

Current Status and Trends of the Brazilian Shrimp Farming Industry

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Overview of Brazilian Farmed Shrimp Production

The Brazilian shrimp farming sector works exclusively with Pacific white shrimp *Litopenaeus vannamei* since the late 1990s, basically when the country started to expand its production in commercial terms. Although in 2010 it used only 2,0% (20.000 ha) of its suitable production area (1.000.000 ha), shrimp farming is already a firmly established activity in the Brazilian aquaculture scenario, mainly in the Northeast Region, having demonstrated its technical, economic, social and environmental viability while actively contributing to the alleviation of rural poverty through the generation of business opportunities, income and the creation of permanent jobs.

From 2000/2003, shrimp farming was the rising star of Brazilian aquaculture, with ever increasing production and productivity numbers year after year, at one point being the world leader in productivity (2003). At that time, the shrimp farming sector was very much export oriented having reached the position of number one supplier to the French market and number two supplier to the Spanish market (2004/05) while also making strong inroads into the United States market (2003).

From 2004/2006 however, the sector started to encounter difficulties in part due to its dependence on export markets and in part due to factors outside its control. The valuation of the Brazilian currency, the Real, which started to affect exports, the antidumping process brought on by US shrimpers, the appearance of a new disease, IMNV, plus a series of natural disasters in shrimp farming areas together with a lack of any kind of official support resulted in drastic changes in the shrimp farming sector. Production fell from 90.190 tons in 2003 to 65.000 tons in 2005 and remained at this level for the next 4

years while exports fell from 58.360 tons in 2003 to a little over 1.000 tons in 2010 (Figures 1 and 2).

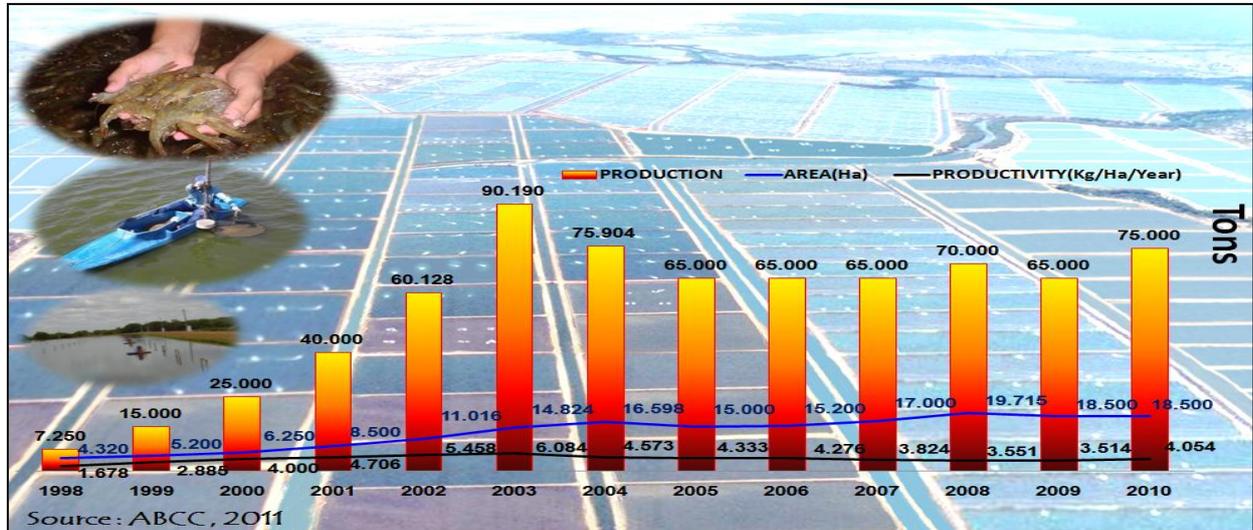


Figure 1. Brazilian Farmed Shrimp Production, Area and Productivity, 1998-2010

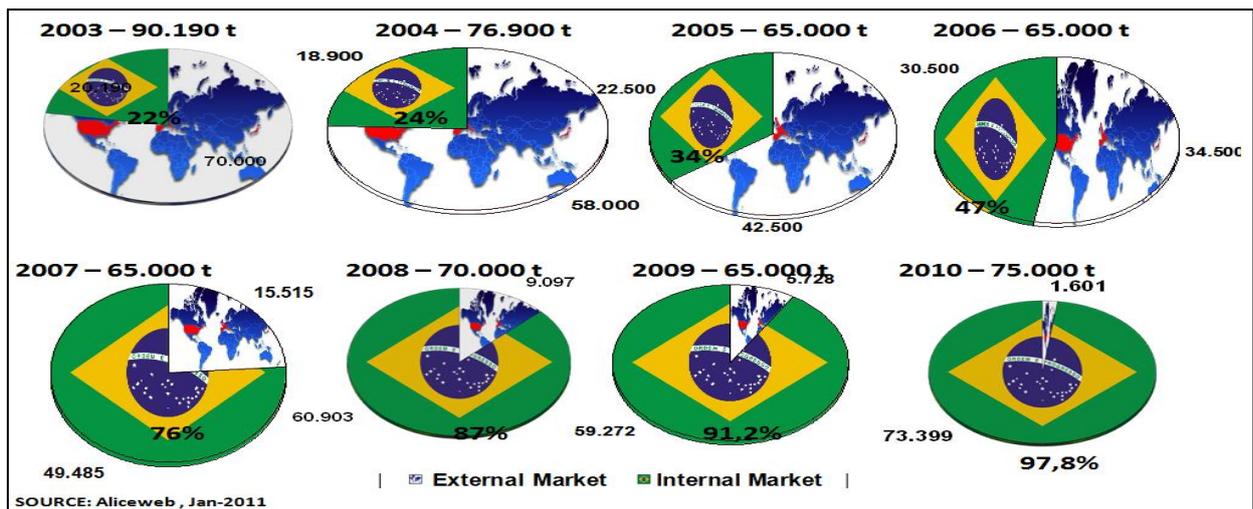


Figure 2. Destination of Brazilian Farmed Shrimp Production, 2003-2010

The sector survived the difficult years between 2005 and 2009 and learned from the experience. Management practices were worked on and improved, lower densities became the norm as one of the ways to successfully deal with IMNV thus reducing production and financial risks, probiotics started to make a difference, but the most important component for the recovery of the sector was the market shift that took place during this period. Shrimp producers finally started to work the country's domestic market where there existed and still exists to a degree a large untapped potential to be explored. The standards of quality that served the sector so well during the export phase

were now directed towards the domestic market, where consumption of fresh, frozen and value added shrimp have all increased dramatically. According to the Brazilian Ministry of Fisheries and Aquaculture, average yearly per capita shrimp consumption in the country increased from 270 g in 2005 to 500 g in 2009, an 85% increase in a four year period.

After some positive signs of recovery in 2008 and 2009, the sector finally started to grow again in 2010 with an estimated total production of 75.000 tons and a production area of approximately 20.000 ha, being that 98% of the production was consumed by the domestic market compared with 22% in 2003. This growth trend is expected to continue in the coming years, although in smaller increments than in the past, with practically 100% of production being directed to the domestic market.

Technological processes adopted by Brazilian shrimp farming

The production of farmed shrimp in Brazil from the technological point of view currently, involves the following steps:

Maturation and Hatcheries: In Brazilian sistem, all the nauplius, the first larval stage of marine shrimp, comes from Maturation Units, where broodstocks are kept under special physical-chemical (temperature, dissolved oxygen, salinity, pH, nitrite, ammonia, etc.) and biological (phytoplankton zooplankton and zoobenthos) parameters allow for the adoption of corrective measures so as to ensure an ecologically balanced environment conditions such as photoperiod control. Density is of 80 to 100 broodstock per round tanks (20.000 l), maintaining a ratio of 1:1 (male and female), with constant water exchange and aeration, plus 6 times feeding/day.

During the hatchery stage, larvae receive special care concerning feeding, temperature control, oxygen, ammonia, nitrite, pH, etc, so that they can overcome the many challenges that arise from the various metamorphoses that take place during this stage. Feeding starts at the ZOEI I (Z_1) stage and is based on microalgae complemented with *Artemia* nauplii and microencapsulated diets. After 18 to 20 days, the post larvae, PL₁₀ stage, with a survival rate of 70 to 80%, are concentrated,

counted and placed into plastic bags or special tanks with water, oxygen and *Artemia nauplii*, being shipped by land or air to the shrimp farms.

Nursery Tanks Growout: The use of nursery tanks serves to improve the acclimation process of the post-larvae allowing them to further develop and become stronger in order to meet the challenges of the pond growout stage. During this acclimation period (10 to 15 days), the post-larvae, which are stocked at a density of 20 to 30 PL's₁₀/l, are kept under constant aeration with feeding taking place at two hour intervals. Proper management techniques together with the use of appropriate feeds result in an average survival rate of around 80 to 90%.

Growout Ponds: Prior to stocking, growout ponds undergo a sterilization process in order to eliminate opportunistic pathogens and predators. They also realize specific preparations in order to eliminate metabolites, reduce organic matter, increase pH and promote the development of bacterial communities. After these steps, the ponds are filled with previously filtered water and stocked with 20 to 70 PL's/m². The growout period can vary from 70 to 150 days which is when the shrimp reach commercial sizes (7 to 25 grams). During this period, shrimp are fed 2 to 4 times daily using pelleted feed distributed by kayaks in "fixed trays". The leftover feed is routinely checked and removed thus avoiding its degradation which can be a cause of stress and have an overall adverse impact on the growout environment. In addition, the use of probiotics as a biosecurity tool as well as prophylactic and nutritional control is becoming part of the management routine of hatcheries, nursery tanks and growout ponds in the shrimp farming sector in Brazil. Harvesting is done with bag nets (manual) or by machines (mechanical) placed behind the flood gates. The harvested shrimp are placed in plastic containers and immersed in a solution of water, ice and sodium metabisulfite. After this treatment, they are placed in boxes with ice and transported by insulated trucks to the processing plant or packed in insulated boxes containing ice to be sold fresh to the local markets.

Processing: Once the shrimp arrive at the processing plant, samples are taken and submitted to sensorial and quality analyses in order to ensure that they comply with and fall within the standards set forth by the Health Authority. They are immediately stored in holding chambers (-5°C) to preserve their characteristics and natural freshness. Once they are released for processing, they go through an Ice Separator containing hyperchlorinated ice water (temperature below 5°C and residual chlorine above 10ppm) where they are mechanically sorted and transported via a nylon conveyor belt to the Washing and Inspection Platform when foreign materials and damaged shrimp or shrimp unsuitable for consumption are removed.

After this process, they are transferred via a nylon conveyor belt to a mechanical grader with six chutes, each one corresponding to a size classification as established by national and international standards. They are then weighed, packed in small boxes and placed in freezing tunnels. The frozen blocks are removed from the freezing shelves and packed in Master Boxes that are stored in cold chambers according to type, classification, and product lot and date of manufacture. Afterwards, depending on commercial demand, they are removed from the storage chambers and shipped by land, by plane or by sea to consuming centers in Brazil and abroad.

Socioeconomic impacts: The farmed shrimp agribusiness has taken on an increasing social importance in Brazil, especially in the Northeast Region which accounts for 98% of national production. In a total, there are around 1.500 shrimp farmers covering an area of 20.000 hectares of ponds, creating 50.000 jobs, with a production of 75.000 tons of shrimp and US\$ 450 million in revenues in 2010.

When one analyzes the comparative table for job creation presented by Sampaio & Costa, 2003, in their research study: **Direct and Indirect Jobs Created by Various Activities of the Primary Sector in Brazil**, the importance of shrimp farming stands out even more. (Table 1).

Product	Direct Jobs	Indirect Jobs	Total
	Generated by Hectare	Generated by Hectare	
Grape	1,44	0,70	2,14
Mangoe	0,42	0,70	1,12
Sugar Cane	0,35	0,70	1,05
Coconut	0,16	0,70	0,86
Farmed Shrimp	1,89	1,86	3,75

Table 1. Job generation by some primary sector production in Brazil, 2003

Source: Sampaio & Costa, 2003

Environmental Sustainability: Throughout the years, Brazilian marine shrimp farming developed and uses good management practices based on technical, social and environmental criteria that ensure a harmonious coexistence with a balanced environment. In this context, a number of research studies by Matanó et al (2003), Cavalcanti (2003), Lacerda et al (2004), Madrid (2004), Maia et al (2005) and Rocha (2005) that analyzed and identified the main vectors and human actions that stress, pollute and impact rivers and estuaries in Brazil, demystified and proved wrong the tenets and false dogmas of the more radical environmentalists who mistakenly or purposely attribute to shrimp farming negative effects on water quality and the integrity of the biodiversity of environments adjacent to shrimp farms.

In addition, an important study on mangrove areas undertaken in the main shrimp producing states in the Northeast Region which analyzed a 26 year interval (1978-2004) showed that there was an increase in mangrove areas of 36,11% which goes against the claims that shrimp farming destroys mangroves (Table 2).

States	Areas (ha) (1978)	Areas (ha) (1999-2004)	Variation (ha)	Variation (%)
PI	2.994	4.040	+1.046	+34,94
CE	14.043	17.658	+3.615	+25,74
RN	10.819	12.971	+2.152	+19,89
PB	6.888	9.631	+2.743	+39,82
PE	9.661	16.138	+6.477	+67,04
TOTAL	44.404	60.438	+16.034	+36,11

Table 2. Study of the mangroves evolution areas, northeast, in 5 states, from 1978 to 2004.

Opportunities, Obstacles and Prospects

Brazilian shrimp farming is back on the growing path. Some new factors such as production intensification in the traditional farms with the use of Good Management Practices and Biosecurity Measures, increasing production from inland farming areas that use fresh or low salinity waters, polyculture with tilapia and a rapidly increasing internationally certified organic shrimp production are all contributing towards this growth recovery while also presenting new production and products options.

The infrastructure that existed prior to the more difficult years is still in place. Brazil has at present 18 maturations/hatcheries units that were responsible for a production of over 15 billion PLs in 2010, 11 shrimp feed manufacturers and 32 processing plants which in most cases are not operating under full capacity and are able to provide the necessary support for further growth and sector expansion.

The main problem the sector faces today concerning future expansion is an internal one that has nothing to do with diseases, exchange rates, international or internal prices and the like. After decades of activity, clear rules are still not in place regarding environmental permits which in turn affects access to credit. The new and recently approved Forestry Code, although it assures the regulation of existing enterprises, has created some barriers for the expansion of the shrimp farming sector in coastal areas, specially in high salinity land areas. However, with the exception of this biome, there are no growth restrictions and there will certainly be a shift towards taking advantage of the vast potential for the farming of *L. vannamei* shrimp present in inland areas

If explored in an efficient manner, based on average national productivity, Brazil can reach a prominent position of leadership in shrimp farming in terms of global production for it has 1.000.000 ha of suitable areas, with exceptional natural conditions, infrastructure, and location as far as the main consuming centers are concerned while also having the appropriate technology in place and a large and promising internal market to lead this growth.