Market Stability: Why Tilapia Supply and Demand have Avoided the Boom and Bust of other Commodities

Kevin Fitzsimmons, Ph.D.
University of Arizona, Professor of Environmental Science
World Aquaculture Society, Past-President
Aquaculture without Frontiers, Past-Chairman
American Tilapia Alliance, Sec. Tres.

INFOFISH, TILAPIA 2015
Kuala Lumpur
2 April 2015
Tilapia: continuing to increase in popularity globally

- Tilapias are second only to the carps as a farmed food fish.
- In 2012 the global volume of farmed fish exceeded global volume of beef for the first time (FAO)
- Tilapia have unique characteristics that will facilitate its continued growth to someday surpass carp production.
- Several closely related species that hybridize
Nile Tilapia
Mossambique Tilapia and Red Tilapia
Tilapia the “Green” farmed fish

- Herbivore / omnivore, low trophic level feeder
- Algae, bacteria, and detritus (bioflocs) are important food sources
- Prepared feeds are mostly grains and ag by-products
- Promoted by aid agencies and NGO’s
- *Dr. M. Gupta awarded World Food Prize for promotion of tilapia aquaculture, June 10, 2005*
- Disease resistant and tolerant of poor water quality. Anti-biotics and chemicals are not needed for commercial farming.
Farmed around the world
diversifying supply

- Tilapia production in 140+ countries.
- China is world’s largest producer.
- Egypt, Philippines, Thailand, Indonesia, Latin America, Middle East, Ghana are significant producers
- Germany, Belgium, Spain, Canada, Korea, Japan, most states in US
Global production of some major farmed fishes

Tilapia
Catfish
Salmon

Metric tons per year

World Tilapia Production of 4,850,000 mt in 2014
2008 Tilapia exports from China

Sales volume = 224,359 mt

- US: 54%
- Mexico: 16%
- SubSahara Africa: 10%
- Russia: 8%
- EU: 5%
- Others: 7%

Sales volume = 224,359 mt
2012 Tilapia exports from China

Sales

US 56%
EU 6%
Others 20%
Russia 6%
Sub-Saharan Africa 2%
Mexico 10%
Farm gate price for 700 g tilapia in China

9.1 RMB = $1.53 /kg
Global production of tilapia

- Aquaculture
- Fishery

Metric tons

US Tilapia consumption (imports and domestic)

- 453,264 mt of live weight (equivalent) – 2008
- 465,953 mt of live weight (equivalent – 2009)
- 579,443 mt of live weight (equivalent – 2010)
- 513,361 mt of live weight (equivalent – 2011)
- 613,406 mt of live weight (equivalent – 2012)
- 660,762 mt of live weight (equivalent – 2013)

Value of Tilapia product forms imported to the U.S.
US Sales of tilapia

• Imports to US in 2013 were $1,034,501,000
• US production of about 30,000,000 lbs at farm
• 2013 US tilapia farm-gate sales were about $88,000,000
• 2013 US Tilapia Sales estimate –
  • $1,034,501,000 + $88,000,000 = $1,122,501,000
Selective breeding and genetic improvements

- Excellent breeding programs
  - G.I.F.T. - Malaysia
  - Acuaplan - Mexico
  - Genomar - Brasil and Norway
  - Chitralada – Thailand
  - TabTim – Thailand (CP Group)
  - GIFT Excell – Philippines
  - Molobicus - Philippines
  - GIFT Bangladesh

- Several in Israel

- YY Supermale - Philippines and Swansea, Egypt and Indonesia
Tilapia Genome Project

- March 2011 - First assembly of the tilapia genome
- *Oreochromis niloticus* – Nile Tilapia
- Matching many segments to those known from other fish
- Publically available and freely accessible
- Next frontier of genetic program for tilapia
Tilapia Genome Project

The 3000 species of cichlid fish, which includes tilapia, are found in a variety of habitats in Central and South America, Africa, and India. From an evolutionary point of view, the most interesting cichlid species are the 1500 species that recently diverged in the lakes of East Africa. Remarkably, the cichlids of Lake Tanganyika have diverged into 250 species in the past 6-8 million years, and the 500 Lake Victoria species and the 700 Lake Malawi species diverged in only the past 1 million years. For the scientific community, these species provide a natural mutant screen superior to any chemical mutagenesis. The cichlids are especially diverse in tissues and systems such as the endocrine and nervous systems that are related to the neural crest, a vertebrate-specific developmental germ layer. Cichlids are also valuable model organisms for the study of sex determination evolution, speciation and behavior. The combination of a sequenced tilapia genome and the wide variety of recently evolved cichlid behaviors and morphological traits will provide a unique opportunity to study social dominance, territoriality, sexual selection, and feeding behaviors, as well as a wide variety of neural crest derived traits.

The Broad Institute has generated a high quality draft from a Nile tilapia, Oreochromis niloticus. The Nile tilapia is 10-15 million years diverged from the East African lake cichlids, and provides a good outgroup for the
The YY male technology

- Combines hormonal feminization and progeny testing
- Breeding programme produces novel YY males
- YY males sire only male (XY) progeny in crosses with XX females
- All male progeny (actually ≥ 95% male) are known as genetically male tilapia (GMT®)
The YY male technology

**Then**

Normal crosses produce equal proportion of males and females

**Now**

YY males produce only male progeny

(GMT®)
Selective breeding and genetic improvements

- Excellent breeding programs
  - G.I.F.T. - Malaysia
  - Genomar - Brazil and Norway
  - Chitralada – Thailand
  - TabTim – Thailand (CP Group)
  - GIFT Excell – Philippines
  - Molobicus - Philippines
  - GIFT Bangladesh

- Several in Mexico

- YY Supermale - Philippines and Swansea, Egypt and Indonesia
Regions of rapid production growth

- Vietnam – conversion of catfish cages to tilapia in Mekong, and culture in all regions
- Indonesia – cage culture, polycultures, rice culture
- Malaysia – government support and private sector investment
- Bangladesh – government support and private sector investment
- Brasil – lots of available water, labor, land, feed
- Thailand – better reporting, shrimp polyculture
- Mexico – continued intensification, some govt support, large and small private investments
- Sub-Saharan Africa - commercialization
Grows well in most production systems

- Ponds
- Cages
- Raceways, round tanks, recirculating systems
- Ranching (lake releases)
- Freshwater, Brackish water, Estuarine, and Marine
Grows well in most production systems

- Polyculture with shrimp, catfish, carp
- Herbivorous and/or omnivorous
- Good growth in fertilized ponds
- Many agricultural by-products can be used in tilapia feeds or to fertilize ponds
Intensive ponds

Ponds in Brazil

Ponds in Costa Rica
Multiple small cages

Taal Lake, Philippines, 2007

Irrigation Reservoir, Arizona

Taal Lake, Philippines, 2009

Paulo Afonso Reservoir, Brasil
Small cage farms

Nile Delta, Egypt

Lake Kenyir, Malaysia

Guilin, China

All tilapia farms have dogs, even cage farms
Large cage farms
Mexico

- 4,623 licensed tilapia farms out of 9,230 total aquaculture licenses in all of Mexico
- 20,000 ton Dos Lagos farm in Chiapas
- Second farm now started, also by Regal Springs
- 2013 sales of 1,343,000,000 pesos ($103,000,000 US)
Nepal

- Live tilapia sales
- Farmed in south near Indian border, sold in Kathmandu and Pokhara
Tilapia and citrus in Hainan, China
Tropical Inland Integrated System

- Tilapia → oil palm, rice, sugar cane

Mexico

Costa Rica

Guyana
Tilapia - shrimp polyculture
Pathways in the use of tilapia as biomanipulator (and disease control?) in shrimp farms for Vibrios and EMS

- Promotion of *Chlorella* dominance
- Feeding on organic waste
- Bioturbation of sediment
- Production of natural antimicrobials

- IMPROVED SEDIMENT QUALITY
- IMPROVED WATER QUALITY
- SUPPRESSION OF GROWTH OF *V. harveyi* and *V. parahaemolyticus*?
### Stocking and harvest schedule

<table>
<thead>
<tr>
<th></th>
<th>JANUARY</th>
<th>FEBRUARI</th>
<th>MARET</th>
<th>APRIL</th>
<th>MEI</th>
<th>JUNI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Panen udang (1)</td>
<td>Tebar udang (1)</td>
<td>Panen udang (1)</td>
<td>Tebar udang (1)</td>
<td>Panen udang (1)</td>
<td>Tebar udang (1)</td>
</tr>
<tr>
<td>IKAN (4 BULAN)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>JULI</th>
<th>AGUSTUS</th>
<th>SEPTEMBER</th>
<th>OKTOBER</th>
<th>NOVEMBER</th>
<th>DESEMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Panen udang (2)</td>
<td>Tebar udang (2)</td>
<td>Panen udang (2)</td>
<td>Tebar udang (2)</td>
<td>Panen udang (2)</td>
<td>Tebar udang (2)</td>
</tr>
<tr>
<td>UDANG (8 BULAN)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Tilapia production in Ecuador and shrimp viral infections

TILAPIA PRODUCTION IN ECUADOR

Year
Production (mt)


IHHN

Taura

White Spot
Improvements in packaging
Traditional product forms

Yangon BBQ tilapia
Tilapia (June 2007, Tesco, UK)

$18 US per kg whole fish!!!!
Byproducts - Tilapia Leather
Tilapia skin furniture from Brazil
Tilapia scales for flowers and skins for shoes
Tilapia pedicures and manicures
Health and Beauty Products
Global Tilapia Market Trends

Prices have been constant, only fresh fillets have increased significantly, will not see increases beyond inflation

![Graph showing market trends for different types of tilapia fillets from 1992 to 2014. The graph includes lines for fresh fillet, frozen fillet, whole frozen, and live tilapia. Each line is color-coded for easy distinction. The y-axis represents price in $/kg, and the x-axis represents the years from 1992 to 2014. The graph visually demonstrates the trends and price changes over time.]
Global Aquaculture Tilapia Sales

- For year 2000 = US $ 1,615,321,000
  (FAO FishStat 2007)

- 2005 sales = $ 2,457,312,000
  (FAO FishStat 2007)

- 2010 sales = $ 5,680,410,000
  (FAO FishStat 2012)

- 2012 sales = $ 7,656,257,000
  (FAO FishStat 2014)

- 2014 sales > $ 10,000,000,000
Future global tilapia aquaculture
ISTA 11

Surabaya, Indonesia

In conjunction with WAS Asia-Pacific Chapter

Regal Springs, Surya University, Matahari Sakti Feeds, AquaFish Innovation Lab, WorldFish, and Aquaculture without Frontiers

26-29 April 2016
Current Global Market Trends

- Increase in demand for all forms of tilapia
- Demand increase will be greatest for frozen fillets
- Demand increase will be significant for fresh fillets
- High profit margin for prepared meals assembled and packaged in developing countries
Conclusions

- Tilapia has long been called the aquatic chicken.
- Instead......

- The “terrestrial tilapia”
Conclusions

• Global tilapia production was 4,507,002 metric tons in 2012 (FAO, 2014), should exceed 4,800,000 MT in 2014. (6% growth)

• Constantly improving farming, processing and packaging for food safety, quality assurance, traceability, and environmental safeguards (with little, if any, increase in price).

• Other aquaculture species will follow the tilapia model.
Conclusions

• Global tilapia production was 4,507,002 metric tons in 2012 (FAO, 2014), should exceed 4,850,000 MT in 2014 and 5,000,000 in 2015. (6% growth)

• Constantly improving farming, processing and packaging for food safety, quality assurance, traceability, and environmental safeguards (with little, if any, increase in price).

• Other aquaculture species will follow the tilapia model.
Buy TILAPIA

Thank you

Questions?