

THE ECONOMIC IMPACTS OF EMERGING DISEASES IN SHRIMP AQUACULTURE

INSIGHTS FROM A MULTI-YEAR, GLOBAL SURVEY OF THE INDUSTRY

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Introduction

- As the most highly traded of all food commodities, seafood plays a key role in nutritional and financial security, particularly in developing economies.
- According to the **OECD-FAO Agricultural Outlook 2015**, fisheries production worldwide is projected to expand by **19%** between the **2012-14** base period and **2024**, to reach **191 million MT**.
- The main driver of this increase will be **aquaculture**, which is expected to reach 96 million MT by 2024, **38% higher** than the 2012-2014 level.
- The OECD-FAO AO 2015 reported that **animal disease outbreaks** will increasingly affect productivity gains in future aquaculture production.
- Emergent diseases, often with cryptic or syndromic etiology, in the shrimp farming sector in Asia confirm **disease as the major constricting factor for expansion of the shrimp aquaculture industry to 2050**.

Recent Articles in the Peer-Reviewed Literature

Highlighting the Ongoing Disease Crisis



OPINION

New Paradigms to Help Solve the Global Aquaculture Disease Crisis

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Advances in Animal and Veterinary Sciences

Review Article

Early Mortality Syndrome (EMS) as new Emerging Threat in Shrimp Industry

Minireview

Disease will limit future food supply from the global crustacean fishery and aquaculture sectors

G.D. Stentiford^a, D.M. Neil^b, E.J. Peeler^c, J.D. Shields^d, H.J. Small^e, T.W. Flegel^f, J.M. Vlcek^g, B. Jones^h, F. Moradoⁱ, S. Moss^h, J. Lotz^j, L. Bartholomay^j, D.C. Behringer^k, C. Hauton^l, D.V. Lightner^m

Infectious Diseases Affect Marine Fisheries and Aquaculture Economics

Kevin D. Lafferty,¹ C. Drew Harvell, Jon M. Conrad, Carolyn S. Friedman, Michael L. Kent, Armand M. Kuris, Eric N. Powell, Daniel Rondeau, and Sonja M. Saksida

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Journal of Parasitology 100(6):743-755. 2014
doi: <http://dx.doi.org/10.1645/14-605.1>

Counter-Insurgents of the Blue Revolution? Parasites and Diseases Affecting Aquaculture and Science

Reginald B. Blaylock and Stephen A. Bullard

Current Disease Threats for Cultivated Penaeid Shrimp in Asia

- New or newly emerged:
 - Early Mortality Syndrome / Acute Hepatopancreatic Necrosis Disease (**EMS/AHPND**).
 - Hepatopancreatic Microsporidiosis (**HPM**).
 - Hepatopancreatic Haplosporidiosis (**HPH**).
 - Aggregated Transformed Microvilli (**ATM**).
 - Covert Mortality Disease (**CMD**).
- Continuing viral threats:
 - White spot disease (**WSD**).
 - Yellow head disease (**YHD**).
 - Infectious Myonecrosis (**IMN**).



Early Mortality Syndrome (EMS) as the Most Recent Threat to the Shrimp Farming Industry

- Outbreaks of EMS naturally occur in the first 30 days after stocking a freshly arranged shrimp pond, and rate of mortality can pass beyond 70%.
- It was first detected in shrimp farms in southern China in 2009, in Vietnam in 2010 and afterwards in Malaysia in 2011.
- Reported in Thailand in 2012 and in Mexico in 2013.
- Associated with declining exports from southeast Asia in 2012 – 2013 and rising shrimp prices in the international markets.



Source: Zorriehzahra and Banaederakhshan (2015)

Shrimp Disease in Asia Resulting in High U.S. Import Prices

Kristin Reed
Bureau of Labor Statistics

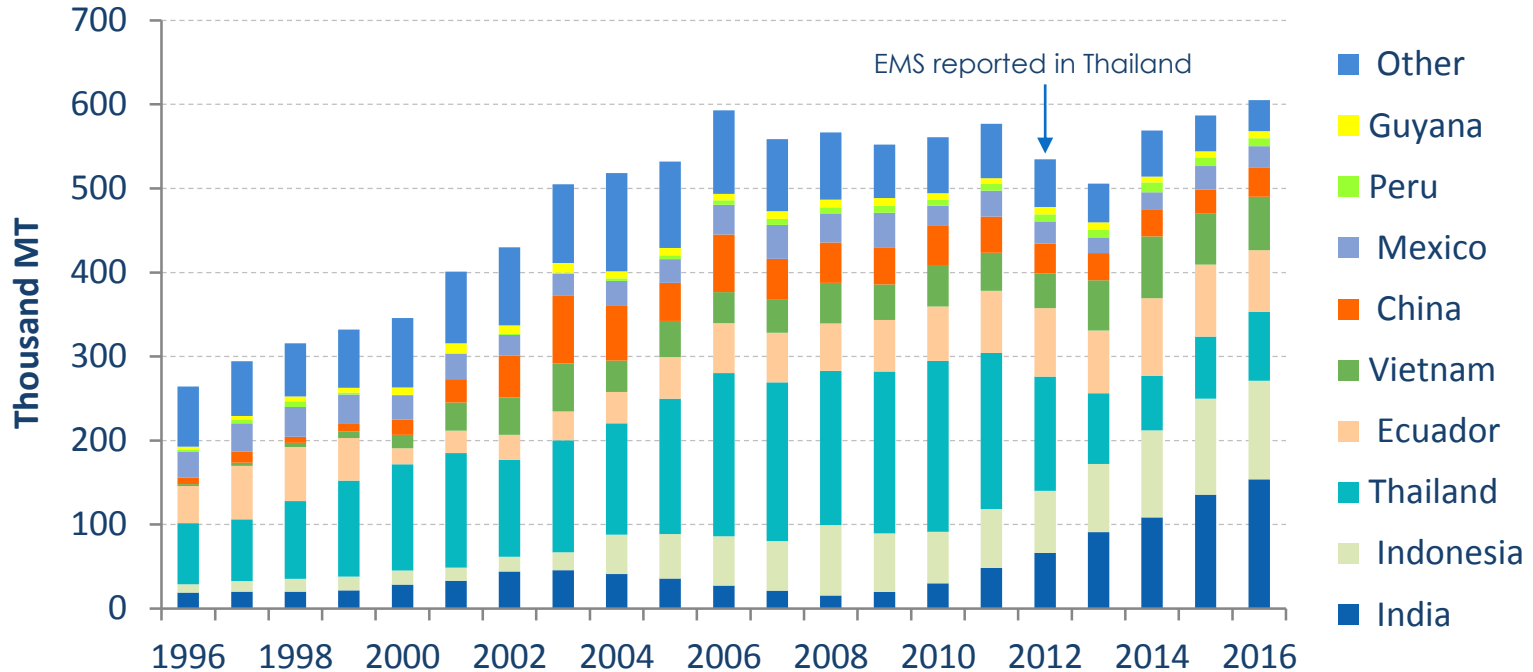
Shrimp-flation is still killing Red Lobster

WRITTEN BY

Gwynn Guilford

Impacts on International Trade

U.S. Shrimp Imports: **Down 12%** between 2011-13, **Up 20%** between 2013-16

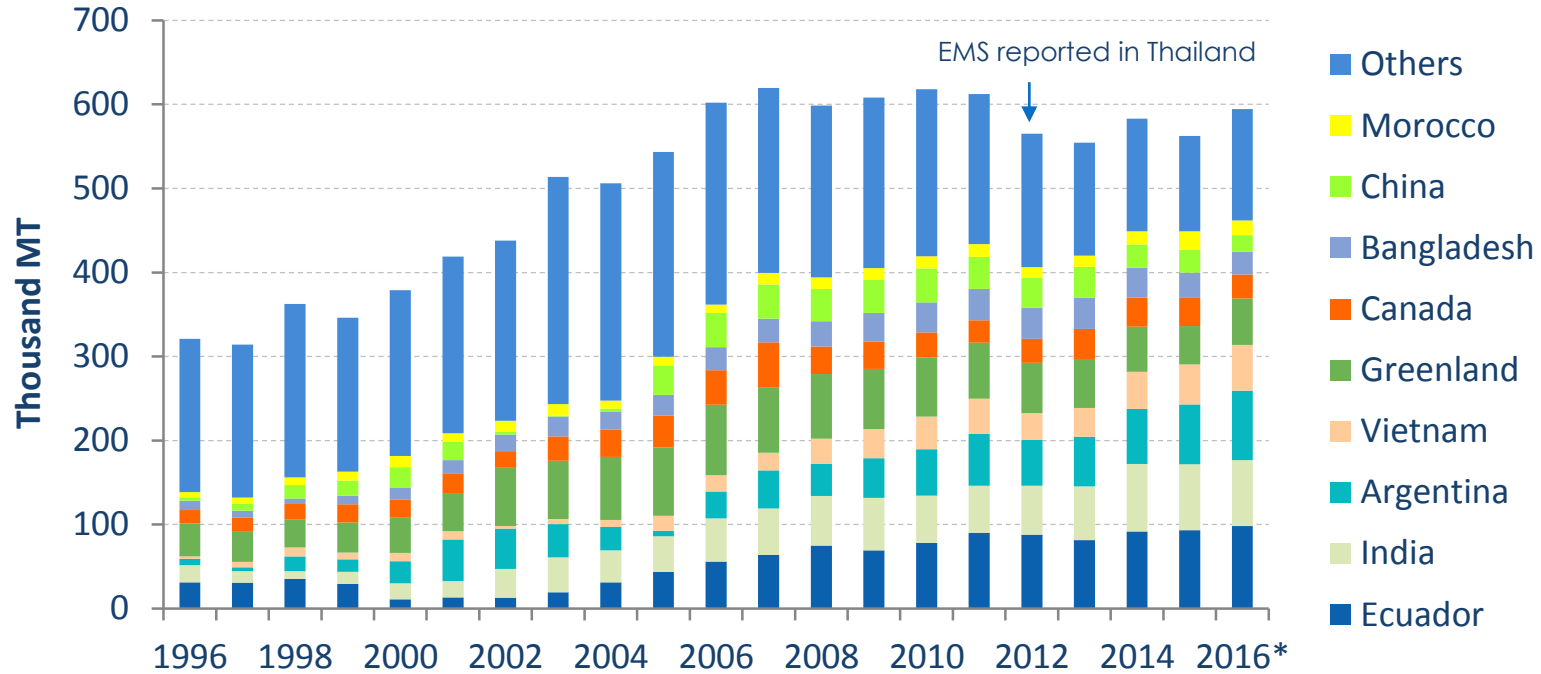


Imports from Thailand declined sharply (by 68%) between 2010 and 2014, recovering slightly in 2015 and 2016.

India and Indonesia have become the top exporters to the U.S. market, accounting for 45% of imports in 2016.

European Shrimp Imports from Extra-EU Countries

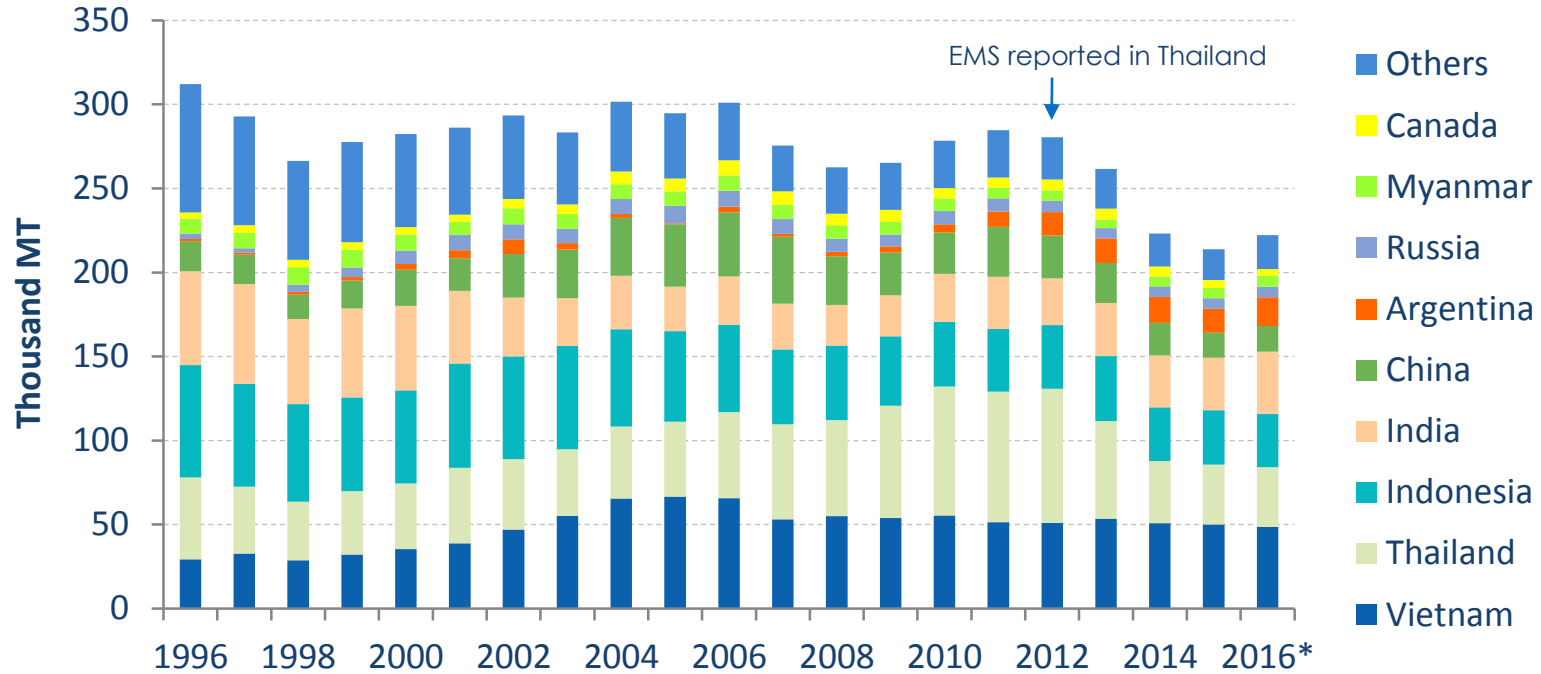
Down 9% between 2011-13, Up 7% between 2013-16



Source: Eurostat (2016).
* Estimate.

Japanese Shrimp Imports

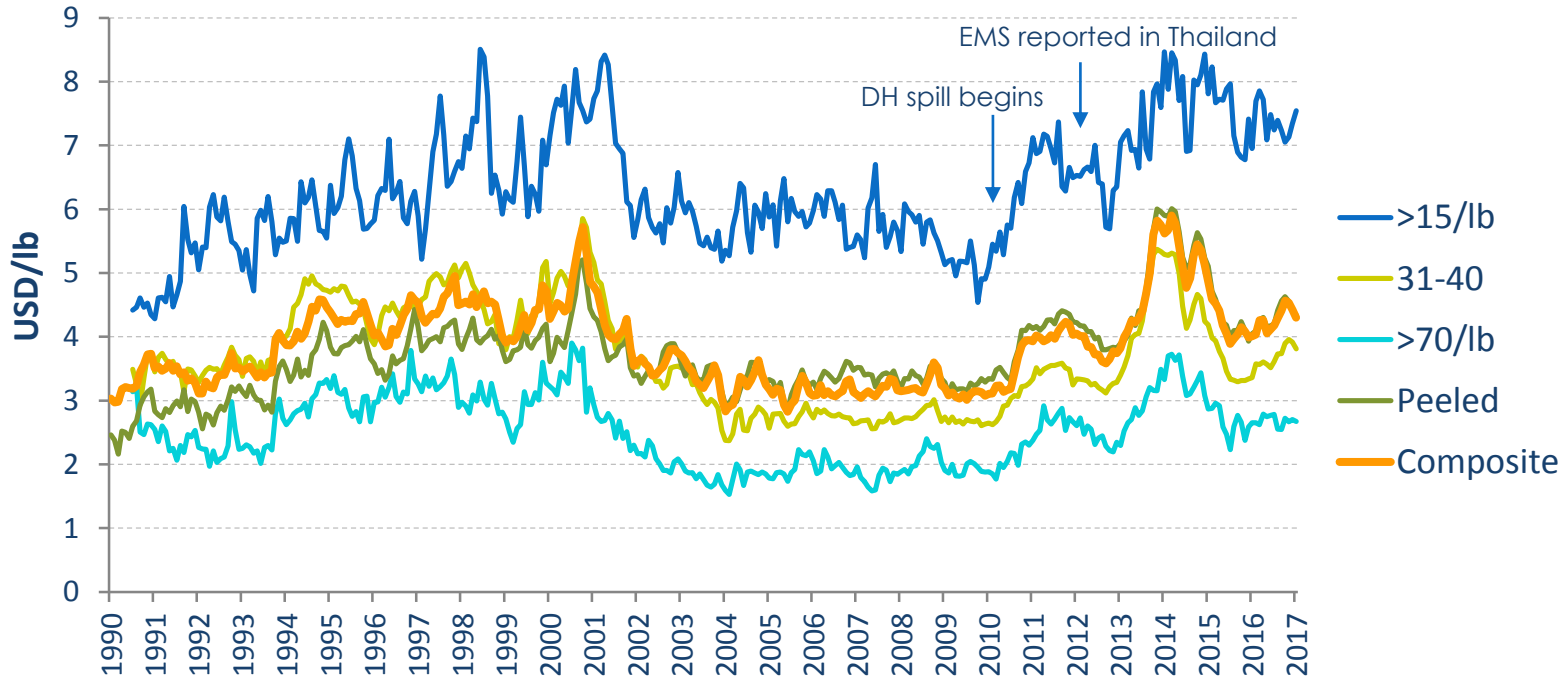
Down 25% between 2011-15, Up 4% in 2016



Source: Japan Customs (2016).

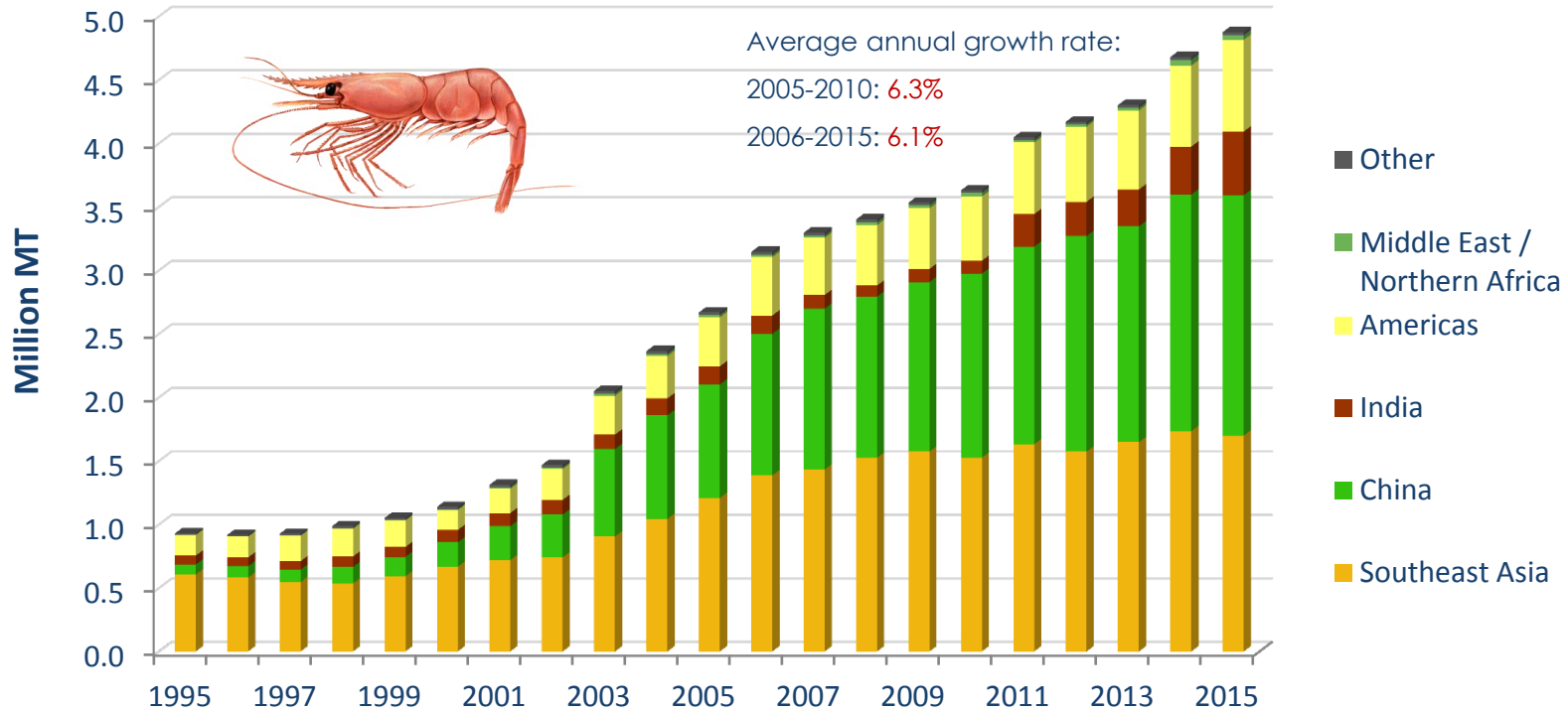
* Estimate.

Impact on Prices: Trends in U.S. Shrimp Import Prices



Source: USDC/NMFS (2017).

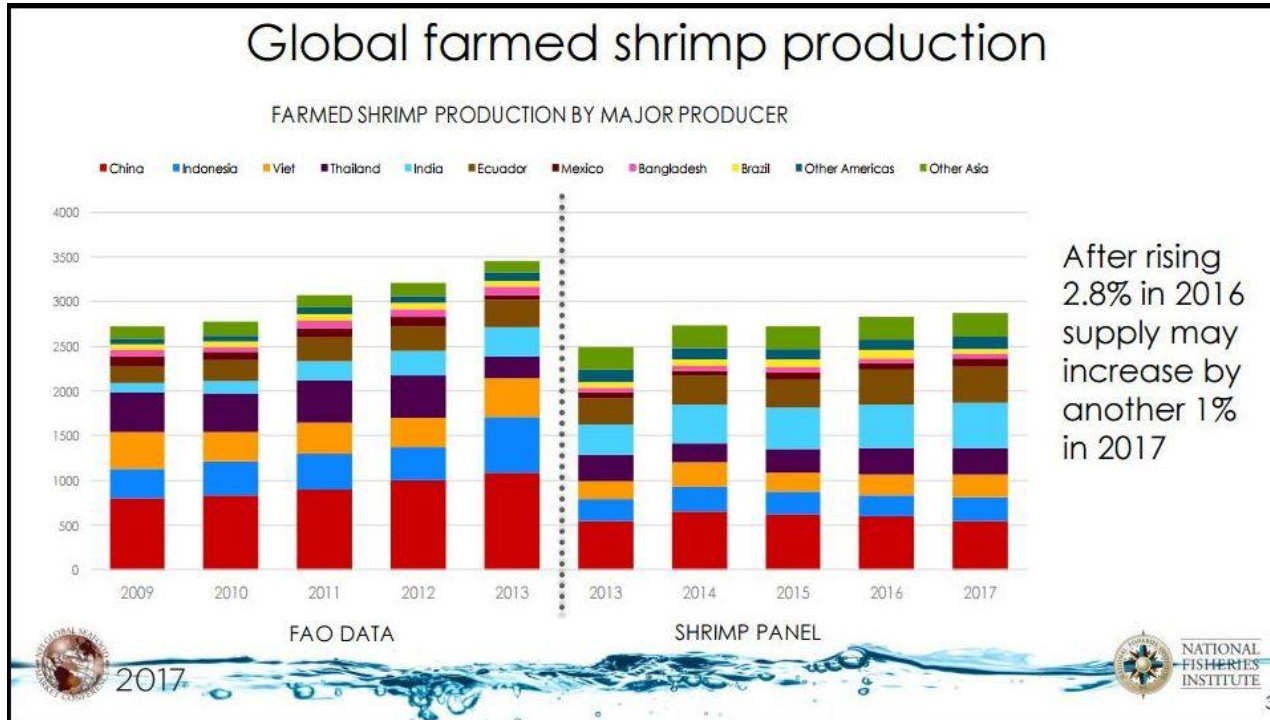
Official FAO Statistics Do Not Reveal any Major, Aggregate Impact of Shrimp Diseases on Global Shrimp Production from 2010 Onwards



Source: FAO (2017).

Disagreement with FAO Statistics

Data from NFI's Global Seafood Market Conference 2017



According to GSMC (2017), global farmed shrimp production **decreased 19%** between 2011 and 2013.

Average annual growth rate between 2013 and 2017 is estimated at **3.6%**.

What was the True Economic Impact of EMS/AHPND?

- FAO data and export statistics reveal a **major impact** of the EMS/AHPND crisis on **Thailand**, but the effect in **China** and **Vietnam** is much less clear.
 - According to FAO, shrimp production in **China** has **increased 31%** between 2010 and 2015.
 - Nevertheless, FAO statistics acknowledge remarkable growth in **India** and **Ecuador**, identified by industry observers as major “**winners**” of the crisis.
 - The two factors above have led **FAO** to report a **33% increase in global production** between 2010 and 2015.
- Estimating the economic impact of EMS/AHPND requires a re-assessment of global production statistics, corroborated to the largest extent possible by export statistics.
 - It is imperative to determine the true growth trajectory of global shrimp aquaculture in order to meet future production expectations.
 - The economic impact of EMS/AHPND also requires an **estimation of gains** accrued to “winners” of the crisis, i.e., India and Ecuador.

The Global Outlook for Aquaculture Leadership (GOAL)

Annual Survey of Shrimp Aquaculture Production

- Starting in 2006, the authors have conducted an analysis of trends in the world shrimp farming industry based on annual surveys commissioned by the Global Aquaculture Alliance (GAA), a trade association.
- Currently, +60 surveys are collected each year.
- Results are presented in the annual Global Outlook for Aquaculture Leadership (GOAL) Conferences, including updated estimates and forecasts of world farmed production.
- Survey respondents are knowledgeable observers of the shrimp farming industry of the country(ies) they provide information about.
- Responses from these surveys can yield valuable insights about the impact of EMS/AHPND in world production.

GOAL SURVEY 2016

Question 1.

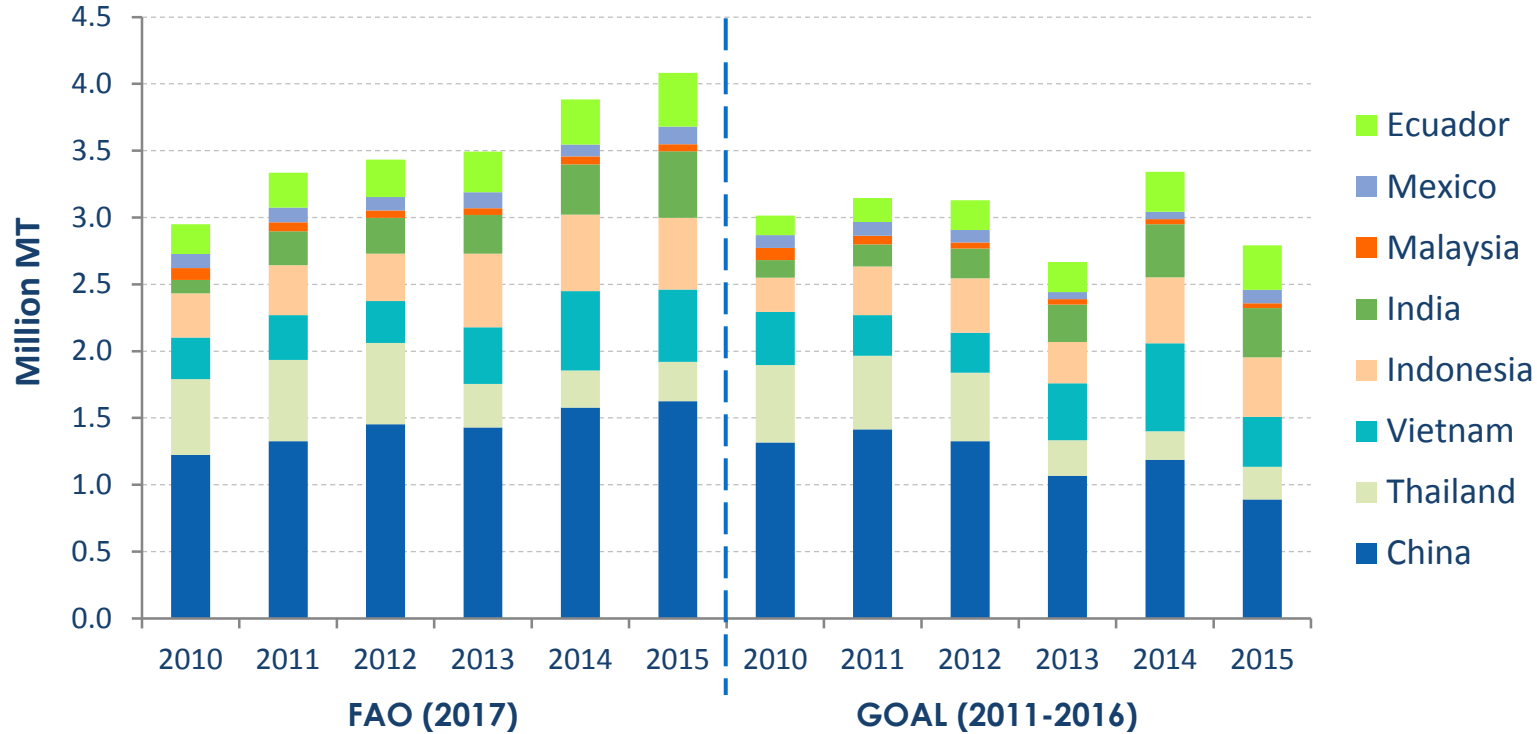
Estimates of Shrimp Aquaculture Production by Species

For the COUNTRY you are most familiar with, please provide your best estimates of shrimp aquaculture production (in metric tons). You may want to refer to the FAO shrimp production estimates found at the end of this survey. Please provide production data per species if at all possible.

COUNTRY (Please specify):				
Species (Please specify) <i>L. vannamei</i> <i>P. monodon</i> Others	Year			
	2015	2016	2017	2018

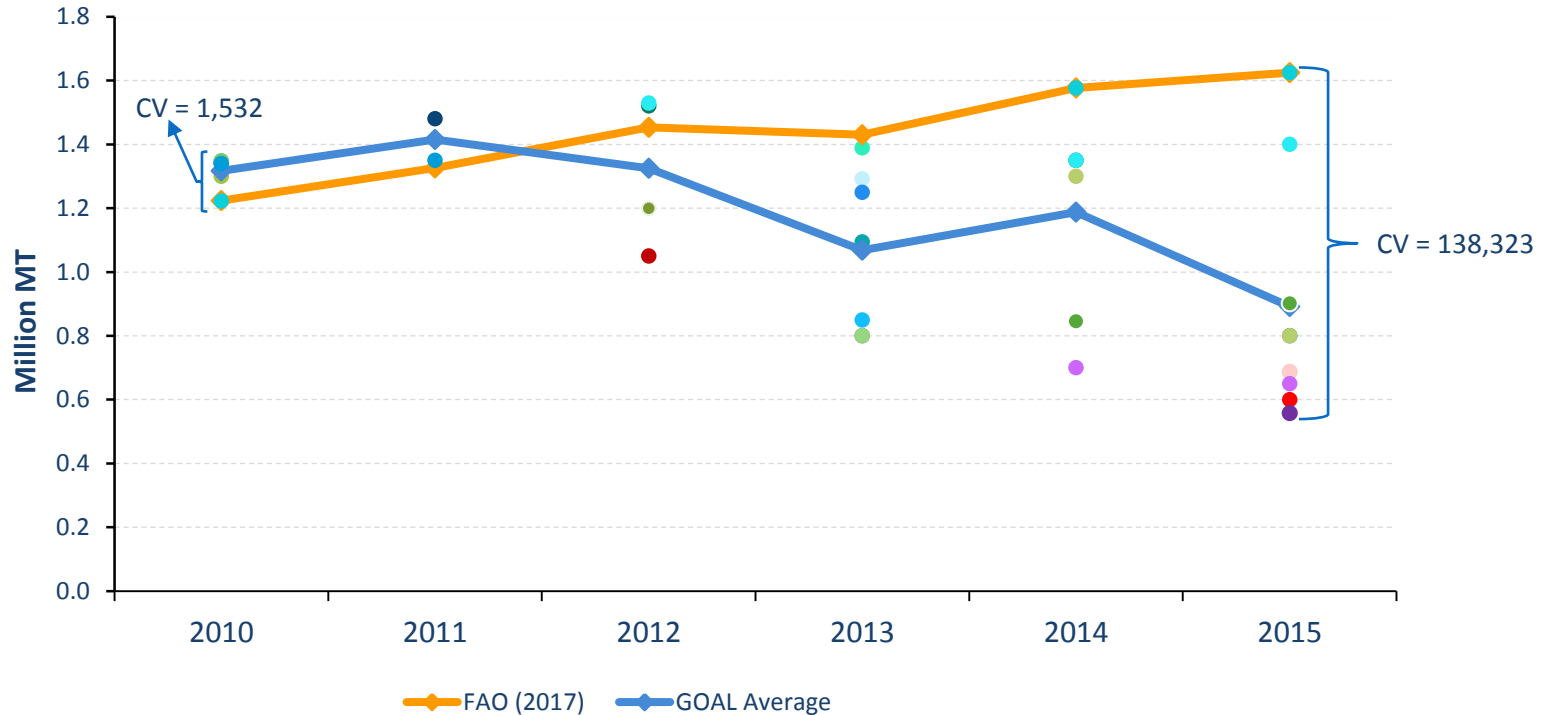
Comparing Production Data for Major Shrimp Farming Nations

FAO (2017) vs. GOAL (2011-2016)



Species included are *Penaeus vannamei* and *P. monodon*, with the exception of China (*P. vannamei* only).

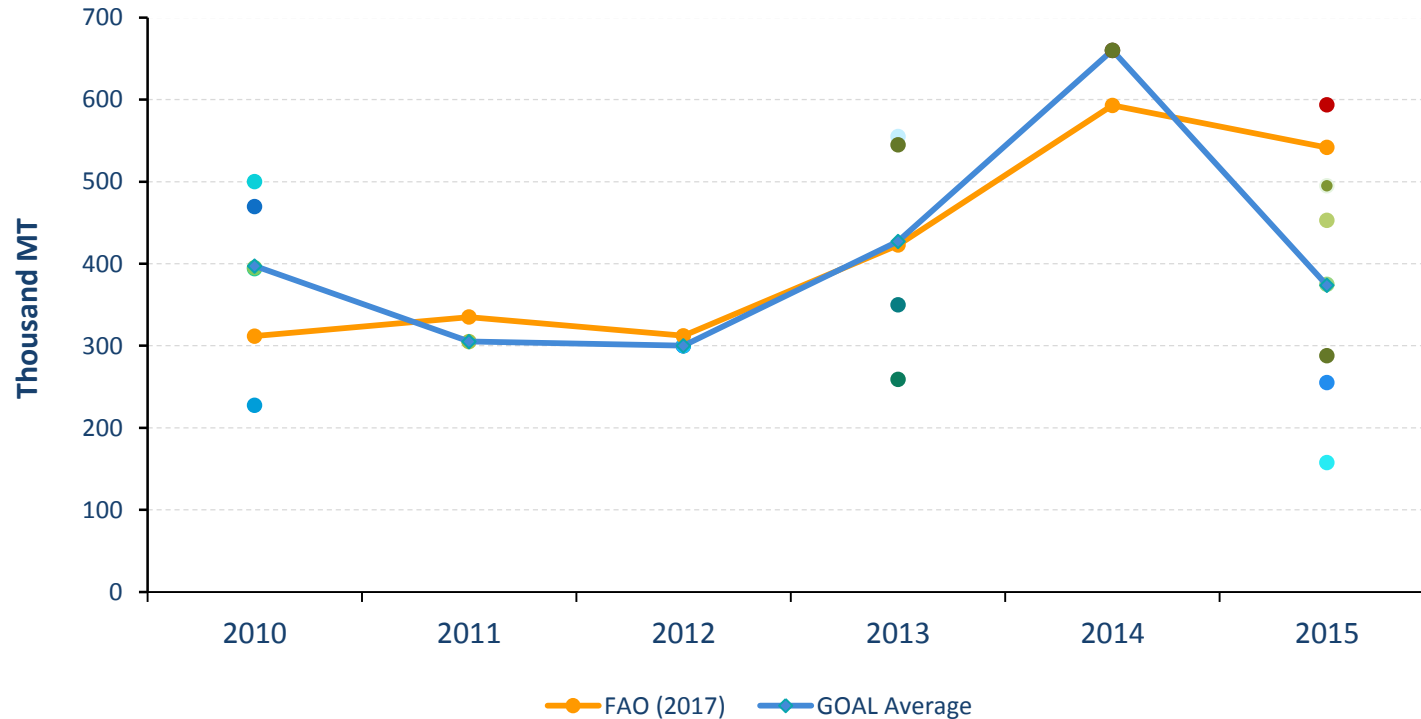
Shrimp Production in China – *Penaeus vannamei*



The close association between FAO and GOAL survey data for China broke down in 2012, coinciding with reported major EMS outbreaks in the country.

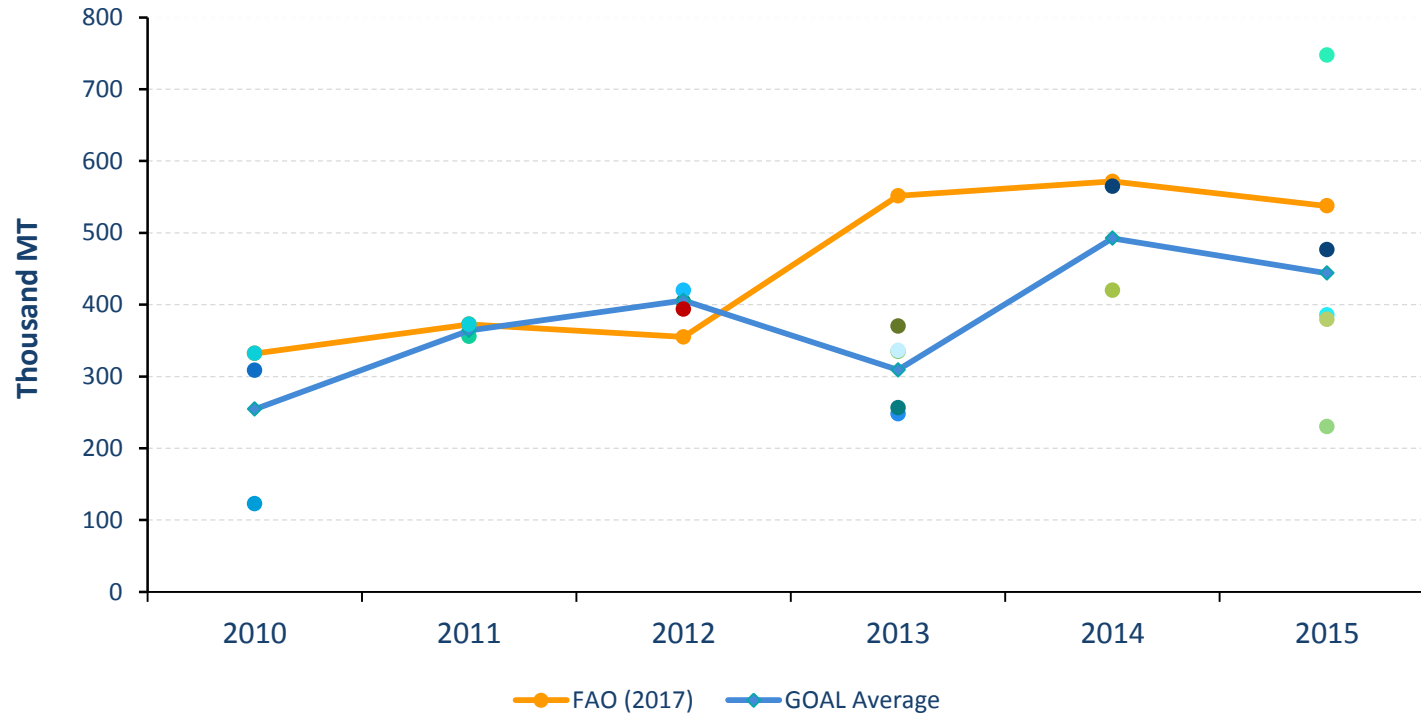
Sources: FAO (2017); GOAL (2011-2016).

Shrimp Production in Vietnam – *P. vannamei* and *P. monodon*



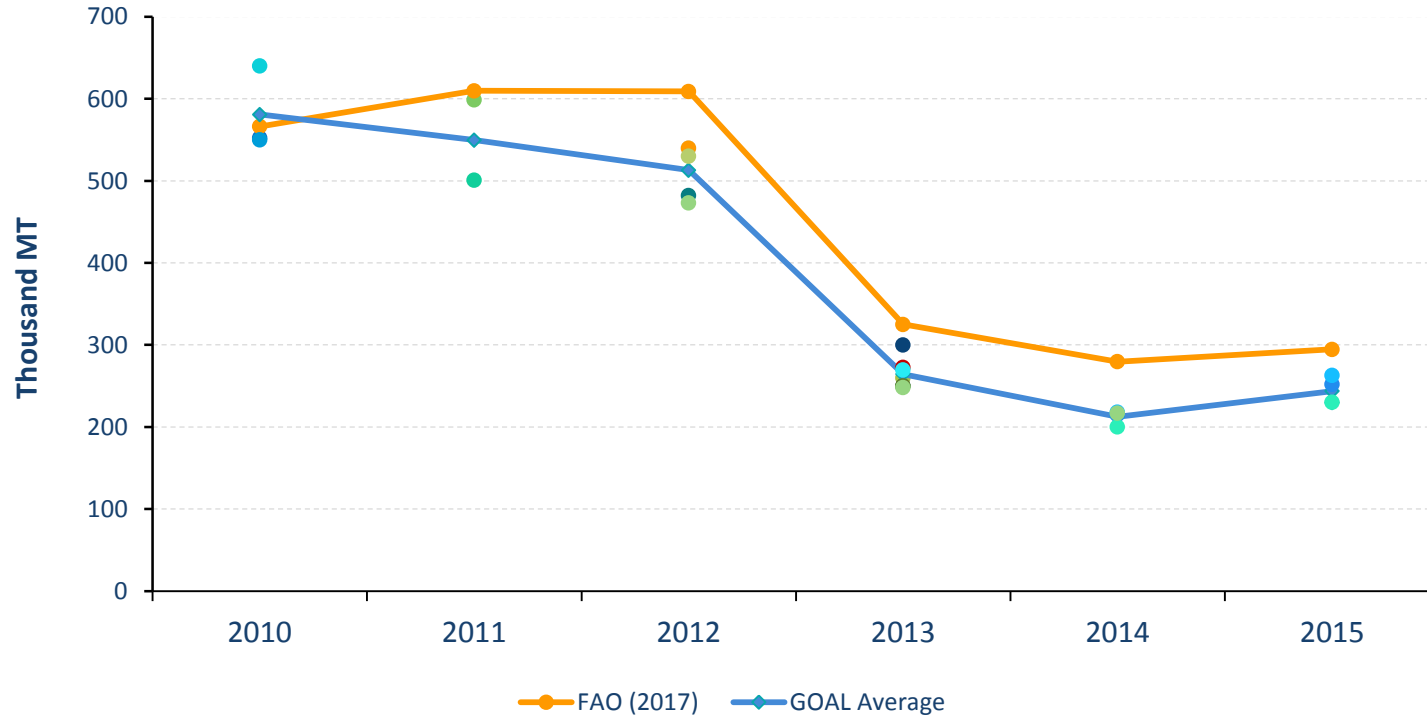
Sources: FAO (2017); GOAL (2011-2017).

Shrimp Production in Indonesia – *P. vannamei* and *P. monodon*



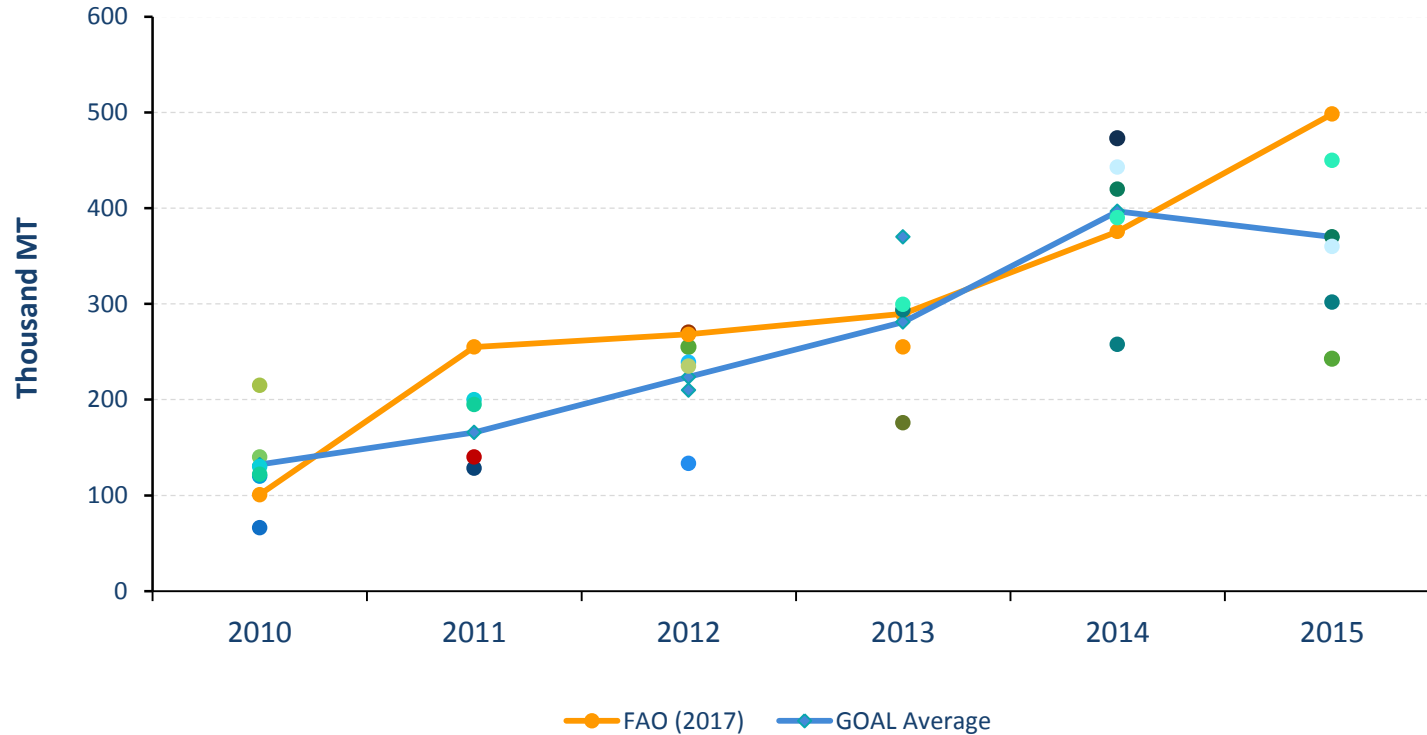
Sources: FAO (2017); GOAL (2011-2017).

Shrimp Production in Thailand – *P. vannamei* and *P. monodon*



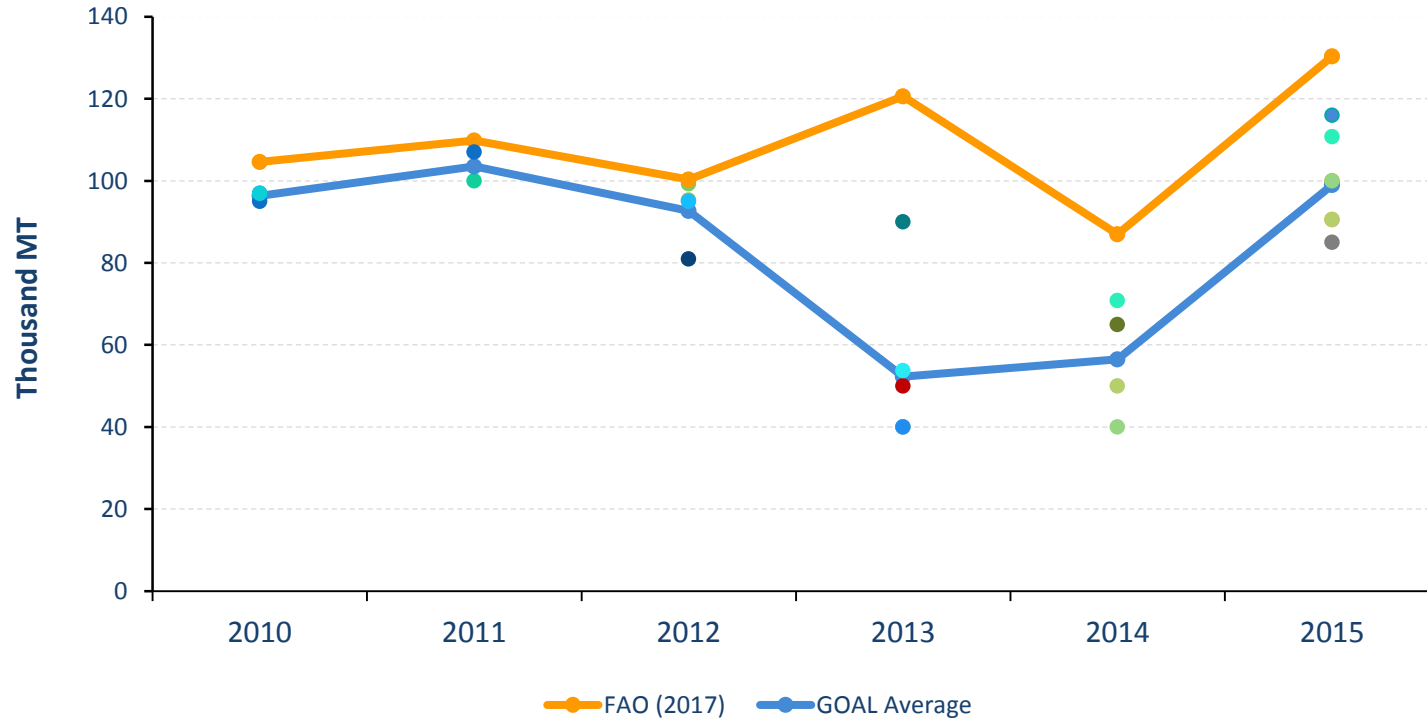
Sources: FAO (2017); GOAL (2011-2017).

Shrimp Production in India – *P. vannamei* and *P. monodon*



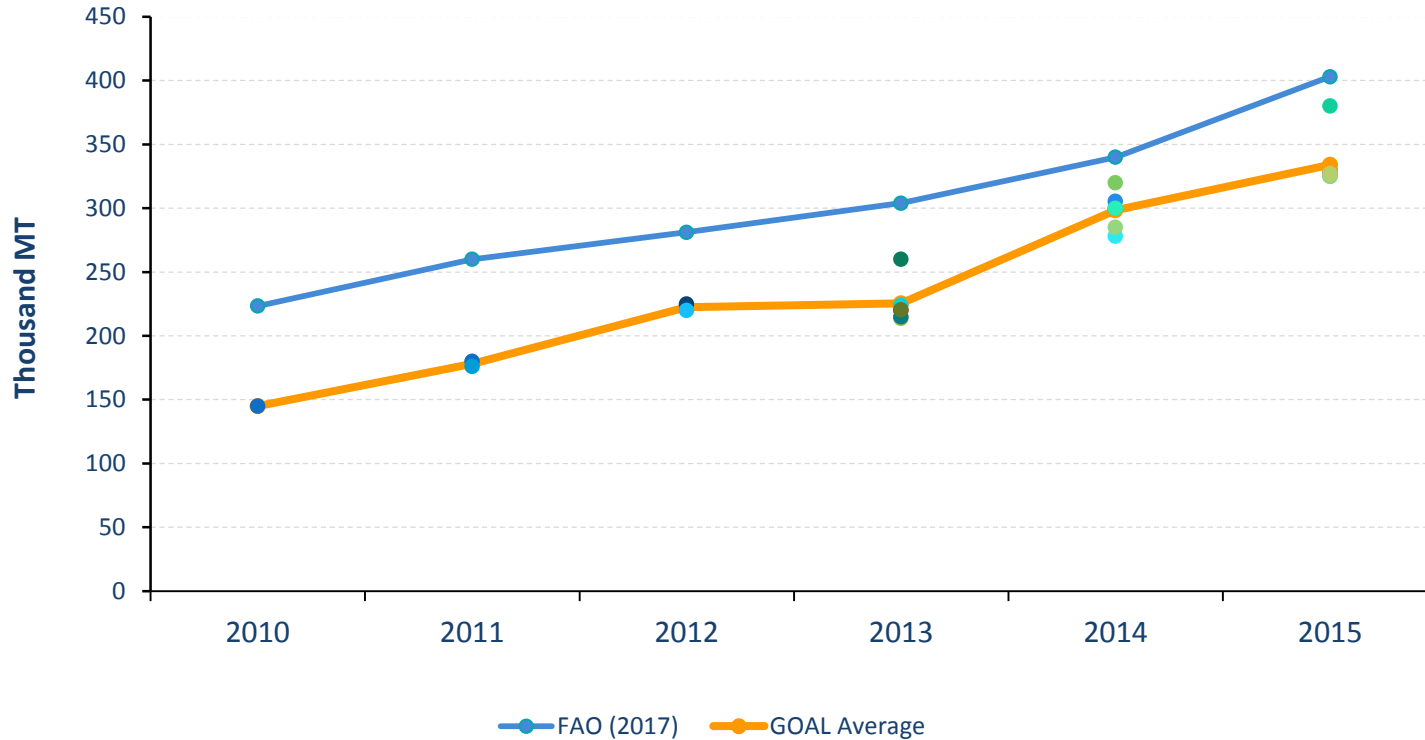
Sources: FAO (2017); GOAL (2011-2017).

Shrimp Production in Mexico – *P. vannamei*



Sources: FAO (2017); GOAL (2011-2017).

Shrimp Production in Ecuador – *P. vannamei*



Sources: FAO (2017); GOAL (2011-2017).

What Does the GOAL Survey Tell Us about the Impact of EMS/AHPND?

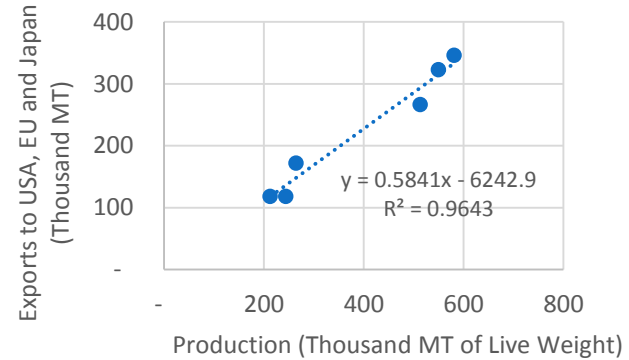
- Although **variability** in responses has increased remarkably over the last five years, the GOAL survey indicates **production of white shrimp (*P. vannamei*) in China has been on the decline** since 2012.
 - The declining trend is at odds with increased production volumes reported by FAO.
 - The high production estimates reported by FAO and government sources is likely the major factor driving increased variability in GOAL survey responses.
- Production estimates from **Vietnam** (reported EMS outbreaks) and **Indonesia** (affected by diseases other than EMS) are also **highly variable**.
 - This variability may also be driven by diverging government and industry estimates of shrimp production.
- Survey responses for **Thailand** and **Ecuador** are much more precise and consistent with FAO data.



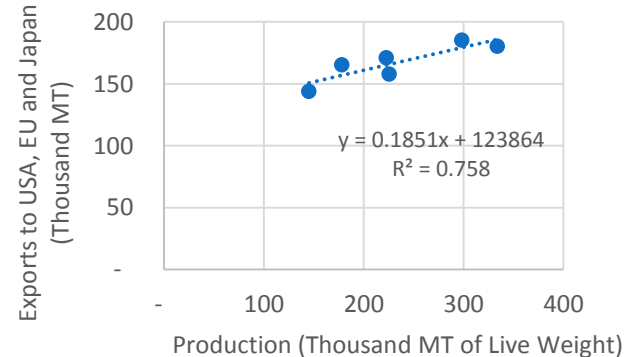
How to Address the Variability in Production Estimates from China, Vietnam and Indonesia?

- Additional sources can be consulted (Globefish, seafood news services, etc.) to complement the FAO and GOAL survey database.
- Production and export data from Thailand and Ecuador can be used to calibrate a **relationship between production** (live weight) and **export data** (product weight).
- This relationship can be used to further refine estimates of production in China, Vietnam and Indonesia.
- In the end, any estimates of the economic impact of EMS/AHPND may **have to rely on two sets of production estimates** (“high” vs. “low” or “government” vs. “industry”) for China, Vietnam and Indonesia.

Thailand

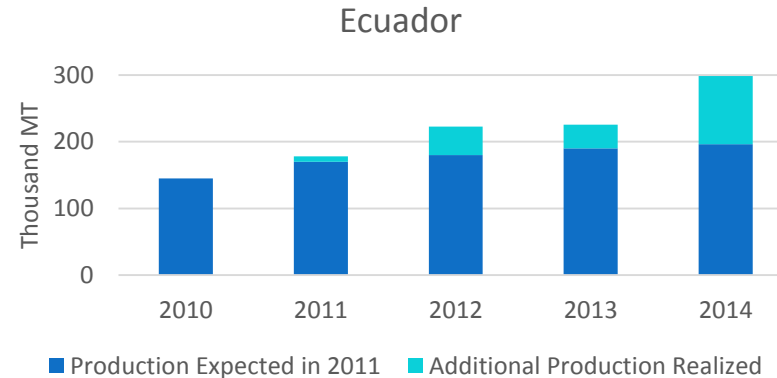
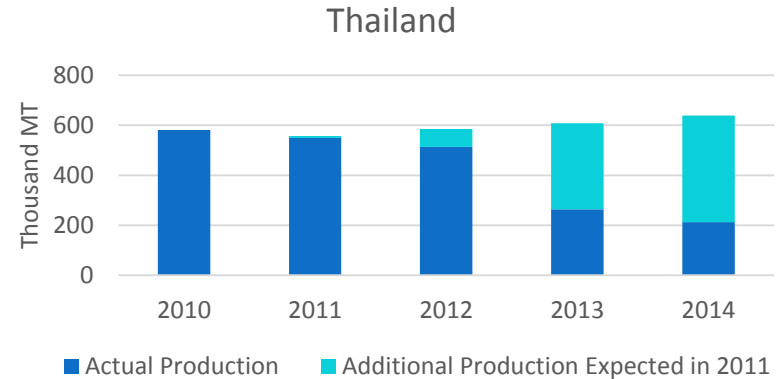


Ecuador



Measuring the Economic Impact of EMS/AHPND

- The Annual GOAL survey also contains valuable information on production expectations.
- Data from the GOAL 2011 conference can be used to estimate “counterfactual” scenarios reflecting expected production and market conditions prior to the onset of EMS/AHPND in 2012.
- Results from the counterfactual scenarios can be compared to actual production and market conditions to estimate the economic impact of EMS/AHPND for each of the major countries involved in the crisis.
 - “Losers”: Thailand, China, Malaysia, Vietnam (?), Mexico.
 - “Winners”: India, Ecuador, Indonesia.

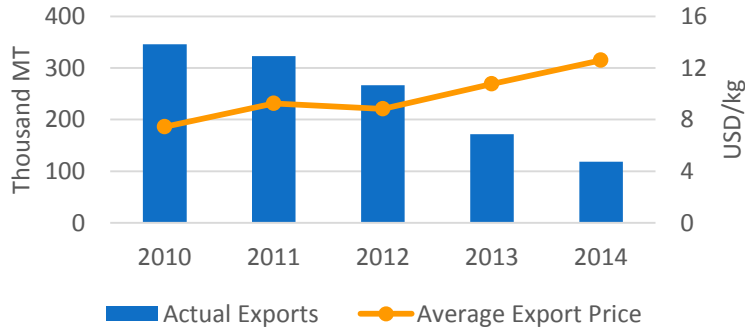


Measuring the Economic Impact of EMS/AHPND

Impact on Exports to USA, EU and Japan

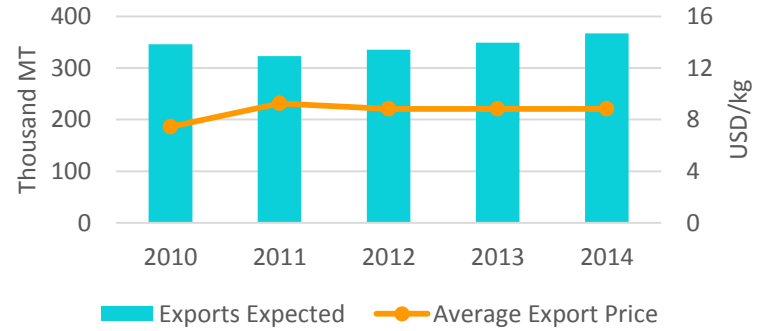
Actual

Thailand



Counterfactual

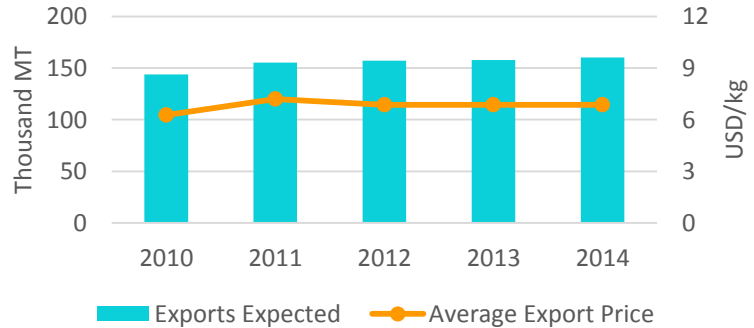
Thailand



Ecuador



Ecuador



A Preliminary Estimation of Export Revenue Gains and Losses (U.S. Billion Dollars) in the U.S., EU and Japanese Markets

	Thailand		
	Actual	Counterfactual	Difference
2010	2.58	2.58	0
2011	2.99	2.99	0
2012	2.34	2.97	-0.61
2013	1.85	3.08	-1.23
2014	1.49	3.24	-1.75
Total			-3.60

	Ecuador		
	Actual	Counterfactual	Difference
2010	0.90	0.90	0
2011	1.19	1.12	0.07
2012	1.17	1.08	0.09
2013	1.39	1.08	0.30
2014	1.80	1.10	0.70
Total			1.17

- Although Thailand's losses exceeds Ecuador's gains, it must be noted that this (very preliminary) analysis excludes **Ecuador's exports to China**, which have been increasing over the last few years.
- The complete analysis will provide an accurate portrayal of the impact of EMS/AHPND in the major farming nations, and an estimate of the **value of investment on improved health management and genetic performance in the industry**.