2024 Keynote Speaker

Robins McIntosh

Executive Vice President, Charoen Pokphand Group Co., Ltd.

McIntosh is Executive Vice President for technical development of shrimp culture within the Group. He joined the Group in 2001 to assist with the restructuring of shrimp culture in Thailand and Southeast Asia. McIntosh is also CEO of Home-Grown Shrimp, a US subsidiary of CPF focused on producing shrimp in indoor facilities in the USA. He developed the first zero water exchange, intensive and revolutionary shrimp farm, Belize Aquaculture, Ltd.

2024 Shrimp SUMMIT

TCRS Shrimp Summit 2024
Chennai India June 27-29

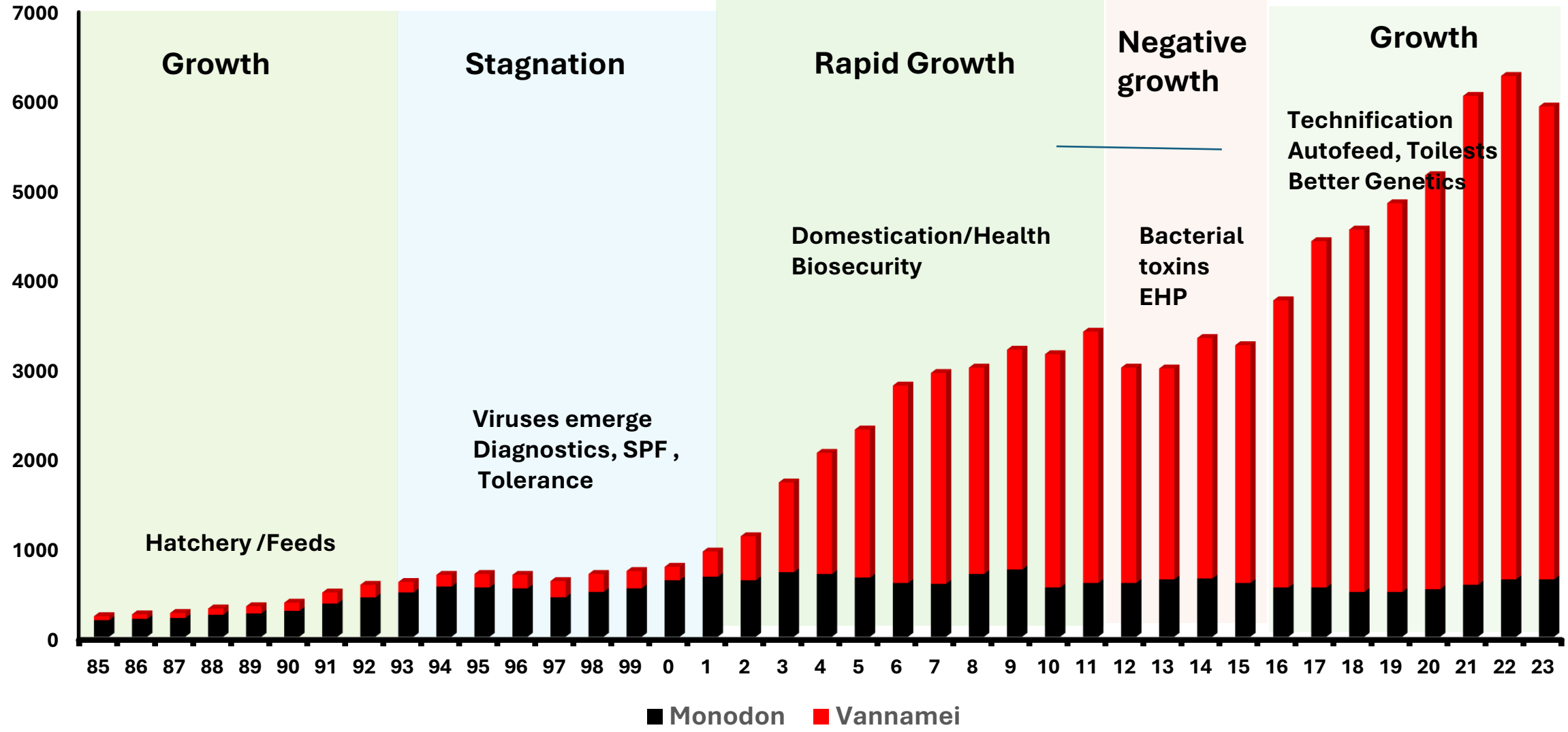
Leaving Failure Behind

The study of success as a Model

Robins McIntosh

Charoen Pokphand Foods
Bangkok Thailand

Shrimp Industry Evolves Rapidly with Crisis (Often sped up by Disease)



Response to Crisis

Year 1

Year 2

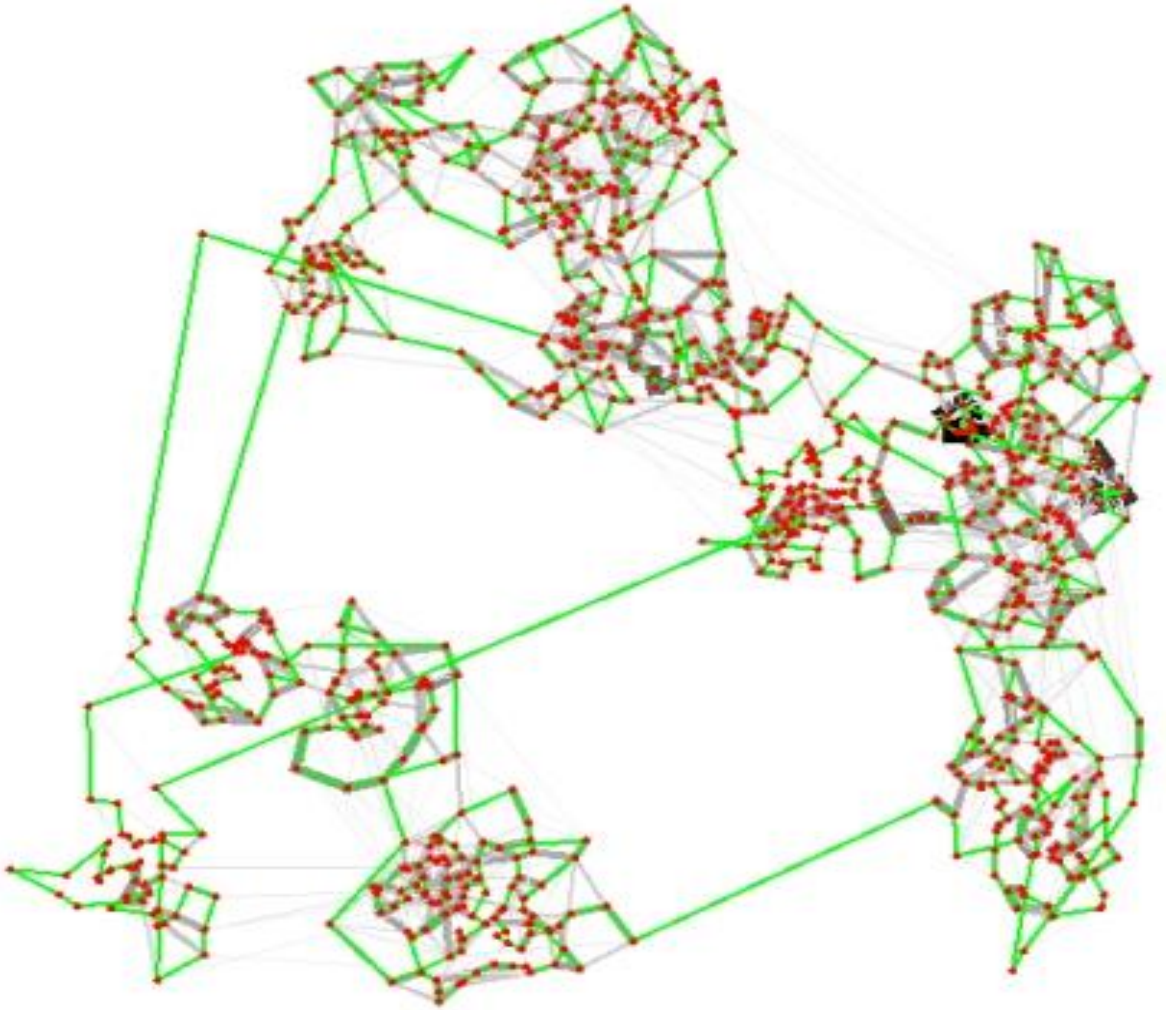
Year 3

What Happened

The First Reaction

Ant Colony Algorithm

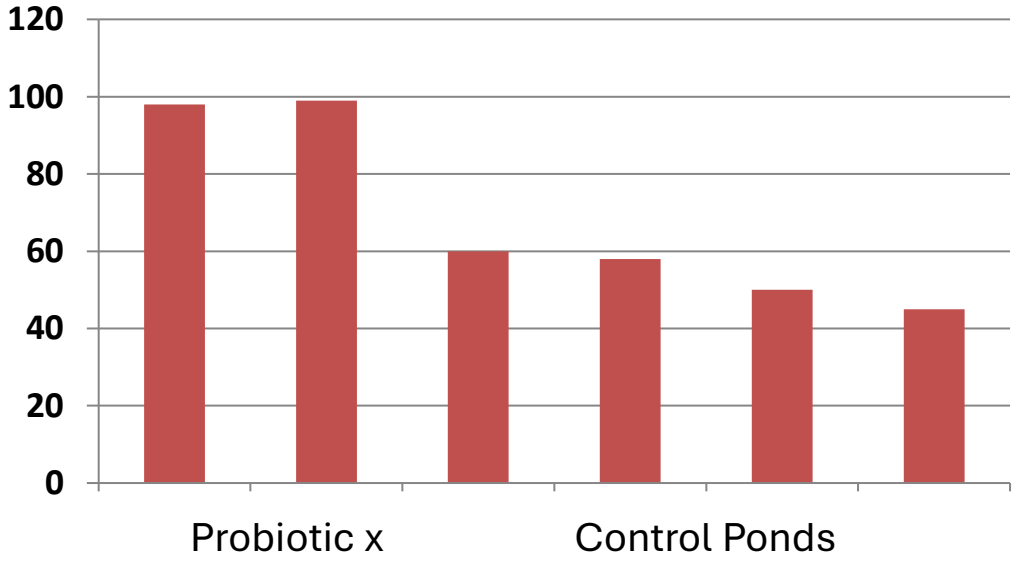
Is this the way we find solutions



Second Reaction:

Introduction of “Silver Bullet Solutions”

Antibiotics
Probiotic Miracles
Feed Additive Miracles
Disinfectant Miracles
and other Miracles



Probiotic Advert for AHPNS

Antibiotic labeled “BMP” (EMS crisis)

Crisis I

Loss of Profits in Central America (1994) and Asia (2000)

Dry Season Syndrome

Monodon Slow Growth Syndrome

Solution:
Healthy Domesticated Shrimp

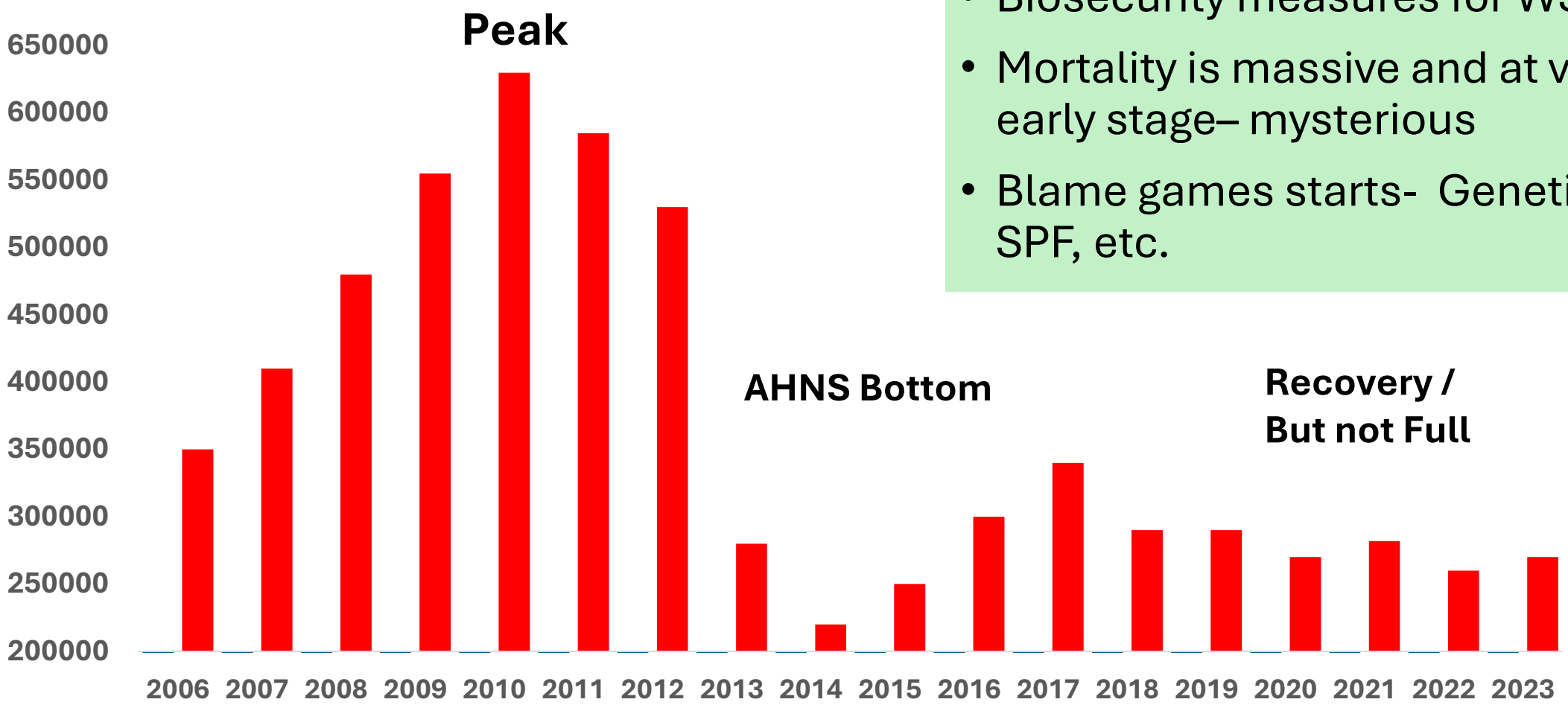
1994

2000

Introduction of Healthy Domesticated Shrimp Benefit of Eliminating Need for Antibiotics

Thai Shrimp Pharmacy

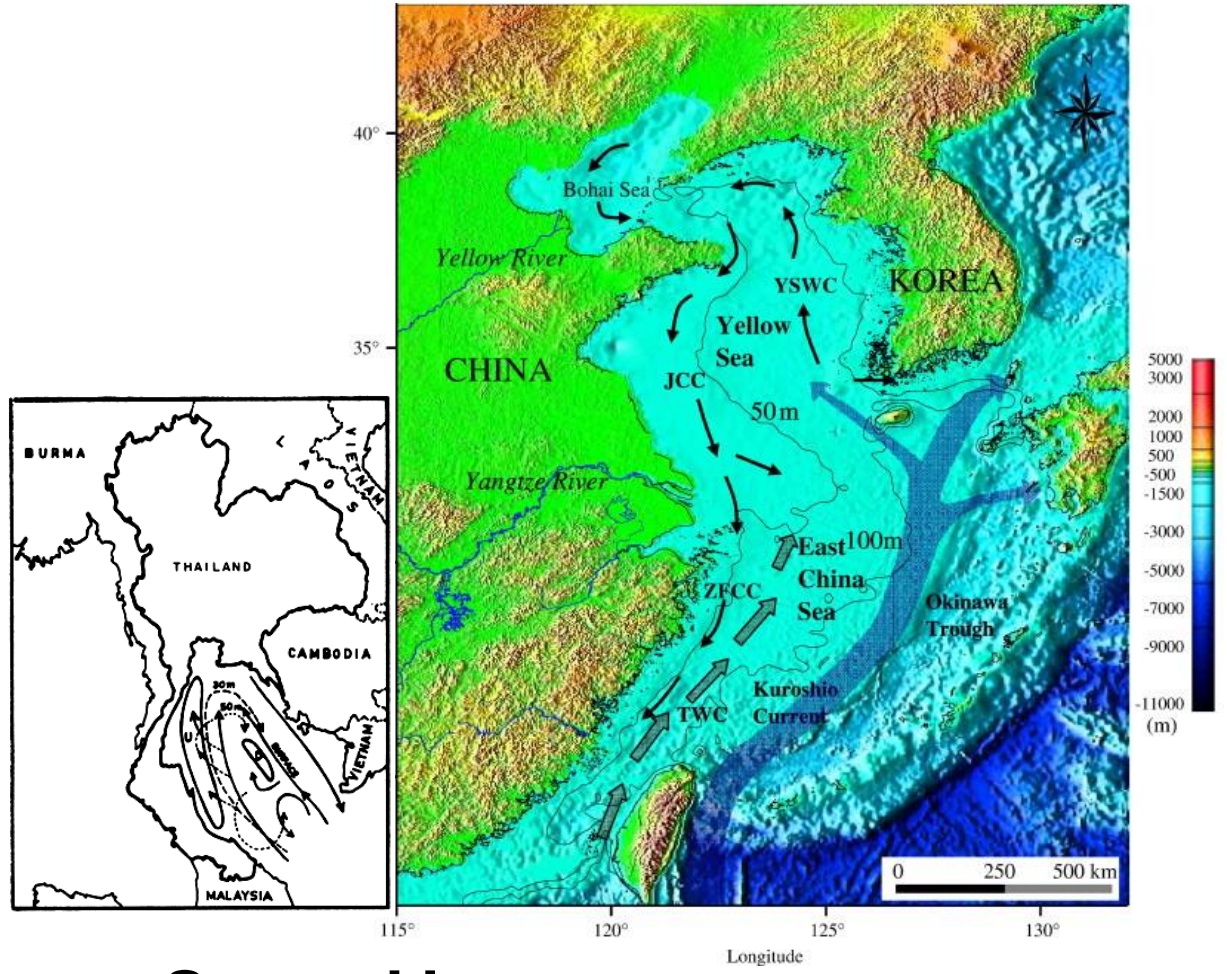
Crisis II/III
EMS/EHP crisis Asia/Thailand



- Biosecurity measures for WSSV fail
- Mortality is massive and at very early stage– mysterious
- Blame games starts- Genetics, SPF, etc.

Solution: Observe and Experiment to Define

- What is the cause of this mysterious mortality
- How is this vector spread
- The Ecology of the vector to elucidate methods of management
- Commonalities of Successful farms



Spread by water currents

A Perfect Killer?

- Appears to be bacteria (filtration expt)
- Identified as a vibrio carrying two toxin genes in a plasmid
- It grows extremely fast (competitive)
- It is a colonizer (very sticky)
- It produces a potent toxin
- Quorum Sensing (coordination of activity)

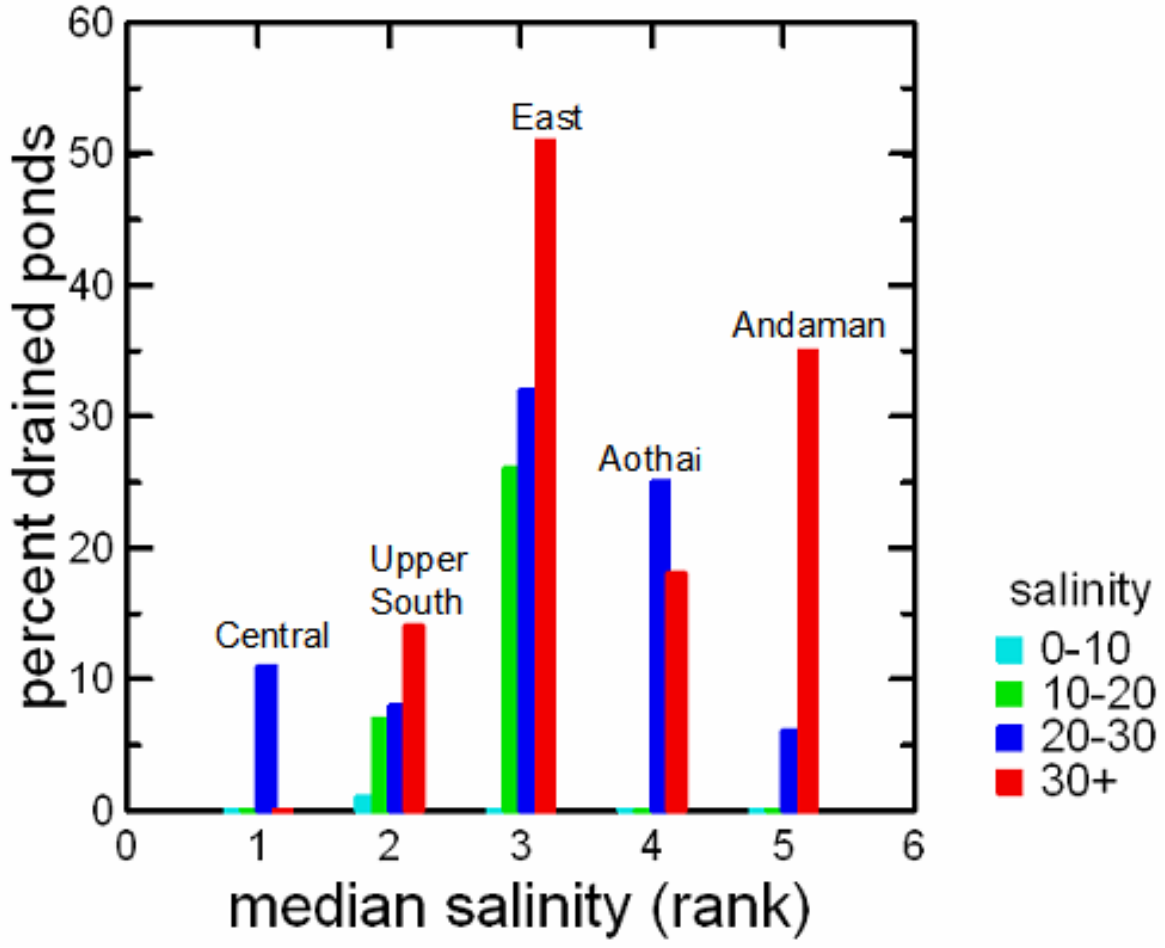
Pond side Hainan China doing isolations

Observations

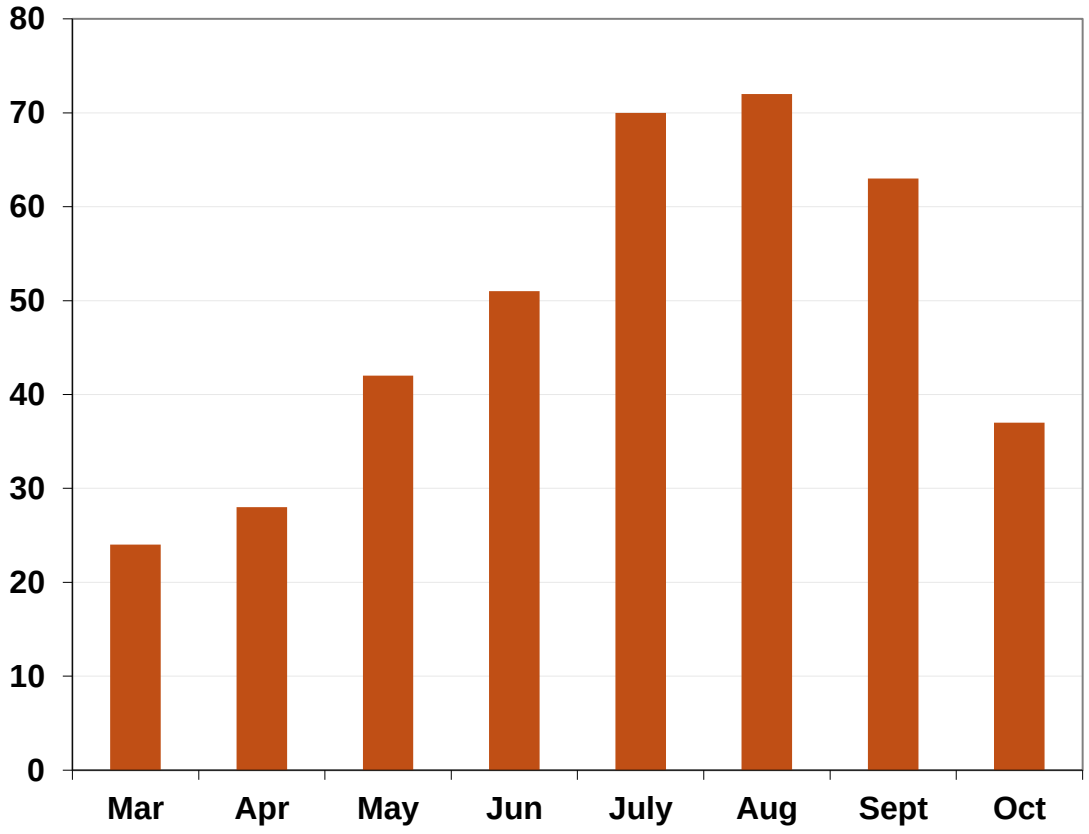
High Risk

Lower Risk

Environmental effects on Survival

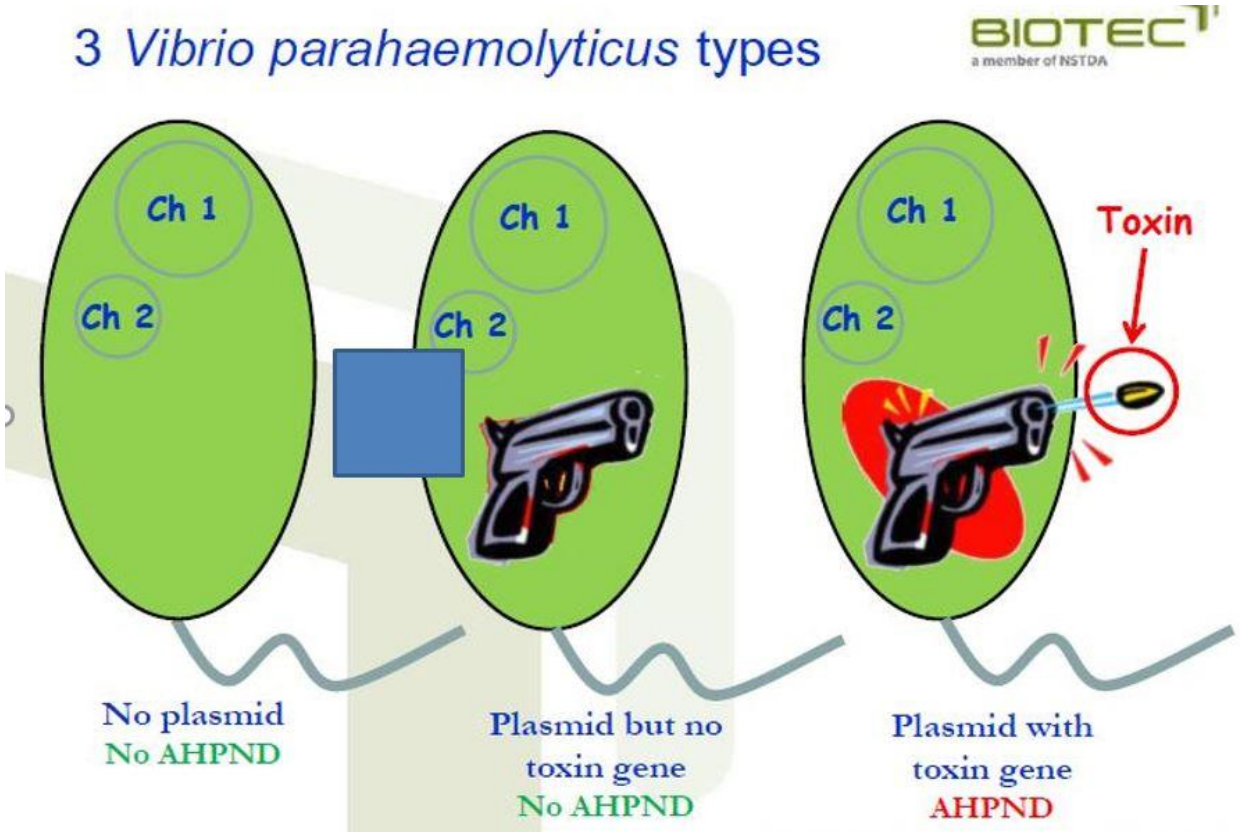


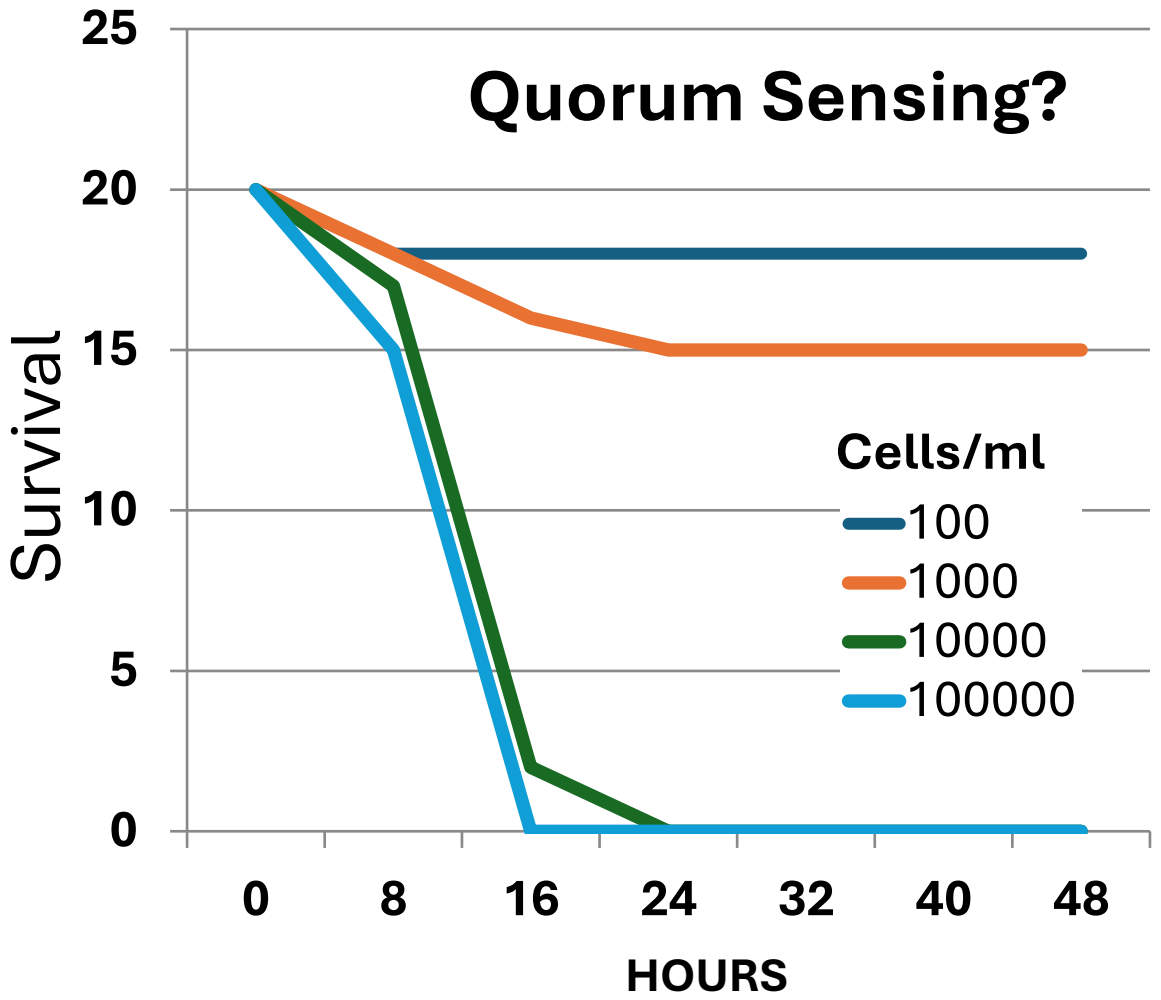
Low Salinity has lower risks



Peak mortality during hot season

What we learned and how this was applied



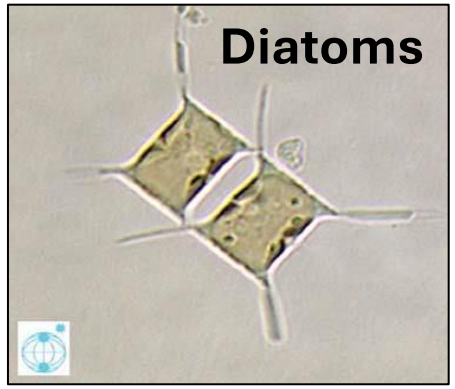


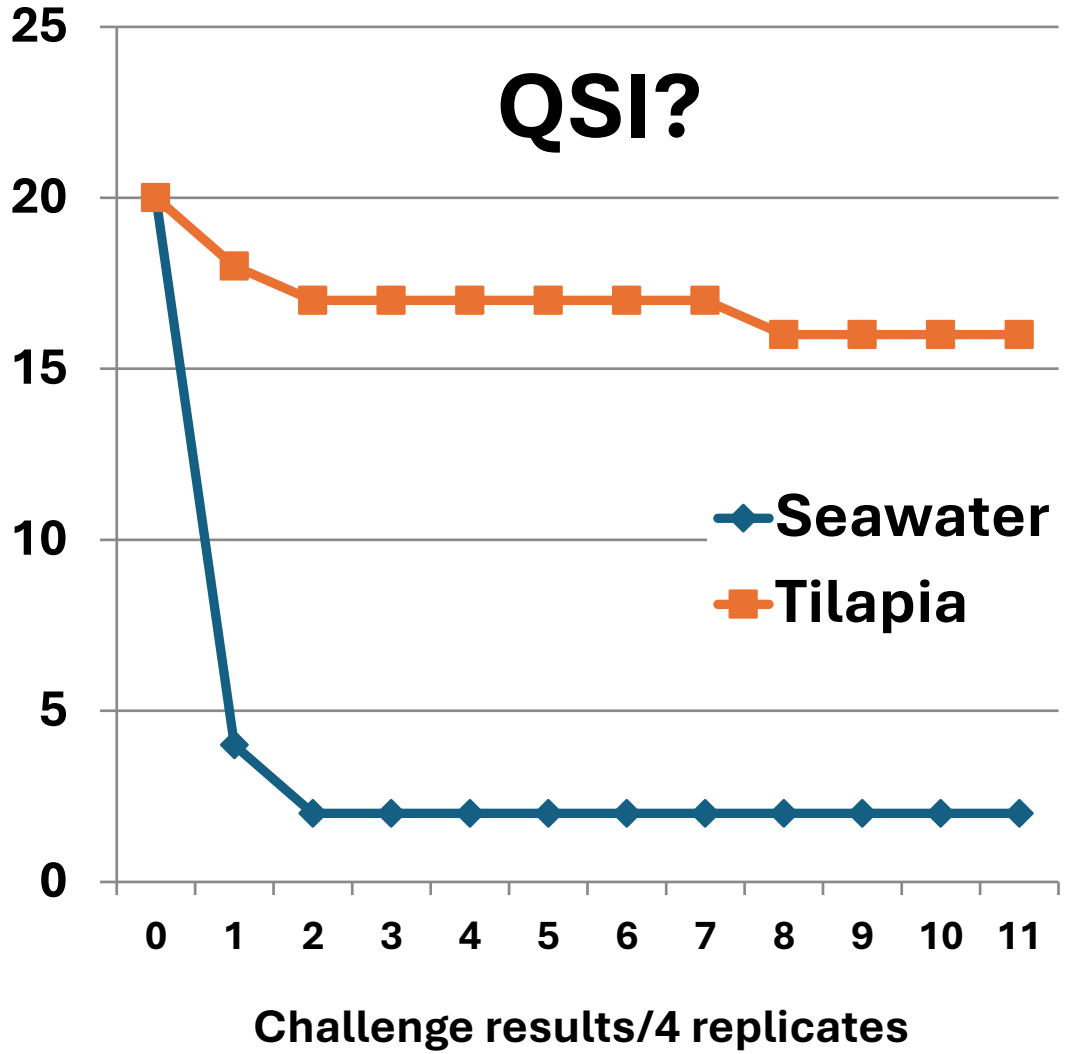
Effect of Water Type

High Mortality

Low Mortality

QSI Inhibitors?





Toxin: Larger size body mass requires higher toxin dose to kill

Raceway Culture: Thailand

Pond side Nursery

Cage Culture: China, Thailand

The toxins concentrated in Pond bottom organics

Simple Trials to identify Risk Factors

Treatment	Survival –pl10
Ozonized seawater	82
Pond Water	70
Pond Sediment	35
Reinfection from dying shrimp	10

Pir Toxins in Pond Sediments

Shrimp Molts
Dying Plankton
Feed over 1 hour unconsumed

Understanding Management to Control APHNS

To understanding the conditions for control of APHNS (microcosms)

Effect of Nutrients on APHNS

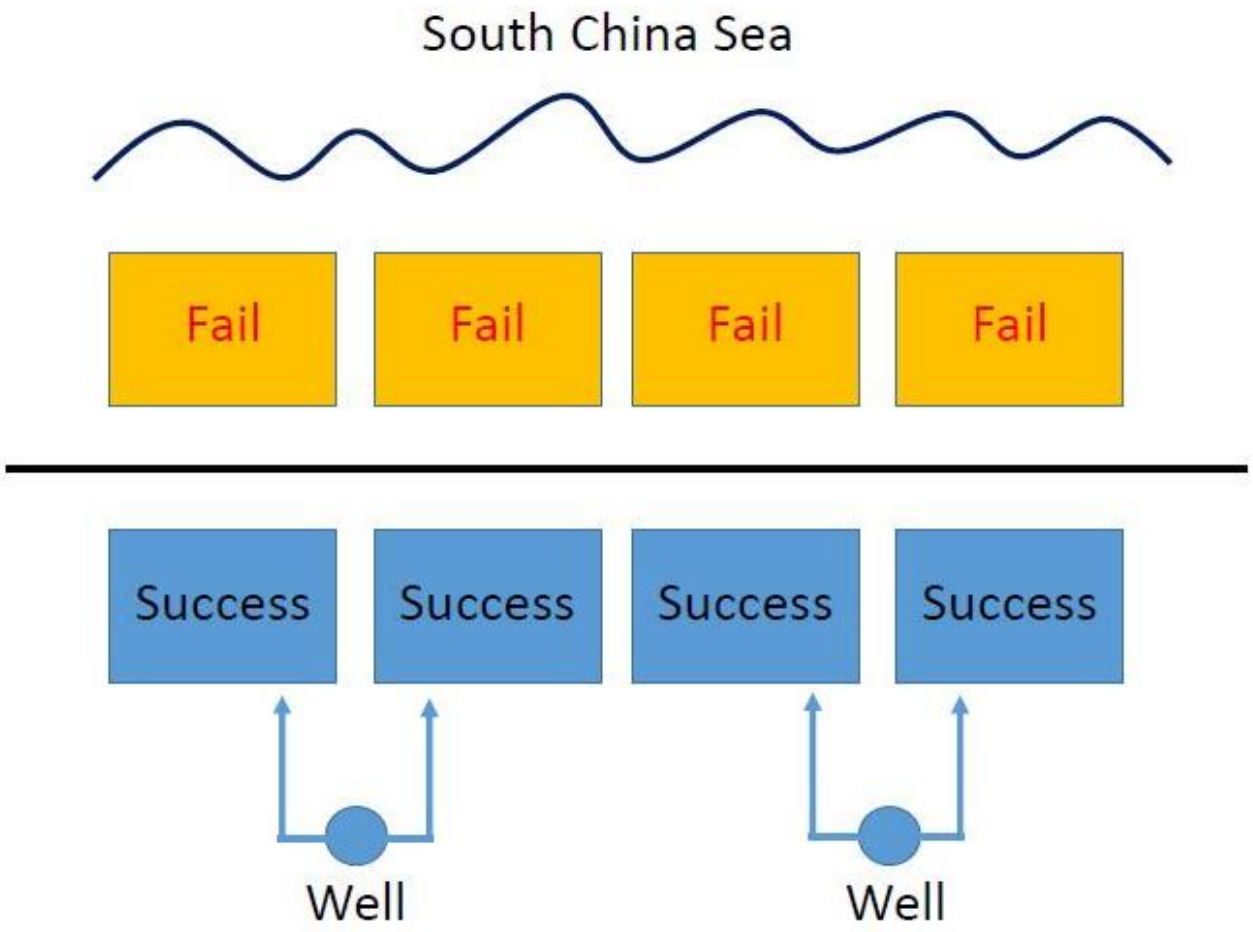
	Survival 72 hours	24 Hrs	48 Hrs	72 Hours
Seawater	80	<10x3	10x4	10x3
Bacteria media/20ppt	20	10x3	10x6-7	10x7
SW, Moll, NH3	25	10x4	10x7	10x6
SW, Moll, NH3, Fe	12	10x5	10x6	10x6

Understanding Leads to new Management and Understanding

Biosecurity is not only Exclusion of Pathogens; but limitation Of Pathogen levels below the level where disease occurs

The main aim of biosecurity: is to "protect shrimp health and to increase and protect shrimp production through the prevention, control and management of biological risk factors" V. Alday

Learning from Farms in the APHNS
Disaster zone of Hainan



Putting Management Knowledge to Work

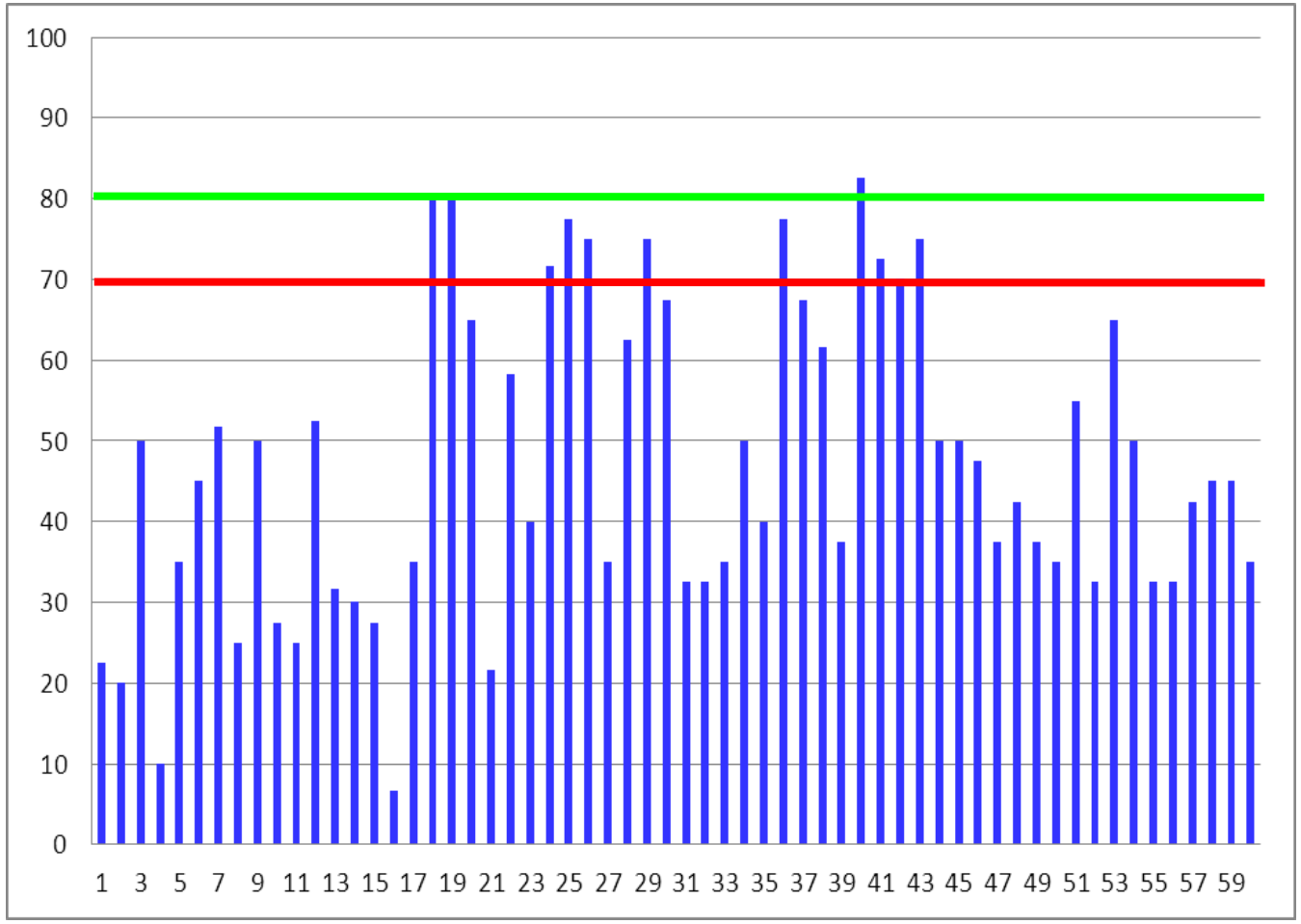
Lease 20 ponds on Hainan;
Total Failure for 2 years

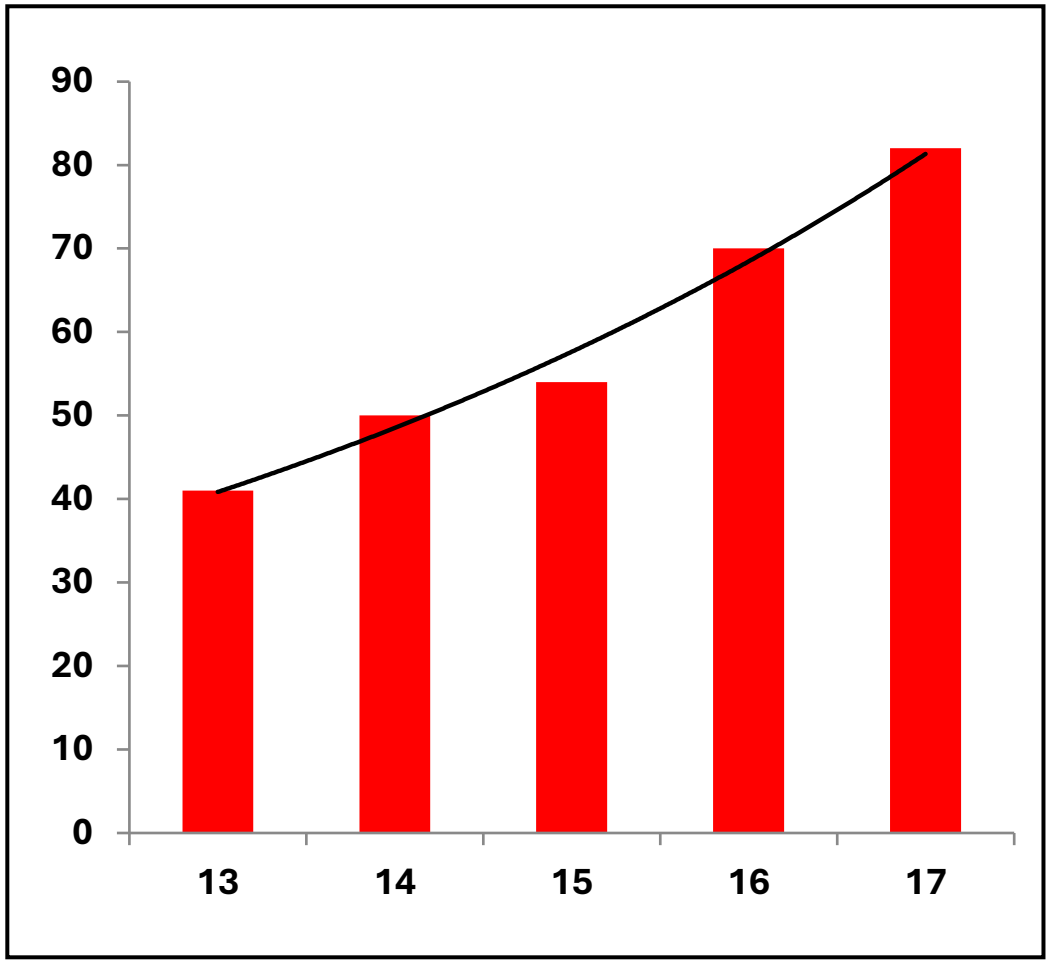
1. **Replace Chlorine with Dipterex**
2. **Fertilize with nitrogen;**
   encourage green algae; no BG
3. **Clean and oxidize bottom**

Result Harvest in June:

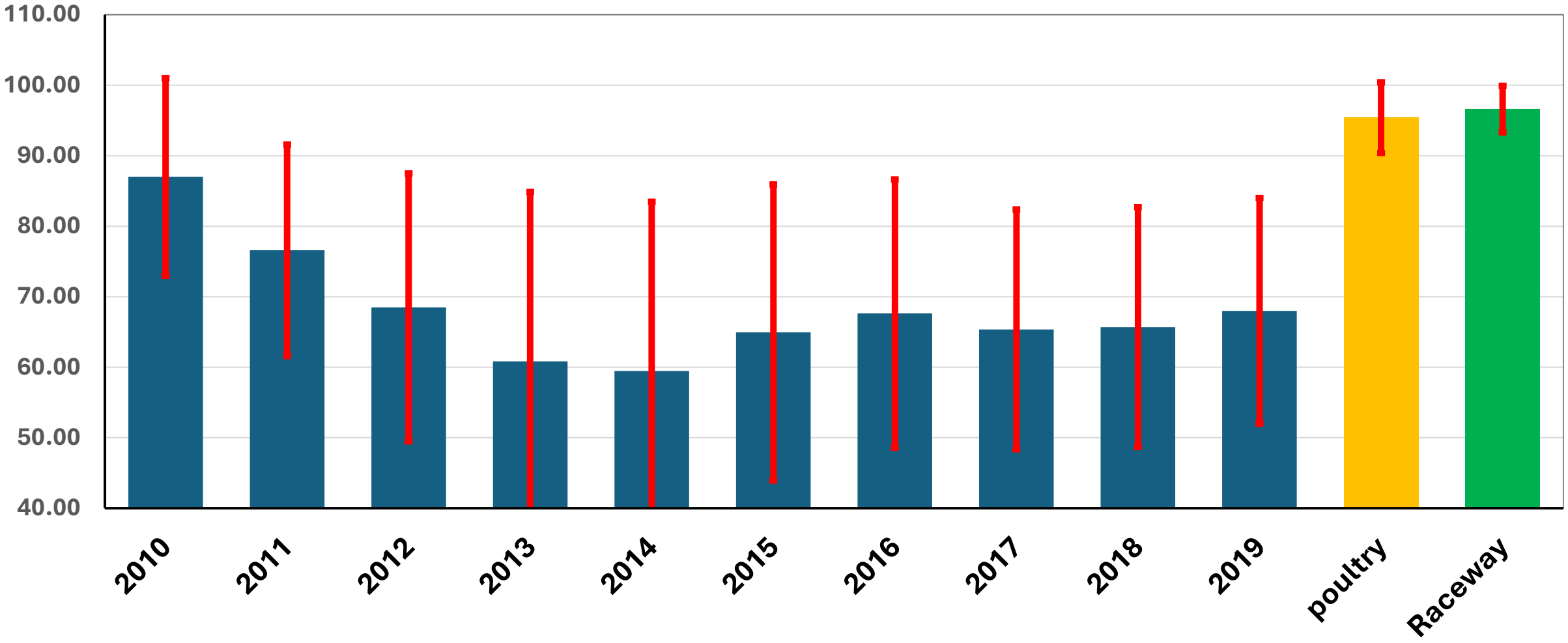
19/20 Successful

Adding Genetic Tolerance to the Solution

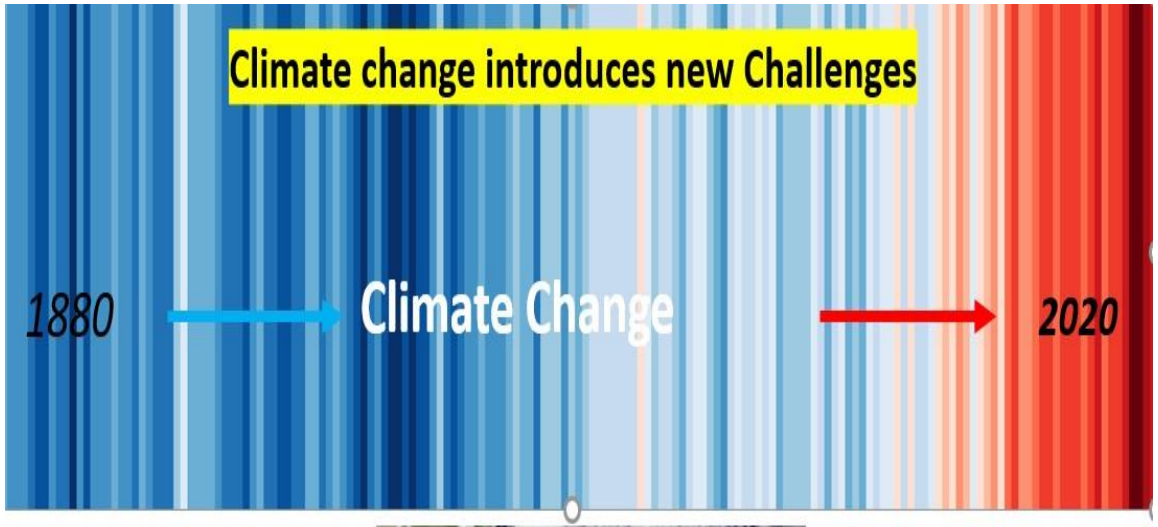


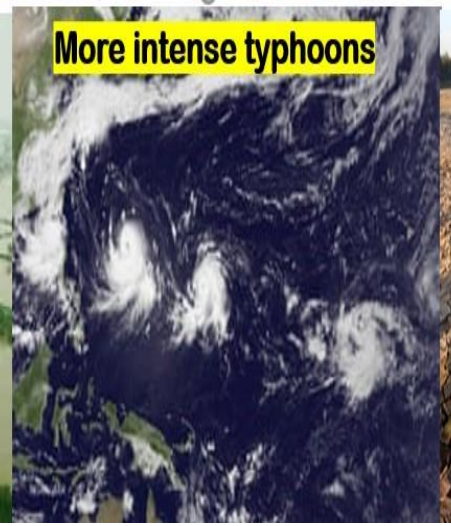


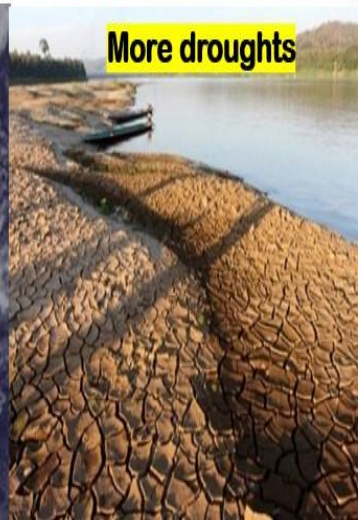
Crisis III: Post AHPNS-
Chronic Mortality and high size variation



Climate and Environment Favor elevated Pathogen levels and increase stress in Shrimp



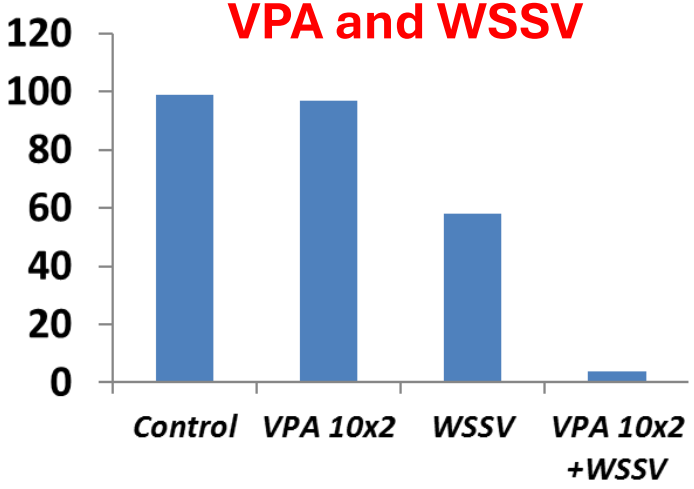




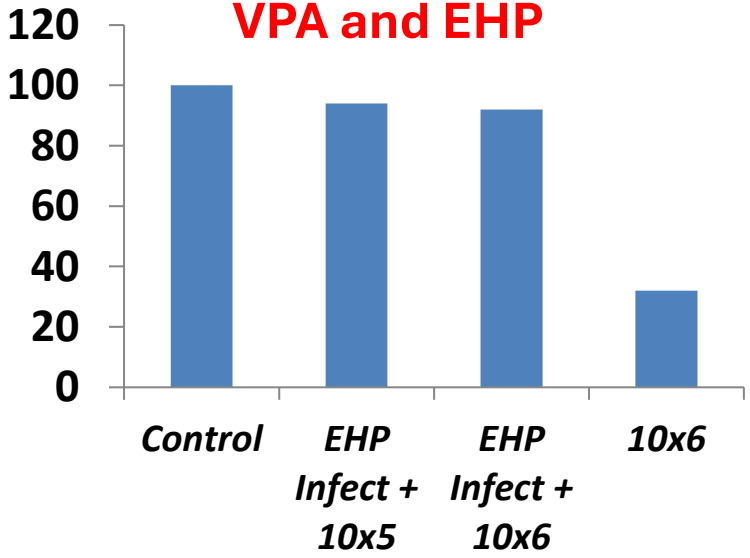
Deteriorating Marine Environments have contributed to stress/Disease

Multiple pathogens emerge in multiple combinations

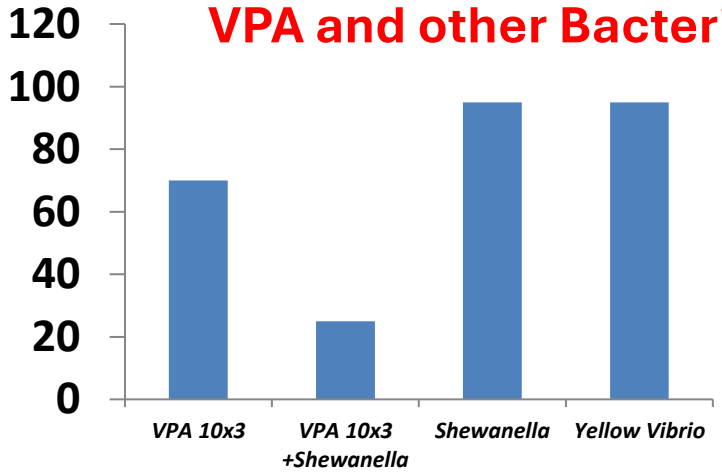
VPA and WSSV

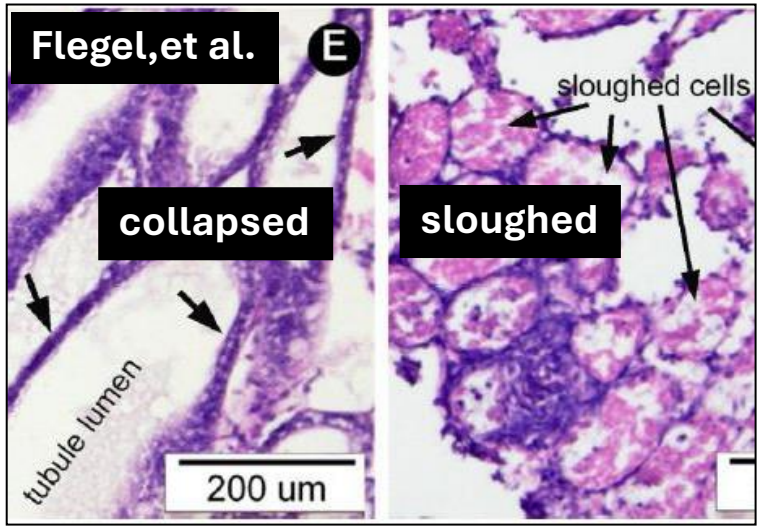


VPA and EHP



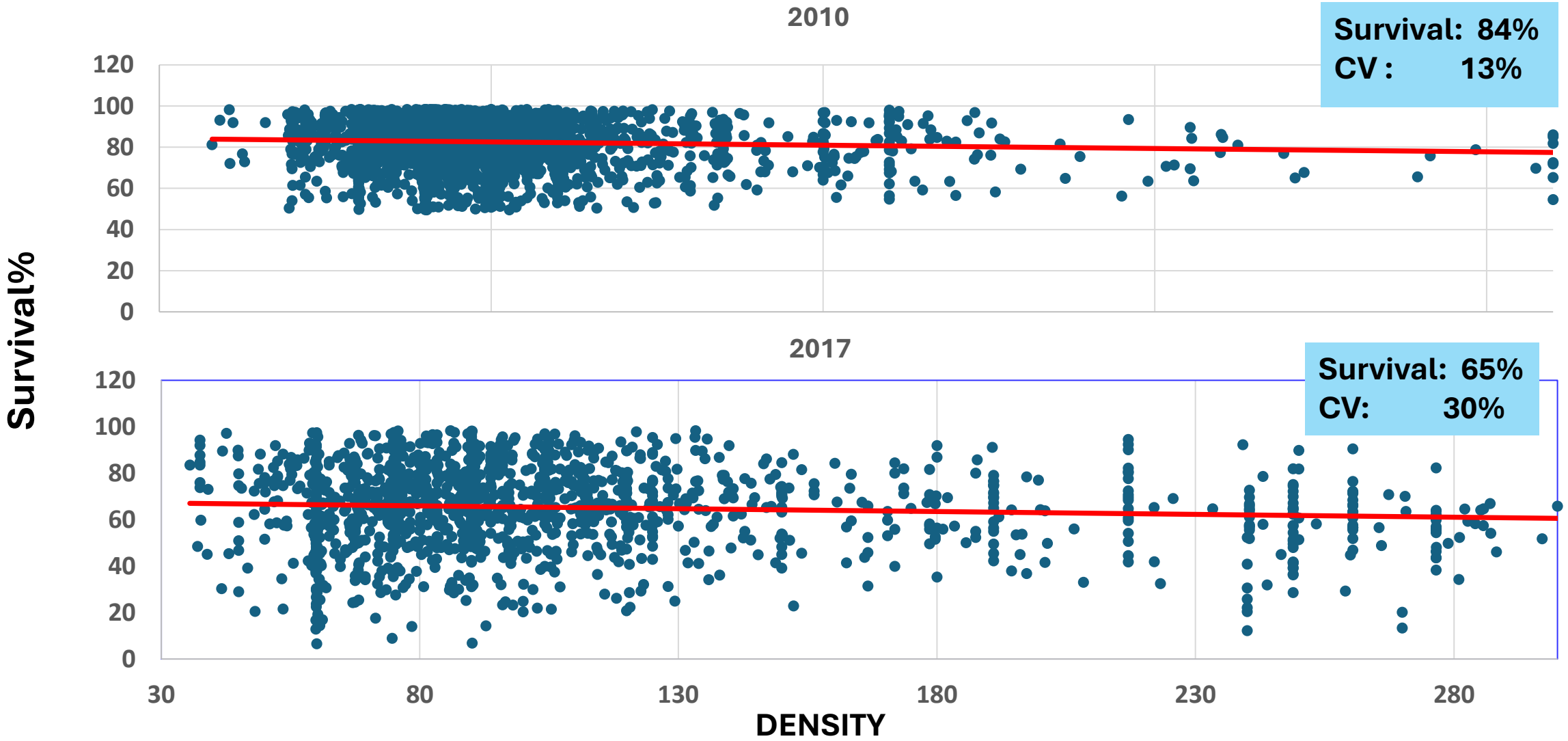
VPA and other Bacteria





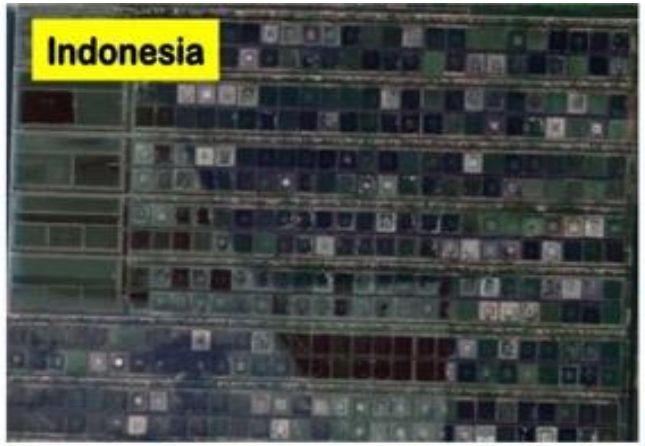
Pir I and II required: 5 ug vs 10 mg toxin

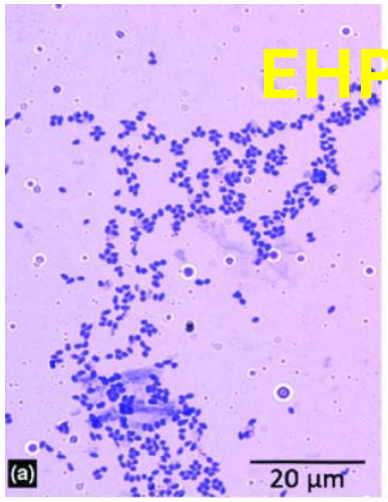
Increased Pond Density/ Feed Rates/ High Protein Feeds increase Shrimp Stress

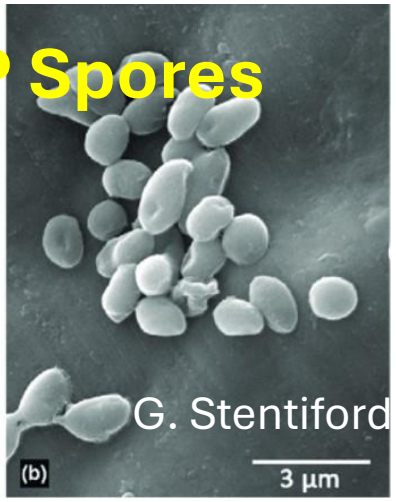


Increased Pathogen Loads

Constant High-Density monoculture in Populated Shrimp Neighborhoods Creates increases in Pathogen Loads

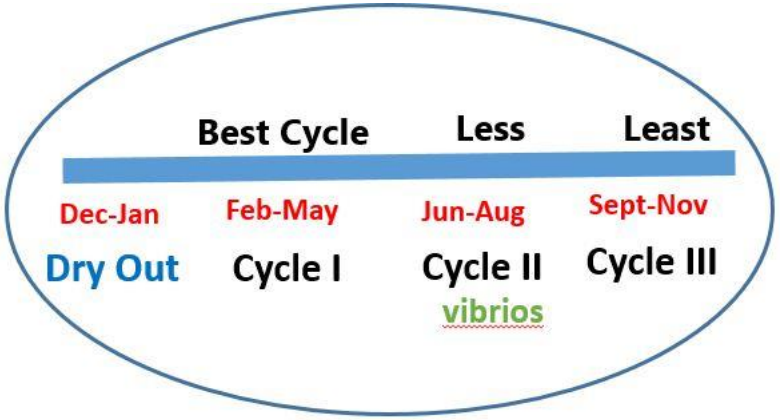




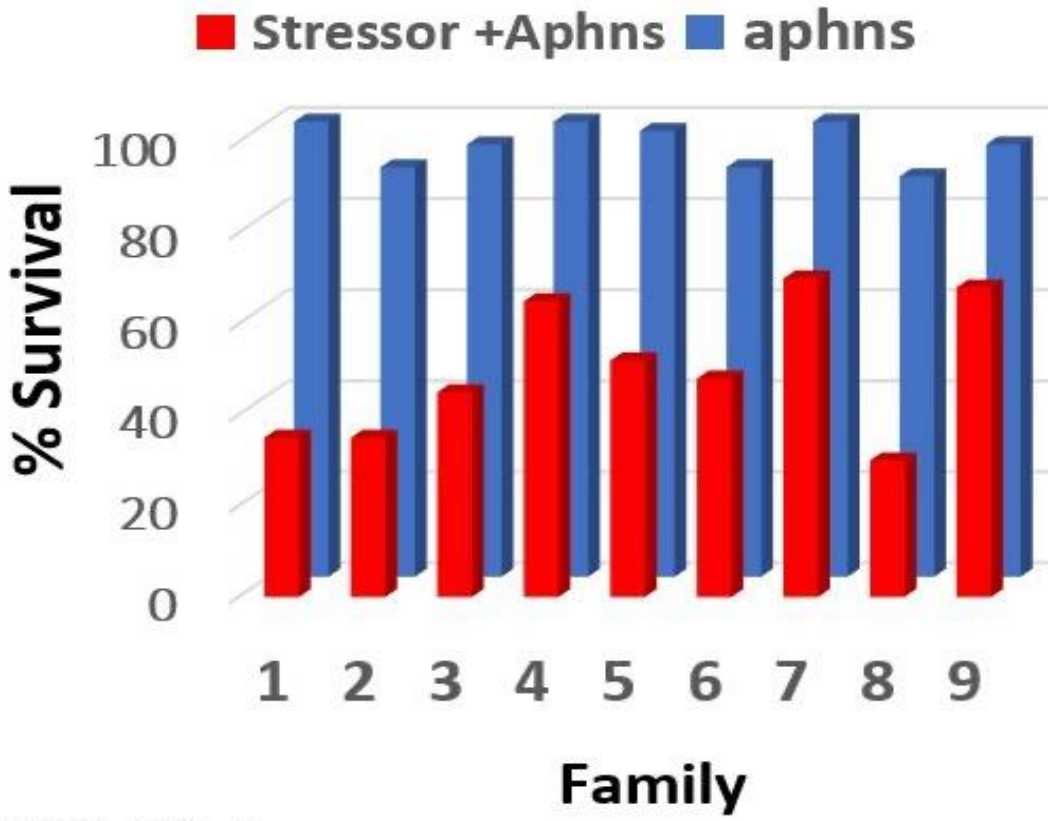


Breaking Cycles or Reducing Pathogen Loads

Alternative Species: P. monodon



Appropriate Management reduces stress; And Results is highest survival



APHNS 10x4

Stressor= 20 ppm NO2

Minimize STRESSES:
Low oxygen
Nitrites
pH fluctuation
Temperature fluctuation
Sulfides
High C02
Toxicity
Nutrient deficiency

Presence of Pathogens do not mean Disease!!

Risk of Disease = Pathogen level X Shrimp Susceptibility

- **Pathogen level**== presence of pathogen at what “density”

  strategy is to exclude the pathogen (virus) or minimize the prevalence of the pathogen

- **Shrimp Susceptibility**= genetic tolerance of the shrimp x stress level of that shrimp

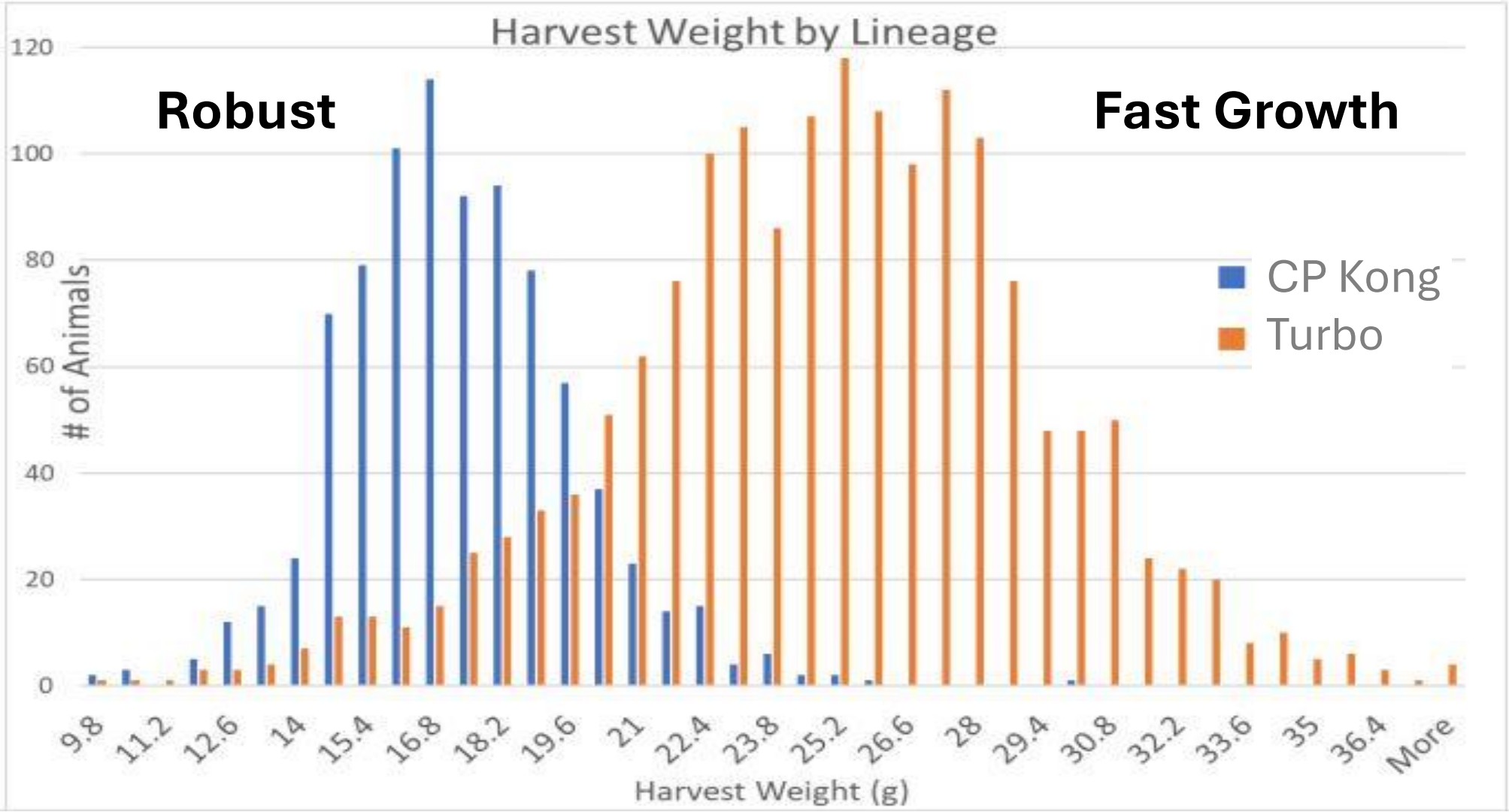
  strategy is to minimize stress in any system and to stock shrimp with sufficient tolerance for the stress levels of the system

Reduce Stress through Management
Not Exceeding the “Carrying Capacity”

Don’t overstock a pond and stock correct counts

Oxygen , Oxygen, and Oxygen

Stocking Genetics with appropriate robustness for The Pond system



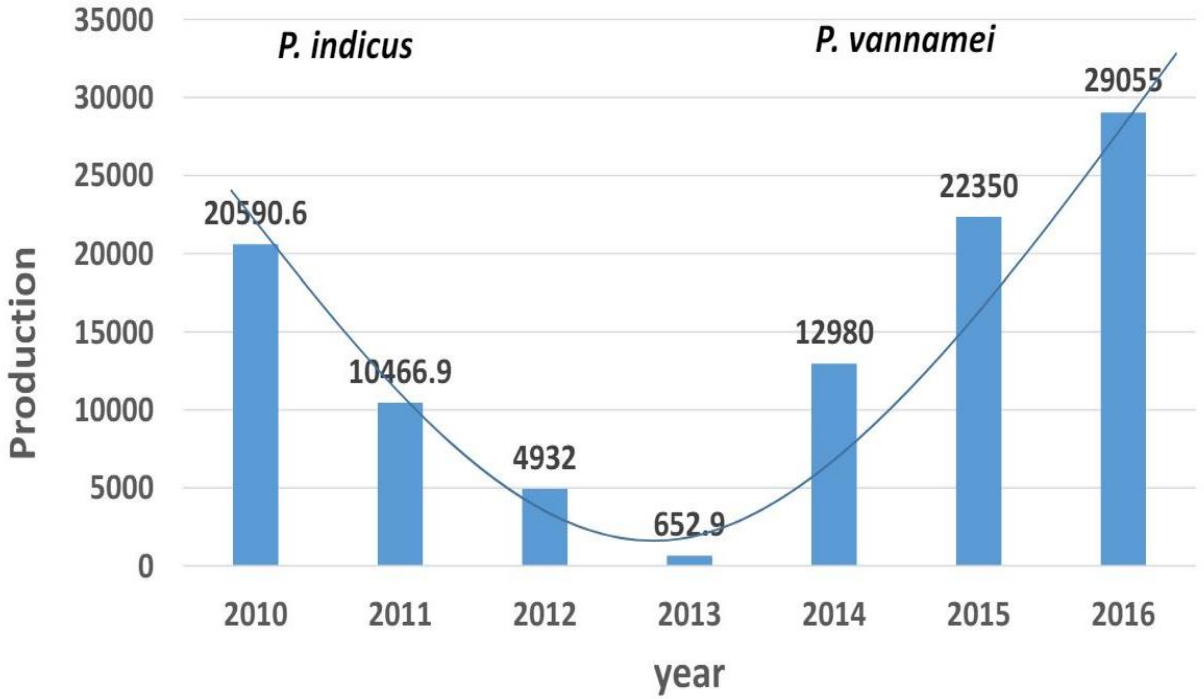
Immune Peptide Gene Expression is Key To Maintaining Healthy Robust Shrimp

	Low Stress	High Stress
Stocking Density	<140/m2	>140/m2
Max Feed Rate	500 kg/ha/day	>950 kg/ha/day
EHP	Positive- NO Disease	Positive - Disease
HSP 70	X	3X
ProPo	4X	X

EHP and Vibriosis have become a serious Issue on Farms due to Stress (and increased pathogen loads)

Crisis IV

WSSV infects Kingdom of Saudi Arabia



Selection of SPF shrimp Tolerant WSSV
Multigenerational APE shrimp Ecuador/Nicaragua

Reverse SPF

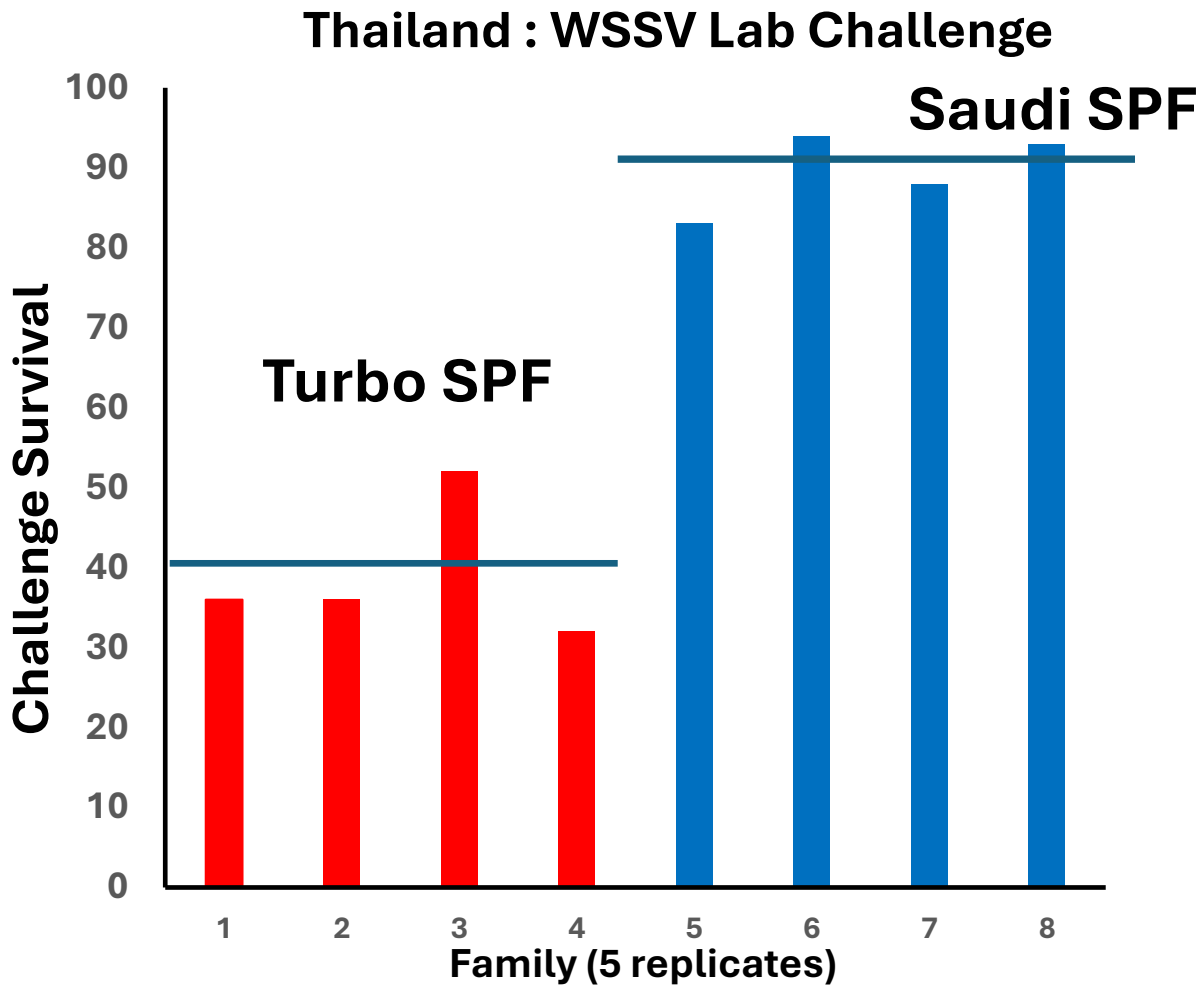
Reverse SPF vannamei increase performance over wild APE and retained WSSV tolerance for 10 year

Kingdom of Saudi Arabia recovered making new annual high in Production

Increase in Hatchery Performance

Ecuadorean SPF vs NON SPF Ape

	No SPF	SPF
Days to PL12	20-21	17-18
PLs/gr	350	200
Survival	45-50%	70-75%
Coeficient of variation	>15%	10-12%



Study Success to understand "What makes for Success"

We learn very little from studying Failure

Lamae Farm Thailand: Successful with AHPNS and EHP

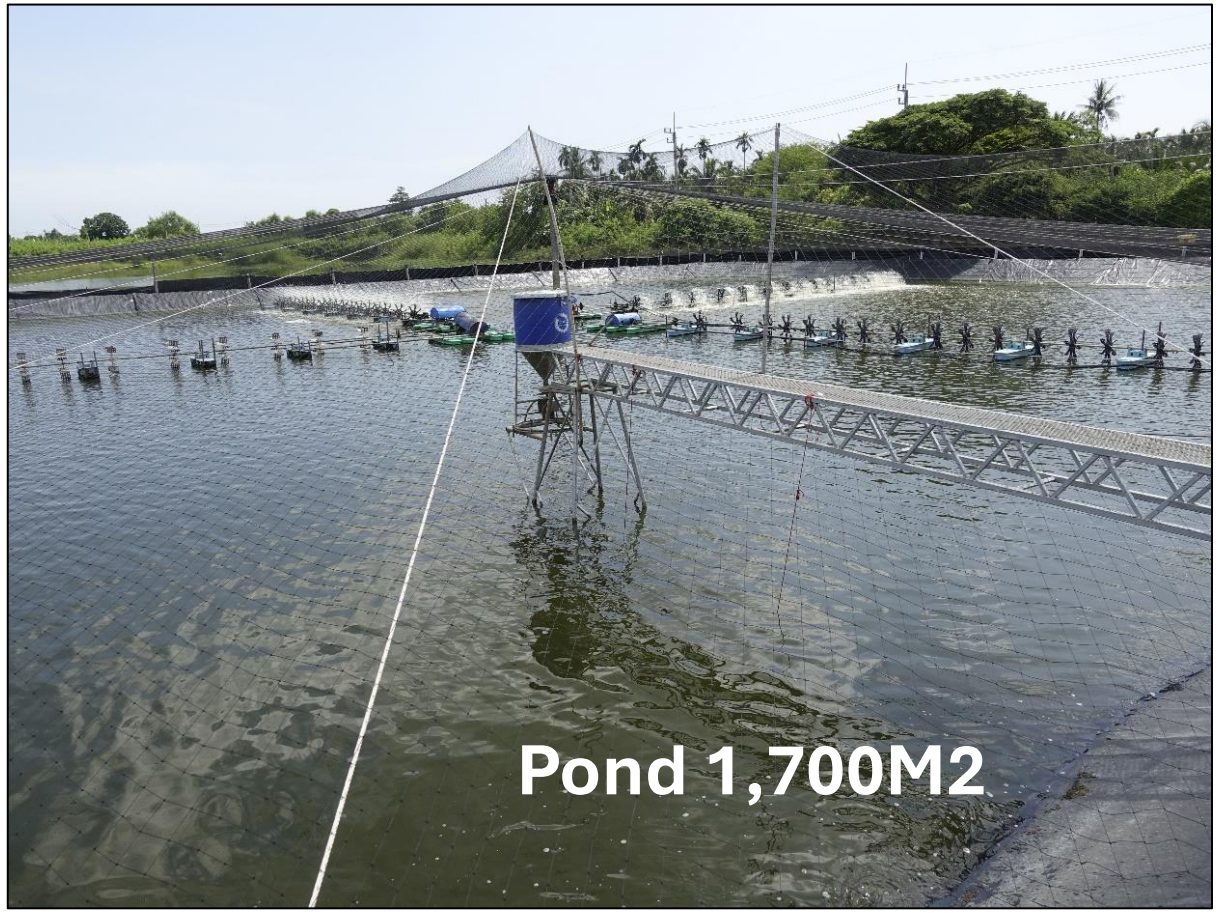
2010

2018

	2010	2014	2018
Stocking Density	110	79	135
Failure Rate	0	60	0
Survival Rate	91	30	80
Growth Rate	0.175	0.28	0.30
Cost /Kg	2.50	13.50	3.25

Smaller ponds, toilets, auto feed, no chlorine

A very Profitable Shrimp Farm in Thailand!
No AHPNs, No EHP Disease

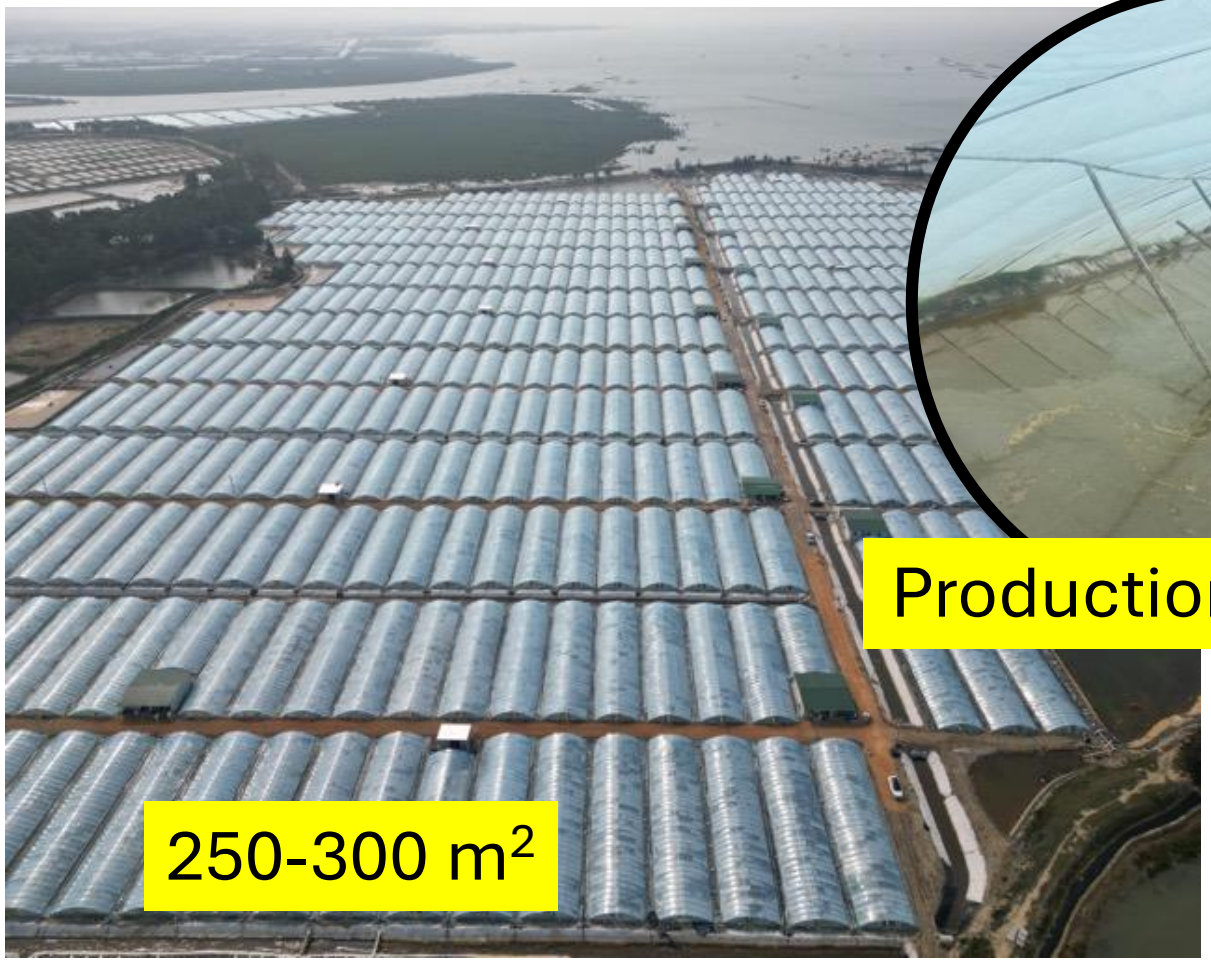


Stocking Rate: 110/m2; Survival 92% FCR 1.15 Harvest Size >30 grams

New Small Greenhouse Raceway China

Pathogen free and fast growth

Disinfect water, no exchange for cycle



Production of 1 ton/cycle

Learn the interaction between density , stress and requirement for pathogen clean seed, with robust genetics

Low Density creates less stress

No disease

High Density creates more stress

IMNV; EHP Disease

Camanor Farms; Brazil using same non-SPF post larvae

Indoor vs Outdoor Tank Farms
Both Successful if moderate stocking density, clean seed, disinfected water with inoculation of Probiotics

Guatemala
WSSV in 2014, AHPNS in 2015, EHP in 2018

Yield: 8 tons/ha/year
Survival: 45%

Shrimp Toilet

Yield: 120 tons/ha/yr
Survival: 75%

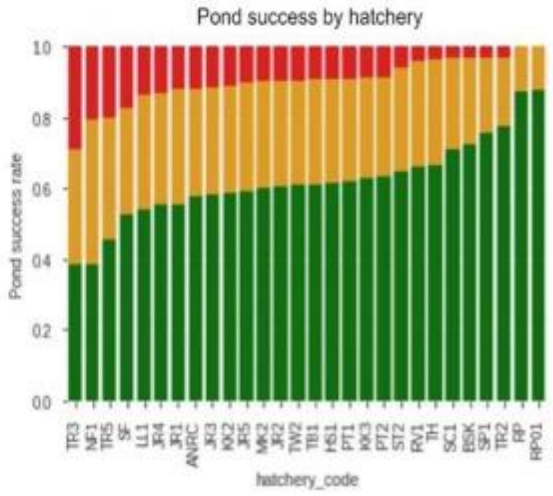
Analysis of Successful conditions replaces the approach of Ant Searching randomly for food

AI will play a large role in searching out solutions

Hatchery Correlation

- Hatcheries on the right of the graph have a higher pond success rate.
- Hatcheries on the left have a lower pond success rate.

*This graphic could be misleading because there are other factors at play like region, season, farmer knowledge, water quality, etc



Post harvest analysis - crop result

In summary, pond are likely to be more successful with:

- Cultured in greenhouse ($V = 0.29$)
- Cultured in certain hatcheries or regions ($V = 0.17$)
- Certain pond bottoms ($V = 0.14$)
- Lower % CV at DOC greater than 6 weeks ($p = 0.20$)
- Higher aerator hp per hectare ($p = 0.17$)
- Higher salinity ($p = 0.12$)
- Lower area ($p = 0.11$)

BEST What we should try to achieve	Country region	S1-N
	Hatchery	TB1
	Pond bottom	PE 1.0 mm
	% CV range	≤20%
	Salinity range	+ 25 ppm

Ponds that failed (not drained) can be distinguished by:

- Lower nursery ABW ($p = 0.11$)
- Deeper ponds ($p = 0.10$)

WORST What to avoid	Nursery PLs under	1 gram
	Ponds deeper than	1.5 m

Analyses by Xpertsea

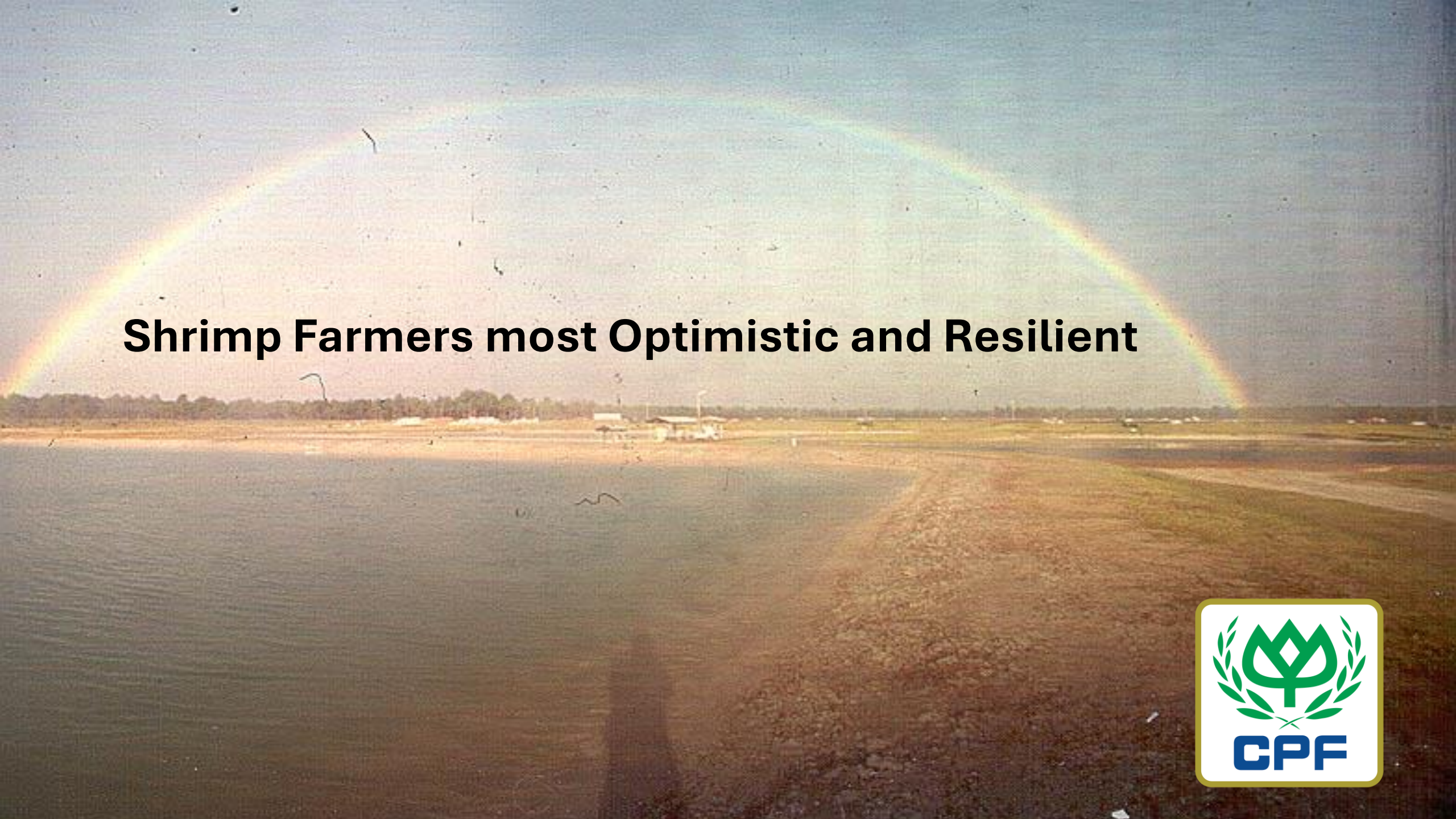
Farming can be successful today

Biosecurity, Not exceeding Carrying Capacity, Appropriate Feeding, Oxygen levels, stocking appropriate genetics of Clean Healthy Seed

Stocking Rate (pcs/sq.m)	50-100
Growth ADG (g/day)	0.35
Survival Rate (%)	>90%
Yield (tons /hectare)	15-30
Harvest Size (grams)	30
Crops/year	3-4

- Control Stocking rates
- Sufficient Aeration/stocking (200-300 kgs/HP)
- Sufficient Aeration/ Feeding Rate

  (Different Genetics/Different Growth Rates)
- Center Sump Sump/Toilet Either Hard Bottom or Sealed Liner
- Eliminate Disinfection/excessive Probiotics
- Use Healthy virus free Post larvae
- Provide a Dry out Rest Period to reduce loads


Shrimp Farmers most Optimistic and Resilient
CPF