I. Overview

Tilapia (*Oreochromis mossambicus*) was first introduced to China in 1957 from Vietnam. Since then, several tilapia species, such as blue tilapia (*O. aureus*) and different strains of *O. niloticus*, have been introduced and crossbred.

- In 1978, hybrids of female *O. mossambicus* and male *O. niloticus* were produced with impressive growth rates of 30-125% and 10-29% greater than *O. mossambicus* and *O. niloticus*, respectively.
- Following the introduction of *O. aureus* from Taiwan, Nile-Blue hybrid tilapias were produced and named *O. aoni*, which became the most important strain mainly for its production of high percentage of male offspring. Its fast growth, large size, and tolerance to cold and a wide range of salinities make it still popular even today.
- In 1994, GIFT (Genetically Improved Farmed Tilapia, or *O. niloticus*) was introduced and improved further by Chinese scientists, leading to the ninth generation of the GIFT strain (GIFT-strain Super Tilapia, or GenoMar Supreme Tilapia™) around 2001.

In general, Chinese tilapia farming is dominated by the culture of *O. niloticus* and its hybrids in freshwater environments, with 1,134,000 metric tons (mt) in 2008, while other tilapia species accounted for 65,000 mt in freshwater and 11,000 mt in brackish water.¹

With strong governmental support for research and development of hybrids and culture technology, Chinese tilapia aquaculture has grown rapidly from the initial stage in the 1960s, to the expansion in early 1980s, and then to large-scale farming and processing in the 2000s. Recent years have witnessed a stable annual production of 1.1 or 1.2 million metric tons, about half of the world total.

China has dominated the world’s tilapia production since 2006 and has become the major source for tilapia exported to the US and Europe. In 2010, US imports of tilapia from China totaled 139,863 mt (154,173 tons) and $555 million, and

increased 22 percent in volume and 36 percent in value over the previous year.\(^2\) Almost 90 percent of frozen tilapia fillets imported to the US come from China.

Various types of culture systems at different levels of intensifications have been adopted in China, including:

- Intensive culture in freshwater ponds/tanks
- Semi-intensive polyculture
- Cage culture
- Raceway culture
- Integrated fish/duck/rice culture
- Intensive culture in brackish water.

These systems are widely distributed across the country. Overall, production mainly concentrates in South China, where four provinces (Guangdong, Hainan, Guangxi, and Fujian) contribute over 90 percent of the country’s total production and more than 100 processing plants are located.

### II. Problems

Over the past 20 years, a general trend towards intensification in tilapia farming has led to an increasing dependence on formulated feeds and freshwater supply. Poor management and unsustainable use of water and feeds invariably lead to contamination in receiving water bodies, disease outbreaks, crop failure, and excessive use of antibiotics. Reflecting the issues surrounding the growth of the tilapia industry worldwide, China stands on the frontline facing the challenge of maintaining a steady yield while minimizing environmental and social impacts of aquaculture.

Supported by many studies, rapid intensification of aquaculture is foreseen to have caused environmental degradation and species degeneration and in most cases are believed to cause more frequent disease outbreaks in tilapia farms in recent years. Negative impacts and potential risks have been identified among some tilapia farms in China, including:

- The impact on public health from the use of the artificial hormone and antibiotics
- Farm effluents and wastes discharged without proper treatment
- The impact on biodiversity from escaped tilapia
- The use of fishmeal (FM) in compound feeds and its traceability
- Potential conflicts with other land and water users

More complicated and problematic scenarios might appear, as global warming will likely expand the geographic range for some farmed tilapia and the survival of escapees. Existing water pollution and shortages facing aquaculture will be aggravated as China’s industrial development continues its rapid growth.

Causes of the phenomenal intensification of tilapia aquaculture in China are attributed to poor management, farmers’ insufficient knowledge of sustainable practices, and inefficient regulatory enforcement. The Chinese government has established regional and national teams of technology support with a series of standards to regulate antibiotics usage and effluent discharge, and has heavily invested in research and development regarding tilapia breeding, feeding, and processing in recent years. However, the improvements have been limited. In addition, the Chinese tilapia industry lacks sufficient communication with the international community, essential for better knowledge sharing and capacity building, and especially critical in meeting the growing demand for eco-label certification in the export markets.

**III. The Role of Sustainable Fisheries Partnership**

Sustainable Fisheries Partnership (SFP, [www.sustainablefish.org](http://www.sustainablefish.org)) is an independent, non-governmental organization (NGO) that advocates for sustainable fisheries and aquaculture by engaging stakeholders in effective dialogues to mobilize the supply chain towards sustainability.

We provide strategic and technical guidance to seafood suppliers and producers, help convene them with other like-minded companies in fishery improvement projects (FIPs) and aquaculture improvement projects (AIPs), and build consensus around specific improvements in policies, marine conservation measures, and fishing and fish-farming practices.

Our strength in the disciplines of economics, aquaculture science, communications, and well-balanced advocacy will help tilapia buyers and suppliers exert their influence where it matters most: in their supply chains and among the key decision makers who govern the tilapia industry.

We find ourselves a key player in the following actions:

- Developing business practices and alliances that support sustainable sourcing of tilapia
- Educating the supply chain about effective options to improve tilapia aquaculture
- Recommending specific improvements, such as effective regulations, monitoring, and enforcement to governing bodies.

In the past two years of scoping Chinese tilapia AIP in South China, SFP has been
widely acknowledged by stakeholders in the market of Chinese tilapia, including key US and European buyers and retailers, as well as producers and processors in China, aquaculture institutes, industry associations, and local Chinese governments. These have built SFP’s reputation and credibility in the Chinese tilapia industry while gaining trust from key stakeholders, placing SFP in a unique and extraordinary position to affect the market.

IV. Sustainable Solutions

Chinese tilapia aquaculture initiative will require significant analysis of existing eco-labeling standards as guidance for defining sustainable practices, measuring and mitigating the environmental and social impacts of various farming practices and systems, and promoting as-yet-unidentified regulatory reform.

Main solutions anchor the following aspects:

• use environmental-friendly technology to tackle water shortage and pollution

• minimize tilapia escapes

• improve feed traceability and sustainable use of fishmeal

• enhance the disease monitoring and management

• enhance the regional policy transform towards sustainable development

Environmental impact of tilapia farming has never been systematically assessed in China. Given the fact that a high number of clusters of tilapia farms concentrated in a region where agricultural and industrial sectors share water resources, a thorough study to identify the environmental impacts and risks at regional scale are urgently needed to prevent the industry from serious pollution and disease outbreaks. In addition, the biodiversity impact of tilapia, a non-native species to China, on the indigenous species and communities shall be evaluated and monitored.

Some of the existing Chinese tilapia farming regulations and practices are not up to international standards. This could be improved through AIP by more effective channels and approaches of knowledge-sharing, and better communication between producers and buyers.

Buyers and retailers need to be informed on the sustainability issues and on-going efforts taken by relevant stakeholders, through both written-format information as well as face-to-face communication with producers and suppliers. Guided trips to farms and plants will not only bring more attention and acknowledgement to the issues, but also to help buyers understand specific needs of further support on AIP with some personal attachment to the place and people.
To ensure the sustainable sourcing of feeds, buyers need to ask their suppliers to find out ingredients of feed and where it is coming from (i.e., traceability/transparency on the sources of inputs. Buyers also need to prioritize sourcing in regions as more farms within the region get certified to credible standard.

On the other hand, Chinese tilapia is procured by many buyers/suppliers across various regions, thus it is necessary to convene a policy roundtable of various buyers/suppliers across various regions to build consensus on improvements needed and to develop consistency in procurement standards.

V. Progress and Proposed Actions

SFP has been engaged with Chinese Tilapia producers and processors since 2007 when we advised key corporate partners on their tilapia procurement policy and sourcing; evaluating sources in Hainan (seven farms) and Beihai, a city of Guangxi (two farms). Following that, SFP started collaborating with several organizations and institutions in China such as technical institutes, other NGOs active in the area, government regulatory agencies, and major global buyers to begin the aquaculture improvement process.

Activities To Date

1. Compare standards and identify potential for harmonization.

Several aquaculture eco-labels (GlobalG.A.P, GAA/BAP, and ASC/ISRTA) have been compared through side-by-side audits. A REPORT HAS BEEN PUBLISHED (INSERT HYPERLINK TO THE REPORT) The benchmarking study helps influence buyer procurement policies by clarifying which eco-labels meet the requirements of different buyers. The study will also establish equivalencies between eco-labels.

The exercise also provides an excellent entry point for engaging farms and supply chains in the AIPs, and provides critical information regarding performance targets for individual farms participating in the AIPs.

2. Aquaculture Standard Orientation

SFP has worked closely with local tilapia associations (e.g., in cities such as Qiong Hai and Wenchang in Hainan province) to assess different tilapia standards that are available in the market. A workshop introducing three international standards for tilapia farming, i.e. BAP, GlobalGAP, and ASC, was held in Haikou on April 26, 2011. Over 40 farmers, processors, technicians and government officers attended the workshop. The comparison of three standards based on the benchmarking study was briefed as well. Follow-up evaluation of the workshop revealed that the participants found the workshop very informative and helpful. This enhanced the producers’ awareness of increasing demands on certificated sustainable seafood from overseas markets, thus further facilitating our engagement of Chinese stakeholders into the supply-chain dialogue towards sustainability.
3. Water Quality Monitoring

The water quality monitoring was completed in Jan 2012 with 2 crops of sampling on 5 representative farms in Hainan, the second largest exporter of tilapia in China. The monitoring data analysis was completed by March 2012. The final report is currently under editing and translation. Results show that the environmental impact from individual pond and farm remain relatively low based on the quality of effluents being released to the nearby receiving waterbodies. No significant amount of heavy metals was detected within water. Levels of Nitrogen found in the effluent are low as compared to the national and international standards. Concerns are raised on two farms where over 50% measurements of total P were found higher than the national standard (<0.2 mg/L). But the mean of total P (0.1997 mg/L) is acceptable. Overall, it tells that these farms that are supplying to big processing plants and inspected by the local government according to the regulations for exported seafood supplier are potentially in good shape for the time being.

However, it is very difficult to account the individual farm’s to the cumulative impacts of hundreds of farms in the region. The risks hidden under the cluster of farms, especially those near natural water bodies, shall be scientifically qualified and quantified. Thus, this pond-oriented monitoring will be combined with the results of the regional environmental impact assessment (see Planned Activities) to give a full picture of the tilapia farming’s environmental impact in Hainan.

Planned Activities

1. Regional-scale Environmental Impact Assessment (EIA)

Area-specific ecological and disease risk assessments will be carried out for improving regional management. SFP currently is working with local institutes of aquaculture and environmental sciences to identify and evaluate both qualitatively and quantitatively the environmental impacts of tilapia farming in Hainan. For the first time in the history of Chinese tilapia aquaculture, the study will investigate the biodiversity impacts of escaped tilapia, an essential component in assessing the tilapia farms against the eco-label standards. This includes an ecological study as well as socio-political analysis to advise local governments and industrial associations to efficiently address the environmental issues associated with tilapia farming in Hainan.

2. Educate buyers and suppliers about possible improvements

- Organize workshops to educate farmers on emerging standards and relevant techniques for sustainable tilapia aquaculture
- Collect and share better management practices (BMPs)
- Work with local tilapia associations, institutes, and the Chinese National Technology System of Tilapia Industry to advocate to the Chinese government for sustainable aquaculture practices
• Organize farmers and processors that have strong links/connections with international buyers to improve procurement policies that favor sustainability.

3. Reduce the impacts of smallholders and enhance their capacity in certification

Initiate studies on how to equip small-scale farmers to meet the eco-label criteria. Based on that information, develop pilot projects that enhance certification potential and improve local livelihoods by increasing aquaculture efficiency while reducing environmental impacts.

4. Strengthen the traceability system for a sustainable sourcing of fishmeal in tilapia feeds

• Organize awareness-building events to enhance farmers’ understanding of the importance of sustainable sourcing of fishmeal in feeds

• Encourage and advocate research and projects on improving feeding efficiency and developing alternative feeds with fewer impacts on wild fisheries

• Facilitate communication and collaboration between suppliers and buyers to build a cost-effective traceability system that covers every stage of tilapia farming and processing.