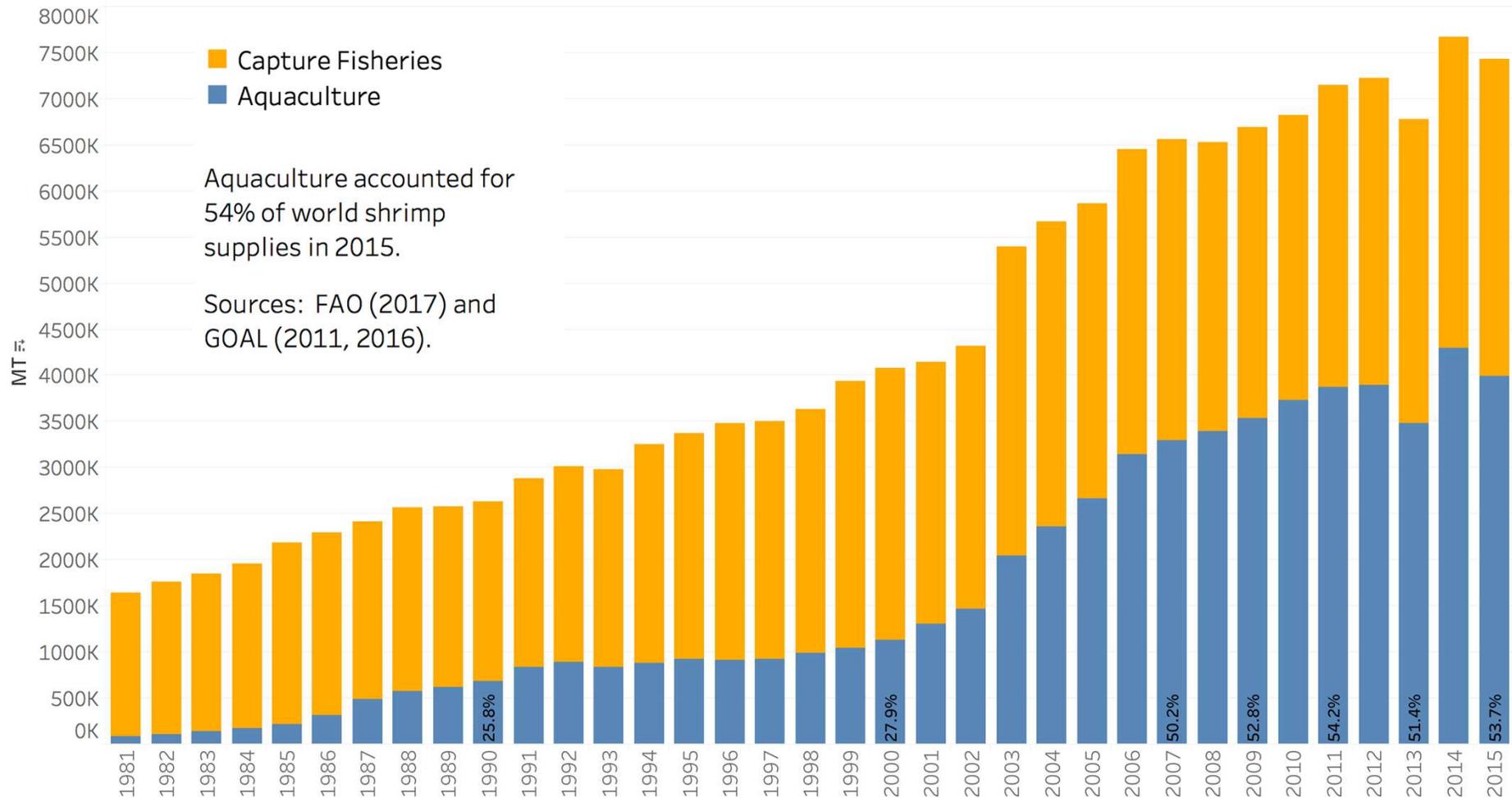




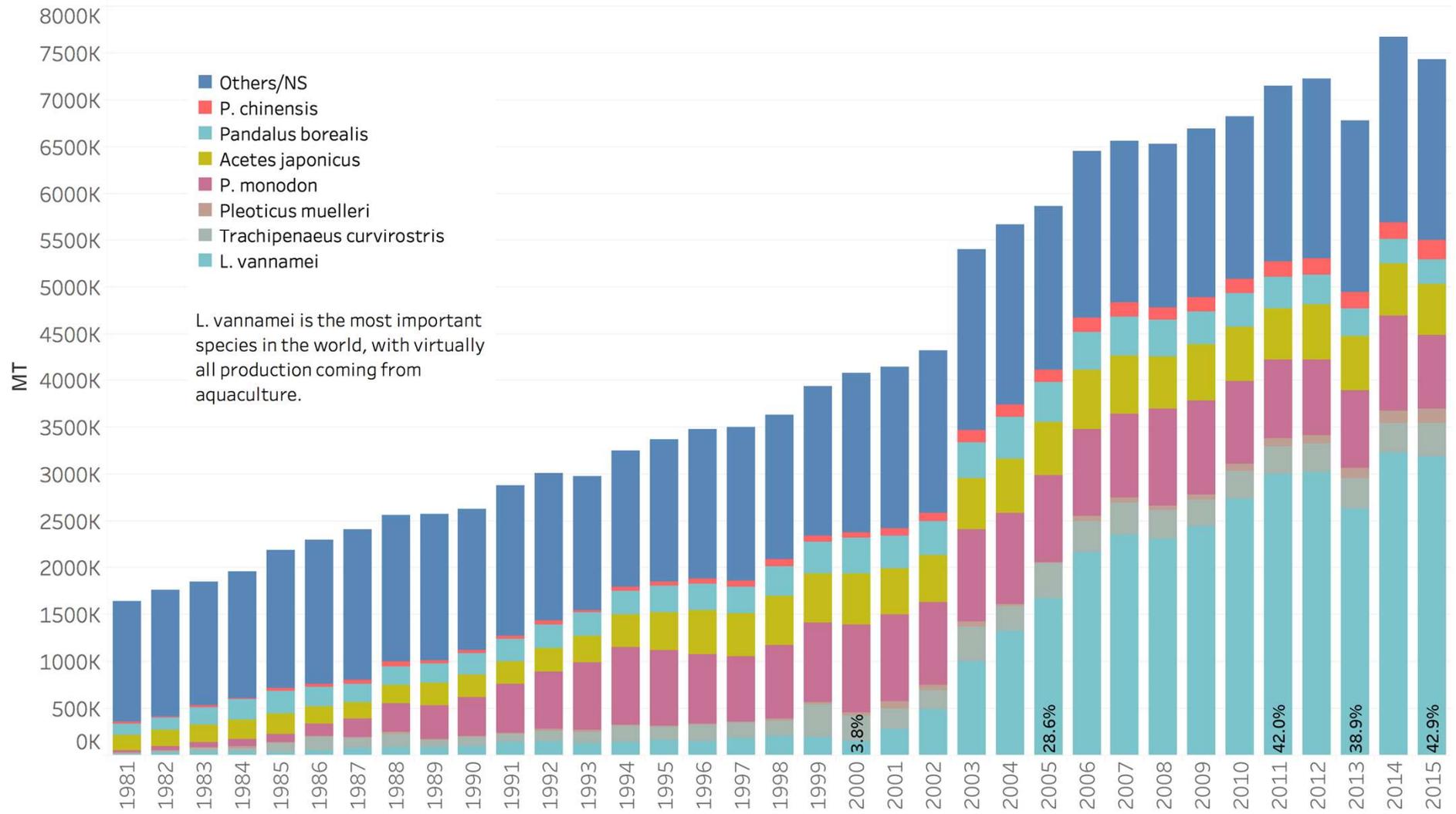
Warmwater Shrimp – Global Development and Trends

George Chamberlain

World Production of Shrimp: Capture Fisheries and Aquaculture



World Production of Shrimp by Species: Capture Fisheries & Aquaculture Combined



- Other
- Middle East / Northern Africa
- Americas
- India
- China
- Southeast Asia
- U.S. End-of-Year Composite Import Price

Sources: FAO (2017) for 2000-2009; GOAL (2011-2016) for 2010-2015; GOAL (2017) for 2016-2019.

Southeast Asia includes Thailand, Vietnam, Indonesia, Bangladesh, Malaysia, Philippines, Myanmar and Taiwan.

M. rosenbergii is not included.

Shrimp Aquaculture Production by World Region: 2000-2019 (FAO and GOAL Data)



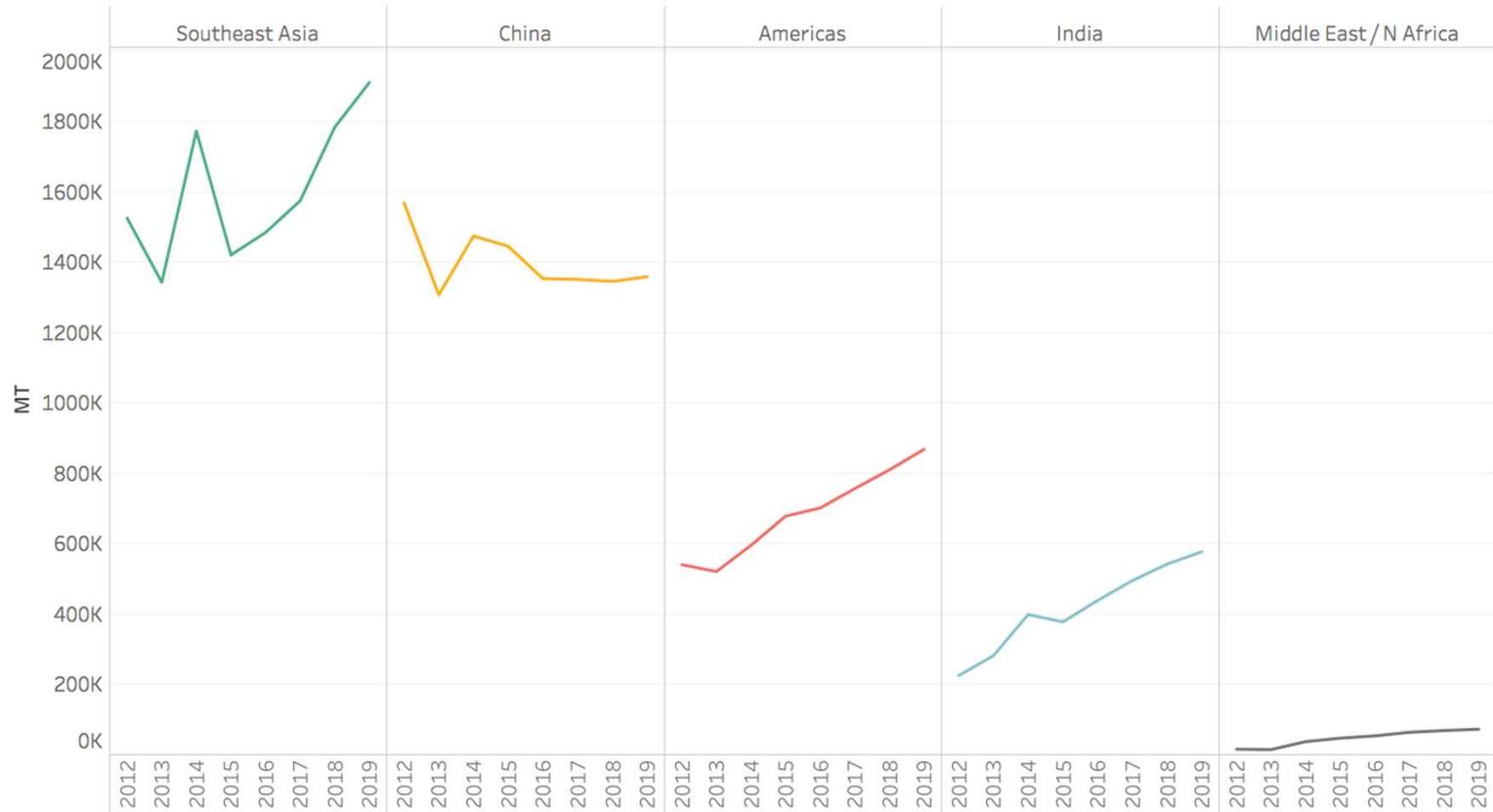
Shrimp Aquaculture by Major Producing Regions: 2012-2019

- Southeast Asia
- China
- Americas
- India
- Middle East / N Africa

Sources: GOAL (2013-2016) for 2012-2015; GOAL (2017) for 2016-2019.

Southeast Asia includes Thailand, Vietnam, Indonesia, Bangladesh, Malaysia, Philippines, Myanmar and Taiwan.

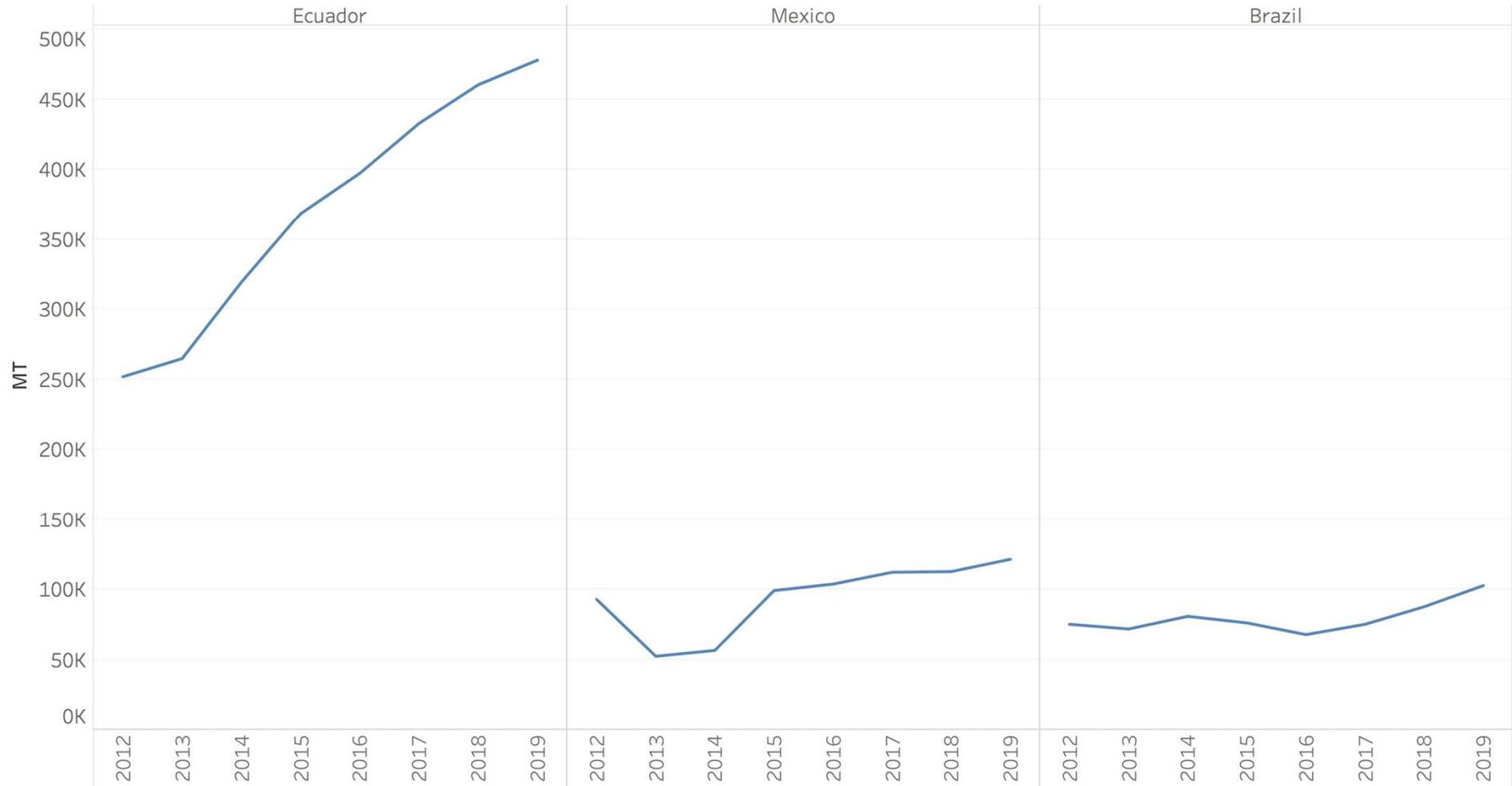
M. rosenbergii is not included.



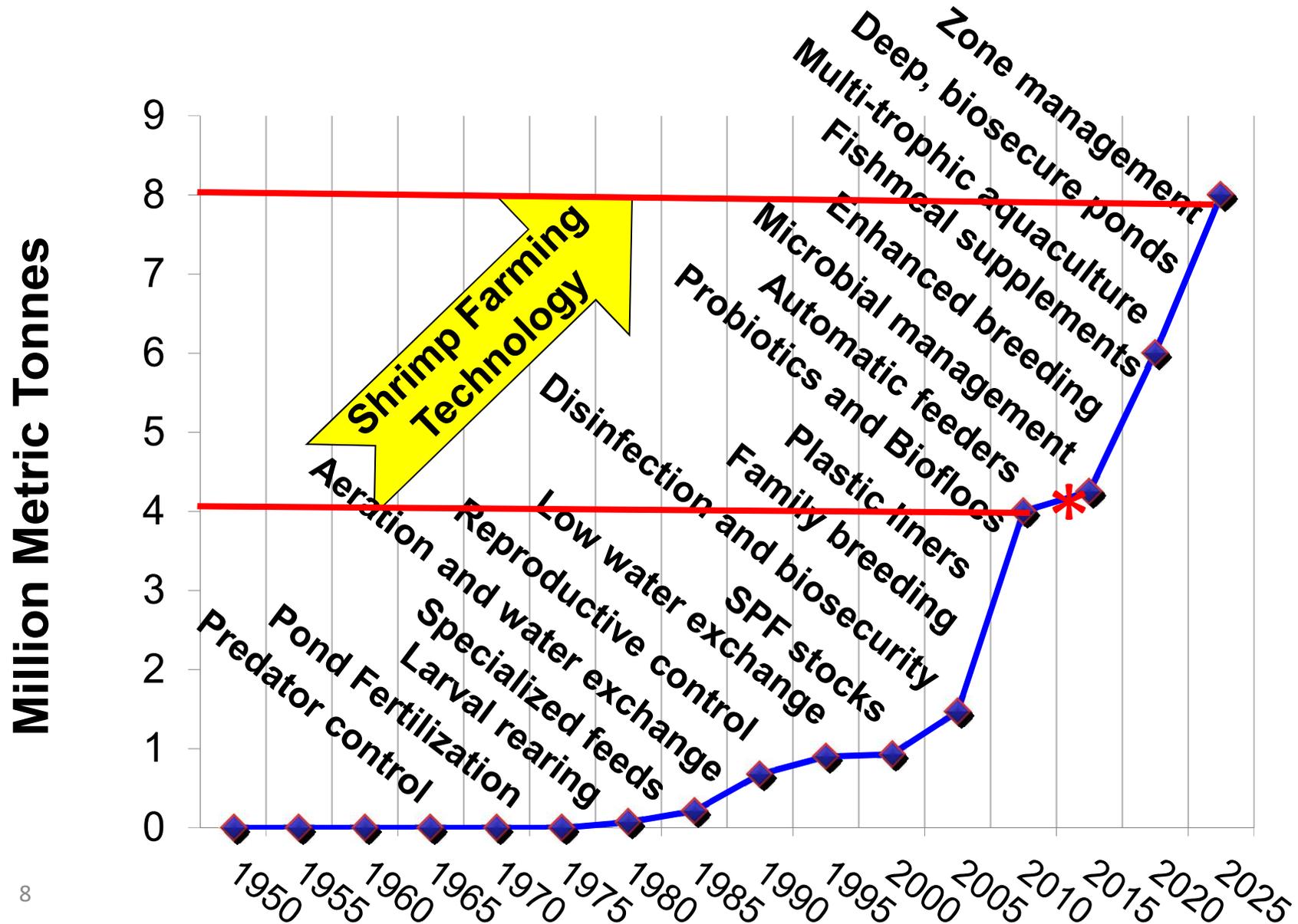
Shrimp Aquaculture in Asia: 2012-2019



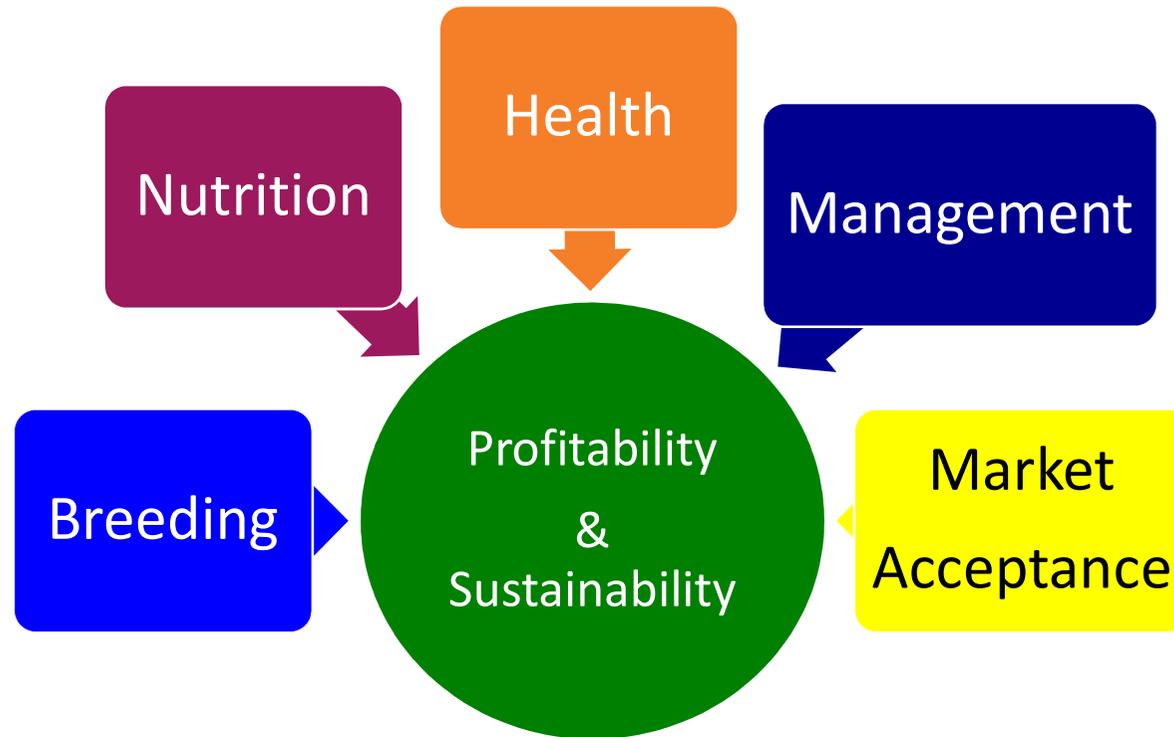
Shrimp Aquaculture in Latin America: 2012-2019



Shrimp Farming Technology is Steadily Improving



The Way Forward is Multidisciplinary



Opportunity to transform the sector by breaking the bottleneck of disease

Essential Disciplines

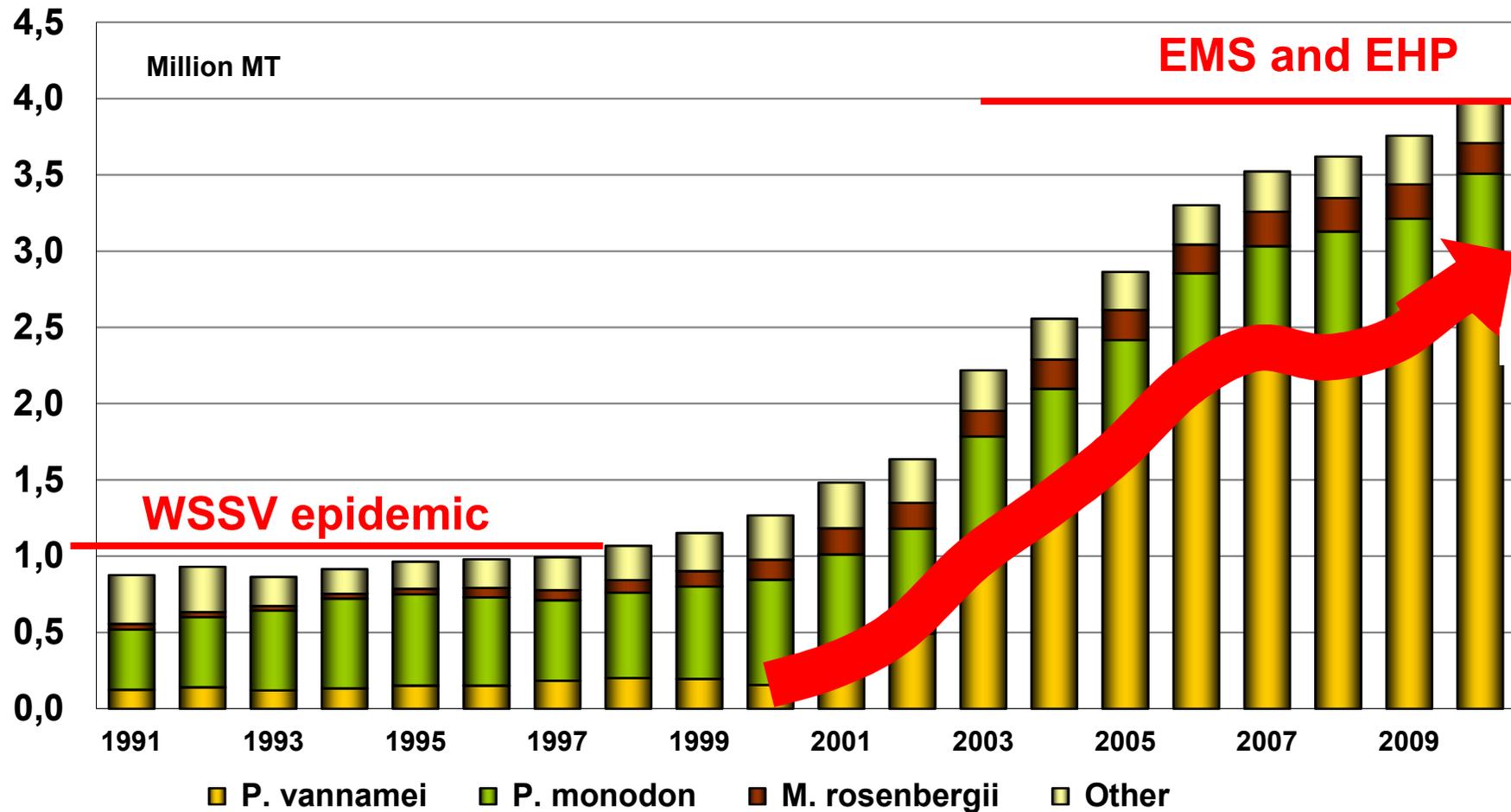
- 1. Health**
2. Breeding
3. Nutrition
4. Management
5. Market Acceptance

Impact of SPF *L. vannamei*

- Specific Pathogen Free stocks developed by Oceanic Institute in Hawaii and bred for resistance to TSV
- Farms could avoid WSSV by stocking clean PLs in a clean pond.
- Rapidly replaced infected *P. monodon*.
- Led to development of private breeding companies



WSSV epidemic of the 1990's, introduction of SPF vannamei, and *quadrupling* of production



Sources: FAO (2013) for 1991-2011; GOAL (2013) for 2012-2015.

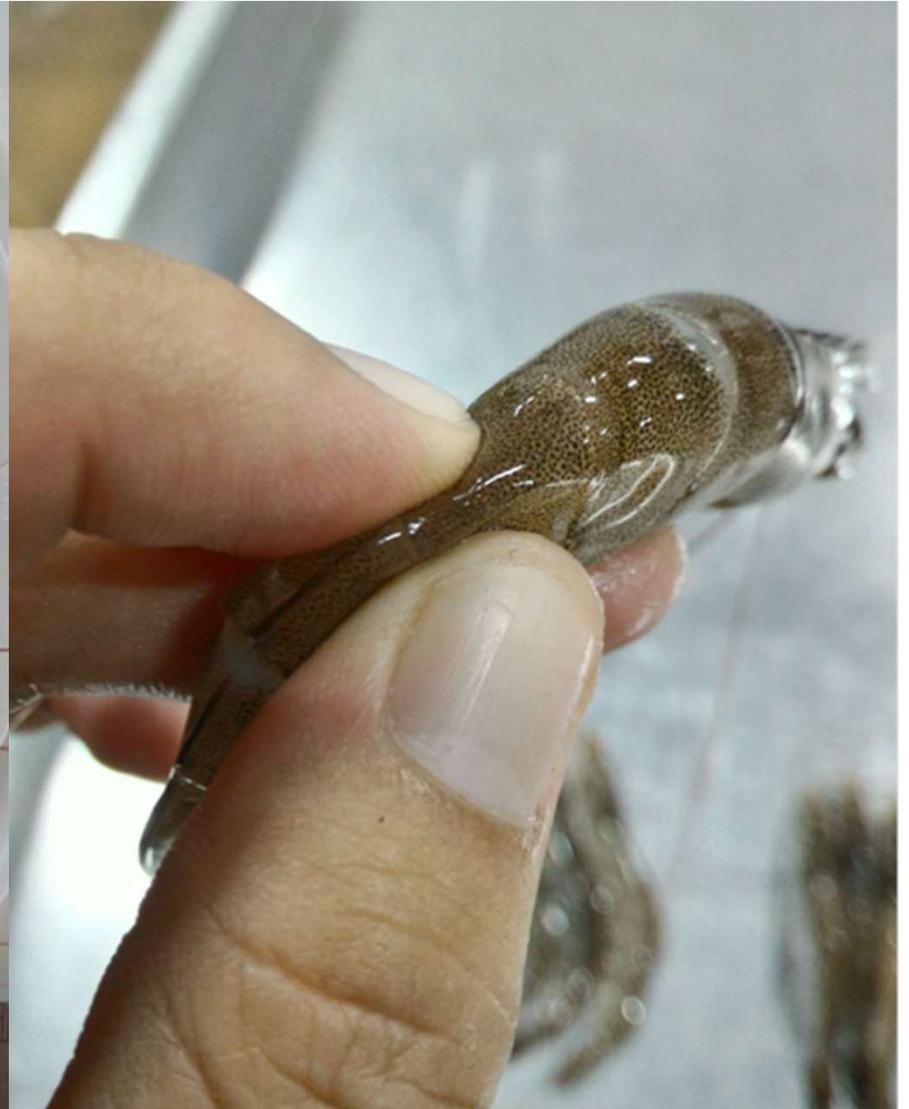
Early Mortality Syndrome



A bacterial disease caused by a strain of *Vibrio parahaemolyticus*. It does not affect humans.



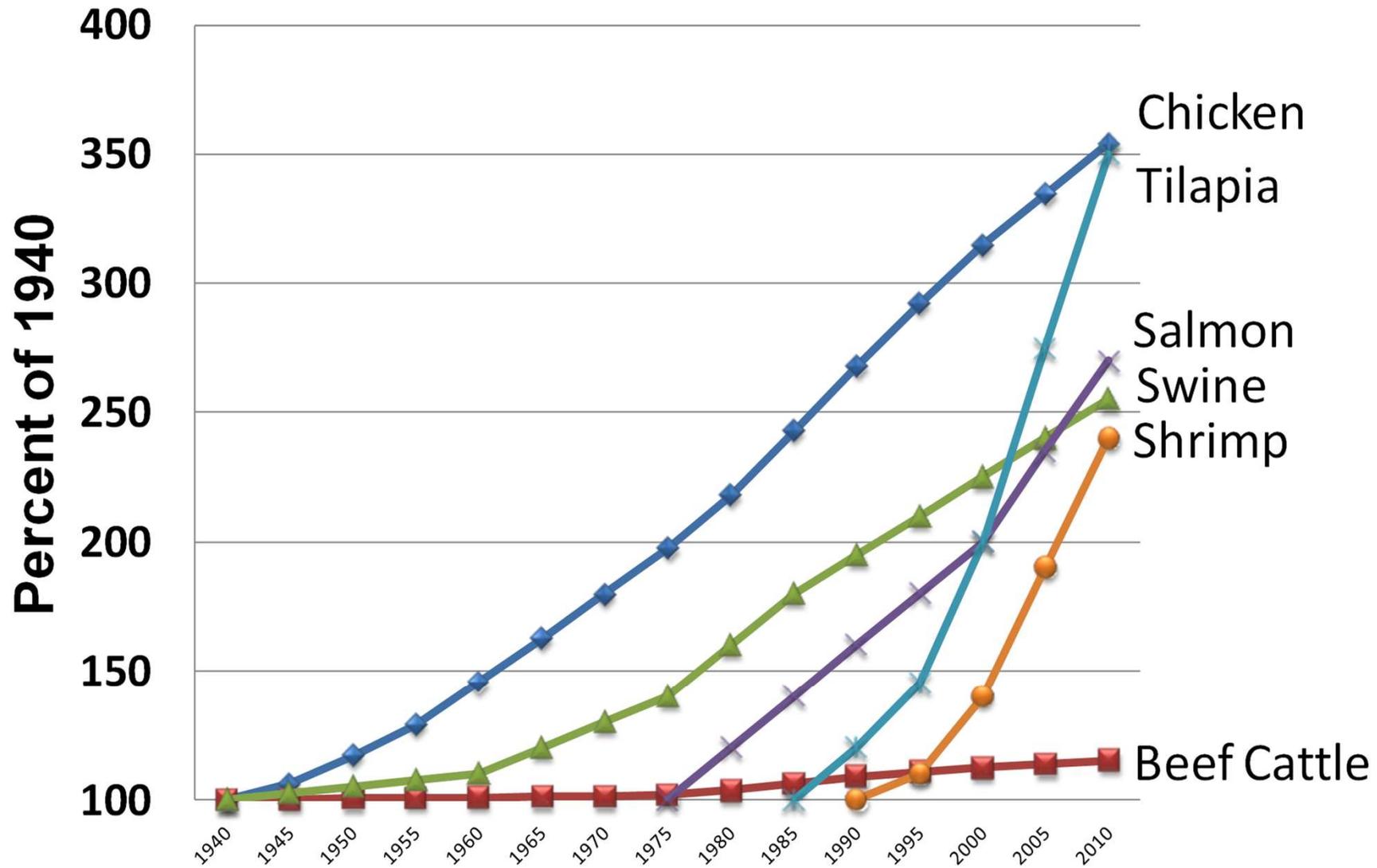
Emergence of EHP



Essential Disciplines

1. Health
2. **Breeding**
3. Nutrition
4. Management
5. Market Acceptance

Relative Genetic Gain in Growth Rate



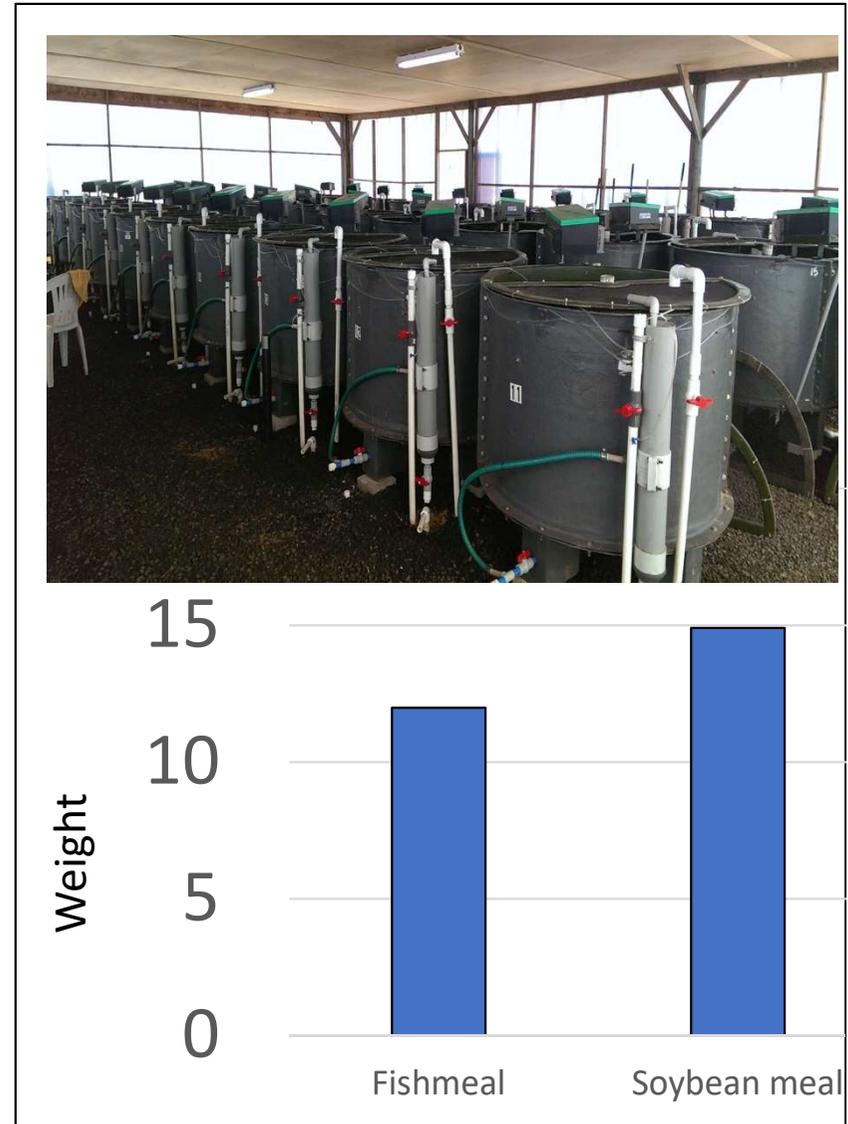
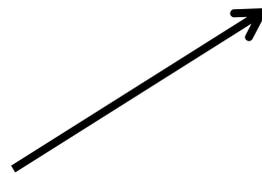
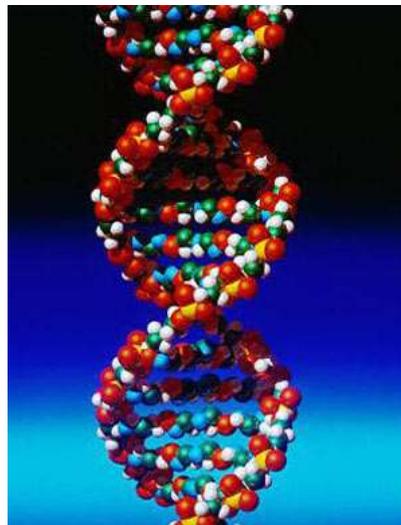
Selection Traits

- Growth
- Disease resistance
 - TSV
 - WSSV
 - EMS
 - IMNV
- Reproduction
- Dietary soy tolerance



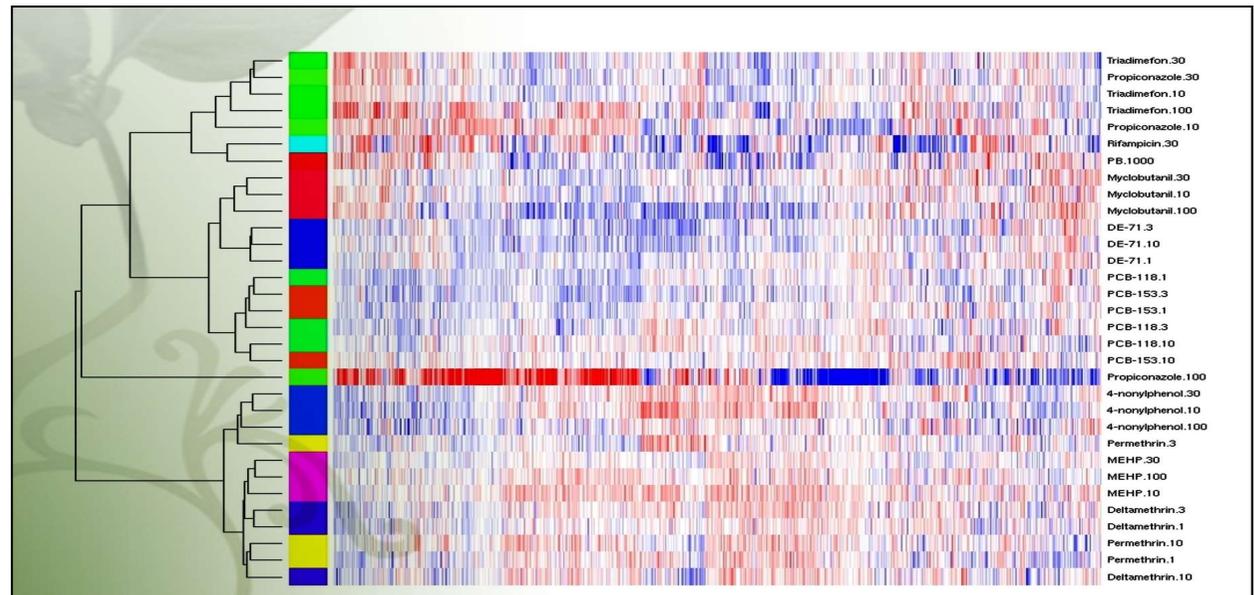
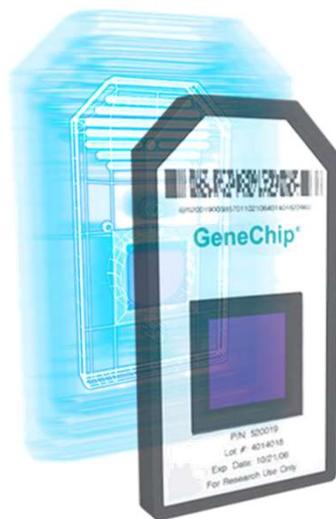
Marker-Assisted Breeding

- Molecular Markers (SNPs) used for trait identification in mainstream agriculture.
- In Hawaii, soy farmers are funding research on markers for dietary soy tolerance in shrimp



Nutrigenomics

Using a microarray to measure nutritional effects on gene expression patterns



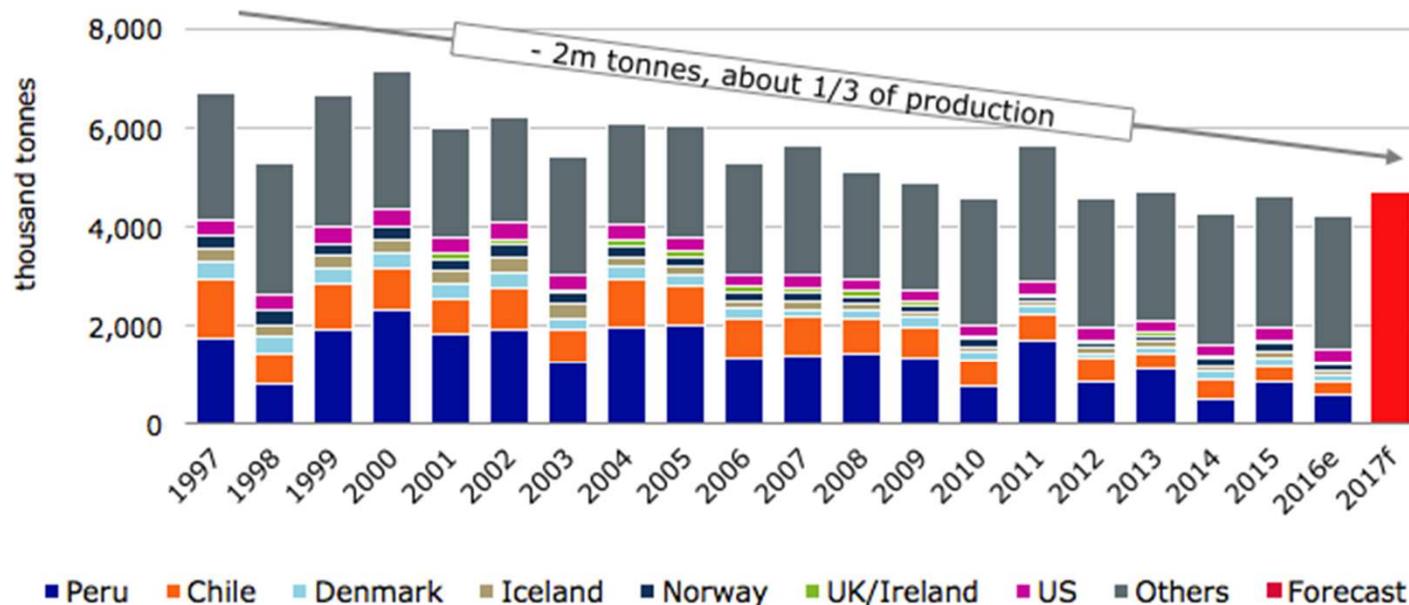
Essential Disciplines

1. Health
2. Breeding
- 3. Nutrition**
4. Management
5. Market Acceptance

After a two decades of decline Fishmeal supply bottomed out in 2016 due to El Niño



Long-term decline in FM production halts in 2017 but still far below historical levels



Source: Kottali Analysis, OI World, Rabobank 2017

Fishmeal Issues

- Environmental Concerns
 - Many of the small feed fisheries are poorly managed
- Social Concerns
 - Forced labor on fishing vessels
- Cost
 - Fishmeal prices have tripled in the last decade



AP Investigation: Slaves may have caught the fish you bought

March 24, 2015

 INCLUDES VIDEO

The Burmese slaves sat on the floor and stared through the rusty bars of



More than 2,000 enslaved fishermen rescued in 6 months

Sept. 17, 2015

More than 2,000 fishermen have been rescued this year from brutal conditions at sea, liberated as a result of an Associated Press



Over 300 slaves rescued from Indonesia island after AP investigation into forced labor

April 4, 2015

At first the men filtered in by twos and threes, hearing whispers of a



The *only* international multi-stakeholder collaboration
with full supply chain participation
addressing risks of forced labour, human trafficking and IUU Fishing
in the seafood supply chain



Practical solutions *right now*

Innovations: Proteins

Empyreal 75

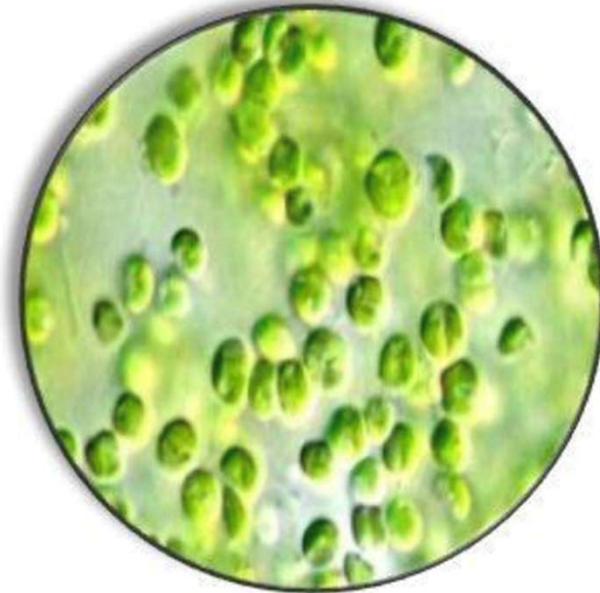


Calysta

Innovation: Alternatives to fish oil

Rape seed oil

Marine omega-3 (EPA and DHA) from GMO rape



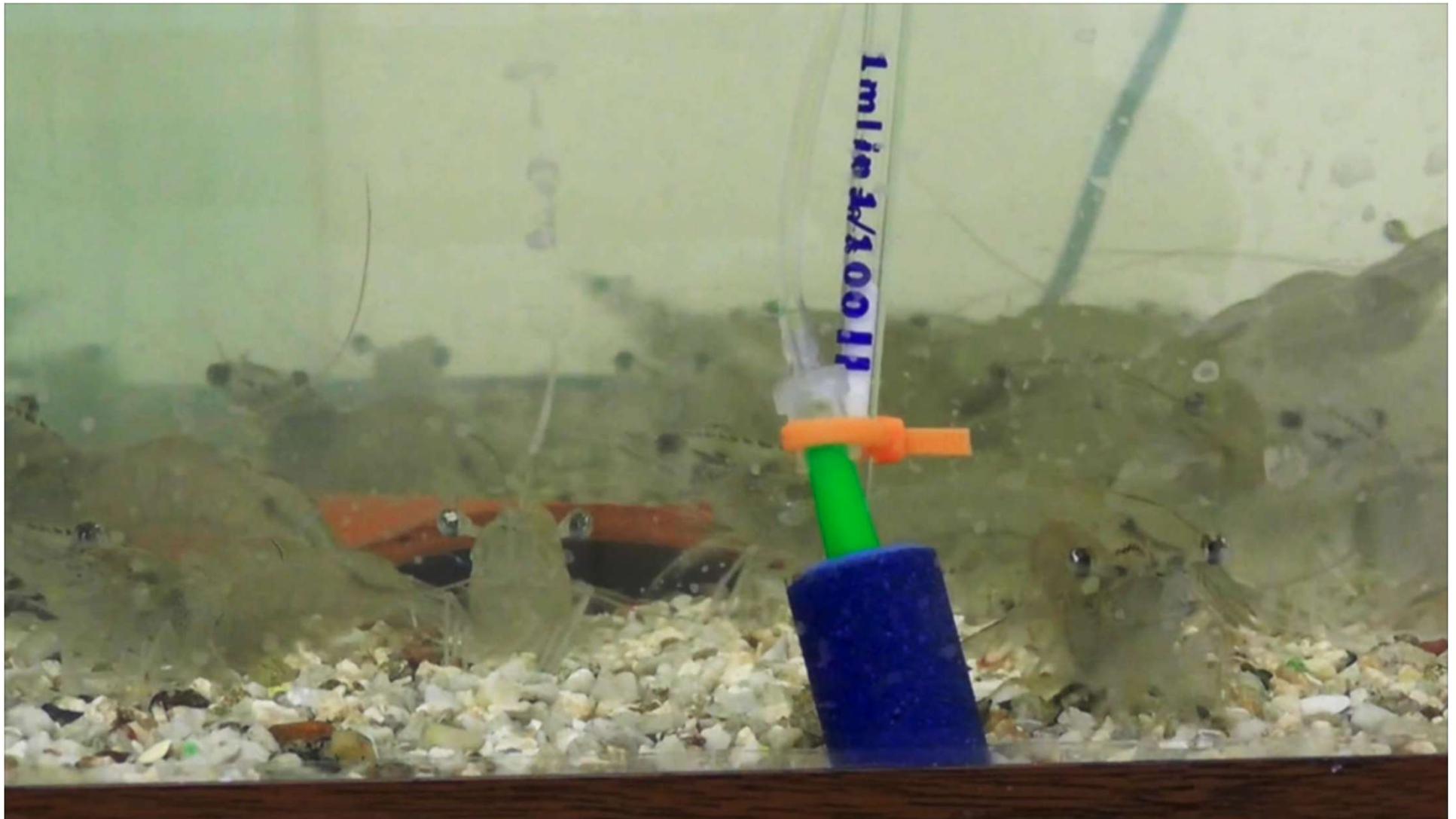
Algae

EPA and DHA produced in algae, nature's producer of marine omega-3

Chemical signaling in Crustaceans



Response of Shrimp to Synthetic Attractant



Essential Disciplines

1. Health
2. Breeding
3. Nutrition
- 4. Management**
5. Market Acceptance

Productive, Sustainable Systems

- GAA Innovation Award to Werner Jost, AquaScience, Brazil
 - 21 g in 116 days at 200/m²
 - Yield: 43 MT/ha
 - No discharge. Water reused for 5 production cycles using nitrification and denitrification



Integrated Multitrophic Systems

- Improved disease control
- Increased productivity
- Multitrophic culture of clams and oysters with shrimp
- Improved sustainability by reducing water, energy and feed use



Zone Management Standard

- Zone management standards are under development as BAP 5th star
 - Proximity among farms
 - Veterinary services
 - Quarantine
 - Management practices
 - Information sharing



The Responsible Seafood Choice.



Essential Disciplines

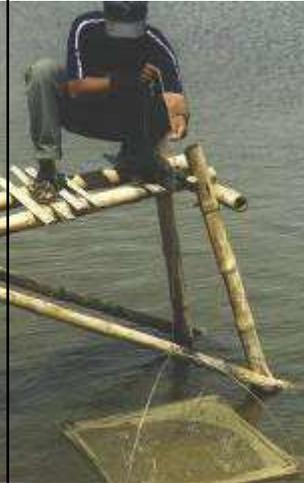
1. Health
2. Breeding
3. Nutrition
4. Management
5. **Market Acceptance**

Market Acceptance

- During the last 20 years, challenges have emerged as aquaculture has grown rapidly around the world
- Can aquaculture avoid the pitfalls facing a young industry?
- Challenges
 - Environmental
 - Social
 - Food Safety
 - Animal Welfare
 - Traceability

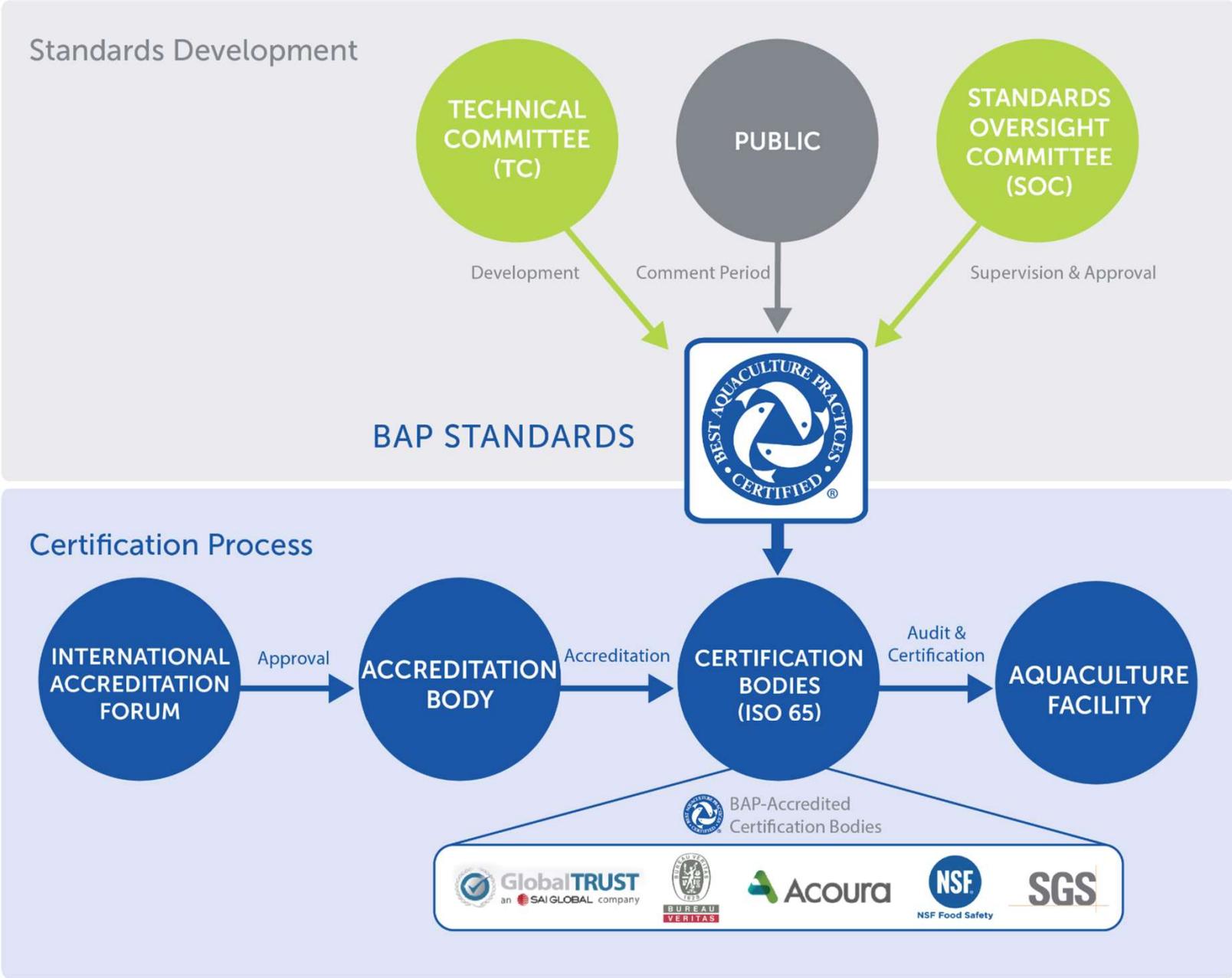


BAP addresses Entire Production Chain

	Production Chain			
	Hatchery	Farm	Feed	Processing
				
Environmental	✓	✓	✓	✓
Social	✓	✓	✓	✓
Food Safety	✓	✓	✓	✓
Traceability	✓	✓	✓	✓



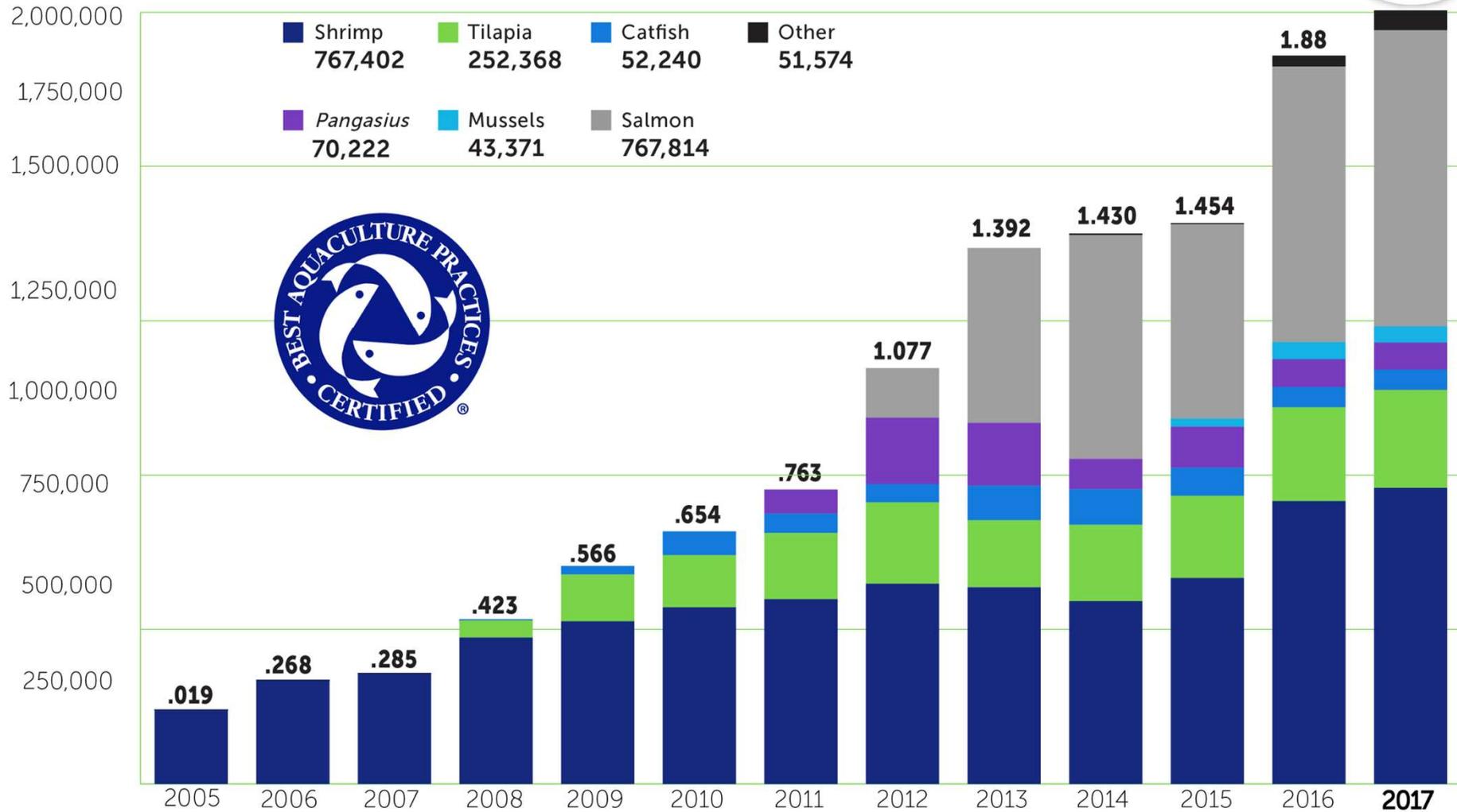
BAP Standards Development Process



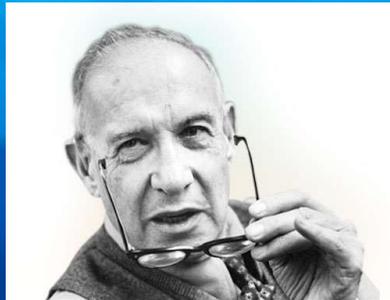
Volume of Seafood from BAP-Certified Processing Plants

Millions of Metric Tons of Product (through June 2017)

2.01
Million
MetricTons



A successful business has
only two basic functions-
marketing and innovation



PETER



Information for customers: MSC is a responsible way to buy seafood. MSC is a responsible way to buy seafood. MSC is a responsible way to buy seafood.

CERTIFIED SUSTAINABLE SEAFOOD MSC www.msc.org



EcoCraft

MADE IN-HOUSE By DAD

SALE! Chilean Sea Bass Steaks \$24.99/lb

HOT DEALS! Chilean Sea Bass Fillet \$25.99/lb

HOT WEEKEND DEALS! SAVE NOW! Lake Trout Fillet \$7.99/lb

SEASONAL Chilean Sea Bass Steaks \$24.99/lb

WILD FRESH USA WHOLE BLUEFISH \$4.99/lb

OUR SEAFOOD STANDARDS: FRESH, RESPONSIBLY SOURCED, ADDITIONAL ANTIBIOTIC RESISTANCE TESTING



The Herring Net, Winslow Homer

How can the coldwater prawn sector up its game ?

- Sustainability assurances
 - Fishery
 - Vessels
- Innovation
 - Use of heads and shells
- Quality
 - Minimum specifications
- Marketing
 - Telling the story

***If you want to go fast, go alone.
If you want to go far, go together.***

African proverb

