The Future of Aquaculture and Its Role in the Global Food System

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The Problem

Conversation heard in reaction to President Zoellick’s interest in the World Bank investing in productive oceans

Place: Elevator between 5th and 1st floors, World Bank, Washington DC
Time: February 2011

“Why would the Bank invest in oceans. It doesn’t make sense. All the fisheries are already depleted”
“What about aquaculture?”
“Well, it’s not sustainable.”

That sums up the problem
9 Billion by 2050

60%
More Food Needed
(Traditional Agriculture Only)


Source: NIC Report (2013); FAOSTAT; U.S. Census Bureau
Food Production Problem?

30% increase in per capita food supply since 1961...

Food Supply kcal/capita/day

...food production is growing faster than population

Global Nutrition in 2014

Undernourished: 799
Obese: 600
Overweight: 1300
Adequately Nourished: 5166

Source: FAOSTAT, WHO
Demand for Fish and Meat

Will it Continue to Grow?

Per Capita GDP and Per Capita Fish and Meat Consumption (2009)

Source: FAOSTAT, World Bank
Nearly 50% in many African countries
63% in Cambodia
55% in Indonesia
56% in Bangladesh
7% in US
21% in China

China’s per capita consumption of seafood
1981: 5.2 kg/capita/year
2011: 33.1 kg/capita/year

Source: FAO (2016a)
Aquaculture is the fastest growing food sector.

Average annual growth rate (percent), 1990-2011

- Fish: 2.3%
- Capture fisheries: 0.5%
- Aquaculture: 7.8%
- Beef: 0.9%
- Pork: 2.1%
- Poultry: 4.5%
- Cereals: 1.4%

Source: FAOSTAT, FishStat
(Excluding Eggs and Dairy Products)

Source: FAOSTAT, FishStat
What is the role of Capture Fisheries?

Source: FAO FishStat (2013), Fish to 2030 (2013)
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Have Marine Capture Fisheries Reached Their Maximum Potential?

WORLD MARINE CAPTURE HARVEST in 2013: 81 MT
Freshwater Capture (12 MMT in 2013)

Maximum Additional Harvest from Sustainable Marine Capture Fisheries

Sunken Billions Revisited (World Bank/Arnason) & EDF Study (Costello et al):

Max Sustainable Marine Harvest – World at MSY: 100-105 MMT (20% +/-)
Max Incl. Freshwater Capture (12 MMT in 2013) 112-117 MMT

This Requires Major Reforms in Fisheries around the World Especially in Developing Countries...
DIFFICULT

NOTE: Enhancement aquaculture could be used as a lever to encourage change

Sources: Sunken Billions Revisited (Forthcoming); Potential for Global Fish Recovery (Forthcoming) (https://www.edf.org/sites/default/files/content/upside-model-report-summary.pdf) Fish to 2030 (2013); WRI (2015)
Future Production Growth must come from Aquaculture

Sources: FAO FishStat (2013); Fish to 2030 (2013) Sunken Billions Revisited (Forthcoming); Potential for Global Fish Recovery (Forthcoming)
Fish for direct human consumption

Source: FAO FishStat (2013)
Fish to 2030

2030 (Model Projection)

* Aquaculture: approx. 50% of total harvest
* Aquaculture: approx. 62% of fish for direct human consumption
* Aquaculture growth: 62% in 20 years between 2010-2030
* Total fish supply (capture + aquaculture) growth: 24% in 20 years between 2010-2030
Aquaculture Supply Growth (1000 MT)

More than 90% increase 2010-2030

40-90% increase 2010-2030

2030 projection
2020 projection
2007-09 data

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Aquaculture Supply Growth: Regions

* More than 100% increase between 2010-2030
  * India
  * Latin America and Caribbean
  * Southeast Asia

* 50-100% increase between 2010-2030
  * South Asia (excl. India)
  * Middle East and North Africa
  * Sub-Saharan Africa

* Less than 50% increase between 2010-2030
  * Everywhere else
Consumption Growth: Regions

- **More than 50% increase from 2010 to 2030**
  - South Asia (excl. India)

- **30-50% increase from 2010 to 2030**
  - India
  - Southeast Asia
  - North America
  - Middle East and North Africa
  - China
  - Sub-Saharan Africa
    - (per capita down about 20%)

- **Decline from 2010 to 2030**
  - Japan
Key Conclusions from 2030 Study

Expectations for 2030:

1. Aquaculture will produce about 2/3 of food fish
2. China will consume nearly 40% of seafood
3. Production of tilapia, shrimp, will nearly double from 2010 to 2030
4. Largest tonnage gains will be in mollusks, carps
5. Aquaculture will grow fastest in India, Latin America, and Southeast Asia
With all this growth what is happening in the US market?
Per Capita Red Meat, Poultry, and Fish and Shellfish Consumption

Source: USDA (2015)
# U.S. Per Capita Seafood Consumption: More Aquaculture - Fewer Species

## 1987

<table>
<thead>
<tr>
<th>Fish</th>
<th>Per Capita Consumption (lbs/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuna</td>
<td>3.51</td>
</tr>
<tr>
<td>Shrimp</td>
<td>2.29</td>
</tr>
<tr>
<td>Cod</td>
<td>1.68</td>
</tr>
<tr>
<td>Pollock</td>
<td>0.88</td>
</tr>
<tr>
<td>Flatfish</td>
<td>0.73</td>
</tr>
<tr>
<td>Clams</td>
<td>0.66</td>
</tr>
<tr>
<td>Catfish</td>
<td>0.60</td>
</tr>
<tr>
<td>Salmon</td>
<td>0.44</td>
</tr>
<tr>
<td>Crab</td>
<td>0.33</td>
</tr>
<tr>
<td>Scallops</td>
<td>0.33</td>
</tr>
<tr>
<td>Other</td>
<td>4.76</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16.21</strong></td>
</tr>
</tbody>
</table>

## 2014

<table>
<thead>
<tr>
<th>Fish</th>
<th>Per Capita Consumption (lbs/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrimp</td>
<td>4</td>
</tr>
<tr>
<td>Salmon</td>
<td>2.31</td>
</tr>
<tr>
<td>Canned tuna</td>
<td>2.3</td>
</tr>
<tr>
<td>Tilapia</td>
<td>1.44</td>
</tr>
<tr>
<td>Pangasius &amp; Catfish</td>
<td>1.21</td>
</tr>
<tr>
<td>Pollock</td>
<td>0.98</td>
</tr>
<tr>
<td>Cod</td>
<td>0.66</td>
</tr>
<tr>
<td>Crab</td>
<td>0.51</td>
</tr>
<tr>
<td>Clams</td>
<td>0.34</td>
</tr>
<tr>
<td>Others</td>
<td>0.86</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14.6</strong></td>
</tr>
</tbody>
</table>

## % Change

- **74%** for Shrimp
- **423%** for Salmon
- **-34%** for Pollock
- **>1000%** for Canned tuna
- **202%** for Tilapia
- **11%** for Pangasius & Catfish
- **-61%** for Cod
- **54%** for Crab
- **-48%** for Clams
- **-82%** for Others
- **-10%** for Total

Source: NFI (1990, 2015)
Growing Market Share and Product Innovation

* Consistently Available
* Consistent Quality
* Stable or Declining Cost
* Meet Consumer Demands
Reframe Aquaculture

• Compare with Other Animal Proteins
• Footprint – Environment
• Efficient Resource Use
• Low Waste
• Cost/Value
• Nutrition
• Traceability
• Reliable and Consistent

Feed Conversion Ratio

Figure 35 | The aquaculture industry has reduced the share of fishmeal in farmed fish diets (percent)

Note: Fishmeal use varies within and between countries; the figures presented are global means. Data represent observations between 1995-2008, and projections for 2009-2020.


Source: World Resources Report: Creating a Sustainable Food Future (WRI 2014)
Water Use Efficiency

Nutrient Emissions

Source: Flachowsky (2002); Hall, Delaporte, Phillips, Beveridge, and O'keefe (2011)
Waste in the U.S. Seafood Production System

Source: Love et al. (2015)
Long Term Commodity Price Trends
Long Term Price Trends

Sources: USDA, Urner Barry (2016), NMFS

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Fresh Tilapia Import Monthly Price Rate of Change (1992 - 2015)

Price volatility less than pork

Price Volatility More Than Pork

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Rate of Change in Import Price of Fresh Atlantic Salmon

Price Volatility
More than Pork
Aquaculture

The Big Risk.....DISEASE
...ISA salmon... EMS shrimp

NEED TO INVEST MORE HERE
Better Farm Management
Zonal Management
Biosecurity
Algae and Seaweed

28% of Aquaculture Volume – 96% in Asia

- Quality Protein Source
  - High Omega 3 content
- Pollution remediation
- Carbon Sequestration
- Biofuel production
- Extremely land and fresh water requirements
With all this growth what is happening with the US supply?
Moving Forward

- Manage Disease – Biggest risk
- Improve feeds
- Reduce waste and improve efficiency
- Eliminate fraud and lack of transparency – Trust is essential
- Challenge the bureaucracy
- Improve the relationship with environmental community and traditional fisheries
- Learn more about China: #1 importer & #1 exporter
- Algae
Conclusion

- Aquaculture will continue to grow because fisheries cannot meet market demands
- Aquaculture will continue to dominate and lead the seafood industry
- If fisheries and aquaculture governance is poor – consumers in developing countries will be worse off
- Low cost and reliable producers will usually win in a free trade world
Thank You

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Photo: J.L. Anderson