Food and Agriculture Organization of the United Nations

Benefits of specific pathogen free stocks for shrimp aquaculture:

Experience from the Kingdom of Saudi Arabia

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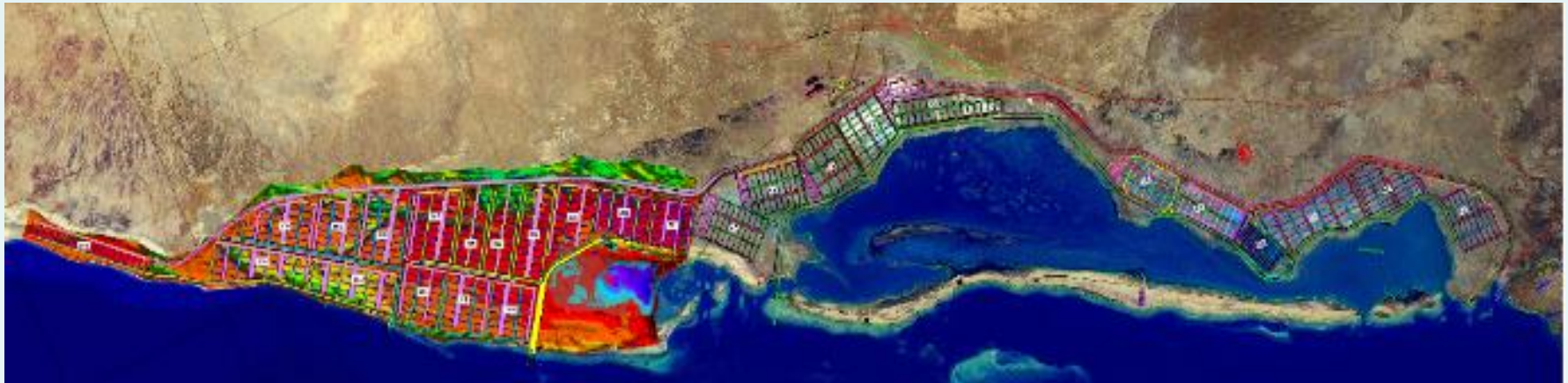

What is SPF?

Specific pathogens:
-Not necessary free of all
-OIE listed? Not: EHP, MBV, HPV, BP, LSNV, MSGS, PvNv, spiroplasm, gregrarines…?
-**All known pathogens**

- Stocks coming from a population that:
  - Has tested negative for specific pathogens for at least 2 consecutive years
  - Has been raised under high biosecurity facilities under stringent biosecurity measures
  - Has been fed with biosecure feeds

- Requires a surveillance program in place (molecular and histopathology)

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Facts, truths and myths about SPF shrimp in Aquaculture

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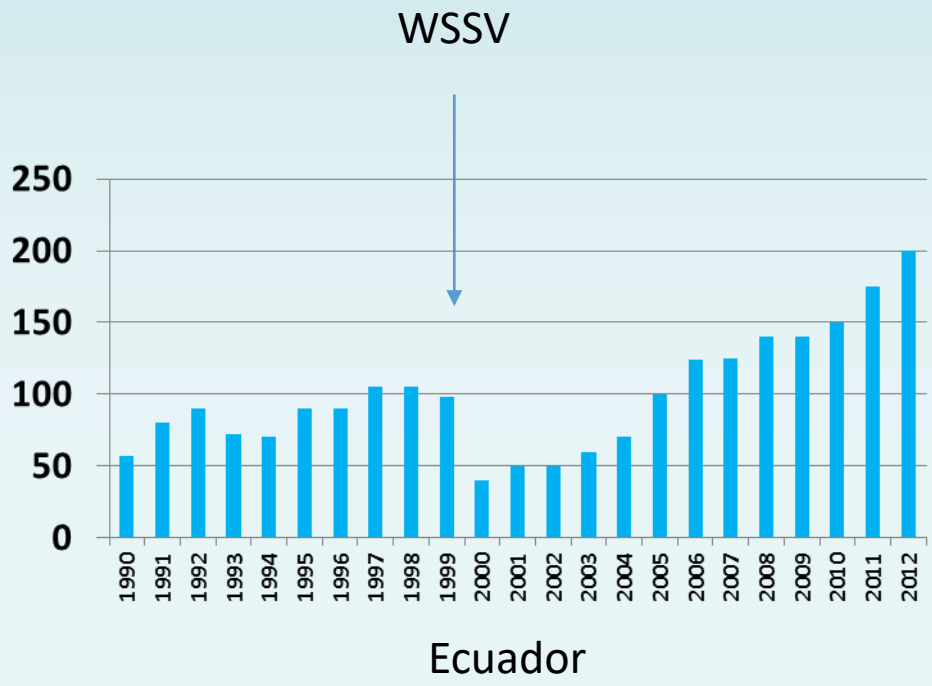
1 National Aquaculture Group (NAQUA), Al Lith, Saudi Arabia
2 Aquatic Farms, Kaneohe, HI, USA
3 Centex Shrimp, Faculty of Science, Mahidol University, Bangkok, Thailand
4 Charoen Pokphand Foods Public Company (CPF), Bangkok, Thailand
5 Food and Agricultural Organization (FAO), Rome, Italy
6 Genetica Spring SAS, Benchmark Breeding and Genetics, Bogota, Colombia
7 FUTUREFISH, Kelaniya, Sri Lanka

Two ways to generate SPF

- Original way (USMSFP): wild shrimp from isolated areas far from shrimp farms
  - Lower possibility to find animals with tolerance or resistance
- Reverse way: Look for non-infected animals in endemic areas
  - Looking for animals tolerant or resistant to endemic pathogens
  - Reduce the cost of diseases and cost of biosecurity implementation



Specific Pathogen Resistant (SPR)

- Stocks that remain refractory to infection even after challenge with a lethal dose.
  - Resistance may be specific to a pathogen or strain or to several of them.
  - Does not refer to health status (may be infected with a pathogen is not resistant to)
  - WSSV SPR *P. monodon* have been developed by G. Lo (Taiwan)
    - Obtained from wild fisheries

Specific Pathogen Tolerant (SPT)

- Stocks that are susceptible to infection by a specific pathogens but do not develop clear signs of disease or they do to a lesser extent.
  - They can tolerate the disease expression depending on the pathogen strain and environmental conditions
  - Does not refer to health status (may be infected with a pathogen they are tolerant to or another)
  - Most Latin American stocks can be considered SPT to endemic pathogens (NOT SPR)
- Prof Flegel Accomodation Hypothesis:

https://biologydirect.biomedcentral.com/articles/10.1186/1745-6150-4-32

Combined approach

Health status	Genetic response to pathogens	Productivity
SPF	Susceptible	High growth
INFECTED	SPR	High salinity tolerance
	SPT	……
Specific for each pathogen!!!		

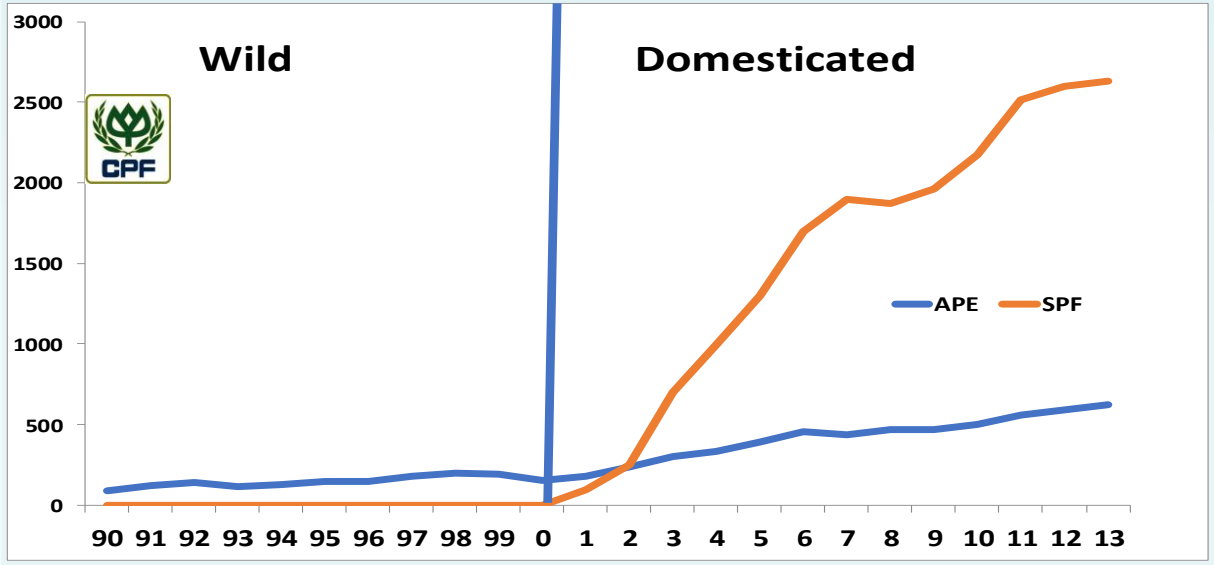
High biosecurity facilities

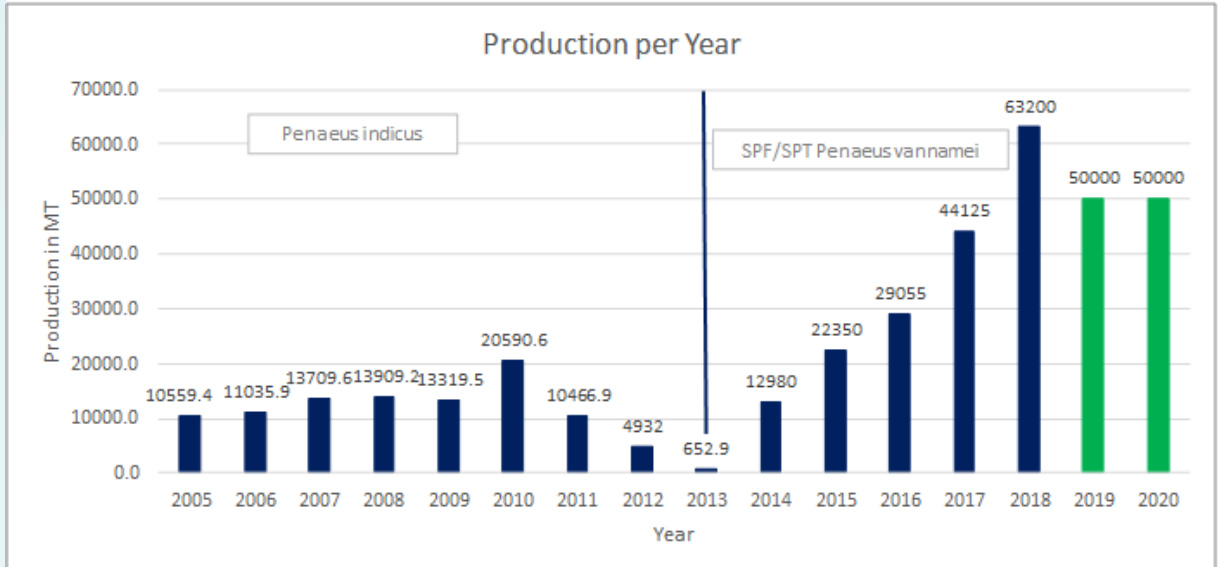
Lower biosecurity facilities

NO reference to growth, robustness, genetic diversity etc….

Why using SPF?

- Infected broodstock perpetuates diseases in ponds
- Diseases in ponds:
  - Increase production cost
  - Production is less predictable
- Fundamental for selection and expression of genetic gains
- Market access (China and Korea)





SPF as part of a biosecurity strategy

PMP/AB (FAO): Biosecurity is the **cost-effective management of risks** posed by **pathogenic agents** to aquaculture through a strategic approach at **enterprise, national and international levels** with **shared public-private responsibilities**.

NATIONAL LEVEL

1. National Reference Diagnostic Laboratory (JFRC):
   -PCR, histology, microbiology, ELISA
2. List of pathogens: "Dynamic" OIE +AHPND+EHP
3. National surveillance program:
   -Endemic and emerging pathogens
   -Farm and wild samples
4. Health certificate for animal movement (domestic and imports)
5. Zoning and compartmentalization
6. Compulsory reporting of disease outbreaks
7. Emergency response and contingency plan
8. Pre-approved supplier of any live imported aquatic animals (on site audit)
9. Quarantine and testing on reception
10. No wild broodstock allowed
11. Restriction on aquatic products based on the SPS agreement of the WTO

FARM LEVEL

1. **Switch from *Penaeus indicus* to SPF+WSSV SPT *P. vannamei* (IRA) -Only stocks used in the country**
2. Viral exclusion strategy at NBC, maturation and larviculture
3. Reduction of viral carriers and filtration at pond level (nurseries and grow-out)
   -Decrease filter mesh size up to pond: 250 to 1000um
4. PCR testing at transfer (nursery, PGO)
5. Zoning for the control of staff and vehicles
6. Listed pathogens: OIE+++ (14 for shrimp)
7. Targeted Surveillance Program (PCR and histology) including wild populations
8. Animal Health Monitoring program
9. Syndromic surveillance
10. Updated Diagnostic Laboratory
11. Emergency response (24h/7days/week)
12. Contingency plan (nurseries and 3 stage culture)
13. Treatment of Processing Plant effluents

Cost of development and maintenance of SPF

- A relatively small centralized investment versus huge widespread cost of disease impact
- Investment:
  - High technical level staff
  - Know-how
  - Facilities
- SPF/SPT development program (2010) close to $2million over 2 years
  - Is scaling it down to farm level profitable?
- Maintenance NAQUA SPF/SPT broodstock production 2019:
  - Cost of broodstock/kg of shrimp produced: 0.02sar/0.0053$

Thank you very much