James Anderson

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Dr. James Anderson leads the World Bank’s Global Program on Fisheries and Aquaculture.
He previously chaired the Department of Environmental & Natural Resource Economics at the University of Rhode Island.
Dr. Anderson was also the editor of *Marine Resource Economics* from 1999 through 2011.
His recent work has focused on the role of seafood in food security, constraints to aquaculture development and seafood market analysis.
FISH 2030 and Shrimp Production Review

James L. Anderson, The World Bank
Diego Valderrama, University of Florida
Mimako Kobayashi, The World Bank
Siwa Msangi, International Food Policy Research Institute
Overview

Fish 2030 – Supply and Demand

Shrimp Production
“Fish to 2030” Modeling Project

- Collaboration: The World Bank, International Food Policy Research Institute (IFPRI), University of Arkansas, and FAO
- Projection of global supply and demand for fish and fish meal & oil using IFPRI’s IMPACT Model
- Capture and aquaculture supply modeled
- Model expanded since “Fish to 2020” Project
  - Country groups: 36 → 115
  - Seafood groups: 4 → 16
How the Model Works

- Calibrated using FAO data for 1984-2009
- Exogenous factors shift supply and demand curves
- In each country, Production + Imports = Consumption + Exports
- Equilibrium is reached when S = D globally
Definition of Regions
## Commodity Groups

<table>
<thead>
<tr>
<th>Consumption Aggregation</th>
<th>Production Aggregation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrimp and Prawns</td>
<td>Shrimp and Prawns</td>
</tr>
<tr>
<td>Other Crustaceans</td>
<td>Other Crustaceans</td>
</tr>
<tr>
<td>Mollusks and other Aquatic Invertebrates and Animals</td>
<td>Mollusks and other Aquatic Invertebrates and Animals</td>
</tr>
<tr>
<td>Salmon, Trout and other Salmonoids</td>
<td>Salmon, Trout and other Salmonoids</td>
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<tr>
<td>Tuna</td>
<td>Tuna</td>
</tr>
<tr>
<td>Freshwater and other Diadromous Fish</td>
<td>Tilapia and other Cichlids</td>
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<td></td>
<td>Pangasius and other Catfish</td>
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<td></td>
<td>Major Carp and Milkfish</td>
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<tr>
<td></td>
<td>Eels and Sturgeon</td>
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<tr>
<td></td>
<td>Silver, Bighead and Grass Carp</td>
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<tr>
<td></td>
<td>Other Freshwater and Diadromous Fish</td>
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<tr>
<td>Demersal Fish</td>
<td>Demersal Fish</td>
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<tr>
<td></td>
<td>Mullet</td>
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<tr>
<td>Other Marine Fish</td>
<td>Other Marine Fish</td>
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<tr>
<td>Other Pelagic Fish</td>
<td>Other Pelagic Fish</td>
</tr>
<tr>
<td></td>
<td>Cobia and Swordfish</td>
</tr>
</tbody>
</table>
Total Fish Production: 1984-2030
Aquaculture Growth

2010 (Data)

• Approx. **41%** of total harvest
• Approx. **49%** of fish for human consumption
• Aquaculture growth 2000-2010 – **79% in 10 yrs**
• Growth in total supply 2000-2010 – **17% in 10 yrs**

2030 (Model)

• Approx. **51%** of total harvest
• Approx. **64%** of fish for human consumption
• Aquaculture growth 2010-2030 – **66% in 20 yrs**
• Growth in total supply 2010-2030 – **28% in 20 yrs**
Aquaculture’s Share in Total Harvest

**2011 (Data)**
- Capture: 90.4
- Aquaculture: 63.6
- Total Harvest: 154.0 Million Tons

**2030 (Model)**
- Capture: 93.4
- Aquaculture: 95.7
- Total Harvest: 189.1 Million Tons
Other Aquaculture Forecasts

- Growing fisheries (0.7% per annum)
- Stagnant fisheries

- Global consumption rises to 22.5 kg/y
- Global consumption remains at 1996 levels (15.6 kg/y)
- Technological advances in aquaculture
- Baseline scenario
- Ecological collapse of fisheries

Source: Hall, S. Blue Frontiers (2011), WorldFish Centre
Supply Growth (Capture + Aquaculture)

- More than 50% increase from 2008 to 2030
  - Tilapia
  - Pangasius
  - Carp
  - Salmon
  - Shrimp

- 20-40% increase from 2010 to 2030
  - Crustaceans
  - Molluscs
  - Other Fresh Fish
  - Other Marine Fish
Sources of Aquaculture Supply Growth By Commodity

- **More than 100% increase 2008 to 2030**
  - Tilapia
  - Shrimp
  - Demersal
  - Other marine Fish

- **50-100% increase 2008 to 2030**
  - Pangasius
  - Carp
  - Crustaceans
  - Molluscs
  - Salmon
  - Tuna
Supply Growth (Capture + Aquaculture) By Region

- **More than 20% increase 2008 to 2030**
  - China
  - Southeast Asia
  - India
  - Other South Asia
  - Latin America
  - Cent./West Asia & North Africa
- **Less than 10% increase 2008 to 2030**
  - Europe
  - North America
  - Sub-Saharan Africa
  - Other Asia & Pacific (Korea, etc.)
  - Japan

![Bar chart showing supply growth by region from 2008 to 2030](chart.png)
Consumption Growth

- More than 50% increase 2006 to 2030
  - China
  - India
  - Other South Asia
  - Cent./West Asia & N. Africa

- Less than 20% increase 2006 to 2030
  - Southeast Asia
  - Sub-Saharan Africa
  - North America
  - Latin America

- Regions with little growth or decline
  - Other Asia & Pacific
  - Europe
  - Japan

![Bar chart showing consumption growth for different regions](chart.png)
Impact of Hypothetical Disease Outbreak

Scenario: Disease outbreak in Asia shrimp aquaculture in 2015

Assumptions:
• production declines by 35% in 2015 relative to the default projection for 2015
• Recovery to the default projection for 2015 takes 5 years
• Subsequently resume the original growth path
Scenario Results: Impacts on Shrimp Production

Projected Total Shrimp Production

- 14.6% drop

By Region – Relative to Default

- Thailand
- Vietnam
- Indonesia
- China
- Other SE Asia
- India
- ROW
- N America
- Other L America
- Ecuador

Global Outlook for Aquaculture Leadership

Bangkok 2012
Long vs. Near Term Forecast

- Projections with IMPACT Model are based on aggregate and historical data
  - Useful for deriving global-level forecast
  - Useful for deriving long-term forecast
  - But limited foresight into country and species specific details

- Next: Complementary information from survey of industry and country experts
GOAL 2012
Shrimp Production Survey
Issues & Challenges
GOAL 2012 Survey
Shrimp Aquaculture Production by World Region:
1992 - 2014

Million MT

- Other
- Africa/MidEast
- Americas
- India/Bangladesh
- China
- Southeast Asia

2006 - 2010
Annual growth rate: 5.0%

2012-2014
Projected annual growth rate: 4.9%

Note: *M. rosenbergii* is not included.

China data include both marine and freshwater production of *P. vannamei*

2006-2010 data are from FAO (2012).


Note: *M. rosenbergii* is not included.
Shrimp Aquaculture by Major Producing Regions:

2006-2010 vs. 2010-2014


Note: M. rosenbergii is not considered.
Shrimp Aquaculture in Asia: 2006 – 2014


Note: *M. rosenbergii* is not included.

China data include both marine and freshwater production of *P. vannamei*

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Shrimp Aquaculture in Asia:
2006-2010 vs. 2010-2014

Note: M. rosenbergii is not considered.
Shrimp Aquaculture in Latin America: 2006 – 2014

Note: *M. rosenbergii* is not included.
Shrimp Aquaculture in Latin America:
2006-2010 vs. 2010-2014

Average Annual Growth Rate

Note: *M. rosenbergii* is not considered.
GOAL 2012 Survey

World Shrimp Aquaculture (including M. rosenbergii) by Species: 1992 - 2014

Percentages indicate the share of *P. vannamei*.

2012-2014 data: GOAL estimates.

Trends in U.S. Shrimp Import Prices

Source: USDC/NMFS (2012)
GOAL 2012 Survey
Shrimp Aquaculture (including *M. rosenbergii*) in Asia by Species: 1992 - 2014

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**Million MT**

- 0.0
- 0.6
- 1.2
- 1.8
- 2.4
- 3.0
- 3.6

- **2011-2014 data:** GOAL estimates.

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Percentages indicate the share of *P. vannamei*.

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World Landings of Wild-Caught Shrimp by Species

Million MT

- Atlantic seabob (Xiphopenaeus kroyeri)
- Common shrimp (Crangon crangon)
- Northern white shrimp (Penaeus setiferus)
- Argentine red shrimp (Pleoticus muelleri)
- Banana prawn (Penaeus merguiensis)
- Fleshy prawn (Penaeus chinensis)
- Giant tiger prawn (Penaeus monodon)
- Southern rough shrimp (Trachipenaeus curvirostris)
- Northern prawn (Pandalus borealis)
- Akiami paste shrimp (Acetes japonicus)

Source: FAO (2012).
Aquaculture accounted for 55% of world shrimp supplies in 2010.

Source: FAO (2012).

Notes: *M. rosenbergii* is not included.
China includes freshwater production of *P. vannamei.*
World Production of Shrimp by Species
Capture Fisheries & Aquaculture Combined

Million MT

*P. vannamei* is the most important species in the world, with virtually all production coming from aquaculture. Percentages indicate the share of *P. vannamei*.

Source: FAO (2012).

Notes: *M. rosenbergii* is not included.
Freshwater production of *P. vannamei* in China is included.
GOAL 2012 Survey
Issues & Challenges in Shrimp Aquaculture
All Countries

Diseases
*Production costs - Feed/Fishmeal
*International market prices
Access to disease-free broodstock
Production costs - Others
Production costs - Fuel
Seed stock quality & availability
Access to Credit
Feed quality and availability
Product quality control
*International trade barriers
Environmental management
Banned chemicals / antibiotic use
Market coordination
Conflicts with other users
Public Relations Management
Infrastructure

Source: GOAL (2012).

Asterisk indicates Top 3 issue in GOAL 2007 Survey

- International market prices
- Diseases
- Production costs - Feed/Fishmeal
- Environmental management
- Access to disease-free broodstock
- Seed stock quality & availability
- International trade barriers
- Production costs - Fuel
- Access to Credit
- Production costs - Others

Source: GOAL (2012).
GOAL 2012 Survey

Issues & Challenges in Shrimp Aquaculture - Asia

Diseases
*Production costs - Feed/Fishmeal
*International market prices
Production costs - Fuel
Access to disease-free broodstock
Seed stock quality & availability
Production costs - Others
Access to Credit
Product quality control
Feed quality and availability
*International trade barriers
Environmental management
Banned chemicals / antibiotic use
Market coordination
Conflicts with other users
Public Relations Management
Infrastructure

Source: GOAL (2012).

Asterisk indicates Top 3 issue in GOAL 2007 Survey
**GOAL 2012 Survey**

**Issues & Challenges in Shrimp Aquaculture**

**Americas**

- *Diseases*
- *Production costs - Feed/Fishmeal*
- Access to Credit
- *International market prices*
- Production costs - Others
- Feed quality and availability
- Access to disease-free broodstock
- Market coordination
- Seed stock quality & availability
- Infrastructure
- Environmental management
- Production costs - Fuel
- Product quality control
- Conflicts with other users
- Public Relations Management
- Banned chemicals / antibiotic use
- International trade barriers

Source: GOAL (2012).

Asterisk indicates Top 3 issue in GOAL 2007 Survey
GOAL 2012 Survey

Top Issues & Challenges in Shrimp Aquaculture

Asia vs. Latin America

Source: GOAL (2012).
Composition of Shrimp Aquaculture Production by Size Categories –
Comparison of Survey Data for Asia

GOAL 2007
GOAL 2008
GOAL 2009
GOAL 2010
GOAL 2011
GOAL 2012

Global Outlook for Aquaculture Leadership
BANGKOK 2012

<table>
<thead>
<tr>
<th>Size Category</th>
<th>Asia</th>
<th>Americas</th>
<th>World</th>
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<tbody>
<tr>
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<td>&gt;70</td>
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<td>Stable/Decrease</td>
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Composition of Shrimp Aquaculture Production by Product Form – Comparison of Survey Data for Asia


- Other Forms: 15%, 11%, 6%, 8%, 3%, 13%
- Breaded: 25%, 22%, 20%, 19%, 18%, 9%
- Cooked: 28%, 35%, 30%, 23%, 28%, 15%
- Peeled: 28%, 35%, 30%, 23%, 28%, 15%
- Green / Head-off: 19%, 19%, 22%, 18%, 22%, 18%
- Green / Head-on: 11%, 6%, 9%, 24%, 17%, 33%
Composition of Shrimp Aquaculture Production by Product Form – Comparison of Survey Data for the Americas
### Expected Trends in Shrimp Aquaculture

**Product Form - GOAL Survey 2012**

<table>
<thead>
<tr>
<th>Product Form</th>
<th>Asia</th>
<th>Americas</th>
<th>World</th>
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<tbody>
<tr>
<td>Green / Head-on</td>
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<td>Stable/Increase</td>
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<td>Green / Head-off</td>
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<td>Increase</td>
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<tr>
<td>Cooked</td>
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<tr>
<td>Breaded</td>
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<tr>
<td>Other Forms</td>
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</table>
GOAL 2012 Survey

Global economic conditions will be better in 2013 compared to 2012

<table>
<thead>
<tr>
<th>Outlook</th>
<th>Asia</th>
<th>Americas</th>
<th>Others</th>
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<tr>
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<td></td>
<td>Ecuador</td>
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<tr>
<td>Agree</td>
<td>Malaysia, Taiwan, Thailand</td>
<td>Brazil, Mexico</td>
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<tr>
<td>Neutral/No Opinion</td>
<td>China, Philippines, South Korea</td>
<td>Colombia, Nicaragua, Peru</td>
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</tr>
<tr>
<td>Disagree</td>
<td>India, Indonesia, Vietnam</td>
<td>Honduras, Panama</td>
<td>Madagascar, New Caledonia</td>
</tr>
<tr>
<td>Strongly Disagree</td>
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**GOAL 2012 Survey**

Feed prices will be lower in 2013 compared to 2012

<table>
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<th>Outlook</th>
<th>Asia</th>
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<th>Others</th>
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<tbody>
<tr>
<td>Strongly Agree</td>
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<tr>
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<td>Madagascar</td>
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<tr>
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<td>India, Thailand, Vietnam</td>
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GOAL 2012 Survey

The global shrimp market will strengthen in 2013 compared to 2012

<table>
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<tr>
<td>Disagree</td>
<td></td>
<td>Brazil, Nicaragua</td>
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<tr>
<td>Strongly Disagree</td>
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If you are interested, please come talk to me during the conference.

Thank You!

What is the Global Partnership for Oceans and why and how should the seafood sector be engaged?