other locations. Shrimp production will have less and less impact on the environment as technology develops. It needs to be benign.

Thailand's lead role in shrimp production is due to its unique and intrinsic political, social and economic characteristics and how her people work together. However, I see that Thailand's future growth will be driven by vannamei shrimp production. The economics of vannamei culture is far superior to that for black tiger shrimp culture. Production volumes are 4-5 times those with black tiger shrimp. The better price obtained for black tiger (up to 50% higher) does not make up for the 5 times higher production volume that we can be achieved with vannamei. My view is that the next species to be used in Thailand will be *P. stylirostris*. Before this, we will need to build a solid foundation for this species.

The production of the black tiger shrimp will continue to be using the old style (low cost) model in countries such as Bangladesh, India and Vietnam. Producers may use SPF post larvae but from an industrial standpoint, the economics of black tiger production is still not clear. HHA owns a domesticated, SPF stock of this shrimp.

The driving force

With a PhD in fish genetics, **James Wyban** worked as the Principal Investigator of the US Shrimp Consortium at Oceanic Institute in Hawaii. In 1991, his group discovered that SPF shrimp vastly out produced non SPF stocks. Domestication and breeding was the logical next step in the work with SPF shrimp.

"I am thrilled to be involved in this work. Until today, I find all these things incredibly interesting. We use a lot of the theories of Darwin (my hero) on domestication and selective breeding".

Deep down, I am an entrepreneur at heart. Back then, I was searching for opportunities for shrimp farming in Hawaii. I found that the most viable venture based in Hawaii is production and supply of SPF *P. vannamei* broodstock. I started HHA in 1993 supplying the industry in the US and Latin America. Today the company markets broodstock to 25 countries. We work on the domestication and breeding of 4 species of SPF marine shrimp.

"The Asian market has now become our main market and focus of my work. The key success factors for HHA are our focus on quality, customer service, applying good science with no short cuts and not doing things the cheap and easy way".

"One measure of HHA's success is how many imitators there are for our SPF broodstock. We shipped our first shipment to Asia into Taiwan in 1998 and the outstanding growth performance saw many farms producing F1 broodstock from this stock. The lessons learned was that F1 broodstock did not work as well. HHA continues to grow our business because farmers come back to us to get the great results. Most realize that we do not take short cuts. We do things the right way and this will keep HHA sustainable and will make HHT successful too. For top performing shrimp, they will come to us".



James Wyban. In the background are some of the buildings of the hatchery