



Increasing Aquaculture Productivity: Shrimp

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Robins McIntosh has been involved in shrimp aquaculture for 30 years. In 1996, he helped establish Belize Aquaculture, the first zero-water-exchange commercial farm in Belize.

In 2002, McIntosh joined Charoen Pokphand Foods to assist in the restructuring of shrimp culture in Thailand and Southeast Asia. He continues his work in increasing the efficiency of both white and black tiger shrimp culture



What Led To The Explosion In Shrimp Production?



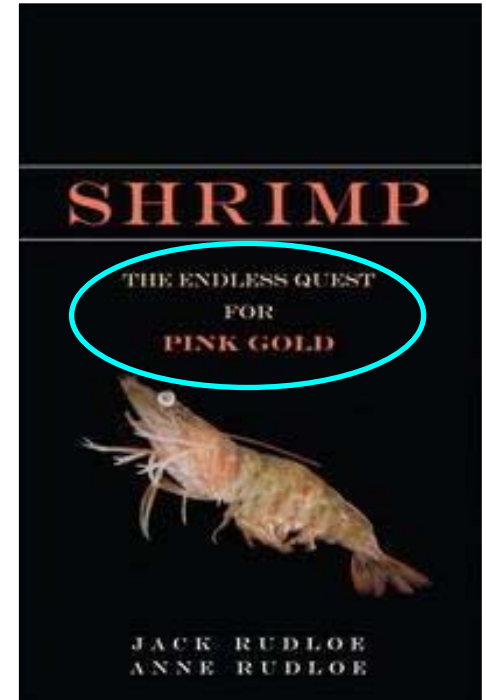
Pre- 1990



Healthy Shrimp- Most of the Time



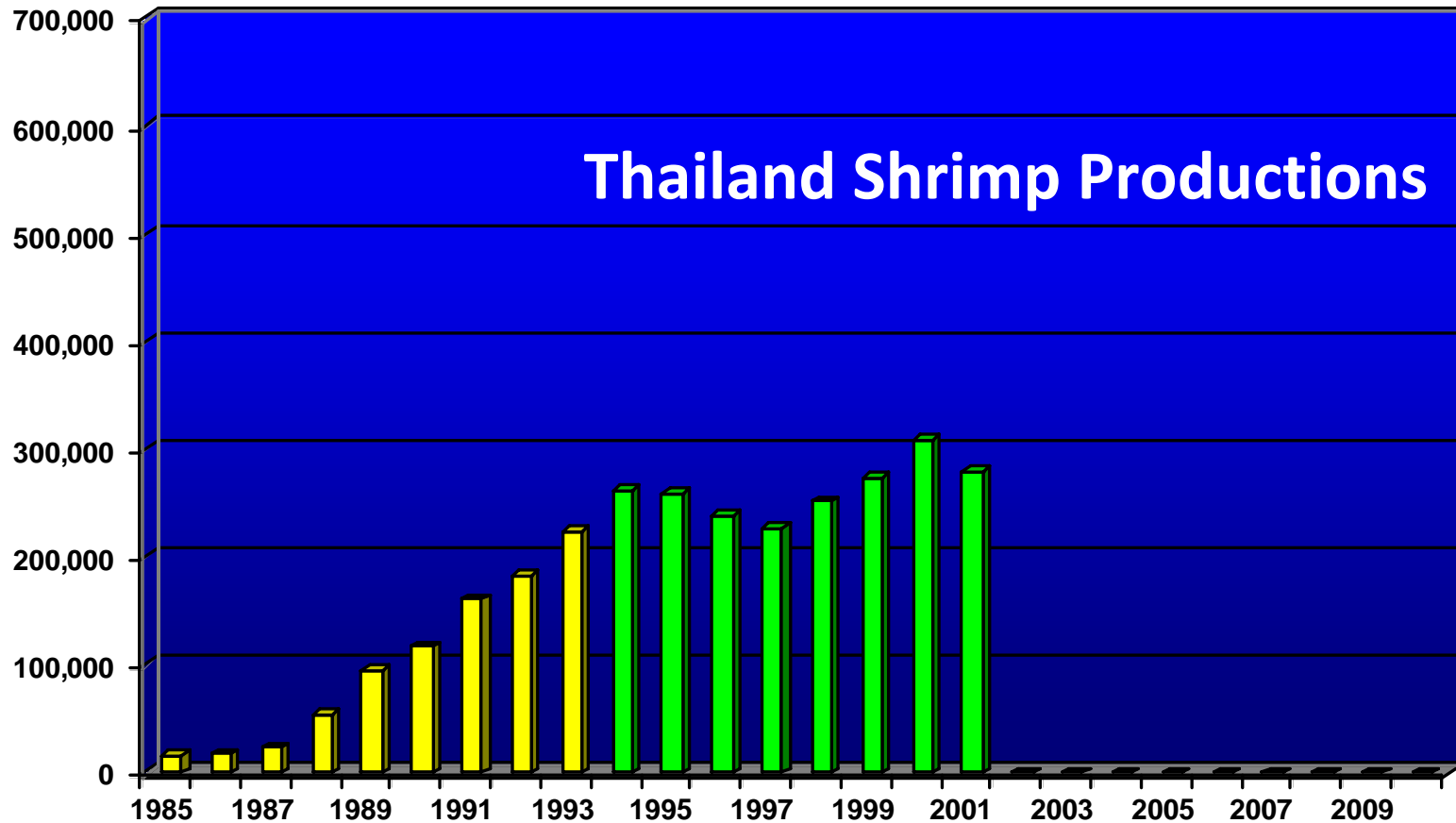
Gambler Mentality



**“High Market Prices”
Lead To Shrimp Fever**



Then Stagnation! 1994-2002



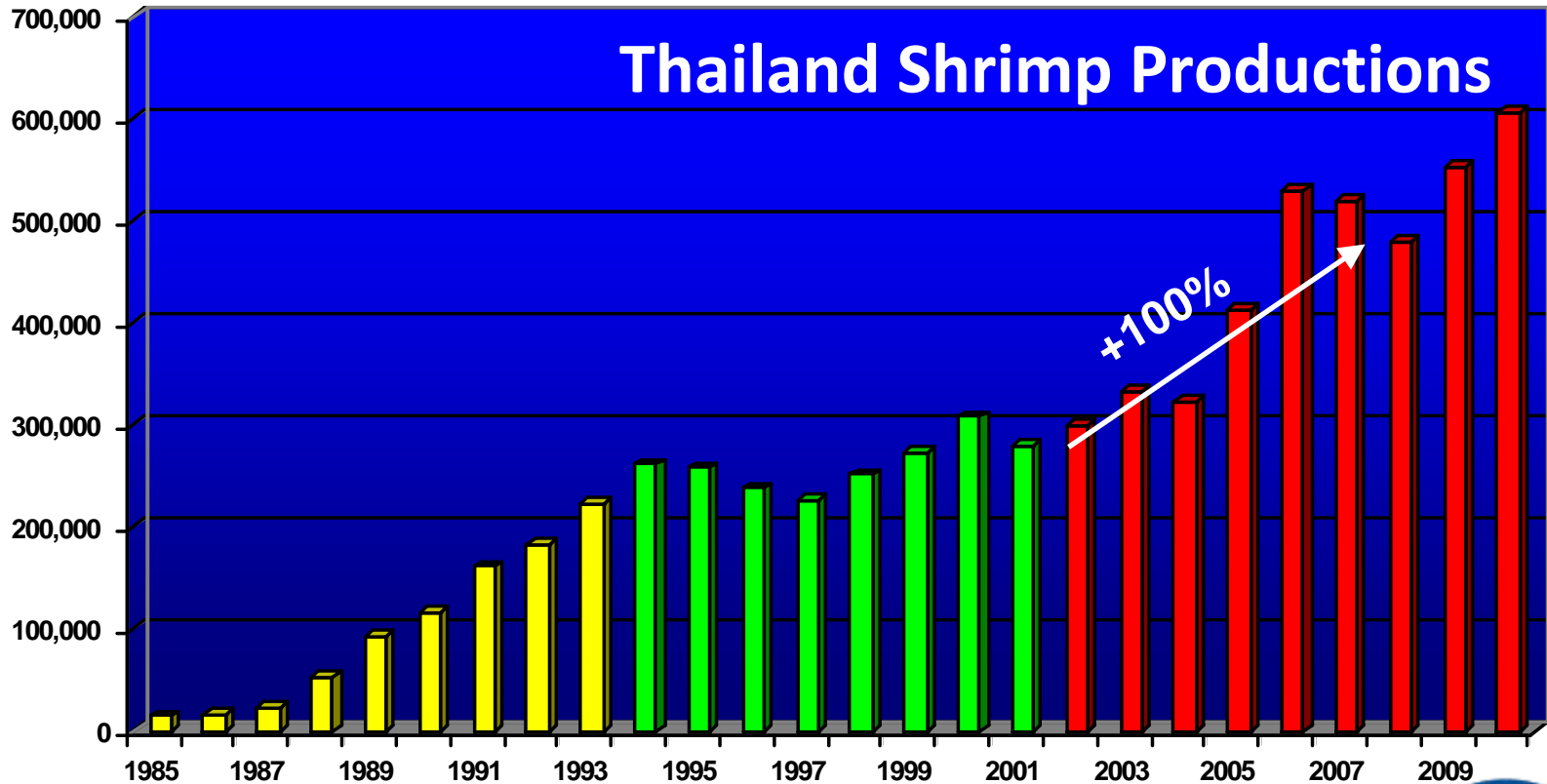
1992-2002



Deteriorating shrimp stocks made farming less predictable, and often unprofitable



Followed By The Explosion In Shrimp Production! 2002-Current





Post 2002

**Domesticate,
Healthy**



Transition to “Industrial Mentality”

- Domestication, Genetic Selection.
- Modernization of Hatcheries.
- Installation of “Controlled Pond” Systems.
- Systemization of Farm Management.



Technology Has Been Key To Increasing Sustainable Production

Species	2002 Monodon	2009 Vannamei
Cycles/yr	1.8	2.95
Stock Density /m ²	65	116
Harvest Size (g)	16.5	14.2
Yield (kg/ha/yr)	11,952	44,651
Survival (%)	62	91
Growth Rate (g/wk)	0.95	1.16
FCR	1.73	1.34

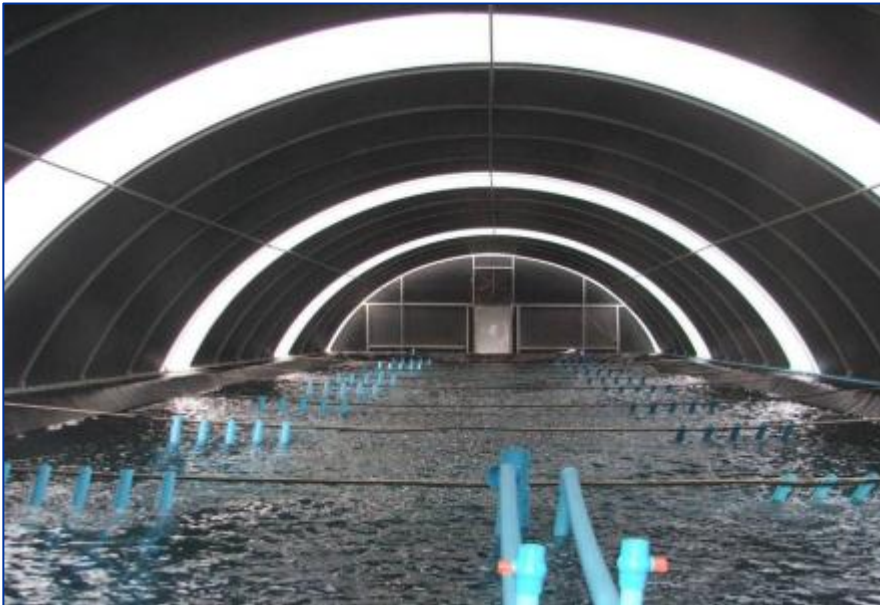


Sustainable Increased Efficiencies Have Resulted In Lower Production Costs

Species	2002	2009
	Monodon	Vannamei
Harvest pcs/kg	60	71
Farm Gate Value (USD/kg)	5.70	3.40
Cost of Production/kg (USD)	5.27	2.71
Profit/kg (USD)	0.43	0.69
% Profit	7.8	25.4



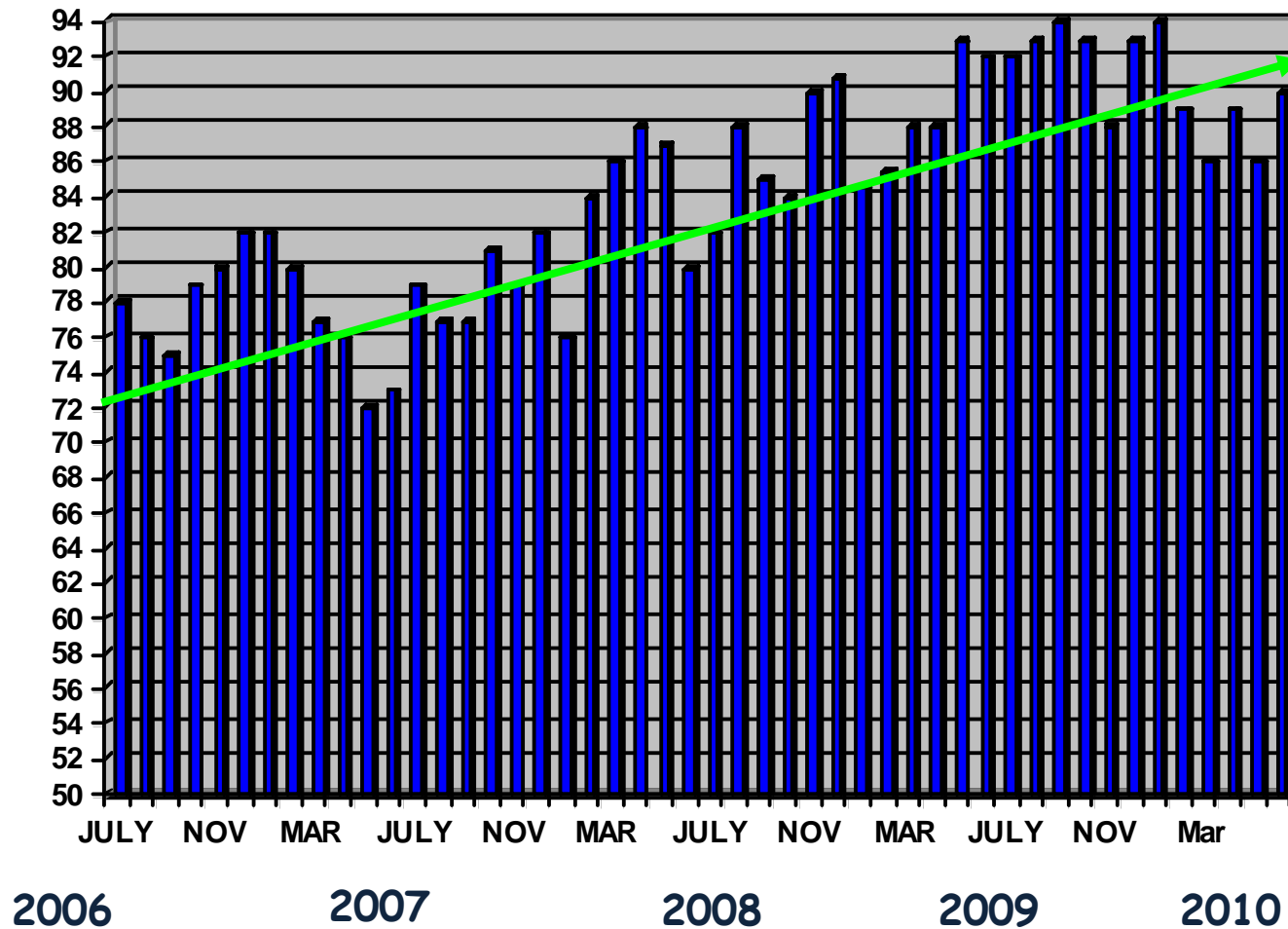
Domestication, Selective Breeding



“SPF” Shrimp



Sustainable Production Has Been: Increasing Survivorship, Reduced Pond Failures

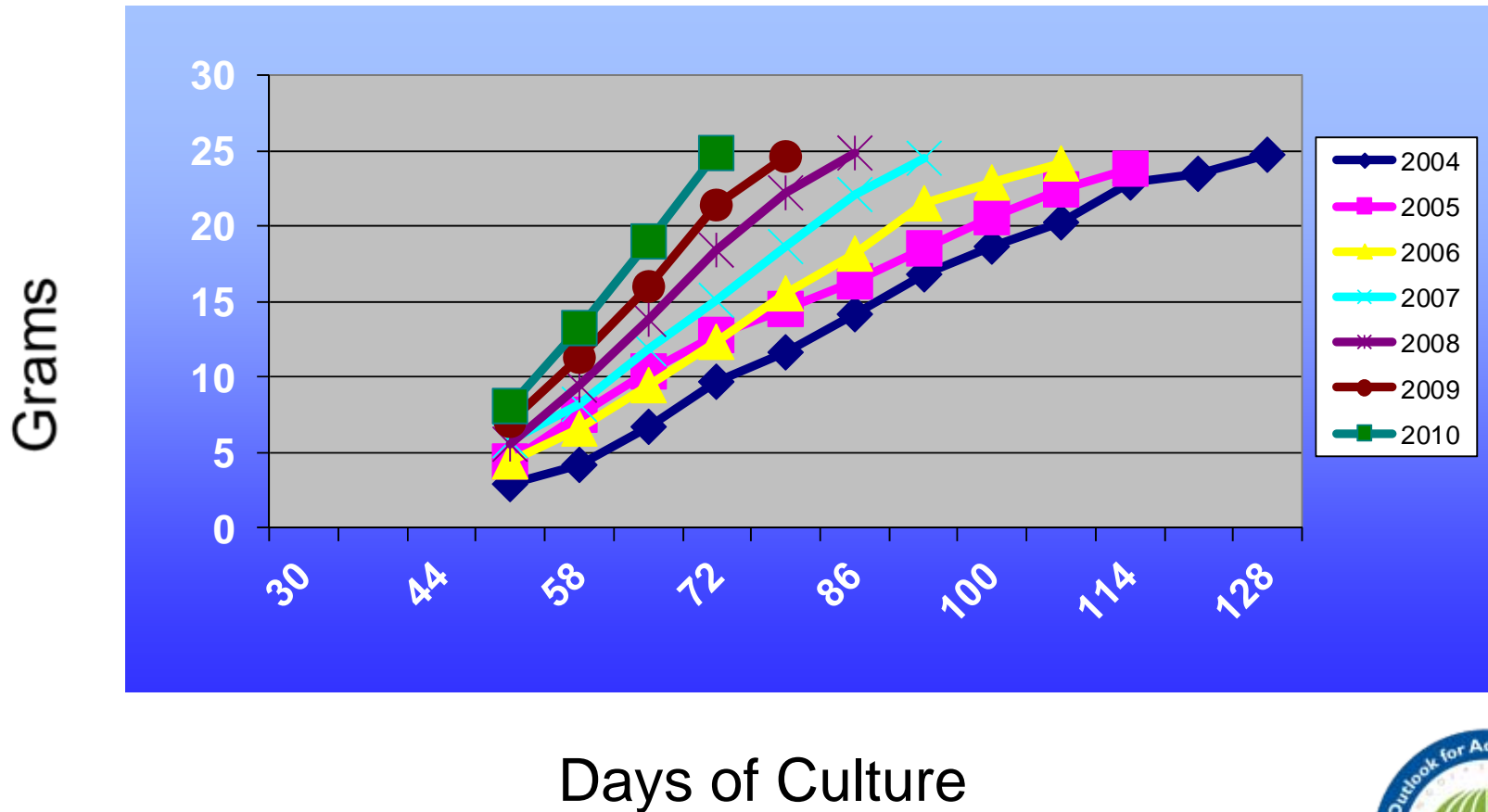


(> 6,000 harvests/yr)

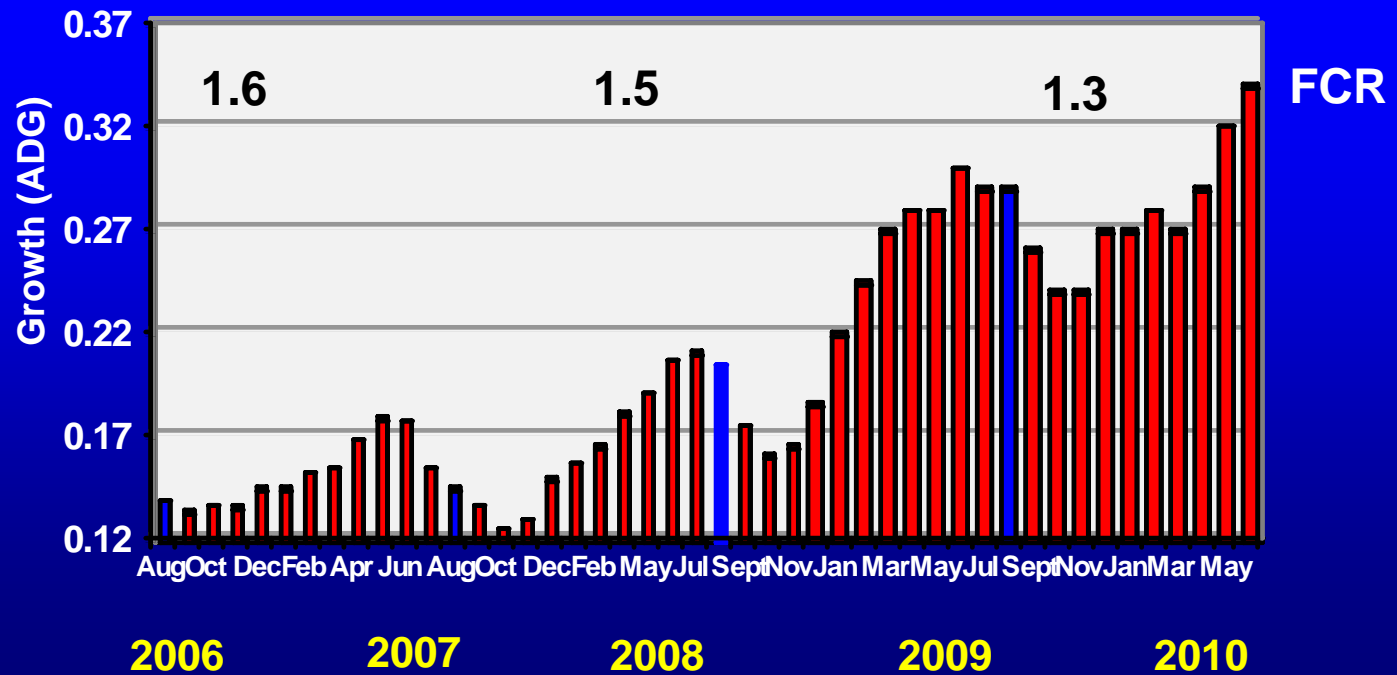


Growth Rate Improvement

Key to cost reduction:
FCR, Time to Harvest, Survival



Genetic Gains Have Contributed To Annual Gains In Pond Efficiency



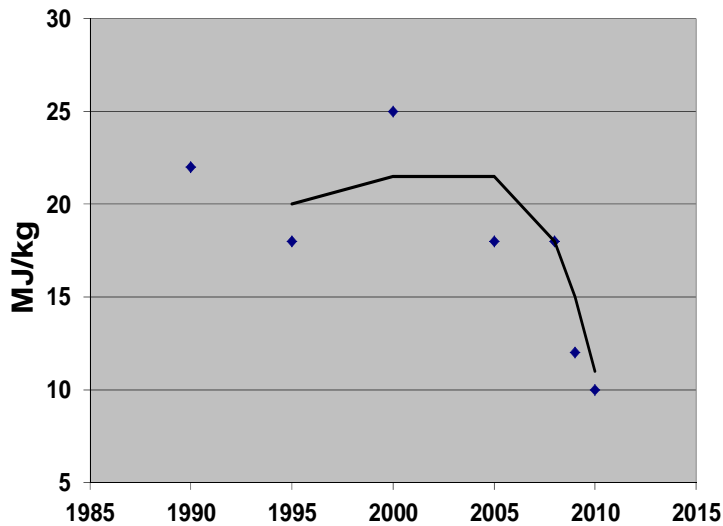
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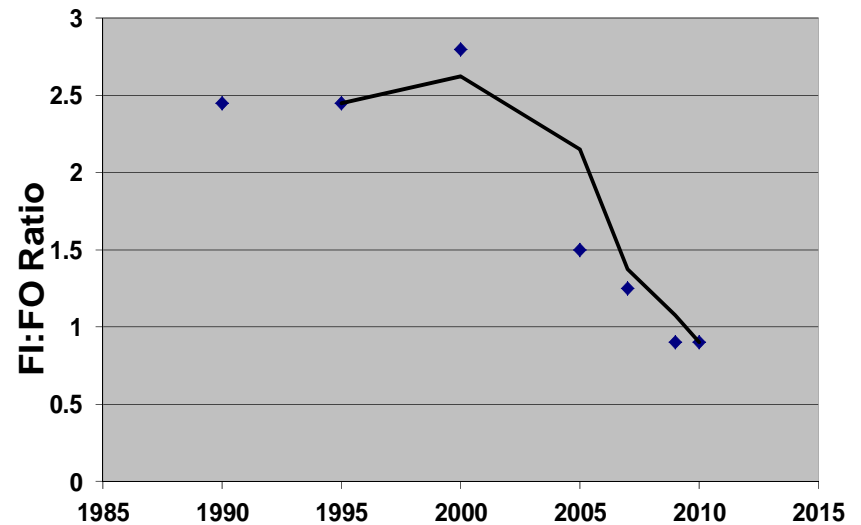
Genetics Is The Driver For More Efficient Production



Pond Energy Cost



Fish In: Fish Out



Modernization of Hatcheries

Pre- 2002



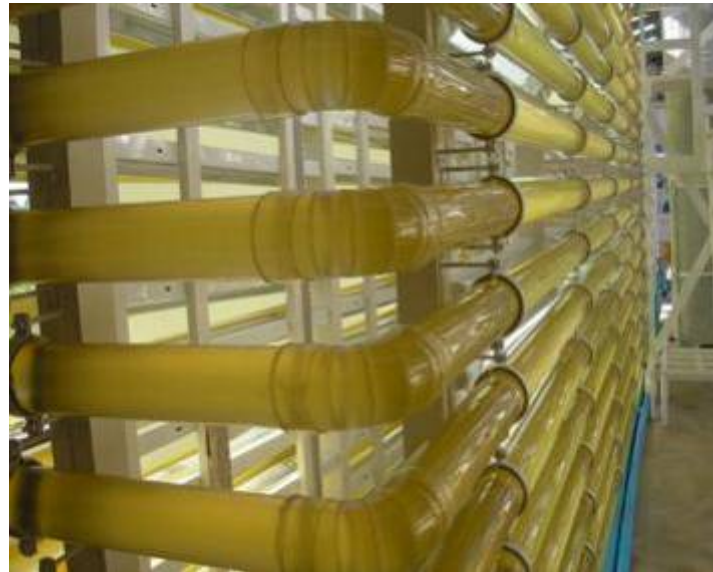
- Low Survivals
- Carriers of Disease
- Poor Performance Consistency





Sanitary

**High
Survival**



**Healthy
PLs**

**Consistent
Operations**



Healthy Shrimp Do Not Require Antibiotics



- Pre-Domestication



- Post-Domestication

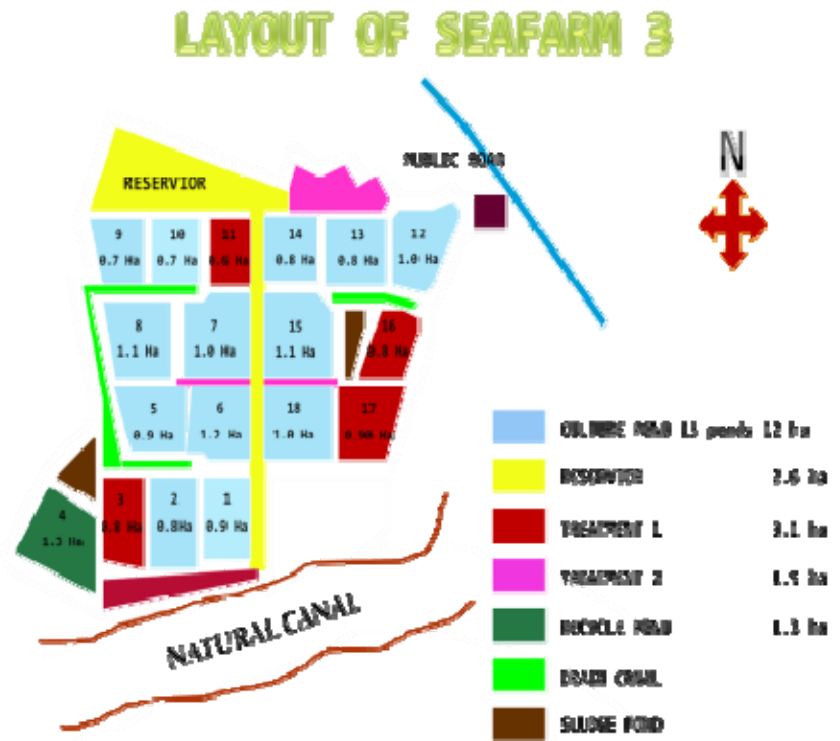


Realization of Genetic Improvement Requires Control Of The Pond Environment

Genetics \times **E**nvironment



Open Systems Move To Closed, Controlled Systems



- Risk Reduction



Controlling the Pond Environment

Key To Realizing Genetic Improvements



- Biosecurity.
- Oxygen.
- Predator and Competitor Exclusion.
- Pond Bottoms.



Control Means Reduced Risk



- Uncontrolled



- Controlled



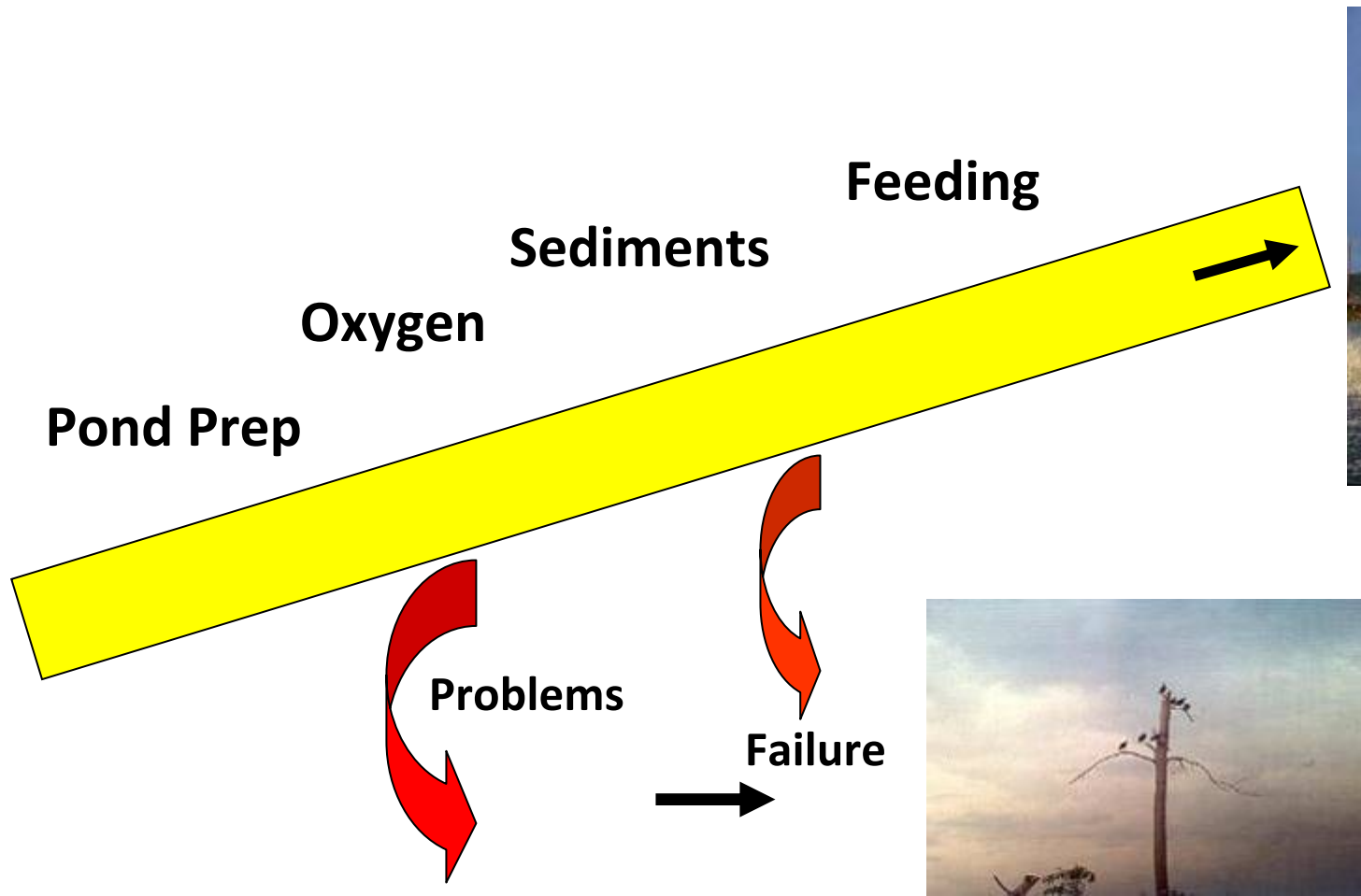
Development Of Technologies That Result In Healthier Environments



Microbes that create a healthier pond environment



Consistent Farm Management : Follow the Yellow Brick Road to Success



Implementation Of New Sustainable Technologies Requires Education and Investment



• Vietnam



• China



The Future: Sustainably More From Less

	Production (tons)	Pond Area (Ha)	Yield/Ha/Yr
	308,000	85,000	3,625
	560,000	55,000	10,200
	900	18	50,000



From The Producers: Can The Established Markets Be Increased?

