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Blue alternative: High Health introduces SPF blue shrimp to Thailand

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L. stylirostris could diversify white shrimp monopoly

A 140-day trial in Thailand yielded 33-g blue shrimp that sold for about $7.57/kg.

The range and biology of Pacific blue shrimp (*Litopenaeus stylirostris*) are quite similar to their conspecific species, the Pacific white shrimp (*L. vannamei)*. Their anatomies are almost identical, differing in only a few minor taxonomic characteristics – such as number of rostral teeth – which are used to identify the species at postlarval stages.

The native ranges of blue shrimp and white shrimp are identical. Both occur along the tropical eastern Pacific coast of Mexico, Central America and northern South America, and both are limited by minimum surface seawater temperatures down to 20 degrees-C. Fishermen in the region regularly catch both species.

Details of the open-thelycum reproductive anatomy and biology of blue shrimp are almost identical to those for *L. vannamei*. In spite of these similarities, the two species do not hybridize. The production of *L. stylirostris* nauplii in commercial hatcheries is virtually identical to *L. vannamei* hatchery techniques.

Ideal environment

Table 1 lists optimum environmental parameters for farming *L. stylirostris*. The species is less tolerant of low salinity than *L. vannamei* and requires salinities above 10 ppt. Its optimum salinity is 25 to 35 ppt. *L. stylirostris* is more sensitive to low dissolved-oxygen (D.O.) levels than *L. vannamei*. Optimum culture conditions include D.O. concentrations of at least 4 mg/L.

Wyban, Optimum environmental conditions for farming, Table 1

	Acceptable Range	Optimum

Dissolved oxygen (mg/L)	3.5-10.0	4.0 or more
Temperature (° C)	20-32	28-30
Salinity (ppt)	10-35	25-35
Feed	35-45% protein	40% or more
Stocking density (m^2)	25-500	120

Table 1. Optimum environmental conditions for farming blue shrimp.

Both white and blue shrimp are considered omnivorous scavengers or detritus feeders. Nutritional studies by D. W. Moore and C. W. Brand in 1992 showed that *L. stylirostris* require a higher protein content in applied feeds than *L. vannamei.* Studies at High Health Aquaculture in Hawaii, USA, have shown that *L. stylirostris* grow very well on a standard 40 percent-protein diet for black tiger shrimp, *Penaeus monodon*.

Farming blue shrimp

L. stylirostris have been farm raised in Latin America for more than 30 years and in New Caledonia for 20 years. In Latin America, *L. stylirostris* were typically produced in extensive farm systems, often in polyculture with *L. vannamei.* This resulted from the industry's use of wild postlarvae, since wild larvae for *L. vannamei* and *L. stylirostris* often co-occur.

In New Caledonia, a small industry based entirely on *L. stylirostris* farming has evolved. This industry is mostly semi-extensive culture growing *L. stylirostris* in large, open ponds without aeration and producing a single crop per year. New Caledonia exports its farmed shrimp to Japan and France and obtains a very high price for its product.

It is interesting that at harvest in polyculture systems, *L. stylirostris* are always at least one size class larger than *L. vannamei.* Blue shrimp are capable of rapid 2 grams a day growth at high (100 per square meter) density up to 35 grams in size. Both blue and white shrimp grow from postlarvae to 20-g size at this rate, but above that size, *L. vannamei* growth usually slows to about 0.12 grams per day. In New Caledonia, typical harvest sizes of up to 35 grams are obtained in a single crop of 200 days.

Another major culture benefit of blue shrimp is that they tolerate a lower temperature regime than white shrimp. While *L. vannamei* feeding and growth slow at pond temperatures below 27 degrees C, *L. stylirostris* grow well down to 24 degrees-C. Blue shrimp could be grown in Asia during cool-weather seasons when pond temperatures are sub-optimal for *L. vannamei*.

Figure 1 shows the annual global production of *L. stylirostris* based on United Nations Food and Agriculture Organization (FAO) numbers. The sharp increase in production between 1994 and 1999 was due to a massive switch to *L. stylirostris* farming in Latin America following widespread devastation at *L. vannamei* farms caused by Taura syndrome virus (TSV).

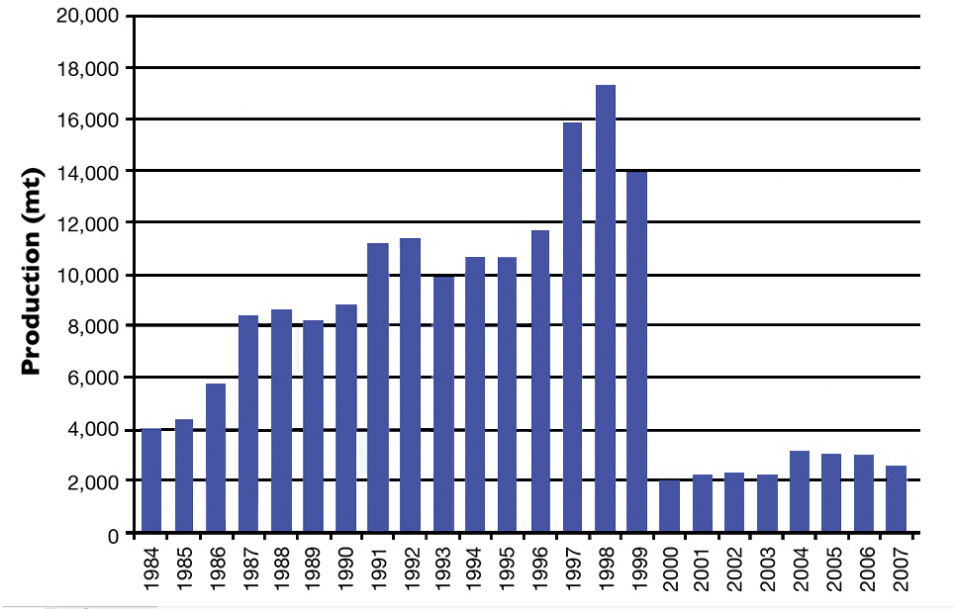

Fig. 1: Annual global production of farm-raised *L. stylirostris*.

Because *L. stylirostris* are naturally resistant to TSV, they were replacing *L. vannamei* as a species of choice. However, by 1999, TSV-resistant *L. vannamei* stocks became available, and farmers returned to *L. vannamei.* In 2000, the 2,000-metric ton annual volume of *L. stylirostris* represented production by the New Caledonia industry.

Culture systems

While *L. stylirostris* have been farmed in Latin America for 30 years, nearly all of that production was based on extensive culture. Stocking densities of 5-10 postlarvae per square meter in huge ponds of 3 to 5 hectares (ha) each with no aeration and poor feed quality are standard. These systems do not provide a meaningful comparison to Asia's shrimp-farming potential, which is technology-based using much higher stocking densities and aeration.

One data set of intensive farming using *L. stylirostris* came from the company Marine Culture Enterprises (MCE). Located in Hawaii, USA, and funded by Coca-Cola, it developed a superintensive shrimp-farming system using raceways in greenhouses.

MCE undertook an elaborate research and development program in which production trials and market studies compared *L. vannamei, L. stylirostris* and *P. monodon* as candidate species. Based on those rigorous tests, MCE concluded that *L. stylirostris* had the best chance for commercial success in superintensive systems. As reported by researchers Moore and Brand, the facility produced 20-g shrimp in 125-day cycles with harvest biomass up to 7 kg/m^2.

High health shrimp

At High Health Aquaculture, which owns the world's most diverse germplasm collection of specific pathogen-free (SPF) shrimp, a founding stock of blue shrimp was imported from Ecuador to the company's breeding facility in Kona, Hawaii, USA, as postlarvae from wild *L. stylirostris* broodstock in 1994. The shrimp were screened for pathogens at least twice per generation using both histology and polymerase chain reaction testing at the University of Arizona. All pathogen screenings were negative.

High Health's SPF *L. stylirostris* are generation F14 and selected for fast growth every generation. The blue shrimp's resistance to TSV – confirmed by lab challenge testing – was one of the principal reasons for High Health Aquaculture's development of its SPF stock of the species.

While some stocks of *L. stylirostris* are susceptible to infectious hypodermal and hematopoietic necrosis virus (IHHNV), challenge data from Dr. Jim Brock indicated the SPF *L. stylirostris* stock from High Health was also resistant to IHHNV. Like other shrimp, *L. stylirostris* are susceptible to white spot virus.

Thailand trial

Thailand is the world's leading supplier of farmed shrimp, and more than 99 percent of its production is white shrimp. The Thai industry is concerned about this high concentration in one species and wants to study crop diversification.

To this end, High Health Aquaculture prepared a comprehensive species risk assessment for introducing SPF blue shrimp to Thailand for the Thai Department of Fisheries (DOF) in October 2009. Based on that document, the DOF issued a permit for Sarasin Hatchery to import SPF blue shrimp broodstock. High Health shipped the F13 broodstock to Sarasin in January.

The hatchery stocked 300,000 postlarvae in a 3,200-square-meter commercial shrimp pond in Phang-Nga at 94/m^2. A high 30 hp/ha level of aeration, similar to that used for Thailand's intensive farming with *L. vannamei*, was applied. A commercial *P. monodon* diet was used throughout. Individual shrimp sizes were monitored by pond sampling (Fig. 2).

Fig. 2: Individual shrimp growth of blue shrimp in a Thai production trial.

The total production of 7,200 kg of 30-count shrimp after 140 days was exciting (Table 2). Because of the large 33-g size of the shrimp harvested, the pond-side value of the crop was equivalent to about $7.57/kg. The gross profit was equivalent to about $36,185.

Wyban, Production statistics for SPF blue shrimp, Table 2

Crop duration (days)	140
Harvest size (count/kg)	30
Harvest size (g)	33
Daily growth (g)	0.24
Total production (kg)	7,200
Production (mt/ha)	22.5
Feed-conversion ratio	2.19

Table 2. Production statistics for SPF blue shrimp in Phang-Nga, Thailand, between January and September.

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