A Code of Good Practice for Hainan Tilapia Farming

The First Version (2015)

To promote a healthy, responsible and environmental-friendly tilapia aquaculture in Hainan, the Hainan Tilapia Sustainability Alliance organized national and local aquaculture experts along with representatives of farms, hatcheries and processing plants to jointly develop a Code of Good Practice. As a result of the first industry-led initiative to set up a benchmark for tilapia farming community in Hainan, the Code aims to provide technical guidance on how to raise tilapia in a most efficient and responsible way that prevents from generating disease and pollution from tilapia farms. The execution of the Code will help reduce use of chemical fertilizers and medicines that potentially threaten consumer's health and natural environment.

This is the first public version of the Code issued by the Hainan Tilapia Sustainability Alliance in Feb 2015, which has been applied to a dozen of pilot farms in Hainan. Through a trial-and-error process, the Alliance will keep revising and updating the Code and monitoring the implementation of the Code. Eventually, this Code will be disseminated to all tilapia farms in Hainan as a voluntary standard.

1 Scope

The Code of Good Practice recommends most suitable measures to manage pond, fish and environment that include technical requirements and recommendations for pond preparation, fingerling rearing, feeding management of growout fish, water quality management and disease prevention and treatment.

The Code applies to pond farming of tilapia in Hainan.

2 Normative References

The following national standards are indispensable references for the application of the Code. For cited standards with date, its revision (excluding correction) or amendment are not applicable for this Code. Nevertheless, it is encouraged that parties using this Code to research whether the latest version of the following references would be potentially applicable to this Code. For those standards without date, this Code will always refer to their latest versions as reference.

GB 11607 Aquaculture water quality standards

NY 5051 Pollution-free food freshwater aquaculture water quality

NY 5071 Pollution-free food fishery drug using guidelines

NY 5072 Pollution-free food fishery feeding safety limits
SC / T 1008 Specification for aquaculture breeding in pond
SC / T1025 Nile tilapia feeding nutrition standards
NY5071-2002 Pollution-free food Standard for fish medicine usage
SC / T 7015-2011 Harmless treatment procedure for infected aquatic animals

3 Environmental Basics

3.1 Site Selection

3.1.1 Farming site shall be located in a place with plenty of water, easy for water intake and drainage;

3.1.2 There shall be no pollution source threatening water quality around farming site;

3.1.3 Ponds shall be air-circulating and sun-facing.

3.2 Water Quality

3.2.1 Water quality shall meet the standards of aquaculture water quality standard GB 11607 and NY 505. Key water quality parameters shall refer to Table 1 during farming period;

3.2.2 It is recommended to use the website (*waterph.jooylife.com*) to obtain specific guidance when adjusting water quality in pond (for details please contact the Alliance);

3.2.3 Opacity of farming water shall be up to 30cm.

3.3 Requirement for pond

3.3.1 The size of pond is recommended to be around 5 to 25 mu (15 mu = 1ha). Depth of water shall be 2 to 3m.

3.3.2 Pond bottom shall be flat. It is recommended to choose loam and sandy loam bottom, so that pond will not have leaking problem;

3.3.3 Pond sediment shall be around 10 to 30 cm;

3.3.4 Before filled up with water, pond shall be drained out and exposed under blazing sun for long enough (1-2 weeks) for disinfection.

Table 1 Reference index for water quality variables in tilapia pond

Key water quality index	Reference values

Dissolved oxygen at the bottom	>3mg/L
Transparency	30-40cm
Ammonia concentration	0.1-0.3mg/L
pH	7.0-8.5
Alkalinity $CaCO_3$	100-200mg /L
Hardness $CaCO_3$	50-150mg/L

4 Rearing Fingerling

4.1 Water Requirement

4.1.1 Water temperature in pond to hold fingerling shall be kept above 22 ℃; if temperature is under 25℃, spread bleaching powder (dissolved in water) in pond (10 meter away from shoreline, with dosage of 1kg per mu per 1.5 m of water depth.

4.1.2 Check pH before and after one hour of aeration, afterwards pH is the pH_0 (baseline) of the pond. The pH value shall not change by more than 0.5. That means $|pH- pH_0| <0.5$;

4.1.3 Ammonia nitrogen < 0.5mg/L, Nitrite nitrogen < 0.05mg/L.

4.1.4 If pH is too low, use lime to adjust it; if pH is too high, use lactic acid bacteria, soluble carbon source and organic acid to adjust it, and turn up aerator more frequently.

4.2 Stocking

4.2.1 Firstly, trial stocking depending on fingerling's stress response: if it shows minor stress response, add 1～2 times of volume of pond water into fingerling bag, set still for 30 minutes before stocking; if stress response is significant,（e.g. pH is too high）, add water, organic acid, glucose, and Vc (anti-stress medicine);

4.2.2 Stocking density is dependent on end size (transferred to growout pond): if the size is expected to be 100 pieces per 500g, stocking density shall be 50,000 pieces per mu; if the size is expected to be 50 pieces per 500g, stocking density shall be 30,000 pieces per mu; if the size is 20 pieces per 500g, stocking density shall be 16,000 pieces per mu. Based on pond condition, recommended stocking density can be + or - 20% of the above.

4.3 Daily Management

4.3.1 After stocking, the first 2 days are adaptive period for fingerlings, thus no feeding. From the 3rd day to the 5th day, limited amounts of feed shall be provided; after 5 days, normal feeding starts. Powdered feed shall be used to feed fingerlings younger than 10 days, shredded feed or Grade One (No.1) Extruded feed shall be used to feed fingerling older than 10 days;

4.3.2 Feed 4 to 6 times per day, daily feeding rate shall be around 6 ~ 12% to ensure sufficient feeding (*i.e.* most of fingerlings are well fed);

4.3.3 During the rearing phase, add clean water into pond over time to gradually increase water level and maintain a good water quality;

4.3.4 Turn on aerator for 2 hours at noon in sunny days; scrape bottom (sediment) every 7 to 10 days in sunny days;

4.3.5 In daily management, check pH every day, keep pH in $|pH - pH_0| < 0.5$ (see 4.1.2)

4.4 Fingerling moved from rearing pond to growout pond

4.4.1 After 20 to 30 days, at appropriate water temperature, when fingerling grows up to 30g per piece, fingerling shall be graded and transferred to growout pond or reared to other size stock;

4.4.2 If for some reason fingerlings have not been fed well for a long time, ensure these feed fingerlings normally 10 days before moving fingerlings,

4.4.3 Scrape bottom 3 days before moving fingerling to growout pond and stop feeding for 1 day before transfer.

5 Growout Pond Management

5.1 Environmental Restoration

Dredging

5.1.1 Pond needs dredging if sediment exceeds 50 cm of thickness.

5.1.2 Dredging method: Use scraper, slit gun or a bulldozer. Warnings: NEVER remove all sediment. At least 10 to 30cm of sediment shall be retained.

Ditch and Drainage

5.1.3 Immediately after previous harvest, pond shall be drained completely. Drainage ditch shall be dig into shapes like : “田” or “丰”, with 30cm in length, 40cm in depth. It is preferred that ditch bottom touches underneath soil;

5.1.4 To achieve the best drainage and sunning, pump is recommended to remove all water from pond.

Sunning pond

5.1.5 To ensure an effective sunning:

- Large number of cracks with 2 to 3 cm of width shall be found in the sediment surface;
- Sediments surface shall be sunned to yellow, not white;
- Step on the sediment, shoeprints shall be visible that indicates a good elasticity, but no water shall come out of sediment;
- Sunning shall continue till deepest layer of sediment is sampled to see if there are no any dark sludge, which indicates organic matter has been fully oxidized.

5.1.6 Time for sunning:

- If weather and drainage situation are favorable, 15 to 20 days are long enough for effective sunning. Otherwise extend sunning time to ensure effectiveness.
- When weather is not favorable, tilling bottom is recommended.

5.1.7 Alkalization:

Subsoil in old pond or in mangrove area may be acid or acidified, thus lime shall be added to adjust pH and to help organic matter decomposed.

5.1.8 Tillage:

Tilling when adding lime to pond sediment is highly recommended to improve soil aeration and promote organic matter decomposition.

5.1.9 Using Probiotics

To enhance decomposition of organic matter in sediment, it is recommended to use probiotics and soil remediation agents based on soil test results. For example, spray soil oxidant to old

pond at 1 to 2 kg per mu, which reduces the reduction potential of pond sediment, so help complete decomposition of organic matter.

Pond Cleaning

5.1.10 Dry cleaning:

- Using 60 to 75 kg lime per mu, dig several small pits all around the pond, add the lime into pit, then add 10 ~ 20 cm water. After lime dissolved completely, spray it to pond bottom.
- Next day, stir up bottom to make lime and sediment mixed completely.

5.1.11 Wet cleaning:

After a complete sunning of pond bottom, add water to a depth of 40 to 60 cm all at once, spread lime to pond (100 to 150 kg per mu, per meter);

5.1.12 Adding water and fertilizing water:

- Water shall be filtered by 40-60 mesh screen. Apply 1.5 to 5kg of urea per mu, 4-5kg of phosphate fertilizer per mu to cultivate zooplankton.
- Pond water opacity shall be maintained at 30 cm or so.

5.1.13 Aerators:

- It is highly recommended that 3 to 4 sets of impeller aerators shall be installed for every 10 mu along with 1 set of wave aerator per 10 mu. For large size fish and high yield pond, micropore aerator shall be installed.
- Aerators shall be placed to form a triangle layout in pond, avoiding all sets in one straight line.

5.1.14 Feeding machine:

- Feeding machine shall be placed downwind with sufficient aeration and facing water in rich dissolved oxygen.
- Feeding machine shall be placed at least 3 m away from shoreline, at least 50 cm above water surface, which prevents feed pellets from being blown outside pond as wasted.

- Feeding machine shall mostly feed to pond area with deepest water depth where more space within water body can allow more fish to be fed, thus enhancing feeding efficiency.

5.2 Stocking Management

5.2.1 Stocking density:

- Depending on the size of fingerlings to be stocked, most favorable stocking density is recommended as 2,000 to 4,000 pieces per mu if pond has >2 m of water depth with sufficient aerators;
- Same-sized fingerlings that swim actively and strong are preferred to stock.

5.2.2 Other species to balance water quality:

It is highly recommended that 30 to 50 bighead carps (each weighed at >250g) (*Aristichthys nobilis*) and 20 silver carps (*Hypophthalmichthys molitrix*) shall be stocked together for every mu of water, which help in the early stage balance water nutrients through algae consumption.

5.3 Growout Management

5.3.1 Monitoring and recording

- Inspect pond every day to check on water quality, change of temperature and fish activity to avoid hypoxia; remove sick fish immediately when being discovered.
- Farming records shall be kept for every pond. Records shall include stocking status, feed source and feeding scheme, medicine source and usage, water temperature, water quality, and harvest (Farming record template see appendix); all records shall be kept for at least two years.

5.3.2 Stirring sediment

- Stirring sediment is a common measure to maintain water quality in aquaculture. Each time only about 20% of sediment shall be stirred up and accompanied by a close check on dissolved oxygen and fish activity;
- If pond has been constantly stirred up every 10 days from the very beginning, it can be entirely stirred up all at once.

5.3.3 Changing water

- Every 15 days, depending on water quality and availability, 15 to 20 cm depth of water shall be replaced;
- Pond depth shall be >2 m, the deeper the better.
- During hot season, frequency of changing water shall be increased accordingly.

5.3.4 Aeration

- When fish swim up to the surface, aerator must be turned all day and night; if not, no aerator needed at night;
- During day time, aerator shall be turned on to avoid water stratification, at least once in early morning, once at afternoon with 2to 3 hours each time;
- Increase time of using aerator when high temperature, cloudy day with low pressure, muggy weather.
- Use wave aerator to enhance nutrient exchange between water and sediment.

5.3.5 Water Quality Monitoring

- Physical and chemistry variables of water quality shall be regularly monitored, including: total alkalinity, calcium hardness, salinity, temperature, pH, ammonia, nitrite, and dissolved oxygen, etc., (see Table 1);
- Balance of total alkalinity and calcium hardness shall be maintained well through adding shell powder and quick lime into pond water. Specific adjustment plan is recommended on the website (*waterph.jooylife.com*). (for details please contact the Alliance);
- In case if farm is equipped with microscopes, composition and quantity of plankton in water shall be checked frequently;
- Try to avoid chemical approach to kill algae.

5.4 Feeding management

5.4.1 Feeding requirements

- Only use compound feed that is in compliance with the national feed standard (NY5072);

- Raw material and auxiliary material shall follow the requirements of GB 13078;
- Nutritional requirements shall follow the requirements of SC / T 1025;
- Choose high quality, balanced nutrition, and low protein feed;
- Feed shall be stored in a moisture-proof, shaded and ventilated place; it shall not be stored for too long.

5.4.2 Regular feeding

Feed twice per day, once at 8:00 - 9: 00 and the other at 13: 00 - 14: 00.

5.4.3 Feeding rate

- Feeding stops when 80% of fish are well fed; try to avoid cluster of fish during feeding. In general, the amount of daily feeding shall be between 1.8% to 3.0% of individual fish weight.
- Make feeding rate and schedule based on temperature, dissolved oxygen, ammonia and other water quality variables;
- Avoid neither temporal nor spatial over-feeding to prevent from local hypoxia;
- When water quality has any problems, immediately slow down or even temporarily stop feeding..

5.5 Harvesting

- Harvest when most of tilapia reach market size (>=500g / tail);
- to avoid hypoxia, harvest day shall be at low temperature, less windy but sunny.
- Two options for harvest, one is purse seine fishing, the other is dry pond fishing.
- Try to avoid damage on other fish. Harvesting all at once is recommended.
- Disinfect fishing gear immediately. Harvesting net shall be exposure to sun.

5.6 Medicine Usage

- Administration of any veterinary medicine requires withdrawal time of 40 days before harvesting.
- Administration of drugs in aquaculture shall comply with the National Veterinary Regulations, and "Pollution-free food guidelines for the use of fishery drugs"

(NY5071-2002, the Ministry of Agriculture).

- Only use drugs under technician's guidance and only use drugs from legal drug manufacturer and supplier (i.e. with valid production license, approval number, and production standard);
- Administration of drugs shall strictly follow instructions of usage and dosage;
- National banned drugs and medicated additives are prohibited;
- Harvest can only happen after passing withdrawal period.

6 Disease Prevention

6.1 Prevention methods

Ecological prevention is the main approach to lower disease occurrence. The key principle of ecological prevention approach is the stability of ecosystem that has been strengthened through water environmental management. It is mainly reflected in the following aspects:

- Increase natural productivity of pond ecosystem
- Lower the chance of animal disease outbreak

6.1.1 Alkalinity and calcium concentration of the pond water shall be adjusted and maintained at its critical point to achieve the highest efficiency of photosynthesis in pond water.

6.1.2 Manage pond bottom to allow sediment to release micro elements, thus maintaining mass exchange supporting a healthy ecosystem within pond.

6.1.3 Appropriate polyculture: every 2,000 to 4,000 pieces of tilapia per mu shall be accompanied by 30 to 50 pieces of silver carp. Through different types of fish that feed on different categories of food, secondary productivity as well as biodiversity within pond ecosystem will be enhanced.

6.1.4 Immunization

- Fingerlings with vaccine (mainly include vaccine of streptococcus and aeromonas hydrophila) to enhance disease resistance are recommended.

6.2 Common fish disease and prevention method（see Table 2 ）

Table 2 Common fish disease and prevention method for tilapia farming

Disease name	morbidity season distribution	symptom	Prevention method
T. spp	Early spring, summer and winter. wet weather	Gill tissue damaged	0.5mg/L~0.7mg/L Copper Sulfate, ferrous sulfate mixture for all over the pond（5:2）
chilodoniasis	December, March to May	Skin and gill are pale, body surface is light blue or covered by gray membrane	0.5mg/L~0.7mg/L Copper Sulfate, ferrous sulfate mixture for all over the pond（5:2）, soak that in saltwater(2.5%)for 20min
Ichthyophthiriasis	December to June	White cysts are all over the body surface, gill and fin	Soak 3.5% saltwater and 1.5% magnesium sulfate for 15min, or mix 0.38mg/L dry chilli powder and 0.15mg/L ginger fillet, then boil that, splash the water into the pond for 2 days.
saprolegniasis	All the year, especially Feb to May	Surface hypha multiply as floccules, congestion in the parasitic position	Avoid fish body injury: soak fish in saltwater (2%～3%)for 10min，or splash salt 400mg/L and soda

			(1:1）in to the pond, or crush gallnut and boil them, them splash the gallnut water into the pond (1.5kg~2.5kg /667m2)
streptococcicosis	When water temperature is 25℃～28℃	Surface become black， eyeballs and body is out of shape, eyeball is bulgy, cornea is turbid, anus is red and swollen	(1)avoid high density aquaculture ,enhance feed management. (2)In early stages of disease, fish can heal themselves through improving water and feed quality. 1 mg/L～2 mg/L bleaching powder can be splashed all over the ponds (28 % chlorine). (3)during attack, chlorine dioxide(auxiliary material) can be splashed into the ponds to disinfect the ponds, at the same time feed the fishes allicin for3～5 d, during the fifth day, Probiotics 0.5 ppm～0.8 ppm should be splashed into the ponds to improve water

			quality.
bacterial infected skin diseases	High density aquaculture, the overwintering period	Body surface hyperemia, scales begin to fall off, skin is fester .	In early stages of disease, fish can heal themselves through improving water and feed quality. 1 mg/L～2 mg/L bleaching powder can be splashed for all over the ponds (28％chlorine).
Note：Fish drug using and withdrawal time should meet the requirement of NY5071			

6.3 Safe disposal for sick and dead fish

6.3.1 Timely collection

- Dead fish and dying fish shall be cleaned up in time to avoid to further exposure to water or under sun. This will stop spreading infectious bacteria and remove infection source.
- Dead fish shall be sent to centralized treatment in distant area away from farming area and water supplying resources.

6.3.2 Deep bury

- Bury dead fish deeply is a common approach: Firstly, dig a deep pit at 1.5 m depth with 1.5 to 2 m diameter; add 2cm of lime in the bottom, then add dead fish followed by another layer of lime again… repeat as needed; eventually cover the top layer with soil of at least 1 m depth. The surface shall be covered with another layer of lime. The surface soil shall not be compressed to prevent gas and liquid leakage.
- Bury place shall be marked out clearly

6.3.3 Transportation control

Sick fish shall not be transferred to other plant or market.

6.3.4 How to dispose tools

- Tools that were in contact with sick or dead fish are strictly prohibited to cross-use;
- Tools shall be disinfected by bleaching powder (concentration 30mg/kg); soak the tools into Strong Chlorine. Process shall follow the standard of "Harmless treatment for infected aquatic animals" （SC/T-7015-2011）.

6.3.5 Dispose records

Entire disposal process shall be recorded.

7 Regional Cooperation

7.1 Community Relationships

Aquaculture farms are usually located in rural areas where other non-aquaculture community members also use natural resources around neighborhood. Therefore, it is important to ensure mutual beneficial partnerships among fish farmers and their neighbors. The Code aims to encourage farmers to develop a cooperative atmosphere and network within farming community.

7.1.1 Farmers should have cooperative attitude when developing a rational exploitation plan to use land and water resources in a balanced approach of maximizing local socio-economic benefits and environmental interests.

7.1.2 Farmers are responsible to maintain a clean and organized outlook through adopting necessary hygiene measures to remove farming wastes that might pollute community;

7.1.3 Aerators and other equipment shall be well maintained to avoid unnecessary noise disturbing local residents.

7.2 Cooperation, mutual assistance and sharing

7.2.1 Actively create or participate in farmers co-ops:

- Nearby farmers shall join local farmer associations or cooperatives, to implement internal supervision system of collaborating organizations;
- Farmers shall actively learn from each other and mutually respect to create self-discipline,

solidarity, mutual trust and win-win business culture;

- Farmers co-op and association shall play a key role in decision-making for water resource allocation and utilization within community;
- Farmers from different region shall strengthen information sharing, cooperation, and implementation of the Code.

7.2.2 Information sharing within the industry

- Supplier of fingerlings, feed and fish drug in the region shall actively share up-to-date technical information with farmers;
- Processing plant and buyers shall share with farmer the information on market demand timely and consumer feedbacks on the product.

7.2.3 Jointly tackle disease and extreme weather

- When wastewater needs to be discharged, farmers shall give at least 24-hours of notice to downstream potentially affected farms, to remind drainage contamination, therefore reducing cross-farm infection.
- When a farm has an epidemic disease, the disease information shall be disclosed and shared with neighbors. Notice within 24 hours to warn neighboring farms and cooperative members shall be sent for a more rigorous disease control and prevention measures.
- When a farm has an outbreak, the information shall be reported to provincial industry organizations and government departments within 12 hours (including time, location, species, farm volume, symptoms, mortality, adopted control measures, contacts information etc. Epidemic information shall be reported in accordance with levels of responsibility step by step.
- When farm suffer extreme weather such as typhoons, floods and droughts etc., farmers shall unite around farmer’s co-op and association to jointly make rational decision. Learning their lessons from disaster, farmers shall help other farmers to prepare for next disaster (for example, pond embankment reinforced, retain or discharge excessive water in advance, to take leakproof measure etc.).
- During disaster recovery, farmers shall unite in order to protect the collective interests of

farming community and reasonably fight for a variety of relief (compensation or subsidy), and support post-disaster reconstruction and resuming production as soon as possible.