



# Warm Water Shrimp: Global production trends

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# The Backstory

- Why has production grown in some countries and not in others?
- At first glance, it doesn't seem related to production intensity, region, or species
- My opinion is that the principal issue has been disease, and the varying ways that each country responded and continues to respond. These are important lessons.

# Lesson 1: There's no where to hide from disease

- WSSV started in China in 1992 and rapidly spread throughout Asia by 1995. In 1999, it jumped to the Americas.
- Even the most remote countries have been hit by WSSV
  - Saudi Arabia in 2011 and 2019
  - Mozambique in 2011
  - Madagascar in 2012

## Lesson 2: Ecuador's Remarkable Solution

- After the catastrophic WSSV outbreak of 1999, Ecuadorian farms were unable to control the disease through biosecurity, so they tenaciously attempted selective breeding
- It took several years to see results.
- The system was simple. Collect the largest shrimp from production ponds and use them as breeders in the hatchery.



# Ecuadorian Shrimp Breeding

- Mass selection typically results in rapid inbreeding, but this was avoided initially with genetic markers and later with ingenious use of various genetic lines
- While rates of genetic gain in growth rate and reproduction are lower than with SPF family breeding, Ecuador has avoided serious losses from WSSV and EMS which hit the hatchery sector in 2017
- Ecuadorian stocks of vannamei have been introduced in areas of Asia with serious disease issues, especially China.

# Ecuador's steady growth has inspired huge investment

- Massive and sophisticated feed manufacturing (extrusion)
- Greatly improved feed efficiency in ponds using autofeeders
- Higher stocking densities, nursery systems, aeration, recirculation.
- Value added processing to access the US market

# Lesson 3: Biosecurity is important

At the GOAL 2012 meeting in Bangkok MPEDA Chair Leena Nair asked the EMS panel how to prevent EMS from entering India

Dr. Don Lightner recommended no broodstock imports from EMS affected countries

India instituted strict broodstock quarantine that excluded EMS and allowed production to flourish.

Indonesia imposed similar restrictions



# Next steps in Asian breeding

- Most SE Asian countries use a combination of fast-growing SPF stocks and disease exclusion from ponds through biosecurity
- Biosecurity is imperfect. Disease control requires greater use of sentinel testing to produce SPF stocks that are more tolerant of local pathogens (as per the Ecuadorian model)

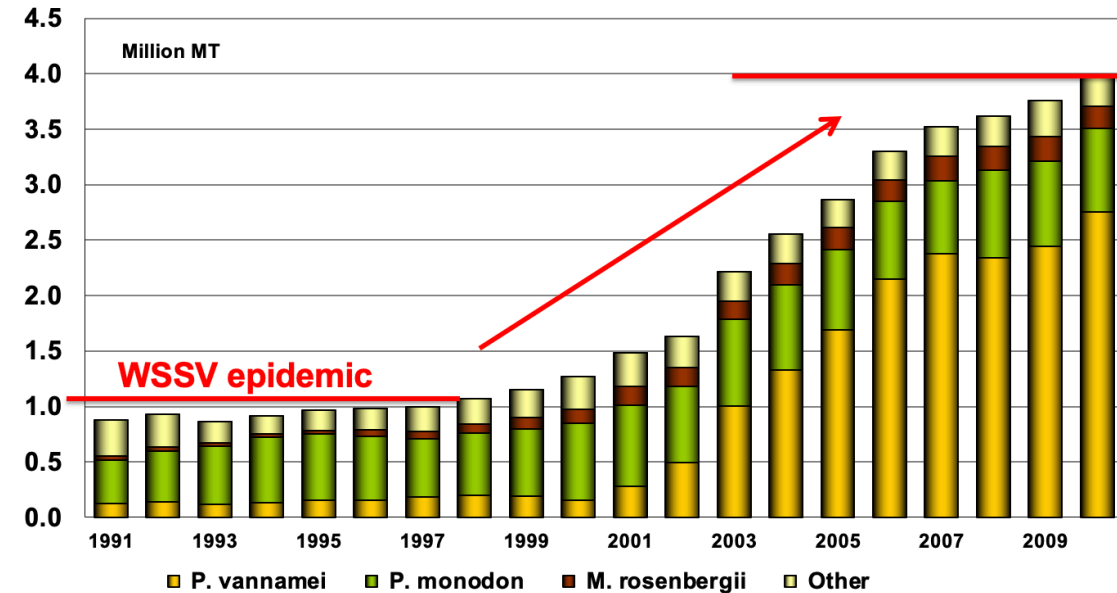


# Two New Developments in Asia

1. Extensive culture of black tiger shrimp (*Penaeus monodon*)
2. Super intensive tank farms (*L. vannamei*)

# What happened to *P. monodon*?

- In 2000, *P. monodon* dominated global shrimp production with a SOM of 63%
- In response to WSSV, SPF *L. vannamei* were introduced to Asia from breeding programs in the US.
- *L. vannamei* production exploded and it rapidly became the dominant global species
- *L. vannamei* SOM has increased to 82% while monodon has dropped to 12%.



# Extensive, Black Tiger Shrimp in Asia

- Small holder family farms
- Very low stocking density (3-5/m<sup>2</sup>)
- Little or no feed
- No pumping or aeration
- Fast growth to large sizes
- Challenge is managing and improving such a fragmented network of small farms.



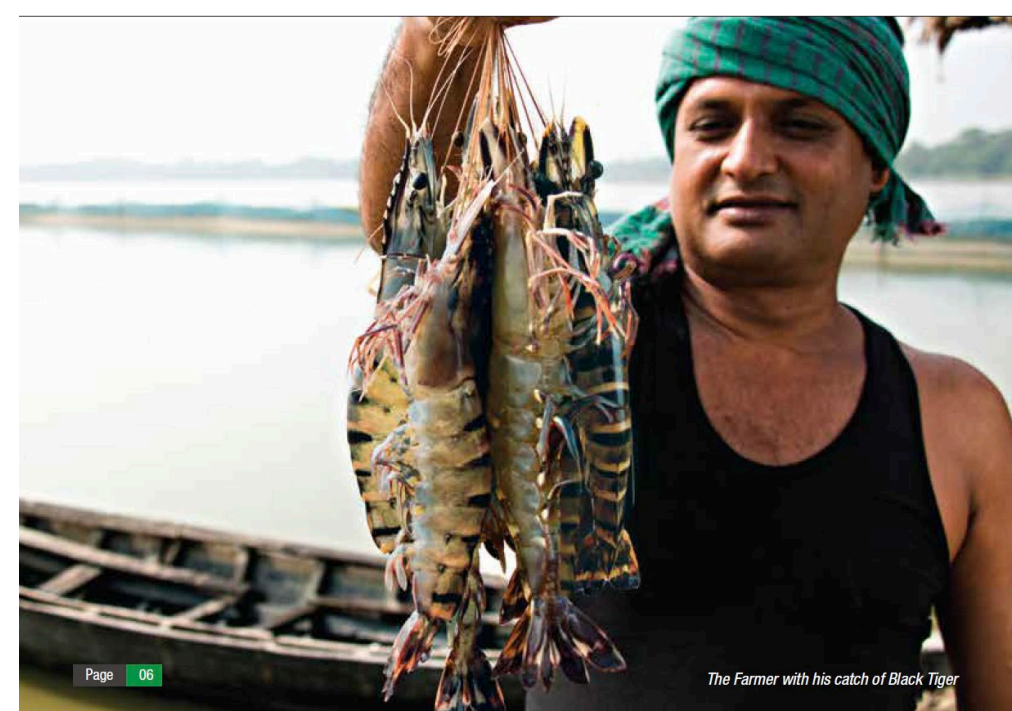
# The Challenge of Black Tiger Shrimp Production

- Only traditional low-density farms continued to produce monodon.
- The volumes from these smallholder farms are too small to sell directly to processors
- Middlemen aggregate harvests, take the lion share of profits, and often neglect product quality. This creates a cycle of poverty.



# The Black Tiger Opportunity

- At low density, black tiger shrimp grow rapidly to large sizes with natural pigmentation and low carbon footprint.
- They are intrinsically valuable
- Opportunity to form clusters of farms, sell directly to processors, produce premium quality, return a fair value to farmers, and help them increase yields using improved practices



# P. Monodon SPF Postlarvae





# Intensifying *L. vannamei* production

- Traditional intensive ponds haven't changed much in 40 years
  - 0.5 ha earthen, flat bottom, paddlewheel aeration
  - Weak biosecurity and sustainability
  - 5-10 mt/ha/cycle





# Intensive *L. vannamei* Tank Farms

- New generation of tank farms
  - Round tanks of 500-1,000 m<sup>2</sup> with plastic liners
  - Stocking densities of 100-500/m<sup>2</sup>
- Strong biosecurity
- SPF broodstock bred for fast growth
- Use of automatic feeders and aeration
- Partial harvesting
- Yields of 200-400 mt/ha/year



# Convergence of Intensive Shrimp Tank Farms and RAS technology

- Highly controlled, biosecure, automated, and with small environmental footprint
- Opportunity to utilize RAS engineering to optimize area, depth, slope, current velocity, aeration, and lighting to improve productivity and efficiency



# Summary

- Much of international shrimp farming performance can be explained by diseases and the way each country responded
- Lesson 1: Diseases have hit the most remote locations
- Lesson 2: After catastrophic losses from WSSV, Ecuador developed disease tolerant genetic lines through mass selection. The resulting steady growth has inspired massive investment.
- Lesson 3: India protected its industry from EMS by requiring strict quarantine of imported broodstock. Indonesia has a similar program.
- *P. monodon* production in Asia is revitalizing through low density production by small holder farms.
- *L. vannamei* intensive tank farms are improving in productivity and efficiency