TILAPIA CULTURE IN MAINLAND CHINA

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INTRODUCTION

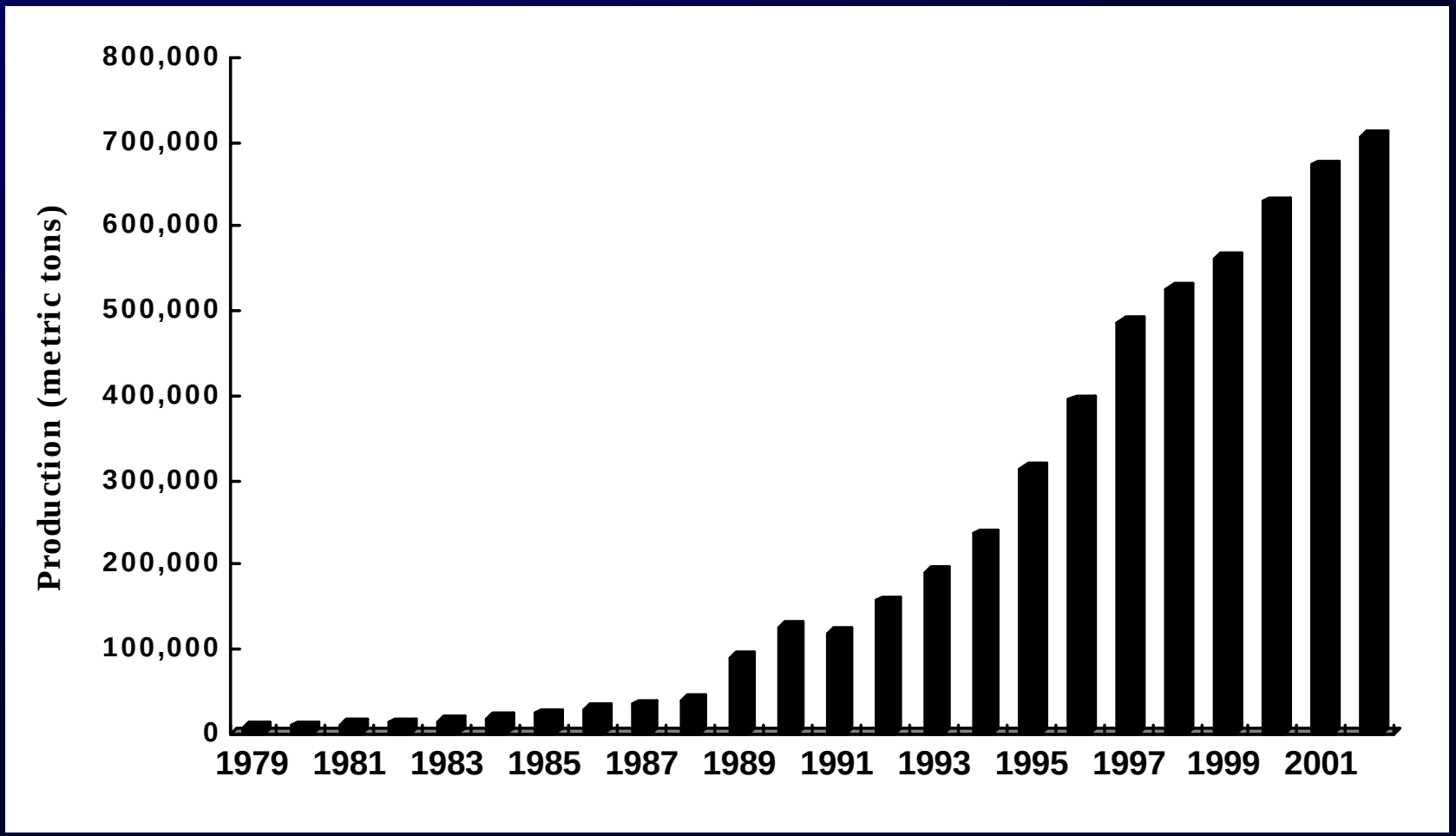
Tilapia culture in mainland China

- Started in early 1960s.
- Not successful, due to many reasons.
- Have expanded rapidly since early 1980s

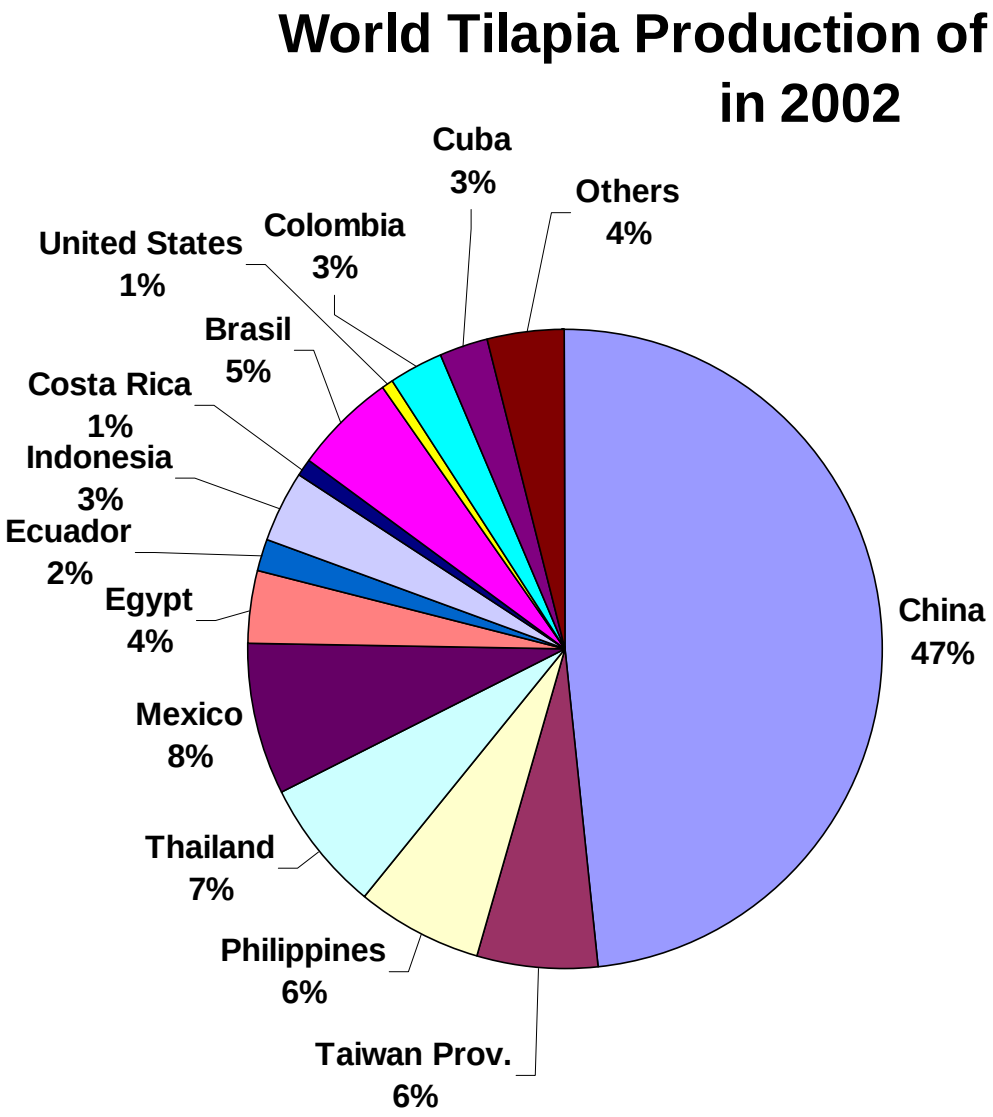
In responds to:

- Introduction of new strains
- Success in all-male tilapia production
- Improvement in both nursing and grow-out technologies

- 18,100 mt in 1984 ---- 706,585 mt in 2002
- Annual growth rate of 25%.
- Since 1997, production in China has produced about 50% of the world tilapia production



World Tilapia Production



Major Tilapia Producers (2002)

- China - 706,000 metric tons / year
- Mexico - 102,000 mt / year
- Thailand - 100,000 mt / year
- Philippines - 92,284 mt / year
- Taiwan Province - 85,000 mt / year
- Brazil - 75,000 mt / year
- Indonesia - 50,000 mt / year

HISTORY OF TILAPIA INTRODUCTION AND CULTURE IN CHINA

Initial stage: 1960s - 1970s.

- Mozambique tilapia: Introduced to Guangdong province from Vietnam in 1956

  Culture failed, due to:
  - early maturation
  - overpopulation
  - small size and slow growth
  - poor cold-tolerance

- Israeli red tilapia was introduced from Japan in 1973, but no large-scale culture in 1970s.

Development stage: 1980s

- Nile tilapia: firstly introduced from Sudan in July 1978
- Hybrid tilapia (Fu So Fish): (♀Mozambique tilapia × ♂Nile tilapia) was produced in Pearl River Fishery Research Institute of Chinese Academy of Fisheries Science in July 1978.
- Hybrid tilapia culture was promoted in many provinces due to,
  - 30-125% faster than Mozambique tilapia
  - 10-29% faster than Nile tilapia
  - larger size and better flesh,
  - small size difference between male and female, and better cold-tolerance

Fast expansion stage: Since early 1990s

- Blue tilapia: introduced in 1981 from Taiwan and in 1983 from USA.

- Nile-Blue hybrid tilapia: success in 1984, emerging as the most important tilapia strain due to:

  - its high male percentage (85-90%),
  - fast growth and large size,
  - good cold-tolerance, and wide tolerant range of salinity.

- GIFT: introduced to China firstly in 1994.

- 9th generation of GIFT strain (GIFT-strain Super Tilapia, or GenoMar Supreme Tilapia™): introduced to China in December 2001
  - GenoMar ASA company has established a large hatchery (GenoMar Supreme Hatchery China, GSHC) for the super tilapia strain.
  - Since June 2002, 30 millions of the off-spring have been yielded and sold mainly in Guangdong province followed by Hainan province.
  - A new generation of GenoMar Supreme Tilapia™ with improvements of 20% increase in growth rate and 10% low in FCR were introduced by GSHC in March and May 2004.

- Red tilapia has become more and more popular since 1990s, due mainly to success in the strain selection of red tilapia and preference of domestic consumers.

- Thai red tilapia (100,000) was introduced in 2000 by CP from Thailand to Hainan province for distribution and seed production on its own farm there

Year of introduction	Introduced strain	Place of introduction	Introduced number	Institutions
Mozambique tilapia (*Oreochromis mossambicus*)				
1956	Mozambique	Vietnam	----	Guangdong
Nile tilapia (*Oreochromis niloticus*)				
1978	Sudan	Sudan	22	Yangtze River Fishery Research Institute, Chinese Academy of Fisheries Science
1978		----	30	Hubei Provincial Bureau of Fisheries
1985	Egypt	Egypt	9	Hunan Provincial Bureau of Fisheries
1993	American	Auburn University, USA	----	National Department of Fisheries Extension
1994	GIFT	ICLARM, Philippines	5,000	Shanghai Fisheries University
1994	Egypt	ICLARM, Philippines	3,000	Shanghai Fisheries University
1995	Sudan	Sudan	53	Yangtze River Fishery Research Institute, Chinese Academy of Fisheries Science
1998	Egypt	Egypt	3,000	Shanghai Fisheries University
2001	GIFT-strain Super tilapia (GenoMar Supreme Tilapia™)	Philippines	2,000	GenoMar Supreme Hatchery China
2004	New generation of GenoMar Supreme Tilapia™	Philippines	----	GenoMar Supreme Hatchery China

Year of introduction	Introduced strain	Place of introduction	Introduced number	Institutions
Blue tilapia (*Oreochromis aureus*)				
1981	Africa	Taiwan	250	Guangzhou Fishery Research Institute
1983	America	USA	33	Freshwater Fishery Research Center, Chinese Academy of Fisheries Science
1994	----	CP Foods, Thailand	----	Guangdong Tilapia Stock Farm
1998	Egypt	Egypt	3,000	Shanghai Fisheries University
Red tilapia (*Oreochromis spp.*)				
1973	Israeli	Japan	1,200	Pearl River Fishery Research Institute, Chinese Academy of Fisheries Science
			2,900	Guangdong Fishery Research Institute
1981	----	Taiwan	----	Pearl River Fishery Research Institute, Chinese Academy of Fisheries Science
2000	Thailand	Thailand	100,000	CP Foods, Thailand
Yellow-belly tilapia (*Oreochromis anulerson*)				
1987	Africa	Africa	----	----

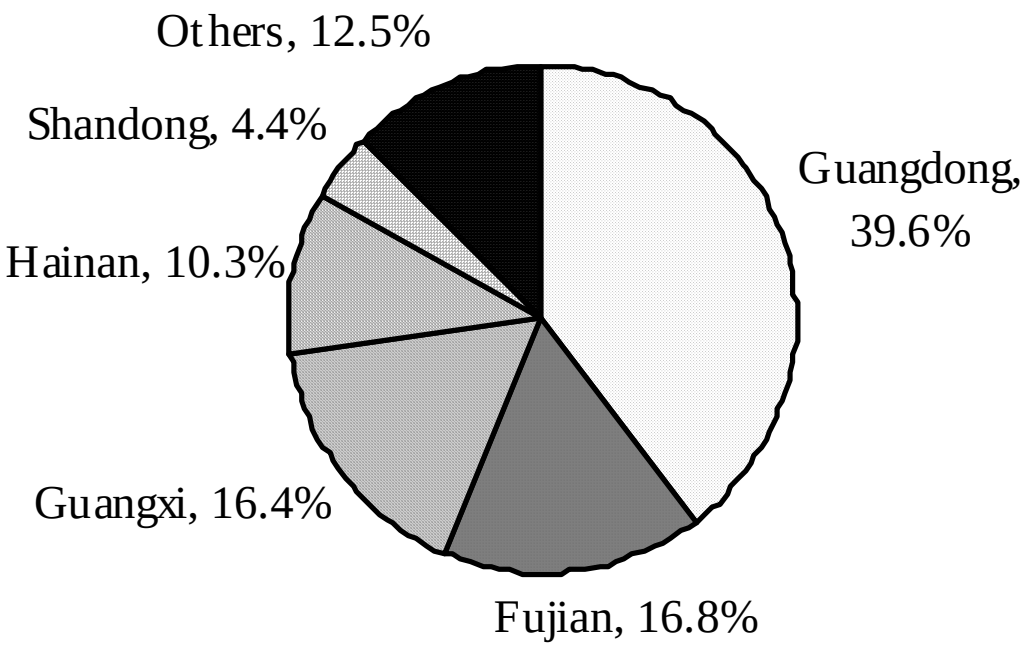
Sources: Zhang et al., 1979; Wang et al., 1987; Li et al., 1998; Wu et al., 1998; Li and Zhou, 2000; Ma et al. 2003; Xia, 2000; Li, 2002; Ye, 2002; Zimmermann, 2002; Yang Yi, per. comm.; Zimmermann, per. comm

MAIN TILAPIA PRODUCING PROVINCES

- Guangdong, Fujian, Guangxi, and Hainan

  - warm climate and rich rainfall
  - relatively long history of tilapia culture,
  - good tilapia selection programs,
  - well-developed large scale- tilapia hatcheries,
  - well-trained researchers and extension workers
  - more than 20 tilapia processing factories have been established and annual processing capacity has reached 200,000 metric tons

Production of tilapias by the main producing provinces in 2000



TILAPIA SEED PRODUCTION

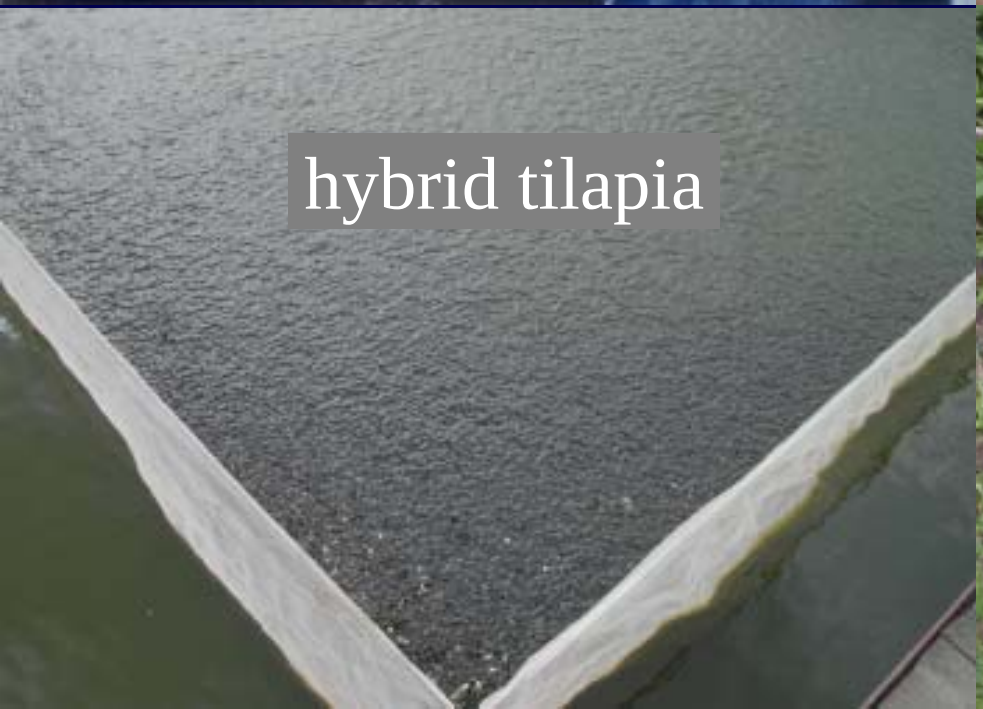
- Hybrid tilapia: two popular methods

  - Seeds caught from grow-out ponds
    - poor seed quality
    - labor intensive
    - can not supply for large scale grow out

  - Seeds produced in hatcheries:
    - produce 1 billion Nile-Blue hybrid tilapia fries annually
    - good seed quality
    - high male percentage.


♂


♀


hybrid tilapia


hybrid tilapia

Hatchery practices

- Breeders are stocked at 1 fish/m^2
- Female Nile tilapia to male blue tilapia ratio of (♀:♂ 3:1)
- Earthen ponds of 1,200-2,500 m^2 in surface area
- Water depth of 100-120 cm
- Breeders are fed with artificial feed (32-38% crude protein) twice daily (11:00 and 17:00) at 0.5-1.0% BW
- Hatched fries are harvested by seining using fine mesh nets.
- Male percentage of the Nile-Blue hybrid tilapia fry ranges from 85% to 90%
- Harvested fries are nursed in local nursery farms to 2-3 cm long, and sold to farmers at an average price of 0.1 Yuan/fry (1US$=8.21 Yuan)

MT treatments for hybrid tilapia fry

- In some hatchery, male hormone - MT feed (38-40% crude protein; 50 mg MT/kg feed) is used to treat tilapia fries to increase male percentage to 98-100%.
- The hybrid swimming-ups stocked at 4,000/m^2 outdoor cement tanks of 20-50 m^2 in surface area and 100-120 cm in water depth.
- DO is maintained > 2.5 mg/L through 24-hr aeration.
- Fries are fed MT-feed 4 times daily (07:00, 12:00, 18:00 and 22:00 h) at 10-15% body weight per day for 15-18 days.
- When reaching 2.5 cm long, fries are transferred to hapas suspended in ponds for nursing for 4-5 days before sale.
- Survival of the fries ranges normally from 90% to 95%.

nursery tanks

nursery hapas

TILAPIA GROW-OUT

Major culture systems

- Intensive culture in freshwater ponds/tanks
- Semi-intensive polyculture
- Integrated fish/duck culture
- Intensive culture in brackishwater ponds
- Cage culture
- Flow-through culture
- Integrated tilapia/rice culture

➢ Intensive culture in freshwater ponds/tanks

- Mainly practice in the top four tilapia producing provinces
- Pond size: 0.2 to 0.5 ha
- Aeration: 1-3 paddlewheel aerators per ha of surface area
- Stocking density: 30,000 to 37,500 fish/ha
- Feeding: artificial feed (28-35% CP) 2-3 times daily at 10-6% BWD for small fish (<100 g), 6-3% for medium fish (100-250 g), and 3-1.5% for large size fish (300-800 g)
- Culture period: 150 to 180 days
- Gross yield ranges: 15-20 mt/ha, 600-800 g/fish, FCR 1.5-2
- Average market price - 6.5-7.0 Yuan/kg
- Tilapias are also intensively cultured in tanks in temperate regions such as Shandong province, using heat effluent water from power plants.

➢Semi-intensive polyculture

- Dominant practice in most parts of China.
- Polyculture, mostly with Chinese carps
- Species composition varies at different areas
- Fertilization, manure and supplemental feeds (on-farm and commercial feeds)
- For exapmle:
  - 20% tilapia – 80% silver+bighead carps
  - Commercial feeds

➢Integrated fish/duck culture

- Mainly in the top four tilapia producing provinces.
- Pond surface area: 0.6-1.5 ha, duck houses are often located near pond dikes.
- Stocking density: 15,000-22,500 fish/ha, 2,000-3,000 duck/ha
- No aerator; local-made auto-feeders become popular.
- Duck manure is the sole nutrient source.
- Tilapia reach 150-200 g when ducks are sold, then tilapia are fed artificial feed (28-30% crude protein) twice daily at 2-4% body weight per day.
- Harvest: 600-800 g; gross yield 7.5-12mt/ha
- FCR of 0.8-1.2
- Culture period: 180-240 days.


Photo: P. Edwards

➢Intensive culture in brackishwater ponds

- Practice in the southern and southeastern coastal area of China with many abandoned and existing shrimp ponds.
- The main cultured strain is Nile-Blue hybrid tilapia.
- Prior to stocking, fish are acclimated gradually to the salinity of 15‰.
- The salinity level in ponds should be controlled below 20‰, beyond that the hybrid tilapia grow poorly and even die.
- Practices of the intensive culture of the hybrid tilapia in brackishwater are similar to those in freshwater.

➢Cage culture

- Open sea, lakes, reservoirs and rivers
- Common dimension of cages: 6 x 4 x 3 m
- Stocking size: > 50 g
- Stocking density: 100-150 fish/m^3
- Feeding:
  - artificial feed (28-35% CP); 2-3 times daily
  - Feeding rates
    - 7-10% BWD for small size fish (< 100 g)
    - 4-6% for medium size fish (100-250 g)
    - 1.5-4% for large fish (300-800 g).
- Culture period: 120 to 150 days
- Harvest: 600-800 g; Gross yield: 30-60 kg/m3
- FCR - 1.5-2.0

➢Flow-through culture

- The ponds range from a few to hundred square meters in surface area.
- Water in ponds is exchanged 300-400% per day.
- Tilapias are either monocultured or polycultured with carps.
- Fish are stocked at 30-80/m^2
- Feeding: artificial feed (28-35% CP) 2-3 times daily at 3-6%.
- Culture cycle: 160-200 days
- Gross yield: 20 to 30 kg/m^2

➢ Integrated tilapia/rice culture

- Mainly practiced in Guangxi, Sichuan and Hunan provinces.
- Stocking size and density: 5 cm size and 4,500-7,500 fish/ha in the rice fields.
- Stock at about 10 days after transplanting rice seedlings.
- No artificial feed is given, only natural foods.
- Harvested size: about 150 g.
- Gross yield: 500-1,100 kg/ha after 100 days of culture.
- Due to the small size, the tilapia can only be sold to nearby farmers in local markets.

Rice – fish culture in China

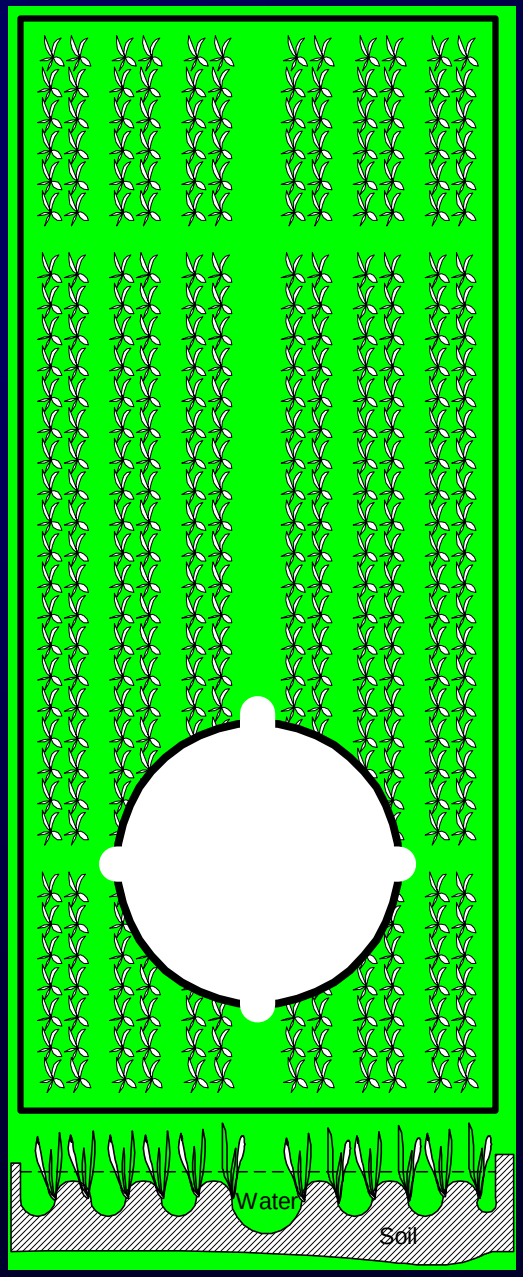


Diagram of rice-fish culture in China

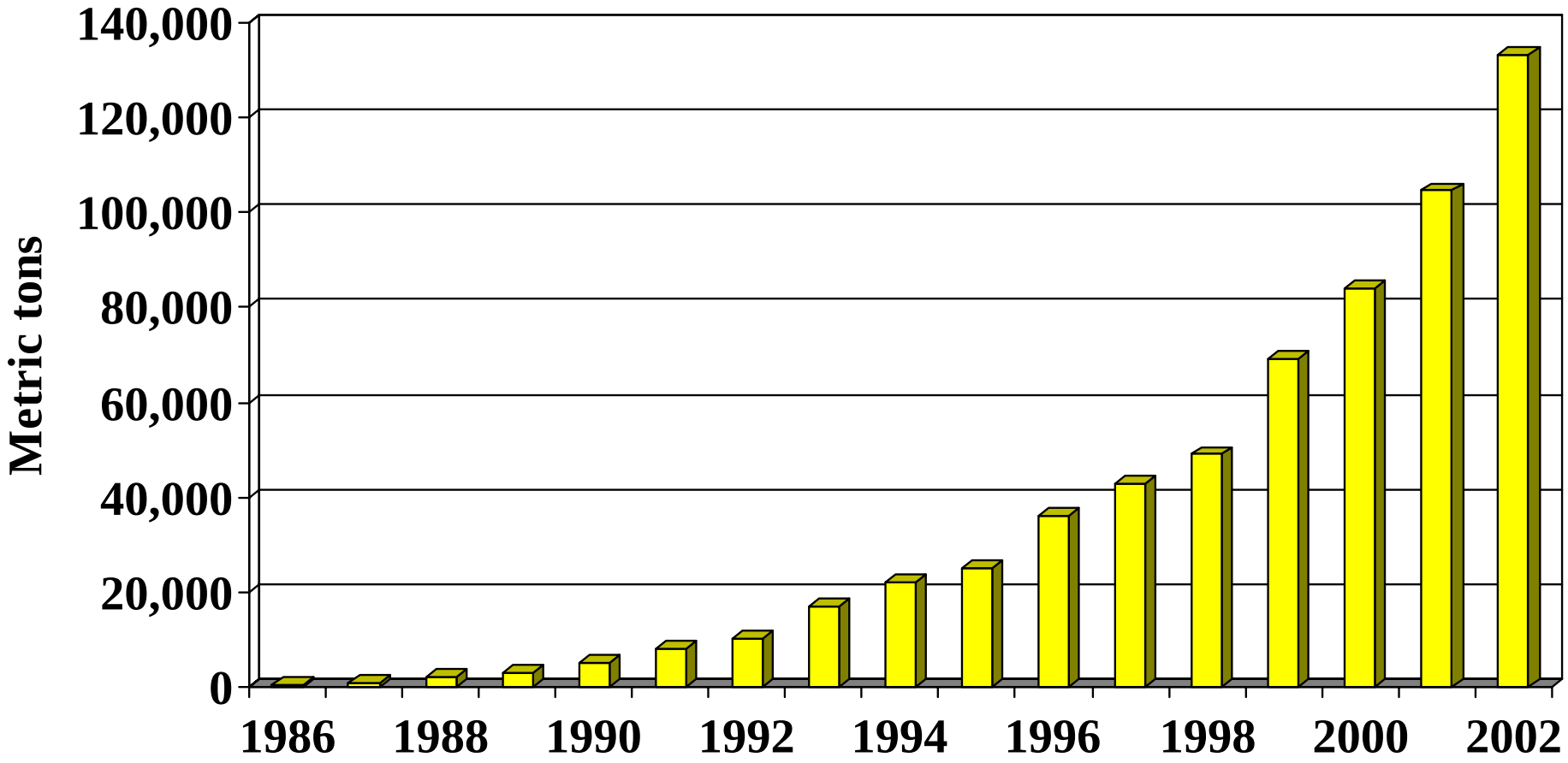
MAJOR PROBLEMS FOR FURTHER DEVELOPMENT OF TILAPIA CULTURE

- Quantity and quality of tilapia seeds
- Impurity of tilapia strains
- Insufficient technological knowledge of small-scale farmers and poor management

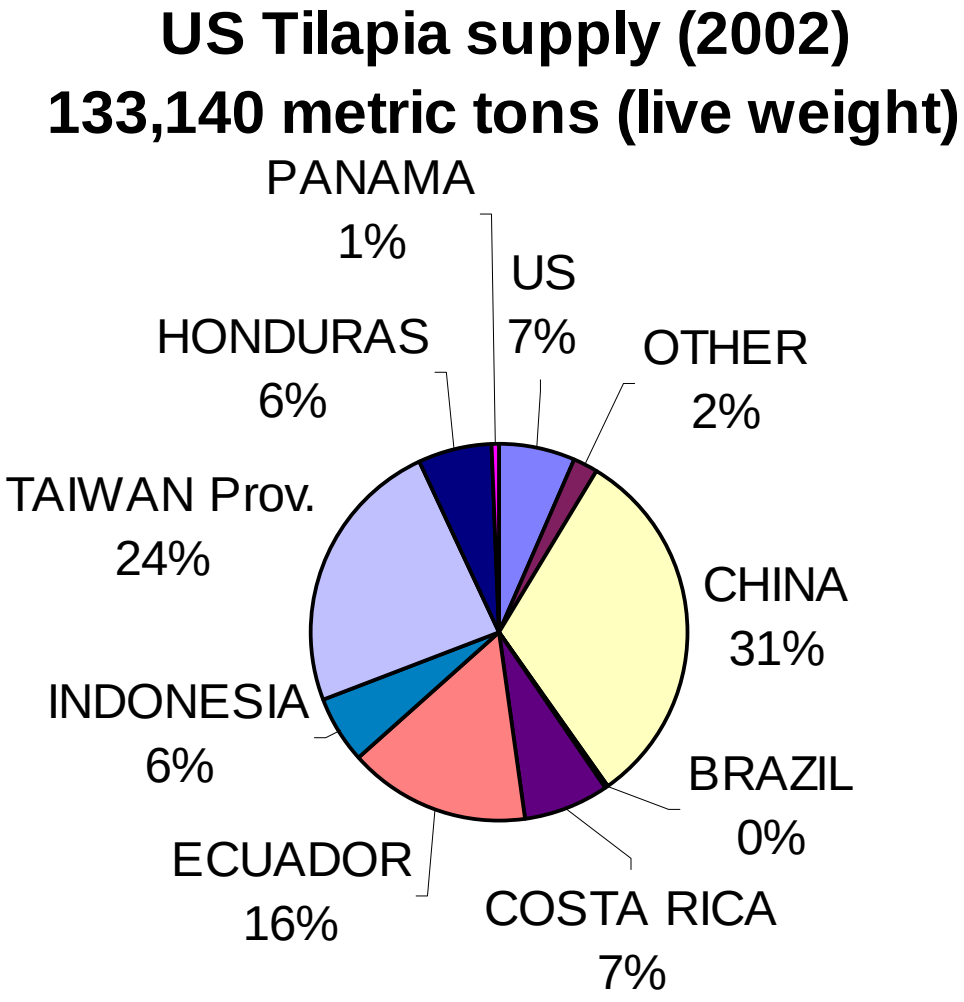
The model “company + base farm + farmers” may be a good way to link small-scale farmers with large markets, to ensure seafood safety, and to enhance the healthy development of tilapia culture.

Tilapia trade

- USA market: consumed 133,140 mt in 2002



China-produced tilapia in USA Market



Major Tilapia Products in International Trade

- China - whole frozen, IQF fillets
- Ecuador - fresh fillets
- Taiwan - whole, IQF, sashimi
- South & Central America - fresh fillets
- Indonesia - IQF fillets
- Thailand - IQF fillets

Current International Market Trends

- Increase in demand for all forms of tilapia
- Demand increase will be greatest for fresh fillets
- Prices have been constant for several years and will remain stable, will not increase with inflation.

Domestic Markets in China

- Domestic consumption is still low per capita
- Peoples' perception on tilapia especially black color tilapia is not very high.
- Red tilapia has been promoted very well.
- Huge potential in the domestic market

Environmental Issues

- This is a big challenge faced by aquaculture/fisheries sector in China

- Problems:
  - Nutrient and solid wastes and eutrophication in reservoirs, lakes and streams/rivers.
  - Alien species and biodiversity
  - Food safety and abuse/overuse of feed additives, medicines and drugs.
- Strategies:
  - Environmentally friendly culture systems for pond culture.
  - Waste control and management in public water bodies.
  - Appropriate control mechanisms for introduction of alien species.
  - Appropriate control of use of feed additives, medicines and drug.

FUTURE PROSPECTS

- China is major supplier of tilapias in USA markets, accounting for about 31% (41,200 mt) in 2002, however, it is less than 6% of total tilapia production in China.

- Average seafood consumption per capita in China is 10.3 kg in 2000, which is lower than the world average level, thus further expansion in tilapia production can be envisaged, due to its many advantages.

- With the improvements in tilapia genetic breeding, nutrition and feed and feeding technologies, and production technologies, there is a huge potential for further expansion of tilapia culture in China.


Thank you !